ICEHHA 2025

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ICEHHA 2025

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Preface

It is with profound academic honor and intellectual vigor that we present the formal proceedings of the 5th International Conference on Education, Humanities, Health, and Agriculture (ICEHHA) 2025, hosted by Universitas Katolik Indonesia Santu Paulus Ruteng. This year's assembly represents a definitive milestone in our institutional commitment to advancing interdisciplinary discourse under the rigorous theme: "Knowledge in Action: Empowering Education, Humanities, Health, Agriculture, and Engineering for Sustainable Societies."

The 5th ICEHHA 2025 serves as a high-level scholarly forum where researchers, practitioners, and theoreticians converge to disseminate empirical insights across seven critical academic domains. The compendium of 42 peer-reviewed papers featured in these proceedings underscores a collective dedication to the application of theoretical knowledge to real-world exigencies. From the ontological foundations of Manggarai local wisdom—encapsulated in concepts such as the 5-T (*Teing, Toing, Titong, Tatang, Tatong*) and *Manuk Rombeng*—to the sophisticated integration of Artificial Intelligence within pedagogical leadership and institutional governance, these works illustrate how traditional value systems can substantively inform modern socio-technical progress.

Within the sphere of Education and Pedagogy, the research interrogates inclusive instructional design, blended learning modalities, and STEAM-centric frameworks, ensuring that future cohorts are equipped with both ethical character and technical proficiency. The Civil Engineering and Engineering contributions offer critical analyses of smart mobility planning and hydro-dynamic discharge in burgeoning tourism hubs like Labuan Bajo, emphasizing the categorical imperative of balancing infrastructural expansion with ecological preservation.

Furthermore, the proceedings scrutinize the nuances of Linguistics and Communication, examining transitivity and discourse in political rhetoric alongside the shifting paradigms of digital mediation in language acquisition. The Social Sciences, Psychology, and Economics section interrogates the "Tourism-Education-Culture Trilemma," providing a robust critique of structural inequality and the socio-spatial dimensions of regional rituals. This interdisciplinary breadth is augmented by significant advancements in Agriculture and Health, which prioritize sustainable agronomic practices and livestock optimization, alongside investigations into Theology and Culture that synthesize ritualistic traditions with holistic community well-being.

We extend our deepest commendations to the authors for their scholarly rigor, to the reviewers for their evaluative precision, and to the organizing committee at Universitas Katolik Indonesia Santu Paulus Ruteng for their steadfast stewardship. It is our hope that these proceedings function as a scholarly catalyst for future inquiry and provide high-fidelity insights that facilitate the sustainable advancement of both local and global societies.

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Implementation of Pancasila Education Based on Local Wisdom 5-T *(Teing, Toing, Titong, Tatang, Tatong)* in Forming Solidarity Habitus of Elementary School Students in Manggarai

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Abstract. This study investigates the implementation of Pancasila Education enriched with local wisdom Teing, Toing, Titong, Tatang, Tatong (5-T) in shaping the solidarity habitus of elementary school students in Manggarai Regency, East Nusa Tenggara, Indonesia. Employing an interpretative paradigm with a qualitative case study approach, the research explores the integration of national values (Pancasila) and local cultural values (5-T) as a contextual strategy for character education. The study was conducted in elementary schools in Langke Rembong Sub-District, involving principals, Pancasila Education teachers, upper-grade students, parents, and community leaders. Data were collected through in-depth interviews, participant observation, and document analysis, and analyzed using thematic analysis with a hybrid approach. The findings reveal that 5-T values function as a "spirit of solidarity" that strengthens the internalization of Pancasila through exemplary leadership, contextual learning, and critical dialogue. The solidarity habitus is formed through sustained habituation in daily school and community practices. This study contributes theoretically to knowledge decolonization in character education and practically to the development of Pancasila learning models grounded in local wisdom.

Keywords: Pancasila Education, Local Wisdom 5-T, Solidarity Habitus, Knowledge Decolonization, Character Education

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1. Introduction

The contemporary world faces a systemic crisis of solidarity manifested in various forms of social pathologies, ranging from structural poverty, rising crime rates, to alarming social alienation (Čermák, 2022; Standing, 2021). This crisis is exacerbated by acute individualism in the digital age that drives the atomization of social relations and the weakening of collective solidarity (Bauman, 2013; Han, 2017). The digital era has generated a new paradox in the practice of solidarity. Solidarity often emerges as a symbolic commodity measured through likes, followers, or online image. Friendship is no longer rooted in authentic interaction but rather functions as a stage for self-presentation. Social concern has shifted into a performative display instead of a genuine act of commitment. From an early age, children live amid the paradoxical tension between an artificial visual world and the reality of social relationships. This phenomenon is further exacerbated by the growing intolerance and violence within elementary school environments.

A press release by the SETARA Institute (2025) reported a tragic case of an elementary school student, identified as KB, who died after being bullied and physically assaulted by an older student, allegedly due to religious or belief differences. Data from SIMFONI-PPA reveal a significant increase in child violence cases over the past five years, with the majority of victims being elementary school students (Novianto et al., 2024).

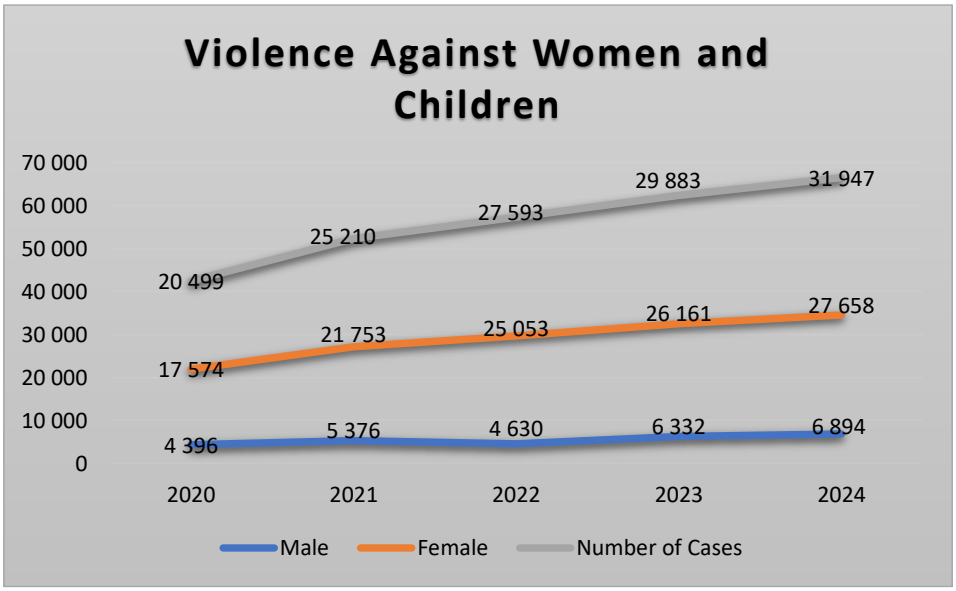

Figure 1. Trend of increasing child violence cases over the past five years

In the midst of these complex global challenges, elementary education has a crucial role as the foundation for character and social habitus formation that enables societal transformation toward stronger social cohesion. In the context of Indonesia, Pancasila Education as national character education faces a dualism challenge: on one hand, as fundamental state values education, while on the other hand, it is often perceived as abstract and non-contextual

education for students in regions with rich local cultural diversity (Sutriono & Hanafie, 2019). This phenomenon reflects the challenge of knowledge decolonization in character education, where "national" values tend to be hegemonic, while local knowledge is often marginalized or "subjugated" (subaltern) in formal education discourse (Spivak, 1988; Santos, 2014).

The epistemic wave of postmodernism has opened space for celebrating locality and heterogeneity as arenas for articulating dynamic and autonomous alternative knowledge (Faulkner et al., 2019). Knowledge decolonization theory critiques "grand narratives" and celebrates epistemic plurality, which allows restoration of the dignity of local communities silenced by Western epistemological domination (Shahjahan, 2023; Tuhiwai Smith, 2021). In the context of education, this wave gives rise to the paradigm of local wisdom-based education as an epistemic alternative that places local knowledge not as inferior "folk knowledge," but as legitimate and relevant epistemological sources (Battiste, 2017).

The mandate of the Indonesian curriculum, through Law Number 20 of 2003 on the National Education System, the 2013 Curriculum, to the Merdeka Curriculum with the Pancasila Student Profile Strengthening Project (P5), has positioned local wisdom-based learning as an essential part of character education (Kemendikbud, 2022). Local wisdom provides concrete contexts for students to construct cultural meanings, build strong local identities, while developing global understanding through local lenses (Moleong, 2019). Various studies have revealed that implementing solidarity education grounded in local wisdom at the elementary school level significantly contributes to strengthening social cohesion. Educational models based on local values not only reinforce students' cultural identity (Suprapto et al., 2021) and prevent deviant behavior (Lon, 2021), but are also effective in fostering social solidarity character among elementary school students (Suprapto et al., 2021).

Manggarai Regency, East Nusa Tenggara, possesses rich local wisdom, particularly the customary values "Teing, Toing, Titong, Tatang, Tatong" (T-5) that regulate social relations and education in Manggarai society (Setyawan, 2021). These T-5 values are not merely traditions, but local epistemologies that underlie how Manggarai people understand and practice education, solidarity, and social justice (Kleden, 2019). *Téing* (giving wholeheartedly), *Toing* (teaching with knowledge and wisdom), *Titong* (educating through guidance and exemplary behavior), *Tatang* (motivating and encouraging potential), and *Tatong* (building solidarity and fostering unity) are cultural capital that has strategic potential to strengthen the internalization of Pancasila values (Bourdieu, 1986).

Elementary school students (ages 6-12 years) are at the concrete operational stage of cognitive development according to Piaget (Piaget & Inhelder, 2008). At this stage, children begin to understand abstract concepts such as justice, others' perspectives (perspective taking), and empathy, which form the foundation of social solidarity (Yusuf, 2020). The formation of solidarity habitus at this age is crucial as it becomes the axiological foundation that will shape solidarity behavior patterns (dispositions) for life (Reckwitz, 2021). Habitus, in Bourdieu's theoretical framework, is a "structured and structuring structure" that organizes individual social practices (Bourdieu, 1990). The formation of solidarity habitus through T-5 based Pancasila Education is the internalization of values through daily practices (praxis) that position solidarity as students' natural dispositions.

Preliminary findings indicate that integrating Pancasila Education with local wisdom significantly contributes to strengthening social cohesion among elementary students. Interviews with several teachers in Langke Rembong District, Manggarai, revealed that

Pancasila Education is perceived not merely as theoretical instruction but as a means of shaping students' character and social behavior. A teacher from SDI Leda emphasized moral habituation as the focus of classroom learning, while another described it as a contextual and dialogical process that allows students to experience Pancasila values in everyday life.

However, challenges arise in the digital era, where students' social behaviors evolve faster than traditional teaching methods. To address this, teachers employ various strategies, such as role modeling and experiential learning *(titong),* group discussions, role-playing, and collaborative approaches *(dodo)* to cultivate empathy and a spirit of cooperation. Observations at SDI Konggang (August 8, 2025) revealed positive solidarity behaviors, such as helping peers in need, participating in communal work, and supporting classmates facing difficulties. This sense of solidarity strengthened when teachers actively engaged in social activities, highlighting the reciprocal relationship between teacher role modeling and students' social practices.

The T-5 values of local wisdom serve as a cultural strategy for managing and preventing social conflicts among students. When minor conflicts occur, teachers prefer dialogical and reconciliatory approaches rather than direct punishment, encouraging students to discuss and forgive one another. Such practices foster a culture of peace *(hambor)* and collective responsibility through shared activities like community service, joint school event preparations, and interfaith prayers. Nonetheless, challenges persist in schools with higher social, economic, religious, and ethnic diversity. While diversity enriches social interaction, it can also lead to friction, including instances of bullying.

This reality illustrates two dimensions of solidarity practices in Langke Rembong elementary schools. On one hand, integrating 5T values into Pancasila Education promotes social cohesion and solidarity habitus from an early age; on the other hand, its success largely depends on teachers' pedagogical approaches, school culture, parental and community involvement, and the influence of popular digital culture. Therefore, research on integrating Pancasila Education enriched with 5T local wisdom is essential, as it provides both conceptual and practical foundations for nurturing solidarity character in elementary education.

Previous studies reinforce the importance of local wisdom in cultivating social solidarity. In various communities, traditions such as Petik Laut in Jember (Rahayu et al., 2022), Ruwah Desa in Jombang, Ma'gere' Tedong in Toraja, Panen Padi in West Sumba, Marsialap Ari in Mandailing, Mubawaki in Siau, Merti Bumi in Central Java, Ngelepot Napai in Lampung, Gawai Dayak in West Kalimantan, and Tri Hita Karana in Bali have been shown to strengthen social cohesion and solidarity (Anggraeni & Puspytasari, 2023; Hendrayani & Laksana, 2023; Mardawani & Veronika, 2018; Yulandi et al., 2023; Aji et al., 2025). Research on the 5T cultural system of Manggarai also demonstrates its role in shaping egalitarian leadership ethics (Doho, 2019). Nevertheless, most of these studies emphasize ceremonial and anthropological dimensions, while the pedagogical aspects, particularly their implementation in Pancasila Education at the elementary level, remain underexplored.

These studies consistently affirm that integrating local wisdom into formal education enriches learning processes and strengthens social solidarity. However, few have advanced toward developing micro-curricular frameworks or pedagogical strategies that explicitly intersect Pancasila Education with local wisdom values, especially within the context of elementary education. Langke Rembong Sub-District was chosen as the research locus for several reasons: (1) this area is known as a "student city" with strong educational traditions; (2) high social heterogeneity (various ethnicities and religions) creates a relevant arena for studying

solidarity implementation; (3) T-5 values are still alive and practiced in the community; and (4) many public and private elementary schools have begun integrating local wisdom in learning (Sari et al., 2022).

Based on this background, this research formulates the following research questions:

1. How is the implementation of T-5 local wisdom-based Pancasila Education in Elementary Schools across Langke Rembong Sub-District?
2. How do T-5 values (Téing, Toing, Titong, Tatang, Tatong) strengthen the internalization of Pancasila values in forming students' solidarity habitus?
3. How is students' solidarity habitus formed through pedagogical practices that integrate Pancasila and T-5?

This research aims to:

4. Examine the implementation of T-5 local wisdom-based Pancasila Education in Elementary Schools across Langke Rembong Sub-District.
5. Analyze the role of T-5 values in strengthening the internalization of Pancasila values in forming students' solidarity habitus.
6. Understand the process of forming students' solidarity habitus through pedagogical practices that integrate Pancasila and T-5.

2. Literature Review

a. Knowledge Decolonization in Character Education

Knowledge decolonization is an intellectual movement that emerged as a critical response to Western epistemological domination in knowledge production (Santos, 2014; Tuhiwai Smith, 2021). The postmodernism wave has opened space to celebrate locality as an arena for articulating dynamic alternative knowledge (Hodgson et al., 2020). In the context of education, knowledge decolonization positions local knowledge not as inferior "folk knowledge," but as a legitimate and relevant epistemological source (Battiste, 2017).

Character education from a decolonization perspective is not the transmission of imposed "universal" values, but the reconstruction of values through dialogue between local and national/global knowledge (Shahjahan, 2023). This epistemic dialogue enables the emergence of cultural hybridity that enriches students' educational experiences while respecting local identity (Bhabha, 1994).

b. Solidarity Habitus

Solidarity is a multidimensional concept encompassing emotional and structural dimensions. Emotionally, solidarity is related to empathy and individual concern, while structurally, it serves as a social principle that maintains social cohesion and continuity. The concept emphasizes shared responsibility and collective bonds. Over time, this concept evolved from Roman law and Enlightenment morals to become a symbol of collective labor struggles in

the 19th century, demonstrating that solidarity is not only normative but also political and ethical.

Émile Durkheim made significant contributions to understanding solidarity as a moral and structural foundation of society. He distinguished between mechanical solidarity, which occurs in homogeneous and simple societies, and organic solidarity, which develops in complex societies with a high division of labor. According to Durkheim, social cohesion is not only the result of shared values but also emerges from interdependence among individuals. This idea is relevant in the modern context, where cultural and professional pluralism actually strengthens social integration through mutual dependence and collective support. The thoughts of Karl Marx, Friedrich Engels, and Max Weber add political and economic dimensions to solidarity. Marx emphasized solidarity as class consciousness arising from experiences of economic oppression, while Engels stressed the importance of collective organizations such as labor unions to address injustice. Weber highlighted the aspect of values and subjective meaning, where solidarity emerges from meaningful actions supporting common goals. The combination of their views shows that solidarity is multidimensional, encompassing moral, political, and existential aspects, and functions as an emancipatory and integrative force in society.

Contemporary perspectives, such as those of Habermas and Arendt, emphasize normative, communicative, and political dimensions of solidarity. Habermas stresses communicative solidarity as a prerequisite for deliberative democracy, both locally and cosmopolitically, emphasizing rational dialogue and consensus. Arendt highlights solidarity as collective political action arising from moral responses to human suffering, promoting structural transformation and a free, egalitarian public space. These perspectives show that solidarity is not only internal but also directed toward social and political change. The concept of habitus was developed by Pierre Bourdieu (1990) to explain how social structures are formed and reproduced through individuals' daily practices. Habitus is a "structured and structuring structure" that organizes individual social practices (Bourdieu, 1990, p. 72). Solidarity habitus refers to internalized dispositions to act with the spirit of solidarity, empathy, and social concern. The formation of solidarity habitus occurs through the process of habituation, namely the repetition of practices that internalize solidarity values into natural dispositions (Thompson, 2019). In the context of education, solidarity habituation involves three dimensions: (1) cognitive dimension (understanding the importance of solidarity), (2) affective dimension (feelings of empathy and concern), and (3) conative dimension (tendency to act with solidarity) (Reber, 2019).

In the Indonesian context, solidarity is rooted in the culture of mutual cooperation (gotong royong) and the values of Pancasila, which emphasize social responsibility, concern, and historical solidarity. These values are embedded in the nation's collective historical experience, from the kingdom era to the struggle for independence. Solidarity manifests in social behavior, public policy, and laws that emphasize care for others. Overall, solidarity is a complex concept combining moral, social, political, and pragmatic aspects, fostering a sense of belonging, trust, collaboration, and collective responsibility, both locally and globally.

c. Pancasila Education as Character Education

Pancasila as the state ideology represents fundamental values that regulate national and state life in Indonesia (Notonagoro, 2017). Pancasila Education is a pedagogical strategy to instill Pancasila values as national identity and citizens' social habitus (Zuchdi, 2019). Effective

Pancasila Education does not only convey values as abstractions, but integrates values into students' daily practices through concrete experiences (Novita, 2020). Local wisdom can function as a "hermeneutic bridge" that connects Pancasila values with students' concrete experiences in local contexts (Gadamer, 2004). Pancasila education is important because elementary school is the initial stage of character formation, where students begin to understand concrete values such as justice, responsibility, and tolerance (Rabbani et al., 2023). Pancasila values must be instilled early so they become the foundation of children's thinking and behavior in the future, especially amid globalization and identity crises. Beyond being a formal subject, this education represents a holistic pedagogical process aimed at shaping students' personalities, moral orientation, and public ethics as responsible citizens (Wahono et al., 2021; Wirayuda et al., 2024). Its success heavily relies on the teacher's role as a moral role model and social agent, providing direct learning experiences to cultivate empathy, cooperation, and collective responsibility (Muslim et al., 2020). Innovative approaches such as project-based learning and the integration of spiritual and non-spiritual elements reinforce the internalization of character values, combining cognitive, affective, and social aspects (Sari, 2024; Ladamay & Mustakim, 2023). A supportive educational ecosystem, including family and community involvement, is also necessary to create an inclusive school climate and strengthen students' moral identity (Sarkadi et al., 2022; Ruth et al., 2023).

Legally, philosophically, and pedagogically, Pancasila education holds a strategic position within the national education system, from reinforcing constitutional values to internalizing the nation's culture (National Education System Law No. 20/2003; Government Regulation No. 19/2005). This education is not merely a transfer of knowledge but a cultural project that demands the integration of cognition, affect, and action, along with the involvement of schools, families, and communities, to develop a generation with Pancasila-based character.

d. Manggarai Local Wisdom T-5 Values

1) Téing: Generosity and Solidarity

Téing means "giving wholeheartedly" (*toto nai bakok*), encompassing *téing tinu* (caring with gratitude) and *téing waheng* (giving advice) (Kleden, 2019). Téing instills values of generosity, sincerity, compassion, and devotion. In the context of solidarity, Téing teaches students to provide help selflessly to those in need, thus strengthening social solidarity.

2) Toing: Knowledge and Wisdom

Toing means "teaching with knowledge and wisdom." Toing equips students to think rationally, act justly, and uphold solidarity values through knowledge. In pedagogical practice, Toing emphasizes the importance of teachers using knowledge and wisdom in guiding students to understand solidarity values critically and reflectively.

3) Titong: Exemplary and Guidance

Titong means "educating through guidance and setting example." Titong emphasizes the role of teacher exemplary behavior as a model of solidarity behavior. Teacher role models are the most effective pedagogical strategy in character education, as elementary school children tend to learn through imitation (Bandura, 1977). Titong strengthens solidarity character through direct manifestation of mutual respect, cooperation, and sharing in daily practice.

4) Tatang: Motivation and Potential Development

Tatang means "motivating and encouraging potential." Tatang nurtures students' resilience to help others and develop individual potential for common good. From a social cognitive perspective, intrinsic motivation for solidarity drives students to act prosocially automatically without external coercion (Deci & Ryan, 2000).

5) Tatong: Social Cohesion and Unity

Tatong means "building solidarity and fostering unity." Tatong strengthens social cohesion and builds unity among learners, teaching them to take care of each other and protect the weak. Tatong values are closely related to Pancasila principles "Just and Civilized Humanity" and "Unity of Indonesia" (Notonagoro, 2017).

e. Solidarity Education in Elementary Schools

Solidarity education in elementary schools aims to instill solidarity, empathy, and social concern values at the crucial age of character formation (Carlo, 2014). Research shows that effective educational interventions in instilling solidarity include: (1) experience-based learning (service learning), (2) teacher exemplary behavior, (3) contextual learning, and (4) reflective dialogue (Seligman et al., 2021). Contextual and local wisdom-based learning strategies can increase the effectiveness of character education because they provide relevance and meaning for students (Lickona, 2019). The integration of local wisdom in Pancasila Education creates authentic and meaningful learning, making value internalization stronger (Yuniar et al., 2023).

3. Method

This research uses an interpretative paradigm, which assumes that social reality is a subjective construction built through meaning interpretation (Lincoln & Guba, 1985). This paradigm is suitable for exploring the subjective experiences of students, teachers, and community members about the implementation of T-5 local wisdom-based Pancasila Education. The approach used is qualitative with a case study design. Case study was chosen because this research wants to investigate contemporary phenomena (implementation of Pancasila and T-5) in depth in real-world contexts in elementary schools in Langke Rembong (Yin, 2018). Case study enables researchers to understand the complexity of interactions between context, process, and outcomes of local wisdom-based character education implementation.

This research was conducted in Elementary Schools across Langke Rembong Sub-District, Manggarai Regency, East Nusa Tenggara. This location was chosen because: (1) this area is known as a "student city" with strong educational traditions, (2) high social heterogeneity (various ethnicities and religions), (3) T-5 values are still alive and practiced in the community, and (4) many public and private elementary schools have begun integrating local wisdom in learning. Research participants consisted of: - School principals (n=9) - Pancasila Education teachers (n=18) - Upper-grade students (IV-VI) (n=54) - Student parents (n=27) - Customary/community leaders (n=9) - School supervisors/inspectors (n=3). Total participants = 120 informants. Participant selection used purposive sampling with criteria: (1) having direct experience with Pancasila and T-5 implementation, (2) willing to participate in the research, and (3) able to provide in-depth information about the phenomena under study.

Data collection in this study was conducted through in-depth interviews, participant observation, and documentary analysis. Semi-structured interviews were carried out to explore participants' perceptions, experiences, feelings, values, and emotions regarding the practices of Pancasila Education and the T-5 values. The interviews were conducted in comfortable and conducive settings, with each session lasting between 45 and 90 minutes; all interviews were audio-recorded and transcribed verbatim for further analysis. Participant observation was employed to examine pedagogical practices in classrooms, social interactions within the school environment, as well as ceremonial and traditional ritual activities, enabling the researcher to directly observe how Pancasila and T-5 values are enacted in everyday practices. Observational data were documented in detailed field notes. Documentary analysis included the collection of lesson plans, teaching modules, school curricula, school vision and mission statements, photographs of learning activities, daily notes from teachers and students, and local cultural texts such as Manggarai proverbs. These documents were used to corroborate and validate findings from interviews and observations through data triangulation.

Data analysis was conducted using thematic analysis with a hybrid approach that integrates deductive elements derived from the theoretical framework and inductive elements emerging from the empirical data (Braun & Clarke, 2022). The analytical process began with data familiarization and organization through repeated reading of interview transcripts, observation notes, and documents to gain a deep understanding of the data. This was followed by initial coding, in which meaningful data segments were labeled to reflect participants' meanings. The codes were then synthesized into broader themes, such as daily solidarity, teacher role modeling, and contextual learning. These themes were reviewed to ensure internal coherence and external heterogeneity, subsequently defined and named to articulate underlying structures of meaning, for example, local wisdom T-5 as the spirit of solidarity. The final stage involved interpretation and report writing, in which findings were presented using direct quotations and systematically linked to relevant theoretical perspectives.

Data validity was ensured through triangulation and the enhancement of participant credibility. Source triangulation was achieved by collecting data from diverse informants, including teachers, students, customary leaders, and parents. Method triangulation involved the use of multiple data collection techniques, namely interviews, observations, and documentation, while time triangulation was applied by conducting data collection at different points in time to examine the consistency of findings. In addition, member checking was conducted by returning interpretations to participants to confirm the accuracy of meanings, supported by an audit trail consisting of detailed documentation of the research process to ensure dependability. The validation process was further strengthened through peer debriefing, involving critical discussions with colleagues to examine potential researcher bias and the robustness of the interpretations.

4. Results and Discussion

a. Implementation of T-5 Based Pancasila Education in Elementary Schools

Research findings reveal that the implementation of Pancasila Education based on the local wisdom of T-5 *(Téing, Titong, Tandang, Toing, and Tatong)* in Elementary Schools across Langke Rembong Sub-District was carried out through innovative, contextual, and transformative pedagogical strategies. This approach does not merely transmit values but builds critical understanding and internalization of the Pancasila principles by utilizing the socio-

cultural capital of the Manggarai community as an epistemological starting point. Pancasila Education teachers act as "cultural brokers" and hermeneutic facilitators, designing integrative learning models. The T-5 values function as a "hermeneutic bridge" that transforms the abstract concepts of Pancasila into meaningful constructs through students' concrete experiences in the local context. This process is a form of philosophical contextualization, where state philosophy is dialogued with customary wisdom to create lived understanding.

Main Pedagogical Strategies and Implementation Analysis:

1. Contextual Learning Based on Local Wisdom with an Ethnopedagogical Approach. Teachers systematically link Pancasila principles with the daily practices, customary norms, and cosmology of the Manggarai people. Learning media are drawn from the oral cultural treasury, such as proverbs, folktales, and customary rites. For example, the value of Social Justice (the 5th principle), which emphasizes harmony and common interest. This approach is a cultural cognitive strategy that utilizes students' innate knowledge schemas for assimilating new concepts.
2. Behavioral Modeling through Teacher Exemplarity *(Titong)* as a Social Learning Strategy. The concept of *Titong* (standing / gathering together) is operationalized by teachers not only as a value to be taught but as a relational ethic in pedagogical interactions. Teachers act as active role models who practice T-5 values in classroom and school dynamics, such as providing extra support to struggling students *(Téing)*, showing respect in differences of opinion, and demonstrating cooperation in collaborative tasks. This observational learning process strengthens teacher credibility and provides behavioral examples that can be directly internalized by students.
3. Value-Laden Project-Based Learning (PjBL) as a Social Laboratory. Students are involved in micro-scale humanitarian and community projects designed to reflect the values of *Téing* (compassion/love) and *Tatong* (togetherness). Activities such as communal work cleaning the school environment, visiting sick friends, or collecting aid for community members in need function as a "social laboratory" for directly experiencing the affective and behavioral dimensions of Pancasila. Through these projects, students do not just learn about solidarity but experience and construct the meaning of solidarity in real action.
4. Reflective Dialogue and Discursive Space Using the Toing Approach. Teachers create safe and participatory discursive spaces for students to reflect on their experiences, feelings, and understanding of the values learned. The Toing (wisdom of words) approach is translated into facilitated dialogue techniques, where teachers become moderators encouraging critical narrative exchange. These reflective dialogues enable value internalization through linguistic articulation, the negotiation of meaning among students, and the resolution of simple moral dilemmas, thereby deepening understanding from the cognitive to the evaluative level.

These findings support the theory of contextual and culture-based value education for character building. The implementation of T-5 demonstrates that the effectiveness of Pancasila Education can be enhanced by accommodating local genius as a learning medium. For replication and development, it is recommended to compile thematic learning modules documenting these best practices, as well as to provide continuous teacher training to strengthen their capacity as cultural interpreters connecting local heritage with global citizenship.

b. Role of T-5 Values in Strengthening Pancasila Internalization

Research findings reveal that T-5 values function as the "spirit of solidarity" that strengthens Pancasila value internalization through three main mechanisms:

a) Recontextualization Mechanism. T-5 values perform recontextualization of Pancasila values by connecting Pancasila's ideological abstraction with students' concrete experiences in Manggarai contexts. For example, the principle "Just and Civilized Humanity" (second principle of Pancasila) is recontextualized through Téing values (giving wholeheartedly) and Tatong values (building solidarity). *Teacher A quote: "We don't just teach Pancasila as abstract text, but connect it with their daily lives. For example, when we teach 'Just and Civilized Humanity,' we ask children to think: 'How can we help friends in difficulty? This is Téing—giving wholeheartedly.'"*

b) Habituation Mechanism. T-5 values form solidarity habitus through repetition of daily practices (habituation). Each solidarity practice (helping friends, mutual assistance, respecting differences) is a repetition that internalizes values into students' natural dispositions. *Student S1 said: "Every morning before entering class, we always greet and help friends who carry heavy items. The principal always says this is Téing—giving wholeheartedly. Now this has become our habit."*

c) Exemplification Mechanism. Teachers use exemplary behavior (Titong) as the most effective pedagogical strategy. Teacher exemplary behavior directly demonstrates how T-5 and Pancasila values are practiced in daily life, so students learn through imitation. A customary leader said: *"Teachers here don't just teach, but also practice T-5 values. When a student is sick, the teacher encourages their classmates to visit and provide assistance. This practice embodies Titong. Titong is a tangible model of exemplary behavior. Students learn values through direct observation.*

d) Formation of Solidarity Habitus Through Pedagogical Practices. Research findings reveal that solidarity habitus formation occurs through three process stages:

1) Cognitive Internalization Stage. Students understand solidarity values through explicit learning about T-5 and Pancasila. Toing values (teaching with knowledge and wisdom) ensure that cognitive understanding of solidarity is built solidly.

2) Affective Internalization Stage. Students develop empathy and social concern feelings through direct experiences in humanitarian activities. Tatang values (motivating and encouraging potential) nurture intrinsic motivation for solidarity.
3) Conative Internalization Stage. Students develop spontaneous tendencies to act with solidarity as a response to social situations. *Tatong* values (building solidarity) strengthen social cohesion among students.

c. Challenges and Implementation Obstacles

The implementation of the T-5 local wisdom-based learning model in the context of elementary education demonstrates positive outcomes, yet it is not without its multidimensional implementation challenges and obstacles. At the educator level, findings reveal that teachers' pedagogical capacity to deeply grasp the essence of T-5 local wisdom is uneven, leading to varied and inconsistent application in teaching practices. This lack of preparedness consequently affects the quality of value internalization.

Regarding the learners, there are constraints stemming from the cognitive and linguistic developmental characteristics of elementary school-aged children. Some students struggle to comprehend the abstraction of the noble values embedded within T-5, due to conceptual complexity that is not entirely aligned with their concrete operational stage of thinking, as well as language barriers when the local wisdom material is delivered in a less contextualized form. Systemic challenges also constitute a significant impediment. The lack of integrated and ad hoc educational policy support, coupled with limited resources, both material and temporal, and an overloaded curriculum, often renders the integration of local wisdom as supplementary and unsystematic. Therefore, this study recommends a series of strategic actions, including the organization of intensive and sustainable teacher training on the philosophy and methodology of integrating T-5, the development of more adaptive and contextual learning media and materials, and the necessity for strong and holistic policy support from educational authorities to ensure the sustainability of this local wisdom-based approach. Despite these challenges, the impact of T-5-based learning on student solidarity behavior shows a strengthening trend. The research documents a noticeable increase in prosocial behavior, where students become more active in helping peers, sharing resources, and fostering cooperation in both academic and non-academic activities. The aspect of empathy also developed, marked by students' improved ability to recognize, understand, and respond to the feelings of others.

Furthermore, a significant decrease in incidents of bullying behavior within the school environment was observed, indicating that the internalization of T-5 values contributes to creating a safer and more respectful social climate. A broader impact is seen in the enhanced classroom cohesion, where bonds of solidarity among learning group members strengthen, thereby fostering a more collaborative and supportive learning community. These findings confirm the transformative potential of local wisdom as a pedagogical foundation for shaping student character and social competencies.

4. Conclusion

This study substantiates that the systematic implementation of Pancasila Education grounded in the T-5 *(Téing, Toing, Titong, Tatang, Tatong)* local wisdom framework within elementary schools across Langke Rembong Sub-District has effectively facilitated a pedagogical synthesis of national principles and local values. This integration has been instrumental in cultivating a robust solidarity habitus among students. The T-5 values operate as a foundational "spirit of solidarity," providing a culturally resonant vehicle for the internalization of Pancasila. This process is mediated through three core pedagogical mechanisms: the recontextualization of abstract national values into local narratives, the systematic habituation of prosocial behaviors, and the power of exemplification by educators and community figures.

The formation of this solidarity habitus is revealed to be a staged, multi-dimensional process encompassing cognitive comprehension, affective attachment, and conative enactment. This tripartite internalization enables students to develop deeply ingrained dispositions toward solidarity, which manifest in observable behavioral shifts. Empirical evidence from this research confirms the model's positive impact, notably in the enhancement of prosocial behaviors, the deepening of empathetic capacities, and the strengthening of overall social cohesion within the school microcosm. Theoretically, this study contributes to: (1) Knowledge decolonization through the integration of local and national epistemologies, creating cultural hybridity in character education; (2) Understanding the mechanisms of *solidarity habitus* formation as a social practice that can be pedagogically constructed; and (3) Strengthening the paradigm of contextual character education based on local wisdom to enhance the effectiveness of value internalization. Practically, this study recommends: (1) The adoption of the T-5-based model by teachers as a pedagogical innovation for contextual Pancasila teaching; (2) The integration of local wisdom as an official learning resource in character education curriculum development; and (3) The strengthening of educational policies that support local wisdom-based approaches, accompanied by adequate resource allocation.

For future research, it is recommended to: (1) Expand the study to different geographical and cultural contexts; (2) Conduct longitudinal research to measure long-term impacts; (3) Undertake comparative research with other approaches; and (4) Develop valid and reliable instruments to measure *solidarity habitus* and the impacts of similar learning models.

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The Regulatory Professional Paradox: Developing Inclusive and Sustainable Professionalism among Early Childhood Education (ECE) Teachers

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Abstract. This study examines strategies to strengthen the professionalism of Early Childhood Education (ECE) teachers in Manggarai Regency through a literature review. The analysis centers on three core pillars: academic qualification, teaching competence, and teacher welfare. Data were sourced from national policy documents, the 2025 Indonesian Education Report, and academic literature, including Starting Strong VI (OECD), the EPPE/EPPSE longitudinal study, and a meta-analysis on teacher coaching. The findings indicate that the predominance of nonformal ECE institutions, which are not recognized under Law No. 14 of 2005, impedes the implementation of quality standards as stipulated by Ministerial Regulation No. 137 of 2014. Local initiatives, such as bachelor's degree scholarships and holistic-integrative training, have been introduced but have not sufficiently addressed classroom practices or economic well-being. The study recommends that the national ministry takes the initiative in regulatory reform, while the district office and school networks should simultaneously focus on strengthening affirmative policies at the regional level. This approach is seen as strategic to achieving inclusive and sustainable teacher professionalism in ECE.

Keywords: teacher professionalism, Early Childhood Education (ECE), qualification, competence, welfare

1 Introduction

Early Childhood Education (Pendidikan Anak Usia Dini, hereafter PAUD) plays a foundational role in shaping children's cognitive, social, emotional, and motor development in an integrated manner. The effectiveness of PAUD service delivery is closely linked to the quality of teacher-child interactions, which are recognized globally as a critical factor for enhancing early learning outcomes [1].

However, in the Indonesian context especially in underserved areas such as Manggarai Regency systemic regulatory gaps continue to hinder the realization of high-quality PAUD services. Of the 313 PAUD units in Manggarai, approximately 87 percent are categorized as

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non-formal, lacking formal recognition under national legislation, particularly Law No. 14 of 2005 [2]. This status discrepancy prevents the vast majority of PAUD teachers from accessing professional benefits, such as certification, allowances, and structured professional development. Consequently, these educators often operate in precarious conditions with limited legal protections, inadequate pedagogical support, and low remuneration.

This study identifies the core issue as a persistent regulatory paradox: national education policy emphasizes quality and professional standards but structurally excludes non-formal teachers from the mechanisms necessary to meet these standards. In this context, the national "Merdeka Belajar" initiative—while promoting autonomy and contextual learning—has not yet adequately resolved the entrenched regulatory exclusion faced by non-formal PAUD teachers. Instead, bureaucratic compliance requirements and fragmented governance often add to teachers' administrative workload, limiting their ability to focus on reflective and responsive pedagogy. The resulting erosion of "organic professionalism"—the intrinsic motivation and community-rooted expertise of teachers—undermines sustainable improvements in ECE quality.

Framed against these structural challenges, the study is guided by three pillars of inclusive and sustainable professionalism: (1) academic qualifications, (2) instructional competence, and (3) teacher welfare. The operationalization of these pillars draws from robust international evidence. For instance, the EPPE/EPPSE studies in the UK show that academically qualified teachers consistently provide more effective instruction [3]. Similarly, a meta-analysis by Kraft et al. demonstrates the efficacy of in-situ coaching in enhancing classroom practices [4]. The Nurturing Care Framework further emphasizes that the emotional and economic well-being of caregivers is foundational to the quality of care and stimulation provided to children [5].

To evaluate the gap between regulatory intent and classroom realities, this study draws on a literature-based analysis, using national policy documents, education quality reports, and peer-reviewed studies. It focuses on how systemic recognition, sustained coaching, and welfare-responsive financing can serve as levers for professional reform. The overarching aim is to develop a locally rooted yet scalable model for improving teacher professionalism in PAUD institutions that remain outside the formal regulatory framework.

Ultimately, this study contributes to the discourse on professional equity in early childhood education, highlighting the need for policy frameworks that accommodate diverse institutional forms while upholding rigorous standards of quality and care. It provides both analytical insights and practical recommendations for closing the regulatory gaps that currently marginalize thousands of PAUD teachers and, by extension, compromise children’s right to quality early education.

2 Literature Review

Professionalism in early childhood education (ECE) is a dynamic and evolving construct that has been subject to considerable theoretical debate and empirical inquiry. Traditionally, teacher professionalism has been framed through a managerial lens, emphasizing compliance with standards, formal credentials, and accountability mechanisms. However, recent global

scholarship has shifted towards more inclusive and sustainable models of professionalism, which emphasize teacher agency, ethical practice, and socio-cultural responsiveness [6].

In the Indonesian context, the transition from managerial to inclusive professionalism is still in progress and faces unique regulatory and institutional constraints. Scholars such as Maiza [7] and Utama [8] highlight that the professional development of PAUD teachers remains fragmented and largely dependent on inconsistent local policies. These limitations reflect a broader issue: the absence of a coherent national framework that supports sustainable professional growth, particularly for non-formal teachers.

Globally, inclusive professionalism is increasingly associated with the concept of teacher agency—the capacity of teachers to make autonomous, ethical, and context-responsive decisions in their practice. Sachs [9] and Osgood [10] argue that true professionalism cannot be reduced to bureaucratic indicators but must include a relational and ethical dimension that honors teachers' voices and contextual expertise. In this light, professionalism involves a continuous negotiation of values, practices, and institutional expectations.

However, teacher agency does not operate in a vacuum. Organizational culture plays a pivotal role in either facilitating or constraining this agency. As noted by Biesta et al. [11], schools with collaborative and reflective cultures tend to empower teachers, whereas those dominated by compliance-driven management often suppress professional autonomy. This observation is particularly relevant in the Indonesian setting, where many non-formal PAUD institutions operate under fragmented supervision and weak institutional support, making it difficult for teachers to exercise meaningful agency.

Furthermore, the literature suggests that sustainable professionalism requires institutional mechanisms that balance regulatory expectations with developmental support. The meta-analysis by Kraft et al. [4] confirms that professional growth is more effectively supported through sustained, context-sensitive coaching rather than one-off workshops. This has important implications for Indonesia, where most PAUD teacher training remains episodic and disconnected from classroom realities.

In summary, the literature converges on the need to reconceptualize ECE teacher professionalism as a holistic, value-driven, and contextually embedded process. While international models provide useful frameworks, these must be localized to address the specific institutional, cultural, and policy challenges facing PAUD teachers in Indonesia. The present study seeks to fill this gap by analyzing how sustainable professionalism can be developed in non-formal PAUD contexts, particularly in underserved regions such as Manggarai.

3 Research Methods

This study employs a qualitative research design with a systematic literature review and philosophical analysis to examine how inclusive and sustainable professionalism can be developed among non-formal PAUD teachers in Manggarai Regency. The approach is appropriate for investigating normative and structural challenges—particularly those linked to

regulation, pedagogical practice, and welfare—that shape the professional landscape of early childhood educators.

Data were collected from 26 selected sources published between 2020 and 2025, encompassing policy documents, national education reports, and peer-reviewed academic literature. The selection process followed a transparent screening protocol. First, documents were identified through targeted searches in Google Scholar, national education portals, and databases such as ERIC and ScienceDirect. Keywords used included: "PAUD teacher professionalism," "non-formal education regulation Indonesia," "inclusive ECE," "teacher coaching," and "teacher welfare." Second, the inclusion criteria were established based on relevance to three analytical domains: (1) regulatory frameworks, (2) capacity-building models, and (3) welfare-oriented policies. Finally, 26 documents meeting the criteria were analyzed using thematic synthesis.

Screening and quality appraisal. To make the selection procedure explicit, all records were first screened at the title and abstract level to remove irrelevant studies. Full-text screening was then conducted against the inclusion criteria (regulation, capacity-building models, and welfare-oriented policies) to ensure conceptual alignment with the three analytical pillars. For transparency, an extraction log was maintained to document (a) the reason for inclusion/exclusion, (b) the document type (policy, report, or peer-reviewed study), and (c) the level of governance addressed (national, provincial/district, or institutional). Although the review is qualitative and interpretive, the appraisal step focused on basic trustworthiness signals: clarity of methods, relevance of the evidence, and the plausibility of reported claims in relation to the Indonesian PAUD context.

Data extraction and indicator development. Indicators were defined as explicit statements, measurable targets, or empirically supported claims that could inform professional standards and enabling conditions for PAUD teachers. Each of the 26 documents was summarized in an extraction matrix containing: bibliographic information; setting/coverage; teacher type (formal/non-formal); key regulatory provisions or policy levers; described interventions (e.g., scholarships, coaching, CPD); reported constraints (e.g., financing, legal status, workload); and outcome claims. From this matrix, indicators were generated at two levels: (1) descriptive indicators (what standards and supports are currently stipulated or practiced) and (2) gap indicators (where standards exist but enabling conditions are absent). This step ensured that the synthesis did not remain at the level of general argument but produced traceable, document-based claims.

Thematic synthesis procedure. Following the logic of thematic synthesis, the analysis was conducted through iterative coding and theme development [12]. First, the extracted text segments relevant to the three pillars were coded line-by-line to capture the meaning of regulatory statements, program descriptions, and evidence claims. Second, codes were clustered into descriptive themes (e.g., credential requirements, CPD access, coaching intensity, certification eligibility, honorarium levels, and administrative compliance demands). Third, analytical themes were generated by comparing descriptive themes across document types and levels of governance to explain the regulatory paradox—namely, how accountability requirements expand while legal recognition and welfare mechanisms remain uneven for non-formal teachers. This stage produced cross-cutting explanations (e.g., compliance without capacity; standards without status) that connect policy intent to classroom realities.

Trustworthiness and synthesis output. To strengthen credibility, themes were checked through constant comparison across sources (policy documents versus empirical studies) and through repeated passes over the extraction matrix to ensure internal consistency. The final output is a

narrative synthesis that integrates: (a) national regulatory requirements, (b) evidence-informed mechanisms for competence development (particularly sustained coaching), and (c) welfare and financing arrangements required to sustain professional agency. The synthesis therefore functions as an interpretive framework, not a statistical meta-analysis, and is intended to inform actionable policy recommendations for Manggarai and comparable under-resourced districts.

Thematic synthesis in this study involved three analytical stages. First, key themes were extracted deductively based on the conceptual framework: qualifications, instructional competence, and welfare. Second, inductive coding was used to identify patterns and sub-themes emerging from the data. Third, the themes were restructured into a synthesized narrative that integrates regulatory analysis with grounded pedagogical insight. This process enables the study to link abstract policy discourse with concrete teaching realities.

The philosophical component of the analysis draws on normative theories of justice and equity in education. This is particularly relevant in highlighting the regulatory marginalization of non-formal PAUD teachers and their exclusion from formal professional recognition. Ethical reasoning was applied to interpret findings regarding disparities in welfare and access to training, particularly through the lens of "professional justice," a concept adapted from Biesta and Sachs [13].

The credibility of this approach is enhanced by triangulation across multiple source types and the use of peer-reviewed literature. While limited by its non-empirical nature, the methodology offers a robust interpretive lens to examine systemic policy gaps and to develop actionable recommendations.

4 Results and Discussion

This synthesis identifies three interrelated pillars that are essential to building inclusive and sustainable professionalism among PAUD teachers in Manggarai Regency: (1) academic qualification, (2) instructional competence, and (3) teacher welfare. In Manggarai, where non-formal PAUD provision predominates, professional expectations expand faster than enabling conditions. This produces an administrative paradox: teachers are required to demonstrate compliance through documentation and reporting while operating with limited recognition, support, and protection.

First, the qualification gap remains substantial. Most non-formal PAUD teachers in Manggarai have not attained the minimum academic credential (S1/D4) stipulated in Ministerial Regulation No. 137 of 2014. A district scholarship initiative introduced through collaboration with Universitas Terbuka in 2024 is therefore a strategic affirmative measure because it targets the most visible bottleneck in professional eligibility. Yet qualification upgrading in under-resourced contexts faces predictable barriers, including indirect costs (transportation, internet quota, learning materials), competing work obligations, and limited mentoring that supports completion and learning transfer. Without these supports, the pathway risks becoming symbolic rather than transformative.

International evidence strengthens the argument that qualifications matter, while also clarifying the conditions under which they become pedagogically meaningful. As Sylva et al. have demonstrated, academic qualifications are a critical driver of pedagogical effectiveness

[3]. For Manggarai, this implies that expanding qualification pathways should be paired with an enabling ecosystem that supports transfer from study to practice. District-level mentoring during study, school-based routines for collaborative planning, and access to basic learning resources can help ensure that increased qualifications are translated into improved teacher-child interaction quality, rather than remaining as formal credentials with little impact on everyday pedagogy.

Second, instructional competence is constrained by weak and uneven access to continuing professional development (CPD). The 2025 Indonesia Education Report notes that only 45% of PAUD teachers participated in CPD, and participation is lower among non-formal teachers. Even where CPD exists, it is often short, fragmented, and detached from classroom realities. Administrative fatigue compounds this gap: teachers are expected to produce lesson plans, reports, and compliance documentation, leaving limited time and energy for reflective practice. In this context, competence development must be designed to fit teachers' working conditions, and accountability mechanisms should be streamlined so they protect time for teaching and learning rather than rewarding paperwork. This is why teachers often experience an administrative-fatigue cycle: the more standards are emphasized, the more time is diverted to proving compliance, not improving practice.

The findings therefore reinforce the need to shift from event-based training toward sustained, practice-embedded support. Kraft et al. emphasize that embedded coaching is a more effective alternative to conventional training models [12]. Field examples from Yogyakarta and Central Java suggest that teacher coaching can enhance classroom engagement and improve learning outcomes [14,15]. In Manggarai, a pilot coaching intervention in one PAUD center reportedly increased child participation and task engagement. To avoid adding administrative burden, coaching should be framed as developmental support with realistic cycles and psychologically safe feedback rather than compliance monitoring.

Reviewer feedback also highlights the practical constraints of collaborative networks in under-resourced regions, and the findings support this concern. Although clusters and communities of practice can strengthen teacher agency, collaboration in Manggarai is constrained by distance, transportation costs, staffing shortages, and uneven digital access. As a result, meetings can drift into administrative coordination (document collection and reporting) rather than pedagogical problem-solving. When networks become primarily a compliance channel, they add to administrative fatigue and discourage participation, especially for teachers who must travel far or cover classes alone. Networks are more feasible when designed for low-resource conditions: small local clusters, rotating host sites, short agendas centered on one classroom problem per cycle, and light-touch follow-up using available communication channels.

Third, teacher welfare is alarmingly low and functions as a binding constraint across the other pillars. Honoraria for non-formal PAUD teachers range between IDR 500,000 and IDR 800,000 per month—far below the regional minimum wage of IDR 2,328,969—and some receive as little as IDR 162,500 per month. Such financial insecurity discourages participation in training, reduces job satisfaction, and contributes to emotional exhaustion; it also pushes some teachers toward additional work that further reduces time for preparation and reflection. Research by Sagita et al. [16] and Hutasuhut et al. [17] affirms that welfare conditions directly influence instructional quality and professional motivation.

Taken together, the three pillars illustrate a broader systemic misalignment between regulatory expectations and institutional capacity. Although local interventions such as scholarships and PAUD-HI training have been initiated, their impact is diluted by the absence of legal recognition and sustainable funding mechanisms for non-formal teachers. Teachers continue to operate in a policy environment where compliance is expected without corresponding structural support. Hogan et al. argue that the institutional status of teachers significantly affects access to resources, rights, and training opportunities [18]. In Manggarai, the exclusion of non-formal teachers from formal frameworks becomes a structural source of inequity, shaping not only welfare but also the feasibility of meeting professional standards. This "standards without status" condition helps explain why professional instability persists even when training and scholarship programs are introduced.

The synthesis reaffirms the need for a holistic reform model that integrates qualification upgrading, embedded coaching, and welfare-focused financing. The success of Surabaya's tiered training model—which combines coaching, welfare incentives, and evaluation mechanisms—offers a replicable framework [19]. For Manggarai, adaptation should prioritize changes in classroom interaction quality over document volume and streamline reporting so it supports, rather than crowds out, pedagogy. Combined with targeted welfare support, this approach can reduce administrative fatigue and make Merdeka Belajar's promise of autonomy more feasible in practice.

Finally, the findings highlight the emotional dimension of professionalism. One teacher's testimony—"We strive to give our best, but without recognition and support, it feels like we're struggling alone"—captures the lived tension between dedication and neglect. Without meaningful recognition, adequate welfare, and supportive professional learning structures, these tensions will persist, undermining the goals of Merdeka Belajar and compromising children's rights to quality early education.

5 Conclusion

This study concludes that building inclusive and sustainable professionalism among PAUD teachers in Manggarai Regency requires an integrated approach encompassing academic qualification, instructional competence, and teacher welfare. Each pillar is interdependent, and none can be meaningfully advanced in isolation. The core challenge lies in the structural misalignment between national regulatory standards and the legal-institutional status of non-formal PAUD teachers. While local initiatives such as scholarships and PAUD-HI training offer promising entry points, they lack the systemic support and sustainability necessary to yield lasting change.

The regulatory paradox remains unresolved: national policies demand compliance with professional standards while denying non-formal teachers the legal status, financial resources, and pedagogical support needed to meet these standards. This exclusion constitutes a form of structural inequity, perpetuating disparities in teacher development and, by extension, in early childhood learning outcomes.

The findings underscore the need for a multi-level strategy that coordinates reforms across national, regional, and institutional levels. At the national level, the Ministry of Education must revise existing legal frameworks to formally recognize non-formal PAUD teachers as professional educators. This recognition is critical for ensuring equitable access to certification, training, and welfare programs. At the regional level, district governments should adopt affirmative regulations and establish performance-based incentives to reward

instructional improvement. Village funds (Dana Desa) and regional budgets (APBD) can be strategically leveraged to support teacher coaching and welfare.

Furthermore, sustainable professionalism cannot be separated from teacher motivation and emotional well-being. Without adequate recognition, teachers feel isolated and undervalued—conditions that erode professional commitment. As previous studies have shown, emotional resilience and economic stability are prerequisites for sustained engagement in professional development.

While this study provides a robust analytical framework based on secondary data, it acknowledges the limitations of its non-empirical methodology. Future research should involve longitudinal field studies and comparative analyses across districts to enhance generalizability and to tailor policy recommendations to diverse local contexts.

The study contributes to the broader discourse on education equity and teacher development in Indonesia. Its findings are particularly relevant for disadvantaged and remote regions, where non-formal PAUD institutions dominate service delivery. By adopting a holistic and context-sensitive model of professionalism, stakeholders can advance the goals of Merdeka Belajar and ensure that every child—regardless of location or socioeconomic background—has access to quality early childhood education.

In sum, systemic reform is not only a policy imperative but also a moral obligation. Only by affirming the professional dignity of all PAUD teachers can Indonesia achieve equitable and high-quality early education for its youngest citizens.

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Building *Manuk Rombeng* Generations: Local Wisdom as the Foundation for Manggarai Education in the Digital Era

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Abstract. This study examines the relevance of Manggarai local wisdom in shaping educational goals amid digital-era challenges. It employs a **qualitative descriptive–analytical approach with a contextual and interpretive orientation**, drawing on in-depth interviews with traditional elders, educators, and community leaders, focus group discussions with youth, and analysis of customary narratives and educational policy documents. The findings show that Manggarai education is grounded in indigenous concepts such as *ngo podo ngasang bodok* (critical enlightenment), *dangka nuk* (multidirectional thinking), and *kudut manga uma duat* (future-oriented self-reliance). In this study, *Manuk Rombeng* refers to an educational philosophy in which success is defined not only by cognitive achievement but by integrated cognitive, affective, and psychomotor development as the basis of holistic character formation. Analysis of the digital generation reveals two key findings: high digital exposure produces superficial learning, and digital skills are weakly connected to future livelihoods. Rather than conflicting with digital culture, *Manuk Rombeng* converges with it by addressing these gaps through intellectual maturity and value internalization. The study recommends embedding reflective digital tasks, locally grounded project-based learning, and digital storytelling into curricula to operationalize *Manuk Rombeng* in digital education.

Keywords: Manggarai local wisdom; indigenous education; qualitative research; digital literacy; *manuk rombeng* philosophy

1 Introduction

The rapid expansion of digital technology has profoundly reshaped educational practices worldwide, bringing both opportunities and disruptions. While digital platforms increase access to information, they also intensify global concerns such as superficial learning, declining critical thinking, ethical erosion, and weakened character formation among young learners [1], [2]. In culturally rooted

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societies, these challenges are particularly acute because digital culture often prioritizes speed, pragmatism, and instant gratification over reflection, intellectual maturity, and moral responsibility. These global trends are increasingly visible in the Manggarai context. Field observations and preliminary interviews with teachers and community leaders indicate that many Manggarai students spend extensive time on social media and short-video platforms, while reading comprehension, reflective dialogue, and critical questioning in classrooms are declining. Teachers report that students frequently seek instant answers from digital sources without evaluating credibility, reproduce information without understanding, and prioritize short-term pragmatic outcomes—such as passing examinations or obtaining certificates—over deep learning and character development. This pattern reflects not only digital dependency but also a weakening of intellectual maturity and future-oriented thinking.

Community elders further observe a declining familiarity among youth with customary life philosophies that once guided resilience, ethical judgment, and long-term life planning. Traditional practices of dialogical learning, communal reflection, and moral formation within families and customary spaces are increasingly replaced by individualized, screen-based interactions. As digital culture becomes dominant in everyday learning experiences, the intergenerational transmission of indigenous educational values has become fragmented, placing Manggarai's cultural foundations under growing pressure.

Within this context, Manggarai local wisdom should not be understood as a collection of isolated moral aphorisms, but as a coherent traditional educational system that integrates cognitive orientation, emotional discipline, ethical reasoning, practical competence, and future planning. This system is articulated through interconnected cultural concepts that function collectively as an indigenous educational philosophy guiding intellectual development, character formation, social responsibility, and personal autonomy.

Historically, Manggarai education has been embedded in the community's social life-world and articulated through principles such as *ngo podo ngasang bodok* (the pursuit of knowledge and intellectual enlightenment), Porot uwa haeng wulang-langkas haeng ntala (having the highest life goals, hopes, or ambitions, rather than minimal or limited ones) and *manuk rombeng* (success is defined not only by cognitive achievement but by integrated cognitive, affective, and psychomotor development as the basis of holistic character formation) [3]. Together, these concepts form a holistic educational framework integrating reflective thinking, moral awareness, emotional regulation, practical competence, and economic self-reliance. While many Indonesian local wisdom traditions emphasize harmony, obedience, or moral conformity, *Manuk Rombeng* is distinctive in its strong emphasis on intellectual maturity, autonomy, and future preparedness.

Previous studies on indigenous and local-wisdom-based education in Indonesia have largely taken three dominant approaches: documenting cultural values as heritage, integrating moral elements into character education, and aligning local traditions with national curriculum mandates [1], [4]. These studies make important contributions by affirming the cultural relevance of indigenous knowledge systems. However, they generally treat local wisdom as supplementary content rather than as a

conceptual framework for diagnosing and addressing contemporary educational problems, particularly those arising from digital learning environments.
This study complements existing research by moving beyond descriptive and normative approaches while offering a new analytical perspective. Rather than positioning *Manuk Rombeng* merely as a cultural value to be preserved, this study conceptualizes it as a value-based educational framework capable of responding directly to epistemic and ethical challenges of the digital era, such as superficial cognition, weakened critical discernment, and unclear life orientation. In doing so, the study extends previous scholarship by demonstrating how indigenous philosophy can function as a practical lens for rethinking digital learning practices.

Unlike value systems that primarily emphasize social conformity or spiritual ethics, *Manuk Rombeng* directly engages with the core deficits of digital learning by emphasizing critical evaluation of information, internalization of values, and responsible application of knowledge. When recontextualized within digital learning environments, it enables technology to function as a medium for reflective learning and purposeful character formation rather than as a source of distraction.

Although digital media offers opportunities to disseminate local wisdom more widely, without pedagogical grounding it risks reducing culture to symbolic or commercialized representations [5]. Therefore, *Manuk Rombeng* must be actively interpreted and operationalized within contemporary educational practices, not merely preserved as cultural heritage. Research on culturally responsive education indicates that integrating indigenous values into curricula strengthens motivation, identity, and learner resilience [1], [4], aligning with Indonesia's national educational goals of developing competent, ethical, creative, and responsible citizens [6].

Given these conditions, the central challenge for Manggarai education is not simply preserving local wisdom, but activating a culturally grounded educational framework that directly addresses digital-era learning problems. This study therefore positions *Manuk Rombeng* as a uniquely Manggarai educational philosophy that offers a novel and context-sensitive contribution to current debates on indigenous education and digital learning, bridging technological competence with intellectual maturity, ethical grounding, and future-oriented autonomy.

2 Method

Research Design
This study adopts a qualitative descriptive–analytical research design to examine how Manggarai local wisdom—particularly the Manuk Rombeng philosophy—functions as a foundation for educational goals in the digital era. A qualitative descriptive approach is appropriate because the study seeks to describe, interpret, and analyze meanings, values, and educational practices as they are understood and experienced by participants, without constructing ethnographic cultural reconstructions or extended participant observation [7], [8].

This approach allows the research to focus on how indigenous educational concepts are articulated, interpreted, and applied within contemporary educational contexts, especially in relation to digital

learning challenges. Qualitative descriptive studies are widely used in educational and cultural research to generate context-sensitive insights that remain close to participants' perspectives while supporting analytical interpretation [9].

Research Site and Context

The study was conducted in Manggarai Regency, East Nusa Tenggara, Indonesia, a region characterized by the continued presence of local wisdom traditions alongside rapidly expanding digital technology use among students. This site was purposively selected because it represents a setting where indigenous educational values and digital learning practices intersect, sometimes in tension. Similar contexts have been identified as critical spaces for examining the relevance of local wisdom in modern education [10], [11].

Participants and Data Sources

Participants were selected using purposive sampling to ensure relevance to the research objectives [7]. The participants included:

1. Traditional elders and customary leaders, who provided interpretations of Manuk Rombeng and related indigenous educational values.
2. Educators (teachers and school principals), who shared observations regarding students' learning behaviors, digital engagement, and character development.
3. Community leaders and cultural practitioners, who reflected on broader socio-educational changes.
4. Students and youth, who participated in focus group discussions to describe their digital learning experiences and future aspirations.

In addition to interviews and discussions, the study analyzed customary narratives, local proverbs, and education-related documents, including curriculum guidelines and policy texts, as complementary data sources supporting descriptive and analytical interpretation [12].

Data Collection Techniques

Data were collected using multiple qualitative methods to enhance depth and credibility [8]:

1. In-depth Semi-Structured Interviews
   Interviews were conducted with elders, educators, and community leaders to explore:
   - Educational meanings of Manuk Rombeng, ngo podo ngasang bodok, dangka nuk, and kudut manga uma duat
   - Observed changes in students' learning and digital behavior
   - Challenges in integrating local wisdom into formal education

   Semi-structured interviews allowed participants to articulate their perspectives while maintaining alignment with the research focus [9].
2. Focus Group Discussions (FGDs)
   FGDs were conducted with students and youth to capture collective patterns related to:
   - Digital media use and learning habits
   - Understanding and internalization of local educational values
   - Self-confidence, motivation, and future orientation

   FGDs are effective for identifying shared experiences and generational trends in educational research [13].

3. Document Analysis
   Document analysis included customary texts, cultural narratives, and education policy documents to contextualize empirical findings within institutional and cultural frameworks [12].

Data Analysis

Data analysis followed a thematic descriptive–analytical procedure [14]. The process involved:

1. Transcribing interviews and FGDs and conducting repeated readings.
2. Coding data to identify recurring themes related to education, digital behavior, and value internalization.
3. Categorizing themes according to key indigenous concepts, with Manuk Rombeng serving as the primary analytical lens.
4. Interpreting patterns to explain how local wisdom shapes or fails to shape students' engagement with digital learning.

In this study, Manuk Rombeng is operationally defined as an educational philosophy in which success is achieved through integrated cognitive, affective, and psychomotor development, forming the basis of holistic character formation and future-oriented autonomy.

Trustworthiness and Rigor

To ensure research rigor, the study employed data triangulation across interviews, FGDs, and document analysis, as well as source triangulation involving elders, educators, and students [8]. Credibility was enhanced through peer debriefing and careful alignment between empirical data and analytical interpretations [9].

Ethical Considerations

Ethical standards were upheld throughout the research process. All participants provided informed consent, confidentiality was maintained, and cultural sensitivity was prioritized in the representation of indigenous knowledge. Local wisdom was treated as a living educational framework rather than merely as cultural heritage to be documented [12].

3 Findings

The findings of this study indicate that educational ideals rooted in Manggarai local wisdom remain strongly recognized at the normative level but are increasingly difficult to realize in everyday educational practice, particularly in the context of the digital era. Data collected from interviews with teachers, parents, customary leaders, and students, as well as classroom and community observations, reveal several key patterns.

First, with regard to *ngo podo ngasang bodok*—the elimination of ignorance through the pursuit of knowledge and critical awareness—most teachers report that students have unprecedented access to information through digital media, yet demonstrate limited depth of understanding. Classroom observations show that many students can recall fragmented information obtained from social media

or search engines but struggle to explain concepts, evaluate sources, or construct coherent arguments. Teachers frequently note that students tend to copy digital content verbatim, indicating that ignorance is no longer characterized by lack of information, but by insufficient critical processing of information.
Second, the findings reveal a decline in *dangka nuk*, or branching and multidirectional thinking. Although students are familiar with multiple digital platforms, learning activities show a strong tendency toward single-answer thinking. When presented with open-ended questions or problem-solving tasks, a significant number of students seek immediate answers online rather than generating alternative ideas or solutions. Educators describe this condition using the local expression *camas kaut* (remaining unchanged), suggesting that formal schooling has not significantly transformed students' ways of thinking despite prolonged exposure to education and digital tools.

Third, empirical data indicate a growing gap between educational attainment and future-oriented self-reliance, which directly affects the realization of *kudut manga uma duat*. Interviews with senior students reveal uncertainty regarding career planning and limited confidence in using their skills for productive or entrepreneurial purposes. Many student's express aspirations for formal employment but lack concrete strategies or competencies to achieve economic independence. This finding is reinforced by parental narratives that measure educational success not merely by diplomas, but by the ability to secure or create sustainable livelihoods.

Fourth, community rituals and everyday metaphors continue to reflect the ideal of *Manuk Rombeng*, understood as holistic success encompassing cognitive, affective, and psychomotor development. However, observational data suggest that contemporary schooling practices increasingly prioritize academic scores and administrative completion over character formation, work ethic, and life skills. Teachers and community elders consistently emphasize that students who excel academically but lack discipline, independence, or social responsibility are not regarded as having achieved *Manuk Rombeng* status.

Finally, the findings highlight structural challenges that further constrain these educational ideals. Economic limitations and unequal access to digital devices force many students to rely on shared smartphones, free Wi-Fi, or borrowed internet access, disrupting learning continuity. At the same time, intensive engagement with digital entertainment contributes to shallow learning habits and weak internalization of moral values traditionally emphasized in Manggarai culture, such as politeness, humility, and social responsibility.

Overall, the data show that while Manggarai educational values remain culturally authoritative, their practical realization is increasingly undermined by superficial digital learning practices, limited critical engagement, and fragile links between education and future economic independence.

4 Discussion

The findings demonstrate that the educational ideals of the Manggarai community—particularly those encapsulated in *Manuk Rombeng*, *ngo podo ngasang bodok*, *dangka nuk*, and

kudut manga uma duat—remain conceptually strong in shaping ethical and reflective engagement with digital technologies. However, empirical evidence indicates that these values are gradually losing practical influence in everyday educational contexts, especially among students immersed in instant, algorithm-driven digital culture. Similar patterns have been identified in global studies showing that digital platforms tend to privilege speed, surface engagement, and measurable performance over reflective learning and character formation [15], [16]. This section explains the causes of this erosion and proposes operational strategies for translating *Manuk Rombeng* into viable digital learning practices.

1. Why *Manuk Rombeng* Struggles in Instant Digital Culture

The weakening of *Manuk Rombeng* is not the result of cultural obsolescence, but rather of an incompatibility between its formative logic and the dominant architecture of digital platforms. Contemporary digital environments prioritize immediacy, entertainment value, and quantifiable engagement indicators such as likes, views, and completion speed [15], [18]. In contrast, *Manuk Rombeng* emphasizes long-term character formation, self-regulation, and the integration of cognitive, affective, and psychomotor development.

Moreover, *Manuk Rombeng* has traditionally been transmitted through embodied and communal educational processes—rituals, storytelling, dialogical interaction, and lived exemplars provided by elders and teachers. Digital learning spaces, however, often isolate learners from these communal contexts, transforming education into an individualized, screen-centered activity. As noted by Turkle [21], such environments reduce opportunities for sustained dialogue and moral reflection, causing learners to perceive indigenous values as symbolic cultural knowledge rather than as practical guides for navigating digital life.

2. Risks of Cultural Nostalgia Without Pedagogical Translation

When local wisdom is preserved only as discourse, ritual, or cultural identity, it risks becoming nostalgic rather than transformative. Research on culturally responsive and indigenous education consistently shows that cultural values lose pedagogical force when they are not embedded in daily learning practices, assessment systems, and learner experiences [4], [20]. In the Manggarai context, this risk becomes evident when students are able to articulate metaphors such as *manuk rombeng* but fail to demonstrate critical digital judgment, creative problem-solving, or future-oriented planning. Without systematic pedagogical translation, indigenous philosophy remains detached from learners' lived digital realities.

3. Operational Strategies: Teaching *Manuk Rombeng* Through Digital Platforms

To ensure that *Manuk Rombeng* remains a living educational philosophy, it must be translated into concrete digital pedagogical practices. Several operational strategies emerge from the findings and supporting literature.

a. Digital Storytelling and Creative Content Production

Manuk Rombeng can be reinterpreted through short digital narratives, animations, podcasts, or student-produced videos that contextualize local metaphors within contemporary digital life. Digital storytelling has been shown to enhance meaning-making, identity formation, and reflective learning when grounded in local culture [5], [21].

b. Local Value–Based Gamification

Educational games or gamified modules can embed *Manuk Rombeng* values into decision-making scenarios. Learners may be required to verify information (*ngo podo ngasang bodok*), explore multiple solutions (*dangka nuk*), and consider long-term consequences (*kudut manga uma duat*). Unlike entertainment-oriented gamification, value-based gamification emphasizes ethical reasoning, reflection, and delayed gratification [17].

c. Digital Community Dialogue and Reflective Forums

Online discussion forums and learning management systems can function as virtual communal spaces where students analyze digital dilemmas—such as misinformation, online conflict, and career uncertainty—using *Manuk Rombeng* as an interpretive lens. Research on dialogical digital pedagogy highlights the importance of guided reflection and community presence in sustaining ethical digital engagement [21], [22].

4. Project-Based Digital Learning Linked to Livelihood (*Kudut Manga Uma Duat*)

Students can be guided to use digital tools for productive purposes, including small-scale digital entrepreneurship, skill portfolios, or documentation of local economic practices. This approach aligns education with future-oriented self-reliance and echoes development theories emphasizing capability, agency, and sustainable livelihoods [19].

5. Value-Based Digital Assessment

Assessment systems should include reflective digital journals, multimedia portfolios, and peer feedback that evaluate not only knowledge mastery but also ethical awareness, creativity, resilience, and independence. Such assessments make the intangible dimensions of *Manuk Rombeng* visible and pedagogically accountable, addressing critiques of measurement-driven education [20].

6. Repositioning Teachers as Cultural–Digital Mediators

The effectiveness of these strategies depends heavily on teacher agency. Teachers must function as cultural–digital mediators who model reflective digital behavior, ethical discernment, and future-oriented thinking. Studies on Digital Citizenship education emphasize that learners' digital ethics are strongly shaped by teacher modeling and value-based guidance rather than technical instruction alone [6], [17].

7. *Manuk Rombeng* as a Living Framework for Digital Education

Taken together, these strategies demonstrate that *Manuk Rombeng* does not lose relevance because of digitalization itself, but because it has not yet been systematically translated into digital pedagogical logic. When embedded in creative content production, gamified learning, community dialogue, and authentic assessment, *Manuk Rombeng* functions as a powerful indigenous framework that regulates digital behavior, fosters critical awareness, and sustains future-oriented autonomy. Rather than resisting modernity, *Manuk Rombeng* offers a culturally grounded pathway for rehumanizing digital education—affirming that educational success lies not in speed or technical efficiency, but in the formation of whole, resilient, and responsible human beings.

5 Conclusion

This study demonstrates that *Manuk Rombeng* and related Manggarai educational values constitute a coherent indigenous framework for addressing the ethical, cognitive, and developmental challenges of digital-era education. Rather than being rendered obsolete by digitalization, these values remain conceptually robust but are increasingly marginalized due to the dominance of instant, performance-oriented digital culture and the lack of systematic pedagogical translation into contemporary learning environments.

The findings affirm that *Manuk Rombeng* functions as a holistic educational orientation integrating intellectual maturity, moral responsibility, creativity, and future-oriented autonomy—dimensions that are often fragmented within mainstream digital literacy and Digital Citizenship frameworks. By situating digital engagement within culturally grounded value systems, this study extends global theories of digital education beyond technical competence and instrumental rationality toward a more integrated human development perspective.

Importantly, this research moves beyond cultural preservation discourse by offering operational pathways for revitalizing indigenous wisdom in digital education. Through value-based digital storytelling, project-oriented learning, gamification grounded in local ethics, reflective digital assessment, and teacher-mediated cultural translation, *Manuk Rombeng* can be transformed into a living pedagogical framework rather than a symbolic heritage narrative. Such strategies enable digital technologies to function as instruments for character formation, critical thinking, and sustainable livelihood preparation.

In conclusion, the relevance of *Manuk Rombeng* lies not in resisting digital modernity but in reorienting it. When consciously integrated into digital pedagogy, Manggarai local wisdom offers a culturally responsive alternative epistemology capable of counterbalancing superficial learning, ethical erosion, and weakened future orientation.

Indigenous finding: *Manuk Rombeng represents an indigenous epistemology in which successful digital competence is meaningful only when it simultaneously develops the learner's cognitive, affective, and psychometric dimensions, leading to intellectual maturity, moral integrity, creative adaptability, and future-oriented self-reliance within a communal cultural context.*

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Educational Leadership in the Age of Artificial Intelligence: A Systematic Review of Trends, Challenges, and Future Implications

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Abstract. This study examines the development, challenges, and future of educational leadership in the age of artificial intelligence by conducting a systematic literature review based on PRISMA 2020. This research includes forty articles listed in Scopus, SINTA, and DOAJ, published between 2020 and 2025. The study results highlight six key areas of focus: AI-driven leadership transformation, digital skills of leaders, adaptive management, responsible ethics, human resource readiness, and future forecasting. These six points form the foundation of resilient leadership, emphasizing the importance of integrating technological capabilities, sensitivity to values, and responsiveness to policies. Artificial intelligence is not intended to replace humans, but rather to strengthen human values thru empathy and data-driven decision-making. Responding to the changes in the current educational landscape, especially in the inclusive and sustainable context of Indonesia, this research emphasizes the need for competent and human-centered digital leadership models.

Keywords: Educational Leadership, Artificial Intelligence, Digital Ethics, Educational Governance

1. Introduction

The development of artificial intelligence opens a new era in educational leadership in the 21st century. The use of AI, as explained by [1], includes automated assessment, personalized learning, and data-driven recommendation systems. The speed of technology adoption has not yet demonstrated sufficient readiness from educators or an adequate ethical framework. Research by [2] revealed that some universities in Sweden are beginning to draft regulations for the use of generative AI, although the implementation of these policies varies across faculties, leading to imbalances in management and inconsistent practices. This situation shows that AI-based digital transformation is not just a technological issue, but a leadership challenge that requires broad vision, ethical thinking, and sensitivity to humanity. New steps in artificial intelligence-based education require strengthening values, cooperation between

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stakeholders, and policies that support humanity so that future leadership remains grounded in justice, empathy, and social responsibility.

The emergence of artificial intelligence has begun to reshape the meaning and direction of educational leadership. As technology becomes more deeply embedded in schools, principals are using AI tools to simplify administrative work, interpret learning data, and improve the quality of communication that informs decision-making [3]. At the same time, leadership that remains centered on human values is essential for ensuring that the use of technology supports moral purpose and social sustainability [4]. These perspectives emphasize that effective leaders must go beyond responding to data or predictions; they need the courage to act ethically and to keep human dignity at the core of every decision. The influence of AI therefore extends beyond technical efficiency as it challenges leaders to think clearly, act with integrity, and guide innovation with wisdom and compassion.

Recent studies show that digital leadership and transformational leadership provide a solid conceptual foundation for the development of artificial intelligence-based educational leadership. The digital transformational leadership approach has proven capable of empowering educators thru continuous professional support and the creation of a learning culture that fosters technological innovation [5]. Digital leadership competencies reflect the strategic dimensions used to assess the extent to which institutions are able to adaptively respond to the challenges of the Fourth Industrial Revolution [6]. The effectiveness of digital leadership in enhancing student engagement thru AI-based learning has also been demonstrated in the context of higher education [7]. These three studies show that effective leaders are adaptable, collaborative, and technologically proficient. The ability to unite human values, strategic direction, and digital proficiency emerges as the core of educational leadership capable of inclusively and meaningfully addressing the challenges of artificial intelligence.

Various studies show that understanding AI-driven leadership can enhance leadership capabilities in the age of artificial intelligence. The three key skills required by today's leaders are technical skills, adaptability, and transformational strength [8].According to [9] and [10], six key qualities will shape future leaders: technological literacy, data management, human-centered thinking, change management, ethical evaluation, and long-term strategic vision. The research findings indicate that effective leadership is not solely focused on technical aspects. Effective leadership also requires deep reflection, sensitivity to ethical issues, and a clear vision of how to address the potential and risks associated with AI usage. To ensure that changes in the world of education remain consistent, leaders are highly reliant on their ability to balance technological advancements with human wisdom.

Ethical issues play an important role in modern discussions about the use of technology. The development of the AI Ethics Compass reflects the answer to the need for principles such as transparency, accountability, fairness, inclusivity, and human

oversight in the process of creating artificial intelligence [11]. Uncertainty regarding moral boundaries in AI implementation raises serious concerns about its impact on social and educational fields, especially when the technology is used without considering the relationship between humans and the AI systems themselves [12]. The ethical leadership framework is designed as a conceptual approach to align strategic considerations with moral values in shaping the interaction between humans and AI [13]. These three thoughts emphasize the importance of educational leadership as the main actor in ensuring integrity in the use of technology, so that AI not only focuses on system efficiency, but also on significantly developing human values.

The transformation of artificial intelligence-based education places human resource readiness as the primary determinant of successful technology integration. Sole reliance on system sophistication is not enough to guaranty effective implementation without the adaptive capacity of the educational actors directly involved. The potential of AI to drive efficiency and innovation can only be realized if lecturers and educational staff master strategic competencies aligned with the digital ecosystem [10]. Nationwide structural barriers remain a weakness, including infrastructure disparities, low digital literacy, and the absence of standard policies capable of bridging the complexities of change [14]. Individual levels also show uneven dynamics, reflected in the digital literacy gap and emotional resistance to technology-based transformation [15], [16]. Social support-based interventions have been shown to contribute positively to students' adaptation processes in AI-based learning environments [17]. The consistency of these findings underscores the importance of educational leadership capable of integrating digital skills with social-emotional sensitivity, ensuring that the transformation agenda proceeds fairly, inclusively, and sustainably.

Recent literature highlights new dimensions of academic assessment and integrity in response to the advent of generative AI, which necessitates fundamental reformulations in the design of learning evaluations and academic ethics systems. The shift from cognitive assessment toward a holistic approach has been proposed as a strategic response to the risk of plagiarism facilitated by artificial intelligence [18]. Inconsistencies between academic integrity policy plans and institutional practices still pose a significant barrier to consistent implementation [19]. This challenge underscores the urgency for academic leadership capable of adaptively reconstructing the evaluation system in line with the dynamics of the digital ecosystem.

A detailed review of the literature reveals four significant gaps that deserve attention. First, the understanding of artificial intelligence remains confined to the idea of technological efficiency, rather than being viewed as a transformative force that can shape the values and daily practices of educational leadership ([5]. Second, there is still no comprehensive conceptual model that brings together digital literacy, institutional governance, and ethical dimensions within a single leadership framework [8], [20]. Third, studies conducted in developing countries remain few and tend to be descriptive, providing little theoretical depth or conceptual innovation [10], [14]. Finally, the continuing gap between policy intentions and what happens in practice remains a major

obstacle to realizing genuine digital transformation within educational institutions [2], [21].

The analysis presented indicates the need for developing a conceptual framework for artificial intelligence-based educational leadership that comprehensively integrates technological competence, ethical governance, and sensitivity to human values. The proposed model includes three main spectrums. The first spectrum, AI-capable leadership, reflects leadership that masters technological literacy and utilizes data as the foundation for evidence-based decision-making. The second spectrum, AI-governed leadership, emphasizes a deep understanding of technology policies and regulations, as well as the capacity to design adaptive and contextual governance systems. The third spectrum, AI-ethical leadership, focuses on upholding moral principles, distributive justice, and empathy at every stage of technology implementation. The integration of these three spectra forms a leadership configuration that is digitally resilient, ethically sound, and socially responsive. This framework is expected to address the epistemological and practical challenges of digital transformation in the education sector, while also ensuring that AI is used in a way that is grounded in human values and implemented responsibly, inclusively, and sustainably.

2. Research Methods

This study applies the Systematic Literature Review (SLR) approach, referring to the PRISMA 2020 guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), to ensure that the literature search, selection, and synthesis process is systematic, transparent, and replicable. This approach was chosen because it provides a relevant and valid framework for gathering and critically evaluating the diverse studies that address artificial intelligence-based leadership in the context of education. The data sources consist of scientific publications published throughout the period from 2020 to 2025, obtained thru reputable databases such as Scopus, Web of Science, Taylor & Francis, SpringerLink, DOAJ, as well as two national databases, namely SINTA and Garuda.

The article search utilized a mix of keywords structured with Boolean logic (AND, OR), which included phrases like artificial intelligence, AI, educational leadership, school leadership, digital leadership, ethics, policy, competency, readiness, and transformation. The choice of words was tailored to align with the study's objectives to collect literature that specifically connects leadership and education with the use of artificial intelligence. The publication timeframe is restricted to 2020–2025 to reflect contemporary academic discussions. Preliminary searches across multiple scholarly databases resulted in 120 articles identified as relevant through their titles and keyword analysis.

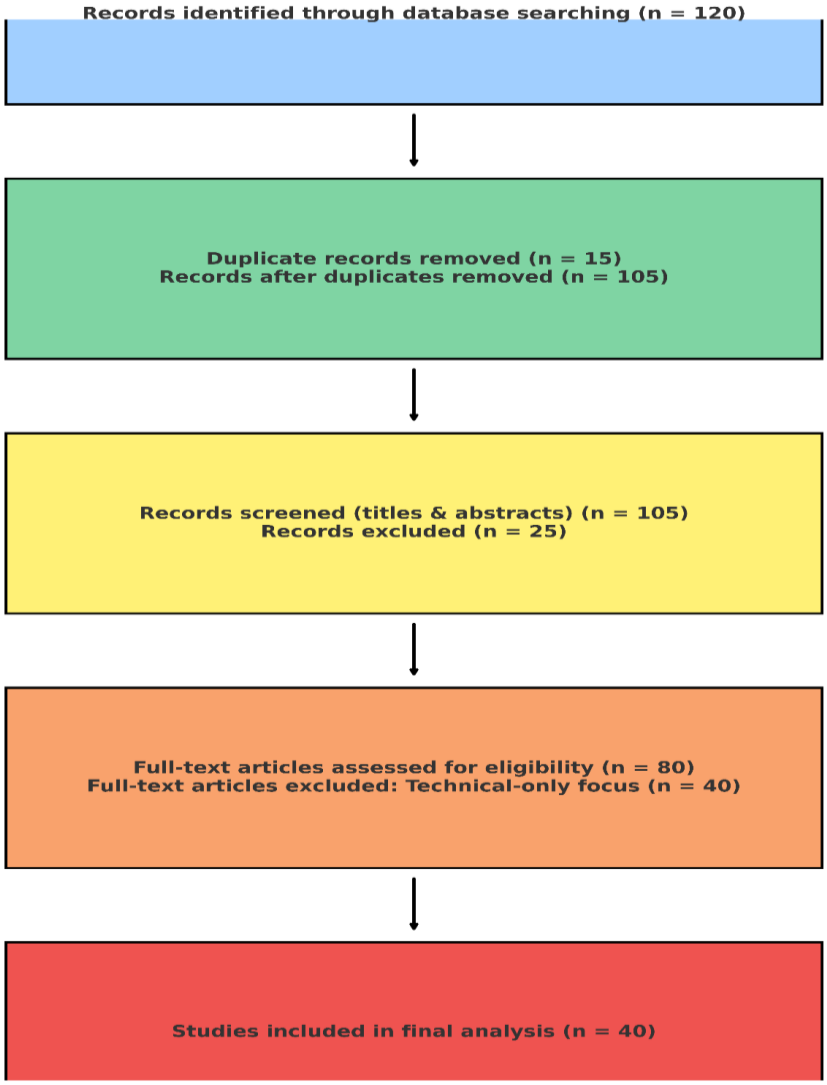

Figure 1. Prism Flowchart

Based on Figure 1, the selection process follows four phases within the PRISMA framework: identification, screening, eligibility, and inclusion. A total of 120 articles were identified in the initial stage. The initial screening process eliminated 15 duplicate articles, resulting in 105 articles for further analysis. The title and abstract evaluation at the screening stage led to the exclusion of 25 irrelevant articles, leaving 80. A full content review showed that 40 articles only discussed the technical aspects of artificial intelligence without relevance to educational leadership. A total of 40 final articles met

the criteria for analysis. Inclusion is based on publications from 2020–2025, in English or Indonesian, full text, and indexed in Scopus, SINTA, or DOAJ.

This study uses bibliometric analysis with VOSviewer to supplement the systematic literature review approach based on PRISMA 2020. Scopus, Web of Science, Taylor & Francis, SpringerLink, DOAJ, and SINTA provided the data for 40 publications, which were then evaluated in RIS and CSV formats. The co-authorship network, keyword co-occurrence, and the visualization of research structure and direction (density and overlay visualization) were the three primary areas of attention for the analysis.

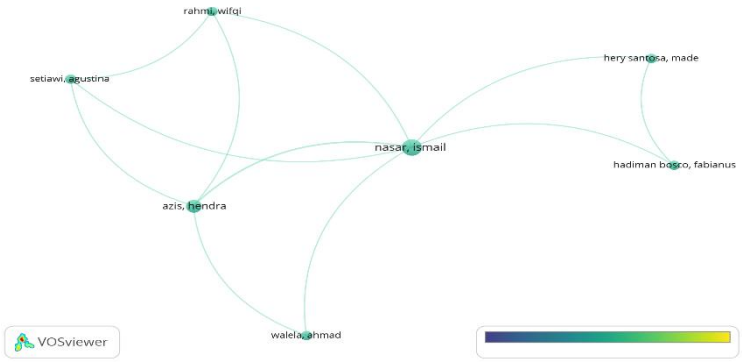

Figure 2. Co-authorship network visualization

This co-authorship network gives a glimpse into how researchers are connected through collaboration. It appears that nasar ismail occupies a central position, linking with several other authors, which may suggest a more active role in joint research. At the same time, smaller clusters can be seen, indicating collaborations within more specific groups. The variation in color likely reflects the closeness of these relationships. Overall, the pattern suggests a network that is somewhat centralized, yet still shows a spread of collaborative connections.

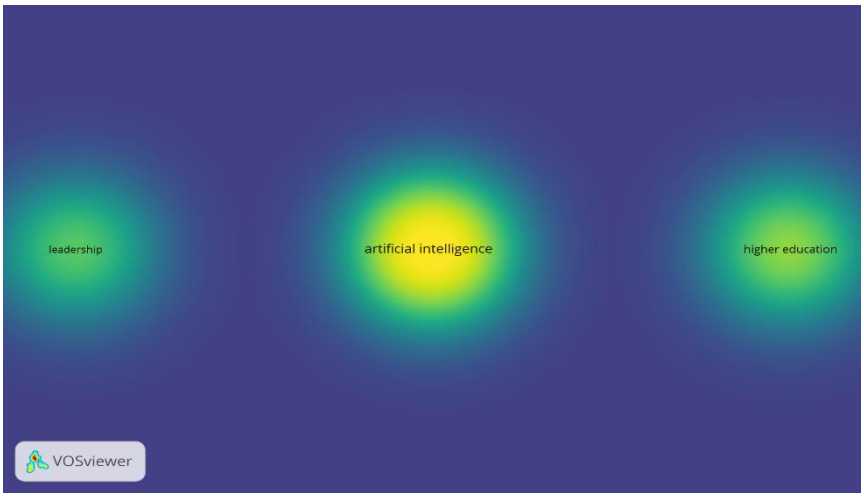

Figure 3. Keyword co-occurrence network

From this visualization, artificial intelligence clearly takes the spotlight as the most dominant term. It appears more prominent compared to the others. On one side, there is leadership, and on the other, higher education, both still connected but not very densely. This gives the impression that existing studies are starting to explore how AI relates to leadership and higher education contexts. The pattern itself is not overly complex, yet it already points to a fairly clear direction in the research focus.

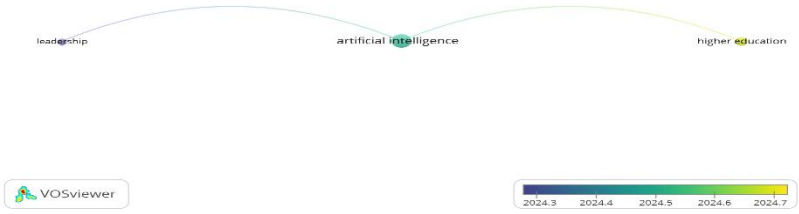

Figure 4. Overlay visualization of research trends

After further examination, this visualization appears to resemble a timeline of research interests. The initial emphasis appears to be on leadership. Then, artificial intelligence emerges, serving as a quasi-bridge to more recent discourse. Ultimately, postsecondary education is perceived as a more recent subject. The variations in color suggest that there have been alterations over time. Overall, it suggests that the research focus is in a state of flux, adapting to the changing requirements and contexts.

3. Results and Discussion

Results

3.1 Tren Global dan Evolusi Kepemimpinan AI

The incorporation of artificial intelligence in educational settings is bringing about significant changes in leadership approaches. AI is being incorporated into curricula and evaluation processes in tertiary education [1]. The movement towards leadership based on data requires a thoughtful and adaptable mindset [3]. Human-centered values continue to play a crucial role in addressing challenges posed by digital innovations [4]. In rural areas, the success of adaptable leadership in embracing technology has been clearly demonstrated [22]. Ethical dilemmas arise from the need to manage algorithms and the conflict between human oversight and automated decision-making [13], [23]. The effectiveness of executing these changes largely depends on the emotional preparedness of teachers [16].

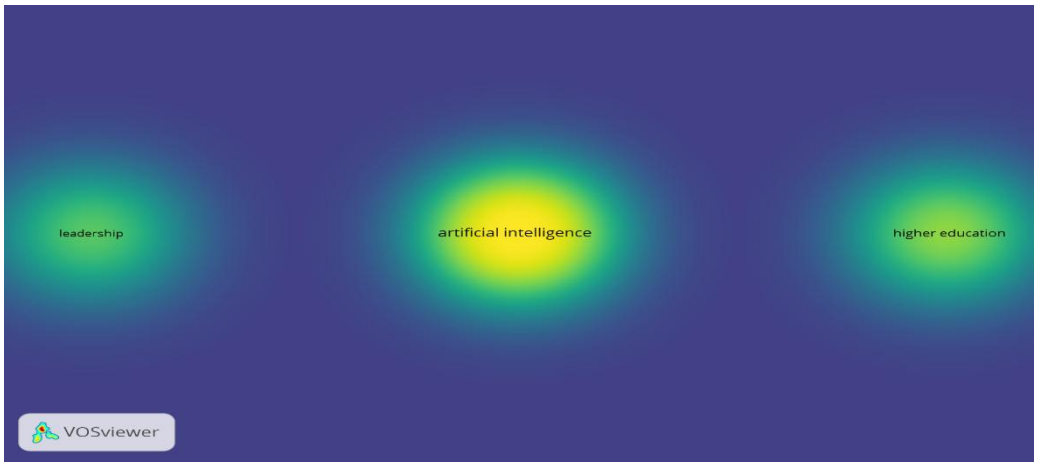

Figure 5. Density Visualization Map

Based on Figure 5, the density map shows the dominance of the artificial intelligence theme in the literature, followed by leadership and higher education. The color yellow represents the highest intensity of AI topic emergence within the time frame of 2020 to 2025.

3.2 Capabilities and Competencies of AI-Based Educational Leaders

Recent research points to the increasing importance of developing strong leadership qualities as artificial intelligence begins to shape how education evolves. Leaders who understand the process of digital transformation are better able to guide teachers in adopting and using AI related technologies effectively [5]. Effective leadership in this area requires a mix of technical expertise, adaptability, and the capacity to inspire

change, qualities that help leaders respond to the demands of the digital age [8]. In addition, several core competencies such as technological literacy, ethical awareness, and sensitivity to human values form the moral and intellectual basis for nurturing visionary educational leaders [9]. Leaders who are confident in using digital tools often drive innovation by fostering teamwork and creative thinking within their institutions [6]. A mindset built on empathy and social understanding further supports leadership success in an era of rapid technological progress [24]. Evidence also suggests that training in digital leadership can significantly strengthen institutional effectiveness [25]. In Indonesia, the growing emphasis on improving teachers' digital competence highlights the importance of well-designed professional learning and collective growth through collaboration [14], [26]. Pre-service teachers see AI as a helpful and efficient tool, yet they remain cautious about relying on it too much or using it in unethical ways. Hence, teacher education should include both practical skills and ethical reflection to build responsible and well-balanced AI literacy among future educators [27].

3.3. AI Governance and Policy

Recent studies show that using artificial intelligence in education is still a complicated process. Many schools and universities are unsure how to translate existing policies into actions that are fair and workable. Although several frameworks have tried to link teaching practice, management, and technology, real implementation tends to move slowly and inconsistently [2], [28]. Within classroom settings, differences often emerge between how lecturers and students perceive the role of generative AI in coursework. Many educators see it as a helpful extension of learning, whereas students sometimes question its proper use and ethical boundaries. These contrasting views reveal the need for clearer guidelines, fair rubrics, and mutual understanding so that institutional policies align with daily teaching practices [29]. In many cases, policy efforts focus more on improving administration than on changing how learning actually happens in classrooms [30]. For AI to bring real benefit, leaders need to make careful use of data while ensuring that every learner has equal access and opportunity [31]. Concerns about data privacy and security still make many educators hesitant to use new digital systems [10]. The effectiveness of AI adoption finally depends on teachers' trust and the presence of supportive policies [32]. Without strong ethical standards and clear regulation, it will be difficult to ensure that AI contributes to education in a fair and responsible way [18], [33].

3.4 Ethics and Responsible Leadership

Ethical awareness has become a central concern in educational leadership as artificial intelligence grows more influential. Many scholars stress that leaders need a strong moral compass to guide decisions involving technology and to ensure fairness in how algorithms are applied [11]. Without clear ethical principles, the use of AI can deepen social inequality and reduce the sense of justice in education [12]. While AI improves communication speed and efficiency, it also risks weakening empathy and

genuine human connection among educators and learners [34]. When guided by ethical understanding, technology can instead reinforce trust and responsibility in leadership [35]. In higher education, tensions between academic integrity policies and technological realities remain visible, demanding renewed attention to honesty and fairness in assessment practices [18], [19] [36]. Ultimately, consistent moral reflection and self-awareness among leaders form the core of responsible and sustainable digital leadership in the age of AI [9]

3.5 Human Resource Readiness and Organizational

Transformation Various studies emphasize the importance of human resource readiness as a key foundation for supporting AI-based educational transformation. Training, digital literacy, and organizational culture adaptation are strategic components in this process. Significant challenges still exist in Indonesia, particularly regarding the digital divide among teachers and the limited technical training for higher education staff [37] [10], [14]. Students' low digital literacy regarding technological innovation raises doubts about their readiness to face an AI-based learning ecosystem [15]. Faculty resistance to the use of AI is often rooted in a lack of systematic technical training and support [16]. University instructors show a wide range of responses when it comes to using AI in their teaching. Some approach it with curiosity and confidence, experimenting with new ideas, while others remain more restrained, weighing the risks and benefits carefully. These differences point to the need for professional learning that respects individual confidence levels and teaching philosophies [38].Organizational culture factors that do not yet support digital change also pose a significant obstacle, as reflected in studies at Moroccan educational institutions [39], Continuous training has been proven to contribute to strengthening organizational transformation toward a technology-adaptive learning system [25]. Digital leadership consistently shapes an innovative culture in educational settings [6]. Collaboration among educators increased under leadership that integrated AI into professional practice [3]. The use of AI by students, including applications like ChatGPT, underscores the need for a clear ethical framework to ensure technology is used in line with principles of academic integrity [40].

3.6 The Future of AI-Based Educational Leadership

The future of educational leadership will depend on how well technology can walk hand in hand with moral understanding. Leaders of the next generation are expected not only to master digital tools but also to make thoughtful and ethical decisions in every innovation they adopt [20]. True digital transformation must be rooted in collaboration and a strong sense of social justice [4]. While technology can automate many tasks, empathy will always remain a uniquely human strength that no machine can imitate [35]. Educational leaders must learn to read the signs of change, guide shared values, and respond wisely to technological disruptions [8], [11]. Continuous moral reflection helps keep the relationship between humans and AI grounded in responsibility and care [13]. With foresight and readiness, institutions can face the

challenges of artificial intelligence while ensuring that technology continues to serve education, not define it [7].

4. Discussion

An examination of the included studies reveals that educational leadership in the era of artificial intelligence is influenced by several emerging trends. Firstly, educational leadership is progressively adopting data-driven governance, wherein AI-powered analytics facilitate strategic planning, oversight, and decision-making activities. Secondly, the literature consistently highlights AI and digital literacy as fundamental leadership competencies, indicating that leaders are anticipated to possess an understanding of AI tools, interpret data outputs, and steer institutional adaptation. Third, recent research emphasizes an increasing emphasis on human-centric and responsible AI leadership, where ethical governance, transparency, and fairness serve as essential principles for the integration of AI. These trends collectively corroborate that AI is not merely an instructional technology, but a transformational force influencing how educational leadership is conceptualized and practiced. Yet, several researchers caution that an excessive focus on efficiency may weaken essential human values, social justice, and the independence of educational institutions [12], [23]. The leaders of the future will need to blend digital expertise with ethical commitment to ensure that technology serves educational progress in an equitable and sustainable way.

Despite these encouraging developments, the review also identifies significant challenges that could impede the successful incorporation of AI in educational leadership. One of the most significant concerns involves ethical risks, such as algorithmic bias, limited transparency of AI systems, and ambiguous accountability when AI recommendations impact educational decisions. Furthermore, data privacy and security continue to be significant concerns, as AI-driven systems necessitate extensive data acquisition that may compromise sensitive information pertaining to students and educators. The review also underscores organizational readiness challenges, including disparities in infrastructure, limited access to dependable digital systems, and inadequate technical support across numerous institutions. Moreover, a persistent capacity deficit remains apparent: leaders may implement AI tools without sufficient awareness of their limitations, thereby elevating the risk of over-dependence on automated outputs rather than enhancing professional judgment and contextual decision-making. The successful implementation of AI in educational settings heavily relies on leadership's capacity to cultivate an organizational culture that supports continuous and adaptive learning [5], [6], [9]. Several studies indicate that AI policies in various countries still focus on administrative efficiency, with limited attention given to integrating ethical values and social sustainability into their design and implementation [21], [28]. This condition reinforces the urgency of developing a comprehensive and value-oriented leadership approach, so that technology is not only operated technically, but also wisely to support the humanitarian vision and social responsibility of educational institutions.

Looking forward, the findings indicate significant future implications for the advancement of educational leadership development, policy formulation, and research. Leaders will progressively necessitate a comprehensive skill set encompassing AI literacy, data stewardship, ethical deliberation, and adaptive change management, guaranteeing that AI serves to complement rather than supplant human judgment. At the institutional level, educational institutions and authorities should establish comprehensive AI governance frameworks that delineate transparency standards, accountability procedures, and measures to ensure equity and inclusivity. Practically, leadership development initiatives should integrate structured professional learning on AI-assisted decision-making, risk mitigation, and the ethical implementation of technology. Future research should extend beyond theoretical analysis by undertaking empirical studies across varied contexts, exploring the long-term impacts of AI integration on school culture and educational results, and creating reliable tools to assess AI leadership preparedness. Overall, this evaluation confirms that the future of AI-integrated leadership relies on harmonizing innovation with ethical accountability and human-centered educational principles. True leadership is not measured by technical mastery alone, but by the ability to uphold fairness, honesty, and public trust [11], [33], [35]. The readiness of human resources remains a major factor, especially in developing contexts where digital competence is still uneven [10], [14], [25]. In Indonesia and other Southeast Asian countries, the integration of AI in education depends greatly on the clarity of national policies and the strength of institutional leaders in managing change with ethical sensitivity. When leadership is guided by values as well as vision, technology can truly become a tool for inclusive and sustainable educational growth.

At the heart of AI-based educational leadership lies an ethical dimension that ties all themes together and reminds us that digital change must remain accountable to people. Leadership in this era is judged not by technical mastery but by fairness, honesty, and the trust it earns from the community [11], [33], [35]. The strength of human resources is equally decisive, particularly in developing regions where digital competence still varies widely [10], [14], [25]. Across Indonesia and Southeast Asia, the success of AI integration depends on how clearly national policies are framed and how effectively institutional leaders steer change with ethical awareness. When moral reflection guides innovation, technology becomes a means to widen access, uphold integrity, and sustain inclusive educational growth.

5. Conclusion

This study highlights that effective educational leadership in the era of artificial intelligence depends on finding a balance between technological capability and human wisdom. Leaders are expected not only to understand digital tools but also to respond to technological change with ethical awareness and empathy. The findings show a growing movement toward evidence-based and adaptable leadership that values fairness and social responsibility. The future of leadership will rely on the ability to

combine data-informed decisions with moral reflection and human sensitivity. Ultimately, true digital leadership unites technical skill with integrity, creating an educational environment that is fair, inclusive, and sustainable.

This systematic analysis shows that educational leadership in the age of artificial intelligence is increasingly defined by three interconnected components: emerging trends, substantial problems, and future consequences. The current trends include data-driven governance, the growing importance of AI and digital literacy for leaders, and a greater emphasis on responsible and human-centered leadership. Nonetheless, the study reveals persisting issues such as algorithmic bias, insufficient transparency, data privacy concerns, uneven levels of institutional readiness, and capability gaps among leadership and individuals. As a result, future leadership development and policy should prioritize AI literacy, ethical governance, and inclusive implementation strategies to ensure that AI improves educational quality while promoting equity. Future research should prioritize empirical studies in a range of educational settings, investigate the long-term implications on corporate culture and performance, and develop strong frameworks for assessing AI-leadership preparation.

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Smart School Leadership in the Digital Era: Integrating Technology, Ethics, and Collaboration in Education

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Abstract. The era of technological disruption is fundamentally transforming educational leadership practices. This study examines the evolution of the principal's role from an administrative manager to a strategic leader who integrates artificial intelligence and data analysis into the decision-making process. Through a systematic review of 37 scientific publications from 2020-2025, this research successfully mapped four domains of digital leadership competency: (1) adapting AI systems in school management, (2) implementing a data-driven decision-making culture, (3) developing a collaborative-innovative leadership model, and (4) integrating digital ethics and sustainability principles. The research findings recommend the Smart School Leadership model as a conceptual framework that synergistically integrates technological, analytical, and humanistic competencies. This study not only updates the discourse on educational leadership in Indonesia but also proposes the AI-Augmented Leadership paradigm, which is responsive to the challenges of 21st-century education.

Keywords: School Leadership, Artificial Intelligence, Data Analytics, Decision-Making, Smart Education.

1. Introduction

The global acceleration of digital transformation in education has positioned school principals as change agents rather than administrative managers. International policy frameworks and empirical research continuously underline that effective digital transformation depends not only on technological infrastructure but also on leadership capability, notably principals' digital literacy and data.-the ability to make educated decisions. Transformations in data analysis technology and artificial intelligence have changed the structure of educational institutions worldwide. Research conducted by [1],

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[2] indicates that AI supports school principals in performing managerial tasks, ranging from learning evaluation to predicting student learning outcomes. AI-driven leadership not only improves efficiency but also enhances accuracy in strategic decision-making, as revealed by [3] and [4]. In recent decades, data-driven methods have become increasingly dominant in policy-making in schools. Research by [5], [6], and [7] emphasizes the importance of a data-driven culture as a key factor for students' academic success. The shift from intuition-based leadership to an evidence-based approach, as noted by [8] and [9], marks the beginning of a more analytical and rational-driven era of educational leadership.

The globalization of digital technology and artificial intelligence (AI) in educational leadership is increasing. The free learning policy in Indonesia requires school leaders to have the ability to implement flexible and data-driven learning approaches. However, various obstacles continue to hinder its implementation. This condition includes infrastructure limitations, access gaps, and low levels of digital literacy among educators [10], [11]. Digital literacy at the higher education level is typically limited to basic skills, and understanding of new technologies like AI and data analytics is still low. This condition indicates that digital barriers are systemic and can affect the ability of educational institution leaders to respond to policy changes [12]. Therefore, we need a leadership model that is not only administrative but also strategically utilizes technology to support sustainable learning transformation.

In the Indonesian context, this challenge becomes more pronounced under the *Merdeka Belajar* policy, which grants schools greater curricular autonomy while simultaneously demanding adaptive, reflective, and innovation-oriented leadership. The policy expects schools to implement learner-centered pedagogy, formative assessment, and contextualized curriculum design—yet these expectations require principals who can interpret evidence, coach teachers, and organize school-level learning improvement cycles. The Merdeka Belajar policy in Indonesia requires school principals to act as learning leaders and innovators in digital transformation. The study's findings reveal significant limitations in digital literacy and low utilization of data-driven culture among the majority of school principals. The direct influence of digital leadership on the integration of Information and Communication Technology (ICT) by teachers was confirmed in [13] research, while the effectiveness of the transformational approach in improving educators' digital literacy was also successfully identified by [14]. The discourse on this is expanded with a focus on the ethical and digital sustainability challenges highlighted by [15] and [16]. The key aspect emphasized is the principal's understanding of the social and moral dimensions of using artificial intelligence. This understanding becomes a vital foundation for ensuring that the digital transformation process remains grounded in human principles within the education ecosystem.

More specifically, a principal’s limited digital literacy can hinder *Merdeka Belajar* implementation in at least three practical ways: (1) weak use of student learning data for instructional supervision and follow-up coaching; (2) limited capacity to facilitate teacher collaboration through digital platforms (e.g., lesson study, peer feedback, shared resources); and (3) reduced ability to evaluate and align digital learning initiatives with school goals, making innovation fragmented or symbolic rather than substantive.Recent literature indicates a significant acceleration in the development of research on digital leadership [17], [18], [19]. The main focus of these studies is still

centered on the utilization of technology in managerial and pedagogical practices. Studies exploring the strategic integration of artificial intelligence (AI) and data analytics in the context of school leadership have not received comparable attention. Meanwhile, research on the application of AI in education [20], [21], [22] more often highlights its functions in adaptive learning, automated assessment, and teacher competency development. The role of the school principal as the main actor in AI and data-driven decision-making is still not widely discussed in the existing research landscape.

As a result, *Merdeka Belajar* risks being implemented procedurally rather than meaningfully. This gap underscores the urgency of developing a *Smart School Leadership* model that integrates digital competence, AI-supported reflection, and ethical leadership practices to strengthen decision-making, teacher support, and sustainable school innovation. The novelty of this study lies in the creation of the Smart School Leadership conceptual model, which is a leadership framework in schools that addresses the times thru the integration of artificial intelligence, data analysis, and ethical principles into a single system capable of adapting and sustaining itself. Unlike previous methods that often separated technology from the value aspects of leadership, this model views the principal as an individual who is not only proficient in digital technology but also ethically sensitive and capable of reflecting on the use of technology to support evidence-based decision-making. This approach provides a new perspective that is more comprehensive and aligned with the dynamics and complexities of the current educational landscape.

This study concludes that intelligent school leadership is a vital facilitator of substantive digital transformation and the successful implementation of Merdeka Belajar. Principals possessing robust digital and data literacy skills are able to strategically oversee school autonomy, promote cohesive innovation, and uphold the quality of learning. Conversely, limited leadership capacity jeopardizes equitable educational outcomes, hampers the coherence of digital initiatives, and leads to perfunctory technology integration, thereby ultimately undermining the objectives of educational reform and long-term school development.

According to research on educational decision-support systems, digital tools can help leaders make better decisions by breaking down complicated educational criteria into clear, logical order. Structured analytical systems help institutional leaders choose between strategic options. The MOORA method is one example of how they are used in curriculum review. But these ways of thinking mostly see digital systems as tools for technical work. There is still room for more research into AI as a thinking partner in thoughtful and adaptable school leadership [23]

In contrast, the emerging idea of AI-augmented leadership views AI not merely as a tool, but as a cognitive partner in school leadership. Used thoughtfully, AI can support principals in making sense of complex learning data, spotting patterns that are easily overlooked, and exploring alternative interpretations. It may also prompt reflective

thinking, helping leaders question assumptions and reduce blind spots that often shape everyday judgments and strategic decisions.

This shift reframes school leadership beyond managing technology toward a form of epistemic and ethical stewardship. Principals are required to interpret AI-supported insights with sensitivity to context, while actively governing risks related to data privacy, algorithmic bias, and excessive reliance on automated systems. In this sense, smart school leadership demands an integrated set of capacities that includes digital competence, data literacy, reflective professionalism, and a strong sense of ethical responsibility in everyday decision-making.

2. Research Methods

The study used a qualitative synthesis method based on [24] six-phase structure and thematic analysis. Learning about the literature corpus, making initial codes, looking for possible themes, reviewing themes by constantly comparing them, defining and naming themes, and writing the report through an analytical story were the steps that were taken for the synthesis.Iterative coding was done on a group of 134 peer-reviewed pieces, and codes were grouped together based on how similar they were in terms of ideas. Themes were kept when they showed up in more than one study and helped explain how leaders should act in the digital change, which led to four main themes.

After the selection process, 37 articles published between 2020 and 2025 met the inclusion criteria, which were discussing school leadership in the context of digital transformation, the integration of AI or data analytics into leadership practices, and the availability of complete documents. The analysis was conducted using a thematic approach, resulting in four main themes: AI-based leadership, data-driven decision-making, collaborative leadership in digital networks, and ethical and sustainability aspects. Each article is thoroughly reviewed to ensure the accuracy of the information and avoid potential errors in interpretation and citation.

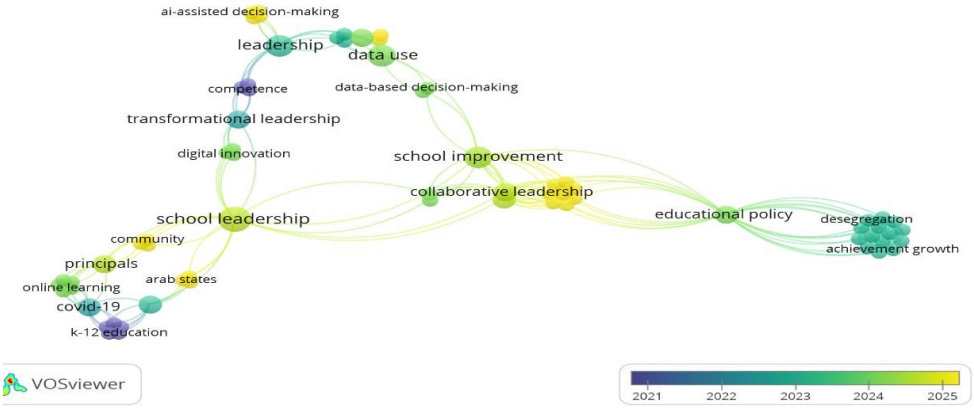

Figure 1. VOSviewer-based bibliometric mapping of keywords in smart school leadership studies

The validity of the findings is strengthened thru bibliometric analysis using VOSviewer to map the relationships between keywords in the analyzed literature collection. The bibliometric visualization (Figure 1) shows the main flow moving from school leadership toward educational policy, desegregation, and achievement growth. Between these two poles, important nodes emerge such as data use and data-based decision-making, which are directly connected to school improvement and collaborative leadership. The strategic location of school improvement and collaborative leadership highlights their central role as a bridge between the data-driven leadership cluster and the education policy cluster. This finding confirms that school quality improvement is not merely the result of a technocratic approach, but rather the fruit of integrating data-driven decision-making with collaborative leadership practices. This interconnectedness map reinforces the conclusion that smart school leadership relies on collaboration, data analytics, and a clear policy direction.

3. Results and Discussion

Results

The results show that teachers often feel psychological pressure when new technologies are adopted quickly. This stress isn't just from having to learn new tools; it's also from feeling watched, having more work to do with both traditional and digital systems, and being afraid that mistakes will be saved forever. Several teachers said they were tired, didn't believe in their own abilities, and avoided using digital platforms. These were all signs of technostress. Smart school leadership lowers these stresses by making gradual adoption common, setting up ways for peers to help each other, separating the use of formative data from punitive review, and making sure that everyone knows why and how data are used.The study also shows that principals are changing their work identities, moving from being administrative managers to digital leaders. This change can be seen in the way people act: principals show that they are always learning by training with their staff, start conversations in meetings that are based on data, use evidence to decide which actions to focus on, and share new ideas.

The analysis conducted on 37 articles yielded four key themes that form the conceptual basis of Smart School Leadership. The first theme emphasizes the use of artificial intelligence in leadership practices in schools. Several studies, including the work of [1], [25], [3], [4], [2], [20], [26], and [22], demonstrate how school principals integrate AI to strengthen strategic functions. The use of this technology includes analyzing student learning achievement, monitoring teacher performance, predicting learning outcomes, and automating administrative tasks. This discovery shows that artificial intelligence is not just a future possibility, but has become an essential element in school leadership practices that are constantly moving toward digitalization.

The second theme emphasizes data-driven decision-making as an essential element of school leadership today. Various studies such as [5], [6], [7], [8], [9], [27], [28], [29], [30], and [31] indicate that school principals are increasingly relying on data

to identify learning problems, assess school performance, and develop strategies to improve quality. Data utilization is considered a tool for logical and measurable decision-making. However, there are some studies that indicate shortcomings in the ability to interpret data and low organizational culture readiness in schools. This constraint means that data usage has not yet had a significant impact on changing practices in the field.

The third theme emphasizes the importance of collaboration and distributed leadership in supporting the digital transformation of schools. Several studies, such as [32], [33], [34], [35], [36], [37], and [18], indicate that the effectiveness of digital innovation depends on the school's ability to build collaborative networks, both internally among staff and externally with other stakeholders. Active teacher participation in the change process is seen as an important prerequisite for successful transformation. This finding confirms that digitalization is not merely about technology adoption, but reflects the social dynamics of organizations that demand a participatory and inclusive leadership approach.

The fourth theme discusses the ethics and mental stress that arise with the development of digital-oriented school leadership. Research conducted by [38], [16], [39], and [40] identified several negative effects of the digitalization process, such as unequal access to technology, potential bias in systems, and increased stress among teachers. [31] and [30] also emphasize the potential risks when data-driven decisions do not consider the social and cultural context present in schools. This situation places the principal in a crucial position to ensure that technology use remains aligned with moral principles and supports the sustainability of educational practices. Sensitivity to ethics is becoming a crucial element in leadership in the digital age, especially when decisions made directly impact the well-being of the school community.

Bibliometric analysis using VOSviewer reinforces the findings obtained through the SLR. Keyword mapping produced three main clusters that align with the broad themes of this study: school leadership in the context of digital innovation and the pandemic, the use of artificial intelligence and data in decision-making, and education policies focused on equity and improving learning outcomes. These three clusters indicate the direction of global research, which increasingly emphasizes the importance of technology integration, careful data usage, collaborative work, and attention to ethical dimensions in leadership practices within school environments.

Discussion

This discussion summarizes the results of an analysis of 37 articles, providing a comprehensive understanding of the concept of Smart School Leadership. The literature synthesis indicates that school leadership in the digital age cannot be understood in isolation. The four interconnected core issues that form a cohesive whole are: the use of artificial intelligence, data-driven decision-making, network

collaboration, and a focus on ethical values and sustainability. The relationship between these issues reflects the complexity of the current school principal's role. Facing various challenges requires a balanced combination of technological capabilities, social sensitivity, and moral maturity, which is reflected in daily leadership practices.

The first theme, AI-enhanced leadership, highlights the transformation of artificial intelligence from a technical aid into a cognitive partner in school leadership. The use of AI needs to be integrated with human values so that its implementation is not only efficient, but also ethical [1], [2]. The research findings indicate that school principals who actively facilitate the use of AI actively encourage teachers' readiness to adopt it in teaching and administration [22], [25], [26]. A balanced collaboration between leaders and technology can improve the quality of administrative decision-making [3]. AI support also strengthens leaders' ability to analyze data and map learning patterns [4], [20]. Psychological pressure is at risk of emerging when the technology adoption process is not accompanied by supportive leadership [38]. The relationship between leadership styles and evolving educational goals also plays a critical role in digital transformation. Evidence from [41] shows that principals who adopt adaptive, learning-oriented, and flexible leadership styles tend to achieve greater success in guiding digital transformation initiatives. Such leadership behaviors allow school leaders to align instructional objectives, technology integration, and organizational change more effectively, making leadership adaptability a key driver in sustaining innovation and navigating systemic transformation

The second theme, data-driven leadership, demonstrates the utilization of information as the primary basis for decision-making in the field of education. Efforts to improve quality become more focused when educational institutions create a culture of shared reflection thru data evaluation. Some studies have found that the presence of data does not always drive positive change. Errors in data interpretation can lead to incorrect decisions [27], [28] The proper utilization of data requires strong literacy among educators [29], [30]. Using performance data without sensitivity to the social context of the school actually opens the door to bias and inequality [31]. The Indonesian context shows that the role of the principal in fostering teachers' digital literacy is crucial for the effectiveness of data-driven leadership [13], [14].

The third theme, collaborative and distributed leadership, underscores the importance of building a strong collaborative leadership structure to support digital transformation in schools. Recent studies [32], [33] show that digital adaptation capacity significantly increases when schools actively facilitate open dialog and foster a dynamic learning community. Furthermore, the distributed leadership model [34], [35], [36], [37] effectively empowers teachers by providing them with autonomy and ample space to lead digital innovation initiatives, both within the context of classroom learning and the overall development of the school organization. A shift in focus is also evident, where the digitalization process is now not only focused on technology implementation, but more on enhancing human resource capabilities. In this situation, adopting an open innovation mindset [18] becomes crucial to ensure the school remains

receptive to external ideas and avoids closed-mindedness, allowing change to proceed more efficiently by making teachers the center of change, not just policy implementers. Beside this collaborative aspect, [42] observed a profound phenomenon: digital transformation is also reshaping the professional identities of school leaders. The study showed that principals undergoing the digitalization process experienced a shift in how they viewed and carried out their leadership roles. Slowly but surely, the traditional identity as an administrative manager is transforming into a digital-oriented leadership identity. This identity reconstruction process proved crucial, as leaders who successfully developed a digital leadership identity demonstrated greater adaptability, openness to innovation, and a more mature capacity to systematically drive digital change.

The fourth theme, digital ethics, policy, and sustainability, emphasizes that the application of technology in education always has value aspects. Using performance data as a reference in public policy can potentially worsen social injustice if it doesn't consider the overall context and background of schools [30], [31]. The role of empathetic leadership becomes crucial during times of crisis, especially when technology-related decisions directly impact the well-being of school members [39]. The direction of digitalization needs to align with global sustainability agendas such as the SDGs, not just focus on system efficiency [16]. The presence of technology doesn't necessarily bring positive impacts if leadership practices are authoritarian and close off space for academic dialog [40].

The challenges of school leadership in Indonesia do indeed stem from unique conditions. On one hand, the digital competency gap among teachers is the first real obstacle. On the other hand, the doubts of some educators about change are further slowing down this transition process. The push for the implementation of the Merdeka Belajar policy also requires school principals to be wiser and more flexible in making decisions [13], [14], [15], [16]. In this context, the role of school leaders clearly goes beyond mere technical proficiency. The essence of their task lies precisely in their ability to navigate complex bureaucracies, respond appropriately to the unique needs of each school, and optimize limited resources according to the context of each educational unit.

Overall, the synthesis of these 37 articles reveals the concept of Smart School Leadership as a form of leadership that harmoniously integrates three dimensions of intelligence: technology, social, and moral. Although analytical capabilities are newly born thru the presence of AI and data analytics, the quality of educational transformation is actually more determined by the strength of collaboration and a solid ethical foundation. The relevance of this type of leadership model seems increasingly evident in the context of developing countries like Indonesia, especially as the process of educational digitalization is being systematically and massively promoted.

4. Conclusion

This study contends that principal certification and ongoing professional development in Indonesia require substantial enhancement for greater practical impact. A planned curriculum remains essential, although it must extend beyond just technical competencies. Initially, principals require the opportunity to address AI ethics, encompassing routine issues related to privacy, bias, and accountability. Secondly, data utilization ought to be conceptualized as reflective supervision, wherein learning analytics facilitate coaching rather than punitive measures. Third, the implementation of technology must be incremental to avert overload and technostress. Ultimately, school-based action projects enable principals to convert evidence into manageable, pragmatic improvement cycles tailored to their specific school environments.

To augment practical impact, Indonesian policymakers should fortify principal certification and ongoing professional development via a more systematic however pragmatic curriculum. This may encompass considerations of AI ethics and governance, including prevalent concerns of privacy, bias, and accountability inside educational institutions. It should also emphasize data-driven reflective supervision, wherein learning analytics are utilized to facilitate coaching rather than exert control. Moreover, incremental strategies for technology adoption can mitigate technostress. Ultimately, school-based action projects enable principals to exhibit evidence-informed improvement cycles within actual school environments.

The Smart School Leadership framework can be operationalized by Indonesian policymakers by incorporating it into national professional development and principal certification programs. The initial step can be taken by integrating core competencies, including AI adaptation, data-driven decision-making, innovative collaborative leadership, and digital ethics, into the current training curriculum. The implementation process can be executed in a staged manner, beginning with the enhancement of fundamental digital literacy and the cultivation of awareness regarding the significance of data. This is followed by the adoption of AI-supported leadership practices, and the process concludes with ethical governance that prioritizes human values. This policy alignment will facilitate a gradual and sustainable transition to digitally competent school leadership, while simultaneously maintaining the humanistic values that serve as the bedrock of Indonesian education.

To facilitate effective policy execution, the integration of Smart School Leadership should use a progressive and systematic approach. In the inaugural year, primary certification programs may commence by integrating fundamental digital literacy and data-driven leadership as essential competencies. The subsequent year may entail increased applied training, emphasizing the practical applications of AI in educational decision-making and reflective supervision methodologies. In advanced phases, professional development may be augmented with modules on ethical governance, human-centered leadership, and portfolio-based evaluations grounded in authentic school difficulties. This timeline provides a pragmatic and contextually aware approach to synchronizing leadership competencies with current certification frameworks while ensuring that reforms are rooted in the values and capabilities of Indonesia's educational system.

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Effectiveness of the Student Management Skills Training in Developing Student Leadership and Organizational Management

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Abstract. Student organizations play a strategic role in developing leadership and organizational management competencies among university students. However, the disruption era requires student leaders to demonstrate adaptive, collaborative, and performance-oriented leadership skills. This study examines the effectiveness of Student Management Skills Training (SMST) in enhancing leadership and managerial competencies of student organization leaders at Universitas Katolik Indonesia Santu Paulus Ruteng. A descriptive quantitative approach with a one-group pre-test–post-test design was employed, involving 97 student leaders from intra-campus organizations. Data were collected using a validated Likert-scale questionnaire with high reliability (Cronbach's Alpha = 0.91). Data analysis included descriptive statistics, paired-sample t-tests, and Cohen's d effect size. The results indicate a significant improvement in leadership and managerial competencies, with mean scores increasing from 4.04 to 4.46 ($t(96) = 9.87$, $p < 0.001$) and a large effect size ($d = 0.97$). The findings confirm that SMST is an effective training model and should be institutionalized with mentoring and long-term evaluation.

Keywords: leadership competence, managerial competence, training effectiveness

1 Introduction

Student organizations at Universitas Katolik Indonesia Santu Paulus Ruteng function strategically as learning spaces for organizational management grounded in local values, culture, and spirituality, while simultaneously serving as platforms for developing student leadership. Student organization leaders face several practical challenges, including limited managerial experience, weak inter-organizational coordination, inconsistencies in program planning and reporting, and the need to align organizational operations with institutional policies and the achievement of higher education Key Performance Indicators. In the era of disruption, these challenges have become increasingly complex due to rapid technological advancement, highly dynamic student social environments, and growing demands for organizational performance and accountability. Effective leadership in educational contexts has been shown to enhance organizational performance, improve decision-making quality, and strengthen adaptive capacity in response to organizational change [1]. Therefore, student

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leadership development should not only focus on the acquisition of technical skills but also incorporate local wisdom (e.g., deliberative culture , prayer and reflective sessions) as ethical and cultural foundation for organizational management [2]. Furthermore, student leadership development needs to be designed in a systematic, contextual, and needs-based manner values in order to effectively address institutional challenges and the dynamic nature of student organizations [1] .

Student Management Skills Training (SMST) is one of the most widely implemented capacity-building strategies for university students in Indonesia. SMST is designed to strengthen both conceptual and practical organizational management skills through structured learning, simulations, group work, and experiential activities. Such training has been proven to enhance leadership capacity, especially when theory and practice are integrated effectively [2]. Experience-based leadership training has also been shown to improve communication, coordination, and students' ability to respond to organizational dynamics [3].

Recent studies demonstrate that experiential learning–based leadership programs significantly improve students' collaboration, communication, and decision-making skills. For example, basic leadership training has been shown to increase students' managerial competencies within campus organizational settings [4]. Civic education leadership programs have likewise strengthened students' leadership value actualization in academic organizations [5]. Similar outcomes were found in interprofessional leadership training, where students demonstrated improved leadership and facilitation abilities after participating in collaborative intensive sessions [6]. These findings are further reinforced by broader empirical research showing that leadership training grounded in cognitive-process development enhances students' ability to analyze problems, manage teams, and enact leadership behaviors effectively [7]. In studies across secondary and higher education contexts, student leaders also reported better readiness, confidence, and competence after participating in structured leadership programs [8], [9]. Additionally, higher education leadership practice reports highlight that well-designed student governance training strengthens organizational engagement and leadership enactment on campus [10]. Collectively, this body of evidence indicates that structured programs such as SMST have substantial potential to holistically enhance students' leadership capacity across cognitive, interpersonal, and organizational domains.

Although experiential and collaborative leadership training programs have been empirically shown to generate positive outcomes for participants' personal and professional development, several studies caution that short-term interventions do not always contribute to sustained behavioral change, particularly in psychologically rooted competencies such as leadership self-efficacy and identity formation. Prior research on leadership development indicates that while procedural and managerial skills, such as program planning, proposal writing, and organizational coordination can be developed through structured practice and simulation, deeper leadership dispositions require sustained intervention, meaningful leadership experiences, and reflective reinforcement over time [7], [9], [11]. Other studies on student leadership training

similarly suggest that short-term programs tend to be more effective in improving observable managerial competencies than in transforming relatively stable psychological constructs closely associated with self-perception and leadership identity[8], [12]. This limitation underscores the importance of empirical evaluation of leadership training. Evaluation should not only assess whether leadership training produces immediate competency gains, but also identify which dimensions are most responsive to short-term interventions. Therefore, pre- and post-training assessments, as employed in this study, are essential to critically examine the practical scope and limitations of short-term student leadership training programs and to inform the design of complementary mentoring and long-term development strategies [1], [4], [10].

However, most previous studies primarily highlight descriptive aspects of leadership training or general improvements in soft skills, without rigorously evaluating program effectiveness using pre-test and post-test designs. Several studies also emphasize the necessity of measurable leadership programs but lack valid and reliable instruments or do not specifically focus on student organizational contexts [13]. Additionally, only a few studies assess SMST in small-to-medium universities, even though leadership development dynamics in these contexts often differ significantly in terms of resources, organizational culture, and coordination patterns. This gap indicates the need for empirical studies measuring changes in students' leadership competencies before and after training.

This study provides a new contribution by quantitatively measuring the effectiveness of SMST using a standardized instrument encompassing two major dimensions: leadership competence and managerial competence. The research involved 97 student organization leaders across program-level, faculty-level, and university-level bodies, offering a comprehensive empirical picture of student organizational capacity development. This data-driven approach has rarely been applied in SMST evaluations, particularly in universities with strong local and cultural characteristics, as highlighted in studies on leadership based on Manggarai and Flores local wisdom [14], [15].

The purpose of this study is to analyze the effectiveness of SMST in improving the leadership and managerial competencies of student organization leaders. Specifically, this research measures pre-test and post-test training score differences, identifies the aspects with the highest improvement, and formulates strategic recommendations for future student organization development programs. The findings are expected to guide higher education institutions in designing more measurable, relevant, and performance-oriented student leadership training models.

2. Research Method

This study employed a descriptive quantitative approach using a one-group pre-test and post-test design. This design was selected to measure changes in the leadership and managerial

competencies of student organization leaders before and after participating in the Student Management Skills Training (SMST). By comparing the pre-test and post-test scores, the study objectively evaluates the effectiveness of the training based on measurable competency changes. The research was conducted during the SMST program for student organizations at Universitas Katolik Indonesia Santu Paulus Ruteng, held on October 3–5, 2025. The pre-test questionnaire was administered on the first day before training sessions began, while the pretest and post-test was completed on the third day prior to the closing mass.

A total of 97 students participated in the study, consisting of executive members of Study Program Student Associations, Faculty Student Executive Boards, and the University Student Executive Board. A total sampling technique was used because all SMST participants represented the primary target group for leadership and managerial development within student organizations.

The research instrument was a Likert-scale questionnaire ranging from 1 (strongly disagree) to 5 (strongly agree), designed to measure two major dimensions: Leadership Competence and Managerial Competence. Leadership competence was assessed through indicators of communicating organizational vision and mission, motivating members, decision-making ability, leadership self-confidence, and cross-organization collaboration. Managerial competence was measured through indicators of program planning, proposal writing, financial management, reporting comprehension, and orientation toward national-level achievement.

Content validity of the instrument was assessed through expert judgment by lecturers specializing in educational management and leadership. Reliability testing using Cronbach's Alpha produced the following results: pre-test Alpha = 0.86, pre-test and post-test Alpha = 0.89, and Total Instrument Reliability = 0.91. These values indicate very high internal consistency, confirming that the instrument is reliable for evaluating the effectiveness of the SMST.

Data were collected through Google Forms in two stages: the pre-test to measure initial competency levels before the training, and the pre-test and post-test to measure competency levels after completion of all SMST sessions. Participants filled out the questionnaire independently to ensure reflective honesty and objective self-evaluation.

Data analysis was conducted through several steps. First, descriptive statistical analysis (mean, standard deviation, and percentage) was performed to describe the distribution and tendencies of pre-test and post-test scores across all competency indicators. Second, reliability testing (Cronbach's Alpha) was conducted to confirm internal consistency, with the instrument demonstrating very high reliability ($\alpha = 0.91$). Third, a paired-sample t-test was used to determine significant differences between pre-test and post-test scores; if normality assumptions were not met, the Wilcoxon signed-rank test served as an alternative. Fourth, effect size (Cohen's d) was calculated to assess the strength of the training's impact, with $d > 0.8$ categorized as a large effect. Fifth, visual analysis through bar charts was provided to clearly

illustrate changes in pre-test and post-test scores. These combined analyses were used to determine the empirical and measurable effectiveness of the SMST in enhancing leadership and managerial competencies among student organization leaders.

3. Research Findings

The results of this study present a comprehensive analysis consisting of four main components: (1) descriptive statistics of leadership and managerial competencies before and after the SMST training, (2) an effectiveness test using the paired-sample t-test to determine significant differences between pre-test and post-test training scores, (3) the calculation of effect size using Cohen's *d* to measure the magnitude of SMST's impact, and (4) visual representations illustrating changes in mean scores across all competency indicators. Together, these findings provide a robust empirical basis for assessing the effectiveness of SMST in enhancing student organizational leadership and management competencies.

The analysis of the research data shows an increase in scores across all indicators of leadership and managerial competencies. The average pre-test score was 4.04, while the pre-test and post-test score increased to 4.46, resulting in an overall improvement of 0.42 points. This indicates a positive change after participants completed the SMST, as presented in Table 1.

Table 1. Mean Pretest and Posttest Scores for Each Competency Indicator

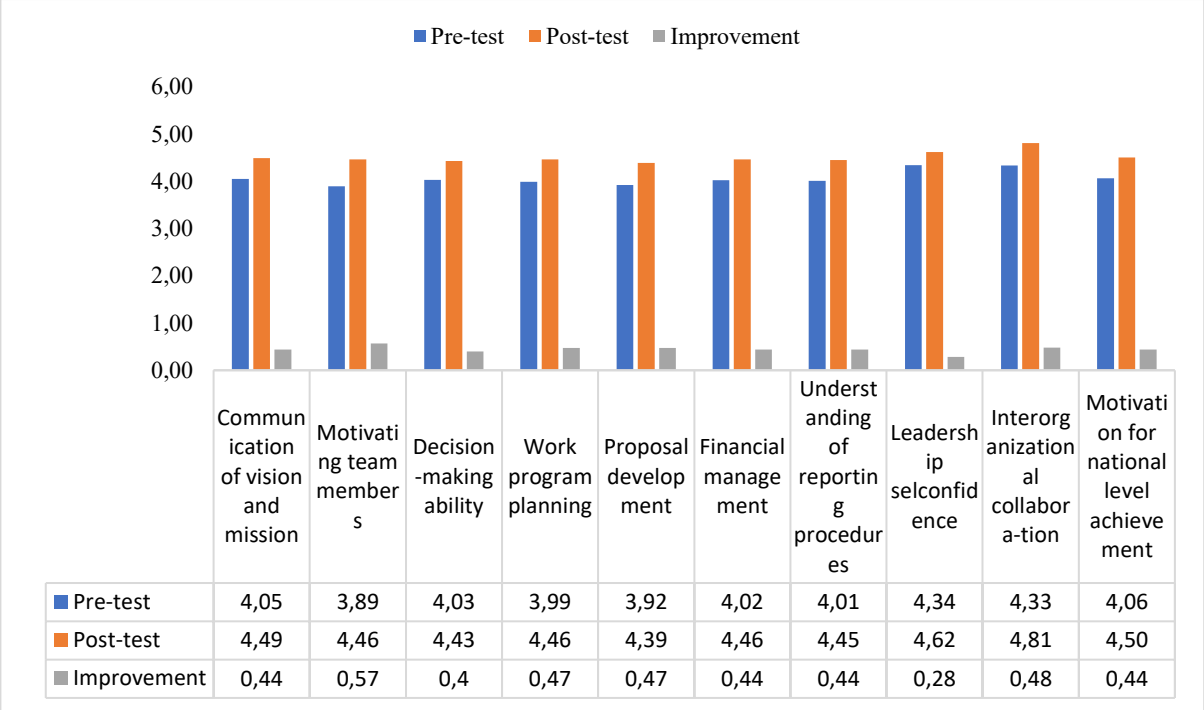
No	Competency Indicators	Pre-test	Post-test	Improvement
1	Communication of vision and mission	4.05	4.49	+0.44
2	Motivating team members	3.89	4.46	+0.57
3	Decision-making ability	4.03	4.43	+0.40
4	Work program planning	3.99	4.46	+0.47
5	Proposal development	3.92	4.39	+0.47
6	Financial management	4.02	4.46	+0.44
7	Understanding of reporting procedures	4.01	4.45	+0.44
8	Leadership self-confidence	4.34	4.62	+0.28
9	Inter-organizational collaboration	4.33	4.81	+0.48
10	Motivation for national-level achievement	4.06	4.50	+0.44

The main findings demonstrate that all indicators improved. The highest increase occurred in the aspect of motivating members, with a gain of +0.57. Meanwhile, the smallest increase was found in leadership self-confidence, with a gain of +0.28, which is reasonable given that the initial score for this indicator was already high.

To determine whether there was a significant difference between the pre- and post-training scores, a paired-sample t-test was conducted. The results showed $t = 9.87$ with $df = 96$ and $p < 0.001$. This indicates a highly significant difference between the pre- and post-test scores. SMST was proven to be effective in improving participants' competencies. The magnitude of the

SMST impact was calculated using Cohen's d. The results showed that the mean difference = 0.42, the standard deviation difference ≈ 0.43, and Cohen's d = 0.97. This finding indicates that the value of d is close to 1.0, which represents a large effect.This means that SMST is not only statistically significant but also very strong in practical terms for improving students' leadership and managerial competencies.

The comparison between the pre-test and post-test means shows an increase in participants' competency scores after completing SMST. Overall, the participants' initial competency level was already high, with a mean score of 4.04. After the training, the mean increased to 4.46, reflecting an improvement of 0.42 points. This increase is clearly visible in the graph, where the post-test bars are higher than the pre-test bars across all competency indicators. Visually, the comparison between pre-test and post-test scores, as well as the magnitude of improvement for each indicator, can be seen in **Figure 1**.



	Communication of vision and mission	Motivating team members	Decision-making ability	Work program planning	Proposal development	Financial management	Understanding of reporting procedures	Leadership selconfidence	Interorganizational collabora-tion	Motivation for national level achievement
Pre-test	4,05	3,89	4,03	3,99	3,92	4,02	4,01	4,34	4,33	4,06
Post-test	4,49	4,46	4,43	4,46	4,39	4,46	4,45	4,62	4,81	4,50
Improvement	0,44	0,57	0,4	0,47	0,47	0,44	0,44	0,28	0,48	0,44

Fig. 1. Mean pre-test and post-test scores across competency indicators

4. Discussion

The increase in the total mean score from 4.04 to 4.46 (Δ = 0.42) indicates that SMST produced a positive and measurable impact on strengthening leadership and managerial competencies among student organization leaders. This pattern of improvement is consistent with previous

studies on the effectiveness of leadership training that integrates conceptual instruction with practical application. Foundational leadership programs implemented in various universities have been shown to improve managerial skills, organizational discipline, and students' readiness to manage activities professionally [4], [13]. Moreover, practice-oriented training emphasizing interaction, simulation, and group dynamics has proven effective in enhancing communication skills, self-confidence, and collaborative leadership among students [3]. These findings affirm that the experiential learning approach embedded in SMST serves as a key mechanism enabling the competency gains observed in this study.

The effectiveness of SMST in improving competency scores is also aligned with research on interprofessional and collaborative training programs. Such studies reveal that practice-based, reflective training coupled with collaborative tasks significantly enhances participants' leadership capacity [6] . In the Indonesian educational context, leadership training that integrates direct practice and problem-solving has been shown to improve decision-making abilities and collaborative competence [5]. Accordingly, the consistent score improvements across all indicators, particularly in motivating members, planning organizational programs, and writing proposals, suggest that the blended methodology of theory, simulation, group discussion, and hands-on document preparation effectively accelerated the transfer of learning into real organizational skills. Thus, SMST represents a relevant and effective training model for strengthening student organizational capacity.

The most significant increases in the indicators of motivating members (+0.57), planning organizational programs (+0.47), and proposal writing (+0.47) demonstrate that SMST was most effective in enhancing procedural and practice-based competencies. This pattern is in line with empirical evidence showing that student leadership training integrating simulations, workshops, and hands-on document development produces higher gains than training focused on abstract conceptual content ([4], [3]. Training that requires participants to produce tangible outputs such, as work programs, proposals, or budget plans while receiving structured feedback has been shown to strengthen self-efficacy, leadership confidence, and the ability to mobilize team members [13], [6]. Therefore, the improvements in these three indicators highlight the success of the experiential learning approach used in SMST in reinforcing core managerial skills essential for student organization governance.

The substantial increase in cross-organization collaboration (+0.48) reflects the effectiveness of program alignment sessions and non-formal activities such as ice breaking, shared prayer services, and social bonding events in building social connections and group cohesion. This finding aligns with literature indicating that training grounded in socio-emotional and interactive engagement strengthens networking, solidarity, and coordination among participants ([6], [3]. Reflective practices, such as shared prayer and contemplation sessions, also function as important spaces for value internalization, cultivating inclusive and collaborative leadership styles aligned with cultural and spiritual values of contemporary youth [16], [17]. Thus, the increase in this indicator underscores the significance of SMST's holistic approach combining

cognitive, social, and reflective components in enhancing collaborative leadership among student organization leaders.

The improvements in financial management (+0.44) and reporting skills (+0.44) indicate that technical sessions on budget planning and accountability reporting provided substantial practical benefits to participants. These findings align with studies confirming that technical, short-term training can improve procedural knowledge and administrative skills, especially when delivered through structured hands-on practice [4], [2]. However, research also highlights that managerial competencies such as financial management and reporting require repeated practice, supervision, and ongoing mentoring in real organizational settings to remain stable and impactful ([18], [1]. Therefore, while SMST proved effective as an initial driver of improvement, the sustainability of these competencies depends on consistent mentoring and follow-up training to ensure long-term organizational performance benefits.

The relatively modest increase in leadership self-confidence (+0.28) can be reasonably explained. Participants' baseline scores were already high, resulting in a ceiling effect. Beyond this factor, the finding also reflects the psychological characteristics of leadership self-efficacy, which tends to be more stable and resistant to change through short-term interventions. Leadership training literature indicates that psychological constructs such as leadership self-efficacy develop gradually, as they are closely linked to self-perception, leadership identity, and repeated mastery experiences. Consequently, these constructs do not change rapidly. Leadership confidence requires the internalization of leadership roles and self-verification through authentic leadership situations [6]; [19]. This contrasts with procedural skills such as proposal writing or program planning—which can be acquired more quickly through structured practice and simulation

Moreover, opportunities to practice leadership in real projects, confront authentic organizational challenges, receive continuous feedback, and engage in regular mentoring processes have been shown to produce more substantial improvements in participants' leadership confidence [5]; [1]. Therefore, the limited gain observed in this dimension does not indicate a weakness in the SMST design; rather, it reflects the inherent limitations of short-term training in transforming deeply rooted psychological structures. Accordingly, a key strategic implication is the importance of strengthening follow-up programs through sustained training, project-based leadership assignments, and structured reflection. Such approaches are more likely to support stable and meaningful growth in leadership self-confidence over the medium and long term.

The Cohen's d effect size of 0.97 shows that SMST produced a very large and meaningful impact on participants' leadership and managerial competencies. Statistically, values approaching or exceeding d = 0.8 are considered large, indicating that the observed changes are not only statistically significant but also strong in practical magnitude. This aligns with studies reporting that experiential, simulation-based, and practice-intensive leadership training produces substantial gains in leadership skills among students and educators [7]; [5]. Similar

conclusions were identified in research on student governance training, where structured leadership modules significantly improved students' ability to manage organizational tasks, solve problems, and coordinate team activities [10]. Likewise, mindfulness-based leadership interventions have demonstrated notable improvements in participants' behavioral effectiveness, suggesting that structured and reflective practice can yield high-impact developmental outcomes [11]. Supporting evidence is also found in student leadership assessments, which highlight that well-designed leadership programs substantially increase students' confidence, initiative, and capacity to perform leadership roles effectively [8]; [9] . Collectively, these findings confirm that training programs blending theory, hands-on practice, and reflective learning consistently yield higher competency gains than lecture-based approaches alone, reinforcing the interpretation that SMST is a high-impact intervention.

This strong effect size is further supported by SMST's instructional design, which integrates technical skill-building, collaborative engagement, and value formation. Such approaches have been shown to deepen learning experiences and improve the transfer of knowledge into organizational practice [1]; [18]. Evidence from leadership development research indicates that structured, cognitively oriented leadership models enhance sense-making, decision pathways, and adaptive leadership behaviors, thereby strengthening the effectiveness of training interventions [7]. Likewise, studies on student leadership programs in secondary and higher education contexts show that combining technical workshops, teamwork-driven activities, and reflective components significantly improves learners' leadership competence, initiative, and organizational readiness ([8] . Activities such as program development workshops, proposal simulations, event management practice, and reflective exercises (e.g., group prayer and community-building activities) contribute to a more holistic formation of competencies, thereby producing a strong intervention effect. Furthermore, practice-based student leadership programs have been shown to "ignite" engagement and foster deeper internalization of leadership values, reinforcing the long-term developmental trajectory initiated during training [12]. Thus, the high Cohen's d value reinforces not only the short-term effectiveness of SMST but also its potential long-term impact on the quality of student organization leadership.

5. Conclusion

The findings of this study demonstrate that SMST is effective in improving the leadership and managerial competencies of student organization leaders, as reflected in the increase in the total mean score from 4.04 to 4.46 and a Cohen's *d* effect size of 0.97, indicating a large impact. Significant gains were observed in practical competencies such as motivating members, planning work programs, and preparing proposals, while more conceptual competencies, such as leadership confidence, also improved although to a lesser extent due to high initial scores. Overall, these results confirm that SMST is a relevant and effective training intervention for strengthening student organizational capacity within the university context.

The study's findings imply that SMST should be institutionalized as a structured and routine development program, given its proven positive effects on the quality of student organization leadership. Strengthening experiential learning components—such as proposal simulation, event management practice, inter-organizational collaboration activities, and value-based reflection—should be maintained, as these elements significantly contribute to competency improvement. To ensure the sustainability of the training outcomes, the university is recommended to implement a structured mentoring scheme for at least one full leadership term (6–12 months) following the training, with mentoring sessions scheduled every two to three months. In addition, long-term evaluation should be conducted through repeated assessments of leadership and managerial competencies at the midpoint and at the end of the leadership term, allowing continuous monitoring of participants' developmental progress. Furthermore, the evaluation instrument used in this study can serve as a standardized monitoring tool to measure competency achievement over time and inform university policies related to student development and the attainment of key performance indicators.

This study has several limitations, particularly due to the one-group pretest and posttest design without a control group, which prevents full attribution of the observed improvements solely to SMST, as external factors may also contribute. The assessment was conducted over a short period, thus not capturing the sustainability of competency development in actual organizational practice. Therefore, future research is recommended to employ a quasi-experimental design with control groups, conduct longitudinal evaluations throughout the term of student leadership, and incorporate qualitative data through interviews or observations to deepen understanding of how leadership and managerial competencies develop within student organizations.

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Analysis of The Needs of Receptive and Expressive Language Learning Model For Early Childhood with A Multimedia-Based Block Center Approach

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Abstract. The development of a multimedia-based block center approach to receptive and expressive language learning for early childhood is an effort to improve children's language skills. Therefore, this study aims to analyze the needs of a multimedia-based block center approach to receptive and expressive language learning for children aged 5-6 years. This research uses a Research and Development (R&D) approach at the Research and Information Collecting stage. Data collection methods were carried out through observation, interviews, and literature studies. Researchers observed Early Childhood Education (ECE) institutions and the learning process that occurred in these institutions, as well as interviewed principals and early childhood teachers. The collected data were analyzed using the Miles & Huberman analysis model to identify the needs of a receptive and expressive language learning model for early childhood. The results of this study are expected to provide information on the needs of an effective and enjoyable receptive and expressive language learning model for early childhood. Based on the results of the research using the Research and Development (R&D) approach at the research and information gathering stage, it shows that early childhood requires an interesting and interactive language learning model to improve their receptive and expressive language skills. A multimedia-based block center approach to language learning can be an alternative to improve the receptive and expressive language skills of early childhood.

Keywords: learning model; receptive language; expressive language; block center; multimedia

1 Introduction

Language mastery in early childhood is an essential foundation for the overall developmental trajectory of a child's cognitive, social, and emotional aspects. The ability of early childhood (5-

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6 years old) to understand (receptive) and use or express (expressive) language effectively can facilitate children in social interaction and is a primary prerequisite for academic success in further education [1]. Children who have strong language competence tend to be more socially adaptable, demonstrate better problem-solving skills, and have a solid foundation for learning to read and write. Language capacity becomes a bridge for children to understand the world around them and express their ideas, feelings, and needs to others. Therefore, receptive and expressive language abilities are one of the important aspects of early childhood development [2];[3].

However, many early childhood still experience difficulties in receptive language (understanding language) and expressive language (expressing language) [3]. This occurs because early childhood struggle with Indonesian language. Early childhood often use their mother language, especially Manggarai language, to communicate with others. In addition, the development of language learning that has been done is less than optimal because teachers are less varied in using approaches, strategies, models, and learning media that are relevant to the characteristics of early childhood. Teachers have not integrated relevant media (multimedia) to develop receptive and expressive language skills of early childhood [4]. Thus, the process of learning receptive and expressive language of early childhood is less than optimal, monotonous, boring or less interesting, less fostering retention, and less exploratory.

Therefore, the use of optimal and relevant approaches, strategies, media, and learning models to the development of early childhood is greatly needed to overcome the difficulties of early childhood in receptive and expressive language. Teachers need to stimulate the development of receptive and expressive language of early childhood with approaches, strategies, methods, and learning media that are relevant to the needs of children. In today's digital era, a learning approach that integrates multimedia (such as video, animation, and interactive sound) with a block center approach model—i.e., structured block play activities to stimulate creativity and cognition—can enhance the effectiveness of learning [5]. This learning model emphasizes play-based learning. Early childhood build block structures while listening to multimedia narratives. With this, early childhood receive stimulation to understand and express language holistically. This approach is in line with the Indonesian Early Childhood Education (ECE) curriculum, which promotes center activities to optimize multiple intelligences, including linguistics. This is because ECE today is faced with the challenge of preparing a generation that is able to navigate the complexities of the 21st century [6]. Language ability for early childhood is no longer just a basic skill, but a core competence that supports critical thinking, creativity, and collaboration.

The development of learning models in ECE that continues to evolve demands new learning models. Early childhood educators need to consistently develop and use the most effective approaches to stimulate various aspects of child development, including language. This is because conventional language learning models that rely on repetitive methods such as memorizing vocabulary or passively imitating speech are proven to be no longer sufficient to

address these challenges [7]. Children need more dynamic, contextual learning experiences that can spark their intrinsic curiosity. Conventional learning models that tend to be teacher-centered are very structured and less accommodating to the active and kinesthetic nature of child learners. This causes a crucial gap between learning practices in the field and children's real needs to learn through exploration, play, and meaningful interactions in a stimulus-rich environment.

Changes in the environment in which children grow and develop, especially exposure to digital technology from an early age, further emphasize the importance of developing this model. This also changes the way children interact with information and their surroundings. A relevant learning model must be able to utilize technology positively as a pedagogical tool, not just a source of distraction. If the education system cannot adapt to this reality, then there will be a gap between the way children learn in school and the way they experience the world outside of school, which can decrease motivation and learning effectiveness. The need for innovation also arises from a deeper understanding of child brain development. Neuroscience research shows that early childhood is a golden age where synaptic connections are formed at an extraordinary rate [8]; [9]. Rich learning experiences that involve various senses and occur in a positive social context are proven to optimize the development of brain circuits responsible for language function [10]. Therefore, learning models that rely solely on a single mode of information delivery (e.g., verbal only) lose the great potential to stimulate children's language development holistically. Ultimately, the need for new learning models aims to ensure equal opportunities for all children. Solid language skills in early childhood are a strong predictor of children's future academic and social success. Children who fall behind in language skills at this early stage are at risk of experiencing ongoing learning difficulties. The world of education has an ethical responsibility to develop innovative, effective, and accessible learning models for all, so as to close the achievement gap and provide the best foundation for every child to reach their maximum potential. [11].

Extensive literature review on language learning models for early childhood indicates several significant gaps that need to be addressed. There are several studies that tend to focus on developing one aspect of language separately, either receptive or expressive. Research examining the effectiveness of digital media, for example, often only measures improvements in vocabulary comprehension (receptive) without exploring its impact on children's ability to use the vocabulary in spontaneous conversations (expressive). This separation ignores the symbiotic nature of these two language domains, where good comprehension forms the basis for meaningful language production [12]; [13]. Another gap lies in the lack of integration between constructivist play-based learning approaches and the structured use of digital technology. On one hand, there is much research highlighting the benefits of play, such as block play, in developing social and cognitive skills. On the other hand, research on multimedia in ECE often positions technology as an isolated activity, for example, through individual use of tablet applications [14];[15]. Research that systematically develops and tests models integrating physical and social interaction in block play with pedagogically designed digital stimuli is still relatively rare.

Furthermore, existing learning models are often generic and lack attention to specific contexts, such as precise age targets (5-6 years) and unique needs during the transition phase to formal education. Research focusing on developing comprehensive models for this specific age group is still limited, despite this period being crucial for sentence structure maturation and narrative skills [3]. Many interventions designed for early childhood have too broad an age range (e.g., 3-6 years), whereas language development in 5-6 years old has unique characteristics that require more complex and targeted stimulation strategies.

Lastly, research using complete Research and Development (R&D) methodology to produce models that are not only theoretically valid but also practical and applicable in the field is still very limited. Many studies are experimental with short-term interventions, without going through iterative development cycles, expert validation, and field trials as mandated by the R&D approach [16]. As a result, many models produced are difficult to be sustainably applied by educators due to lack of practical guidance and consideration of classroom realities, thus hindering their implementation.

This gap will be addressed by developing a language learning model with a multimedia-based block center approach. The novelty of this proposed learning model lies in the innovative synthesis of two powerful pedagogical approaches that are rarely combined systematically, namely the block center approach and multimedia-based language learning. This model doesn't just place digital devices in the corner of the classroom, but integrates multimedia stimuli inherently into the block play activity flow. This integration creates a hybrid learning ecosystem, where the concrete sensorimotor experience of building blocks is enriched by dynamic and interactive digital content.

Therefore, this article answers the research question about the urgency of developing a receptive and expressive language learning model for early childhood (5-6 years old) using a multimedia-based block center approach. The results of the needs analysis in this research serve as the basis for developing a receptive and expressive language learning model for early childhood using a multimedia-based block center approach. An effective and enjoyable language learning model is essential for early childhood. The multimedia-based block center is one approach that can be used to develop the receptive and expressive language skills of early childhood.

2 Method

This research uses R&D methodology at the Research and Information Collecting stage [16]. This approach is chosen to bridge the gap between theoretical research and educational practice. R&D aims to iteratively design, develop, and evaluate a functional product or model that can solve real-world problems in the field. The needs analysis stage is the initial focus of the R&D cycle, which is the core of this research, namely an in-depth investigation to understand

problems, identify gaps, and ensure the developed model meets the needs of early childhood and educators as target users.

Research design

This research uses the Research and Development (R&D) approach in the first step, namely Research and Information Collecting [16],[17]. At this stage, the researcher analyzes the needs of a language learning model for receptive and expressive language skills in early childhood. This means that this development research will continue to the next stages or steps. The complete research design is shown in **Figure 1** below:

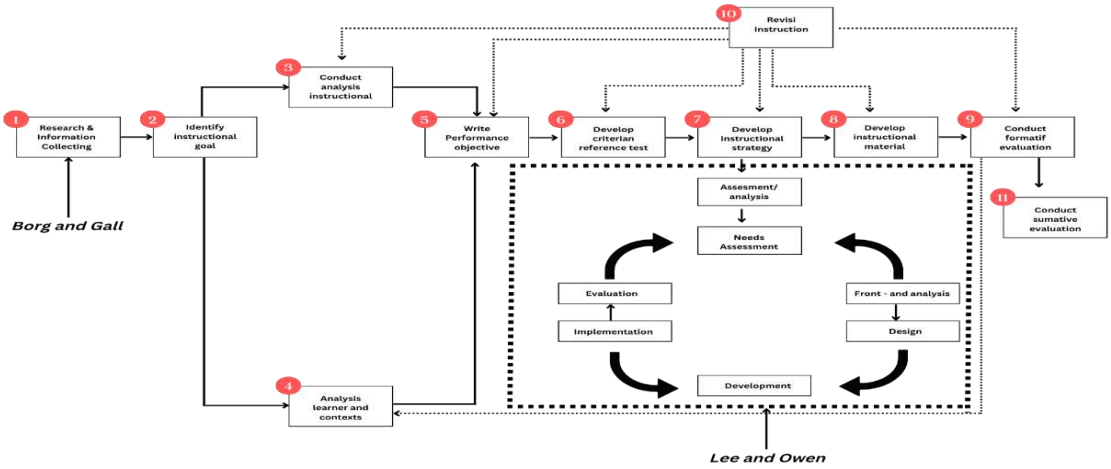

Fig. 1. Stages of Research and Development of Early Childhood Language Learning Model.

Participants

The participants in this study were ECE principals and teachers, as well as early childhood in Langke Rembong District, Manggarai Regency, Flores, East Nusa Tenggara. The selection of participants in this study was conducted using systematic random sampling.

Data Collection

Research data were collected using literature studies, observations, and interviews. These three data collection techniques were used in the needs analysis stage to obtain a comprehensive overview of the existing model and the needs for a receptive and expressive language learning model for early childhood. The first technique was a literature study, conducting a systematic review of research journals, textbooks, and policy documents relevant to early childhood language learning, block centers, and multimedia use. The second technique was classroom observation with non-participant observation in several ECE classes to directly observe language learning in progress. The focus of the observation was on teacher-student and student-student interactions, the use of media and teaching aids, the implementation of play centers (including block centers), and opportunities for language use that arose naturally. The observation provided rich contextual data on "what actually happens" in the classroom. The

third technique was in-depth interviews conducted with educators (teachers and principals) to explore their perceptions, experiences, and needs. The interview questions were designed to explore the challenges they face, the strategies they use, their views on technology use, and their expectations of an ideal learning model. This research and information gathering were carried out in stages as shown in **Figure 2** below:

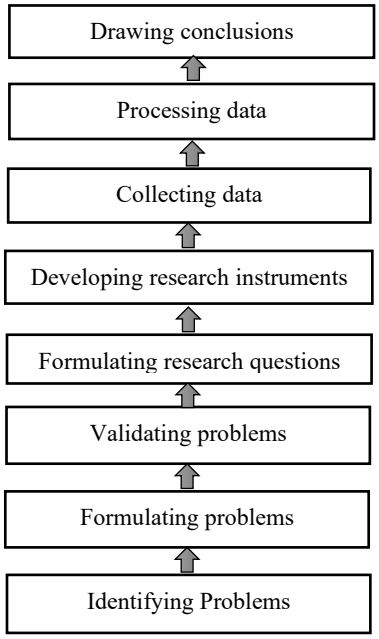

Fig. 2. Steps in Preliminary Research.

Data Analysis

After the literature study data, observations, and interviews were collected, the next step was data analysis to identify the gap between the existing model and the needs of a language learning model for receptive and expressive language skills in early childhood. Qualitative data (interview transcripts and observation field notes) were analyzed using a thematic analysis approach as follows: (1) reading and familiarizing oneself with the data, (2) creating initial codes to mark interesting data segments, (3) searching for themes or patterns emerging from the codes, (4) reviewing and refining the themes, and (5) defining and naming the final themes. The collected interview and observation data were then processed qualitatively by adopting the Miles & Huberman analysis model with analysis steps [18], as shown in **Figure 3** below:

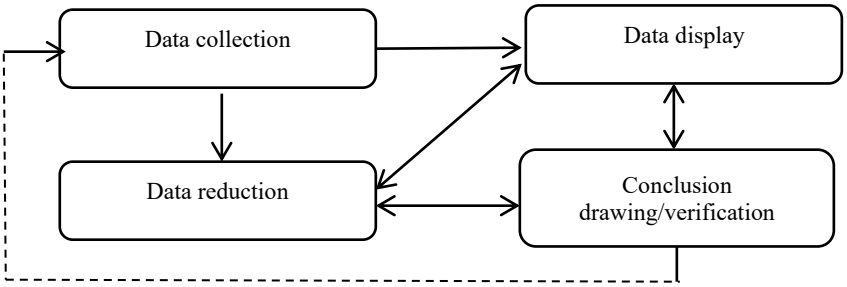

Fig. 3. Qualitative Data Analysis Process by Miles and Huberman.

3 Findings

Based on the results of research and initial data collection in the Research and Development (R&D) methodology through literature studies, interviews with kindergarten principals and teachers, observations of the learning process, and then analyzed qualitatively using the Miles & Huberman analysis model, researchers found that there were problems in the learning process to develop language skills in early childhood. Teachers are less varied in using learning models and media to develop language skills in early childhood. Researchers obtained data on learning models used in several ECE institutions from 64 early childhood teachers. The teachers used the same learning model during the learning process. There were 38 teachers (59%) who answered that the group learning model was used in the learning process of early childhood. This happens because this model is suitable for the abilities and conditions of ECE institutions in Manggarai. Eight teachers (13%) said that the area model was used in learning at school. Six teachers (9%) explained that the center model or a combination of several models was used in learning. Five teachers (8%) said that they did not use a specific model in the

learning process. One teacher (2%) said that the corner model was always used in the learning process. This data can be visualized as in **Diagram 1** below:

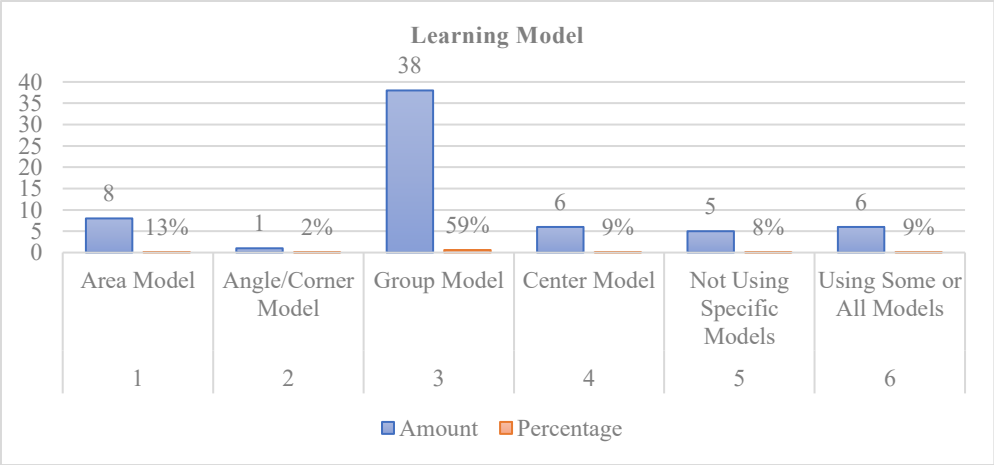

Diagram 1. Learning Models in ECE in Langke Rembong District

The data in this diagram illustrates that teachers who teach in ECE institutions use the same learning model and are less varied. The use of less varied learning models and media will affect the development of aspects of early childhood abilities, including their language skills. The learning process is less interactive, monotonous, and boring. Early childhood is less active or passive, has less retention and attention in the learning process because the learning process tends to be teacher-centered. Early childhood has a limited vocabulary, is less able to convey ideas, and has less developed ability to retell activities or play experiences that have been carried out. This means that early childhood experiences difficulties in understanding and expressing language. Early childhood aged 5-6 years, who are in the pre-operational thinking stage, need language stimulation through appropriate and relevant methods. Developing language skills for children aged 5-6 years is crucial because the stimulation provided at this stage will affect the child's abilities in the next developmental stage, including academic achievement. If early childhood experience language difficulties, it will negatively impact their subsequent education. As a result, a child will be unable to understand language and express themselves, such as difficulty communicating or understanding what teachers or peers convey, difficulty expressing thoughts, ideas, and desires verbally and non-verbally.

Language is an important instrument for humans to communicate messages, thoughts, information, desires, and feelings to others. Therefore, language stimulation needs to be done from an early age. Early childhood language skills, both receptive and expressive, influence the stimulation of other aspects of a child's development, including the ability to achieve academic learning competencies. A child with language difficulties feels inferior or afraid to interact with teachers and peers. This also causes early childhood to be unable to follow the learning process optimally. Teachers have used models, strategies, media, and learning materials in the learning

process to develop language skills in early childhood. However, teachers have not integrated various media (multimedia), learning materials, models, or other relevant learning strategies that suit the characteristics and developmental stages of early childhood. Therefore, teachers need models and strategies, learning media, and learning materials that are more interesting, retain attention, and motivate and stimulate the development of receptive and expressive language skills in early childhood.

Based on the research data and preliminary study information collection, it can be concluded as follows:

1 Teachers manage learning using group and classical models with a seating arrangement scheme of two students at one table, and have not used other learning models
2 Teachers use learning media prepared by the ECE institution, such as ECE teaching materials, videos, student worksheets, picture paper, lego, blocks, plastisin, origami paper, crayons, puzzles, coloring paint, pencils, local natural materials (fruits), and other conventional media, and design media that suits the theme or learning topic.
3 Teachers have not used integrated learning media (multimedia) in the learning process
4 Learning still takes place with a teacher-centered strategy, making it tend to be monologue by reading from prepared teaching materials, monotonous, and boring for students
5 Students are less able to receive and understand (receptive language) and less able to express language (expressive language) due to difficulties with Indonesian language
6 Students lack motivation and interest in the learning process, as evident in their silent attitude, not answering teacher's questions, playing alone, and not participating actively
7 The ECE institution does not yet have a competency map for developing language skills in early childhood

Based on these findings, the researcher concludes that the learning model used so far is less than optimal for developing receptive and expressive language skills in early childhood. This reality presents an opportunity to develop a receptive and expressive language learning model with a multimedia-based block center approach. This is also supported by the commitment of teachers at the ECE institution to accept any effective and enjoyable learning innovations for early childhood.

4 Discussion

The results of this research and initial information gathering indicate that early childhood need an effective and enjoyable receptive and expressive language learning model. The multimedia-based block center is one alternative language learning model that can be used to develop early childhood language skills. Receptive language refers to a child's ability to understand language that is heard or read [19]. For early childhood, this domain is primarily related to understanding

spoken language. It is a complex cognitive process that involves several stages, from listening and distinguishing language sounds (phonemes), recognizing words, understanding word meaning (semantics), interpreting how words are combined in sentences to convey a message (syntax) [20]. The primary function of receptive language is to serve as the foundation for all learning processes. Before a child can speak, they must first understand the words spoken by people around them. This ability allows children to follow simple instructions like "Get the ball" to more complex ones like "Put the blue block on top of the yellow block". Language comprehension enables children to learn new concepts, from object names, colors, shapes, to abstract concepts like feelings and time. Understanding stories being read, for example, not only builds vocabulary but also stimulates imagination and narrative thinking skills [21].

In addition to its cognitive function, receptive language plays a crucial role in social and emotional development. Developmentally, receptive language skills typically develop faster than expressive language. A child may be able to point to a picture of a chicken when someone says the word "chicken" long before they can pronounce the word clearly. This gap between comprehension and production is a normal phenomenon in language acquisition. Therefore, stimulation rich in quality language input, through conversation, reading books, and singing, is vital for building the "mental dictionary" that will serve as the foundation for expressive language development later on [13].

Meanwhile, expressive language is the ability to use language, whether through words, gestures, or writing, to convey thoughts, feelings, and needs [22]. It is the productive aspect of language, where a child actively organizes ideas, selects appropriate vocabulary from their mental lexicon, and structures them according to grammatical rules to create a message that can be understood by others [23]. In early childhood, expressive language is primarily manifested in spoken language, ranging from babbling, first words, two-word phrases, to increasingly complex sentences. The fundamental function of expressive language is as a tool for communication and social interaction. Through language, children can request something like "Want milk", refuse like "No", or ask questions like "What's that?", and share experiences like "I saw a cat". This ability allows children to negotiate, cooperate, and resolve conflicts with their peers. In the context of play, expressive language becomes a medium for creating an imaginary world, assigning roles, and structuring storylines, all of which contribute to the development of high-level social and cognitive skills [24].

Theoretically, the development of this model makes a significant contribution to ECE literature by offering a new framework that integrates Vygotsky’s constructivist theory with Mayer’s multimedia learning design principles. Vygotsky’s theory of the Zone of Proximal Development (ZPD) and the role of social interaction in learning form the basis for using the block center as a collaborative arena [25];[26]. On the other hand, cognitive principles in multimedia learning (e.g., multimedia principle, contiguity principle) provide scientific guidance for designing effective digital interventions that do not overload children’s cognitive abilities [27]. This model

bridges these two theoretical domains, demonstrating how social interaction and technological scaffolding can work synergistically.

The development of this model also enriches the scientific discourse on embodied cognition in language learning. This theory posits that cognitive processes, including language, are deeply influenced by physical experiences and bodily interactions with the environment. By placing physical and spatial block-building activities at the core of language learning, this model provides empirical evidence on how motor actions and spatial perception can serve as a foundation for verbal concept development and expression [28]. This challenges the traditional view that often separates motor development from language development.

From a practical standpoint, this model holds great significance. It offers a concrete solution for educators facing challenges in stimulating children's language effectively and engagingly. With structured guidance, educators can design learning sessions that are not only enjoyable but also pedagogically rich [29]. This model offers an alternative to teaching methods dominated by teacher-centered verbal instruction, shifting towards a child-centered approach where children actively construct their knowledge and skills.

Furthermore, this model has practical implications for teacher professional development. Implementing this model requires teachers to act as skilled learning facilitators, able to observe, provide appropriate scaffolding, and integrate technology wisely. This encourages the improvement of teachers' pedagogical competence in the digital era. Additionally, for curriculum developers and policymakers, this model can inspire the design of richer, more interactive learning environments that meet the demands of the times, ultimately aiming to improve the overall quality of ECE.

Therefore, the need for a language learning model with a multimedia-based block center approach aims to address the challenges of developing early childhood language skills in schools, such as conventional language learning models, lack of integration of interactive and enjoyable learning, limited media and relevant learning tools, and educators' need for effective learning model guidance. In terms of creativity and artistic development, the block center provides unlimited opportunities for symbolic expression. The structures children build are three-dimensional representations of their ideas and imaginations. A child can create a fantasy world, replicate real buildings, or make abstract designs. This process fosters divergent thinking and cognitive flexibility. Since the block center can influence many aspects of development simultaneously, it becomes a rich and natural context for language development, as language becomes the tool that connects all these experiences [28].

The integration of multimedia in ECE has transformed from a mere innovation into a potentially powerful pedagogical component [30];[31]. Multimedia, in the context of education, refers to the use of various media to present information. Literally, "multi" means many, and "media" are communication tools [32];[33]. Therefore, multimedia is the integration of text, images,

graphics, audio (sound, music, narration), animation, and video into a single digital platform that is often interactive [34], [35]. For early childhood, effective multimedia is designed to capture attention, facilitate understanding, and encourage active participation, rather than passive consumption [27]. Therefore, it's essential to distinguish between multimedia that has pedagogical quality and those that are merely entertaining. Effective multimedia for early childhood should have clear learning objectives, an intuitive interface, be free from ads and distracting elements, and encourage critical thinking and creativity, rather than just quick and repetitive responses. The selection of the right type of multimedia should always be based on the learning objectives and the developmental characteristics of the target children [14]. Designing or selecting multimedia for early childhood aged 5-6 years requires a deep understanding of their cognitive development. Based on Richard Mayer's Cognitive Theory of Multimedia Learning [27], there are several principles that should be adapted for early childhood. The multimedia principle itself states that children learn better from words and pictures than from words alone. This is particularly relevant for early childhood who still heavily rely on visual cues to understand meaning [36]. Text should be minimized, while images, icons, and animations should be clear and support the audio narrative. Therefore, developed multimedia should meet the principles of coherence, personalization, meaningful interactivity, and content pacing. The pacing of content should also be controllable by the child, allowing them to progress at their own learning rhythm. Lastly, the feedback provided should be constructive and encouraging, focusing on effort rather than just right or wrong [15].

Multimedia can be a powerful tool to enhance language learning effectiveness if designed and used wisely. Multimedia offers the ability to present information through various modes - visual, auditory, and kinesthetic - simultaneously, which can accommodate diverse learning styles and reinforce concept understanding [37];[4]. Technology should be viewed as a tool that enriches the learning environment and triggers better interaction, rather than replacing human interaction. Thus, multimedia can be an effective partner or tool in the learning process, enhancing the quality of interaction between children and materials, peers, and teachers. Multimedia contributes to increasing children's motivation and interest in learning, integrating visual, audio, and kinesthetic elements that strengthen their receptive abilities. The key to integrating media like this is ensuring that technology always serves to enhance and enrich physical and social interactions, not replace them [14];[38].

This approach goes beyond using multimedia as a one-way instructional tool. In this model, multimedia serves as a narrative trigger, a source of visual information, and a scaffolding tool that sparks dialogue and collaboration among children. For example, a short video about bridge construction can be shown before a play session to stimulate ideas (receptive stimulation), and children are then encouraged to narrate the process of building a bridge replica using blocks (expressive stimulation). Ghofur and Nurhayati [24] demonstrate the effectiveness of story-based media by applying it in the context of meaningful physical construction. Additionally, this model has a dual focus balanced on receptive and expressive language stimulation simultaneously within a coherent activity flow. Activities at the block center naturally encourage

children to use language. Early childhood need to understand instructions (receptive), negotiate with peers (expressive), explain ideas (expressive), and listen to others' ideas (receptive). Multimedia integration is designed to strengthen both aspects. The audio-visual stimulus from multimedia enriches the language input received by children (receptive), while challenges or scenarios presented by multimedia encourage early childhood to produce more complex and structured language (expressive). Additionally, this model offers novelty in terms of structure and flexibility. It is not rigidly prescriptive, but rather provides a framework that can be adapted by educators according to the context and needs of the children. This framework includes clear stages, from orientation with multimedia stimulus, exploration and construction, to reflection and storytelling, while allowing space for teacher creativity and child spontaneity. Furthermore, this learning model addresses educators' need for structured yet non-restrictive guidance, an aspect often overlooked in learning model development.

Therefore, the main recommendation emerging from this needs analysis is that the developed model should be play-centered. Language learning should be seamlessly embedded into engaging gameplay driven by children's interests [39]. The "fun" element shouldn't be considered an add-on, but rather a fundamental design principle to maximize engagement and learning outcomes [40]. In-depth literature review provides strong theoretical support for the integration of block centers and multimedia. Research consistently shows that block play is significantly and positively correlated with the development of spatial skills, problem-solving, and social skills [41]. The literature review for this research identifies block centers as a highly rich context for natural language development, as children spontaneously use language for various communicative purposes [42].

The needs analysis conducted yielded several key points: First, there is an urgent need for a fundamentally play-centered learning model, where language learning is embedded in meaningful and intrinsically motivating activities. Second, the model should balance and integrate stimulation of both receptive and expressive language competencies, recognizing the symbiotic relationship between them. Third, there is a clear need from educators for practical, structured yet flexible guidance to help them translate child development theories into effective daily classroom practice. Fourth, the model should be contemporary, leveraging digital technology's potential wisely and pedagogically to enrich, not replace, rich human interactions.

Thus, the developed model explicitly positions the multimedia-based block center as one of the learning models for receptive and expressive language skills of early childhood. The block center serves as a superior constructivist learning environment because early childhood can learn about physical and spatial concepts and engage in complex social interactions. Moreover, the novelty and strength of this model lie in the planned and purposeful integration of multimedia, not merely adding technology as a decoration. In this model, multimedia functions as a conceptual trigger that builds background knowledge and sparks curiosity in early childhood. Multimedia acts as a visual scaffold that makes abstract concepts concrete and easily understood by early childhood. Additionally, multimedia serves as a catalyst for imagination in

early childhood, enriching symbolic play and eliciting more complex narratives. Multimedia synergistically strengthens and expands learning opportunities for early childhood in block play activities, creating a dynamic hybrid learning ecosystem. The preliminary study results found that conventional approaches in learning are less able to meet the learning needs of early childhood, which are active, social, and kinesthetic. The gap between ideal theory and practical field conditions, coupled with the evolution of the digital environment where early childhood grows, creates an urgency to develop a new learning model that is more relevant, effective, and engaging. Therefore, the framework of a learning model that synthesizes the strengths of the block center with the pedagogical potential of multimedia is designed to directly address the needs and gaps in the learning process of receptive and expressive language skills of early childhood (5-6 years old).

5 Conclusion

The results of research and data collection using the Research and Development (R&D) approach indicate that there are problems related to the receptive and expressive language skills of early childhood. This is because teachers tend to use less varied learning models and media to stimulate the language skills of early childhood. Therefore, early childhood needs effective and enjoyable receptive and expressive language learning models and media. The multimedia-based block center can be an alternative language learning model that can be used to develop the language skills of early childhood. This is because this learning model positions children not only learning about physical and spatial concepts but also engaging in complex social interactions. The need to plan, negotiate, and explain the construction process naturally creates an authentic and rich context for language practice. The block center provides a "stage" for children as the main actors, and language is the "script" that children create together in play activities. Therefore, this research recommends developing a receptive and expressive language learning model for early childhood using a multimedia-based block center approach.

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Local Wisdom-Based Learning as a Means of Strengthening the Creativity and Cultural Identity of Manggarai Students

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Abstract. This study aimed to analyze the implementation of Manggarai local wisdom-based learning to strengthen students' creativity and cultural identity. Local wisdom practices such as Congka Caci and Sa'e not only contain aesthetic and traditional values but also embody pedagogical values that can foster creative thinking, collaboration, and understanding of local cultural identity. This study employed a qualitative case study design conducted in one secondary school in Manggarai Regency. Data were collected through observations, interviews, and documentation. The findings show that integrating local wisdom into learning can enhance students' creativity through imaginative activities, contextual problem-solving, and culture-based artistic expression. In addition, culture-based learning strengthens cultural identity, increases pride in ancestral traditions, and reinforces students' character. This study recommends developing more structured contextual learning models grounded in local wisdom for implementation in Manggarai schools.

Keywords: local wisdom; Manggarai; creativity; cultural identity; contextual learning.

1 Introduction

Twenty-first-century education requires students to have creative and critical thinking skills as well as a strong cultural identity amid increasingly intensive globalization. Through the *Merdeka Belajar* policy, Indonesia emphasizes the importance of contextual, flexible, and student-centered learning to generate meaningful (deep) learning [1]. One approach that is increasingly considered important is integrating local wisdom into learning to strengthen creativity while reinforcing students' cultural identity. However, conventional teacher-centered approaches still dominate classroom practices in Manggarai Regency. This is due to limited teacher training in integrating local wisdom and pressure from the national curriculum, which prioritizes standardized academic achievement over the exploration of local cultural values. This gap results in students' limited familiarity with cultural heritage such as Congka Caci and Sa'e, even though these traditions contain rich aesthetic and strategic values.

The integration of local wisdom into the curriculum is crucial because the current government-designed curriculum remains largely conventional. This stems from a

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history of centralized education policies that focus on uniform achievement, measurable administration, and academic performance. As a result, the curriculum often functions more as a tool of control than as a space for cultural and educational growth. This system emphasizes technocratic standardization and centralized assessment, primarily focusing on cognitive achievement for global rankings. Local knowledge is often marginalized because it is difficult to measure.

One possible pathway for incorporating local wisdom within this rigid system is through Local Content, which should be more than an additional subject—it can serve as a hands-on cultural workshop for students. At a young age, students benefit from experiential learning through traditional arts, which can trigger deeper thinking and keep learning engaging. By integrating local values into the curriculum, teachers can challenge students in ways that are relevant to their own lives and use art as a bridge between cultural identity and thinking skills.

The opportunity to integrate local wisdom is already present within the conventional curriculum structure itself, particularly through a thematic-integrative approach, local content, culture-based projects, and arts education, all of which align with how children learn in early developmental stages.

In Manggarai, East Nusa Tenggara, traditions such as Congka Caci and Sa'e have strong educational value. These cultural forms are not only symbols of identity; they also reflect the Manggarai community's mindset, aesthetics, movement patterns, communication, and shared values. Congka Caci and Sa'e should not be treated as folklore alone; instead, they can serve as rich pedagogical resources by combining movement, rhythm, space, symbols, social relations, and values. These can be adapted across levels: as rhythm and movement games for younger learners, as expression and teamwork activities in elementary school, as studies of meaning and structure in junior high school, and as critical reflection in high school. Integrating Manggarai traditions into the curriculum does not mean abandoning the national framework; rather, it means adapting local culture pedagogically to create engaging and relevant learning experiences grounded in students' lived realities.

Interviews with teachers revealed that the current curriculum provides limited pedagogical guidance for contextualizing local wisdom into daily classroom instruction. While the national curriculum encourages contextual learning, its implementation in Manggarai secondary schools tends to prioritize cognitive outcomes aligned with national examinations, leaving minimal space for culturally grounded creative exploration. As a result, students demonstrate limited engagement with their own cultural heritage, and learning experiences risk becoming repetitive, abstract, and disconnected from students' lived realities [2].

This condition highlights a structural gap between curriculum expectations and local educational needs in Manggarai. Without deliberate strategies to integrate local wisdom, the potential of Manggarai cultural practices as creative and identity-forming learning resources remains underutilized. Therefore, a context-specific educational approach grounded in Manggarai local wisdom is necessary to support creativity development and cultural identity formation in secondary education.

The transition toward creativity development requires stimuli that are close to students' personal experiences. The Congka Caci ritual, for example, is not merely a war dance; it also involves training in strategy and courage, which intersects with dimensions of creativity. Likewise, Sa'e highlights social harmony and coordination. Therefore, this study seeks to bridge creativity theory with Manggarai cultural practices within the framework of formal education.

Given this urgency, systematic efforts are needed to develop learning models that not only promote students' creativity but also instill cultural identity values. Manggarai local wisdom-based learning is a significant step toward achieving meaningful, contextual, and sustainable learning.

An examination of the secondary school curriculum structure in Manggarai Regency indicates that the integration of local cultural content remains limited and largely implicit. Although arts and culture subjects are formally included, they are generally allocated minimal instructional time and positioned as complementary subjects rather than core learning domains [4]. Local cultural knowledge such as Congka Caci and Sa'e is not systematically embedded in learning objectives, competency standards, or assessment indicators. Instead, cultural elements are often introduced incidentally during ceremonial school events or extracurricular activities, without clear pedagogical guidance for classroom integration. This creates a gap between national policy discourse that promotes contextual and student-centered learning and classroom practices that continue to prioritize standardized academic outcomes over culturally grounded creative learning experiences.

This structural misalignment highlights the urgency of developing learning models that deliberately integrate Manggarai local wisdom into formal education. Without such pedagogical intervention, the rich cultural practices of Congka Caci and Sa'e remain underutilized as educational resources, despite their strong potential to foster students' creativity and cultural identity.

2 Theoretical Review

One theory that views local culture as a primary learning resource is ethnopedagogical theory. International perspectives demonstrate the success of this approach, such as *kaitiakitanga* in New Zealand, which integrates Māori ecological values into environmental curricula, and environmental education movements in Brazil that incorporate local knowledge for Amazon conservation. In Indonesia, local wisdom functions as a cultural lens for meaningfully understanding academic concepts and enhancing creativity.

Creativity in this study refers to Torrance's four dimensions: fluency, flexibility, originality, and elaboration. In the Manggarai context, fluency relates to students' ability to generate diverse movement variations in Sa'e. Flexibility is evident when students adjust their strategies during Caci simulations. Originality emerges when ritual values are reconstructed into modern artistic works, while elaboration is demonstrated through students' ability to explain the symbolic meanings of cultural artifacts such as Mbaru Gendang in depth.

Based on this, the theoretical review addresses the following areas:

Local Wisdom-Based Learning

Local wisdom–based learning integrates cultural values, practices, symbols, and traditions into the learning process [4]. This approach strengthens learning relevance, increases learning motivation, and builds students' cultural identities [5]. Local wisdom functions as a cultural lens that enables students to understand academic concepts in their own cultural contexts [2].

Manggarai Culture as a Learning Resource

Manggarai culture consists of symbolic systems, rituals, collective values, and cultural artifacts such as Congka Caci and Sa'e, which embody creativity, collaboration, aesthetics, strategy, rhythm, and solidarity. Previous studies state that integrating local culture into learning strengthens cultural literacy and increases student participation in the learning process [1]. Other research shows that local culture–based learning can significantly enhance students' creativity [6].

Creativity as a 21st-Century Competency

Creativity is the ability to generate new, original, and useful ideas [7]. Torrance identified four dimensions of creativity: fluency, flexibility, originality, and elaboration [8]. Recent research indicates that creativity develops better when students engage in cultural activities, arts, traditional games, and challenging problems within local contexts [9].

Students' Cultural Identity

Cultural identity is a psychological and social construct related to a sense of belonging to a specific culture [10]. Learning oriented toward local culture strengthens students' sense of belonging and awareness of cultural values. In the Manggarai context, culture-based learning helps students understand historical roots, social structures, and values of respect in social relationships.

Research Questions

Based on the background and theoretical review, this study addresses the following questions:

1. What are the characteristics of Manggarai local wisdom that can be utilized as learning resources?
2. How can local wisdom-based learning strengthen Manggarai students' creativity?
3. How can the integration of local cultural values strengthen students' cultural identity in learning contexts?

3 Research Methodology

Research Approach

This qualitative ethnopedagogical case study was conducted in three public secondary schools in Manggarai Regency, East Nusa Tenggara, Indonesia. The schools were

selected purposively based on their proximity to active customary communities and their inclusion of arts and culture subjects in the curriculum. This study used a qualitative approach with an ethnopedagogical design because it focuses on exploring, documenting, and analyzing Congka Caci and Sa'e as forms of Manggarai local wisdom and their utilization in learning to strengthen students' creativity and cultural identities. Ethnopedagogical design enables researchers to understand cultural phenomena, local educational practices, and customary values from the emic perspective of the Manggarai community [3, 1].

This approach was combined with a descriptive-exploratory design because the study not only explored cultural data but also examined the implementation of local wisdom-based learning in Manggarai schools. The study involved 15 arts and culture teachers, 45 students (Grades VIII–IX), and three Manggarai traditional leaders as key informants, as well as customary communities that still practice the cultural rituals of Congka Caci and Sa'e.

Data Collection Methods

Data were collected through methodological triangulation to obtain a holistic picture of local cultural values and their implications for students' creativity and cultural identity.

Participatory Observation

Observations were conducted in school settings and customary communities. The observations focused on:

- learning activities related to local culture;
- patterns of student interaction in cultural contexts;
- cultural practices of Congka Caci and Sa'e; and
- manifestations of students' creativity in culture-based activities.

In-Depth Interviews

Interviews were conducted with:

- teachers;
- principals;
- students;
- Manggarai traditional leaders; and
- cultural practitioners (Sa'e dancers and Caci performers).

The interviews aimed to reveal perceptions, experiences, and cultural practices that can be utilized in learning, as well as how culture contributes to the development of creativity and cultural identity.

Cultural and Learning Documentation

Documentation included:

- photographs and videos of cultural activities;
- local cultural artifacts;

- school documents related to cultural programs; and
- relevant customary records.

Additional Instruments

- Student creativity observation sheet (fluency, flexibility, originality, elaboration) [8].
- Cultural identity checklist (cultural knowledge, cultural pride, cultural engagement) [10].

Data Analysis Methods

Data analysis followed Miles, Huberman, and Saldaña's model: data reduction, data display, and conclusion drawing [11]. A thematic approach was used to identify key themes such as harmony, rhythm, cultural strategies, creative movement, collaboration, and customary symbols. Data were verified through source triangulation and method triangulation by comparing interview results with field observations.

4 Results and Discussion

Results

4.1 Manggarai Local Wisdom (Congka Caci and Sa'e) Contains High Potential Values for Learning

Based on field findings, integrating Congka Caci and Sa'e into the classroom triggered students' deep emotional engagement with the material. These practices possess significant learning potential. Congka Caci embodies rhythm, movement, creativity, strategy, courage, sportsmanship, and aesthetics. Likewise, Sa'e emphasizes bodily coordination, collective aesthetics, rhythmic discipline, social harmony, and cooperation. These values relate to aspects of creativity (fluency, flexibility, originality, elaboration) and cultural identity. Teachers also noted that students found it easier to understand the concept of strategy through analogies drawn from Caci and Sa'e practices.

4.2 The Role of Local Wisdom-Based Learning in Strengthening Students' Creativity

Classroom process analysis shows that when teachers integrated Manggarai cultural activities such as Sa'e movements, students demonstrated increases in creativity across several indicators:

- Fluency: Students generated many ideas when asked to create designs, stories, or solutions based on cultural rituals.
- Flexibility: Students were better able to modify movements or patterns into creative representations in project assignments.
- Originality: Cultural integration stimulated unique ideas that differed from conventional learning contexts.

- Elaboration: Students were able to explain the symbolic meanings of cultural elements in greater depth.

Teachers reported that learning became livelier and that students were more emotionally engaged.

4.3 Local Wisdom Plays an Important Role in Strengthening Students' Cultural Identity

Interviews with students and teachers indicated that integrating local culture into lessons strengthened students' cultural identity by:

- increasing students' pride in their regional culture;
- helping students rediscover meanings of symbols, rhythms, movements, and customary values that have begun to fade; and
- encouraging students to practice cultural values such as cooperation, politeness (*teing hang*), and deliberation, while building awareness of identity as part of the Manggarai community.

Furthermore, students' active involvement in integrating local culture at school, such as practicing Congka Caci and Sa'e, provides a concrete way to shape creativity and strengthen cultural engagement. Actively participating in learning traditions and understanding local cultural practices provides opportunities to build genuine connections, share experiences, and promote inclusivity toward diverse values and practices.

Discussion

The values contained in local wisdom, such as Congka Caci and Sa'e, are described in cultural literature as "socio-pedagogical capital" that can enrich the learning process [3-5]. Socio-pedagogical capital combines the strengths of social relationships, trust, values, norms, and networks (social capital) with pedagogical goals to improve learning quality, development, and character building.

Local wisdom also provides a learning ecology that supports creativity and the formation of cultural identity. Learning ecology views learning as a dynamic process occurring across interconnected contexts—physical, social, cultural, and virtual—with the aim of developing ecological awareness and student self-transformation within a broader system. This process extends beyond the classroom to include local sociocultural interactions and modern technology. These findings are consistent with ethnopedagogical perspectives that local culture contains educational values that can serve as learning resources [1, 12]. Moreover, local culture–based education enhances engagement, sense of belonging, and students' cultural identity orientation [11].

Studies [7, 8] suggest that creativity emerges when students receive stimuli that are close to their personal experiences. The rhythmic values in Sa'e dance and the strategic values in Congka Caci serve as cues and symbols that promote divergent thinking and can increase creativity [1, 13]. Cultural activities provide authentic and challenging situations for students to express their ideas. In this context, local wisdom is no longer supplementary material but an effective and creative pedagogical resource.

This aligns with theories of cultural identity [12], which argue that learning that acknowledges and utilizes local culture strengthens students' sense of belonging and cultural identity in school. Revitalizing local wisdom through education can positively impact generational cultural continuity, consistent with culturally responsive pedagogy [2, 14].

Despite its pedagogical potential, implementing local wisdom-based learning faces practical challenges within standardized educational environments. Teachers reported difficulties balancing cultural exploration with the demands of national standardized examinations that emphasize written, text-based assessment formats. Limited instructional time and the absence of culture-sensitive assessment instruments further constrain meaningful integration. Without systemic support—particularly curriculum flexibility and assessment reform—local wisdom-based learning risks remaining peripheral rather than transformative.

5 Conclusion

This study shows that Manggarai local wisdom-based learning effectively strengthens students' creativity and cultural identity. The values embedded in Congka Caci and Sa'e provide authentic inquiry spaces for students. Therefore, Manggarai local wisdom-based learning has strong pedagogical potential for development in educational practice.

First, Manggarai cultural characteristics, including Congka Caci and Sa'e, contain aesthetic, moral, social, and movement creativity values that can be used as contextual learning resources for teaching creativity. Second, local wisdom-based learning has proven effective in enhancing students' creativity, particularly in fluency, flexibility, originality, and elaboration.

Third, integrating local culture into learning strengthens students' cultural identities. Through school-based cultural activities such as Sa'e practice, appreciation of Congka Caci, and customary discussions, students show increased pride, a deeper understanding of cultural symbols, and greater self-awareness as members of the Manggarai community.

Overall, this study confirms that local wisdom-based learning is a strategic means of strengthening both the creativity and cultural identity of Manggarai students. Therefore, more structured, culture-based contextual learning models are needed and should be sustainably implemented in Manggarai schools.

This study recommends that the Manggarai Regency Education Office develop technical guidelines for a local content curriculum that integrates customary rituals into arts and social studies subjects. Continuous teacher training is also needed to improve competence in designing ethnoscience- and ethnopedagogy-based learning materials so that local culture becomes the core of character education rather than a ceremonial add-on.

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Blended Learning Enhancement in Nationally-Required Curriculum Courses and University-Required Courses: A Survey-Based Analysis Based on Lecturer Perceptions

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Abstract. Despite the increasing use of blended learning in higher education, studies examining lecturers' perceptions in compulsory and predominantly theoretical courses such as Nationally-Required Curriculum Courses (MKWK) and University-Required Courses (MKWI) remain limited. This study investigates blended learning implementation in MKWK and MKWI at Universitas Katolik Indonesia Santu Paulus Ruteng during the 2024/2025 academic year from lecturers' perspectives. A quantitative survey using a total sampling technique involved 30 lecturers and employed a structured Likert-scale questionnaire assessing learning outcome clarity, instructional design, Design Thinking integration, project relevance, assessment practices, LMS utilization, and challenges in synchronous online learning. In these courses, Design Thinking was applied through problem-based and SDG-oriented project assignments. The findings show high perceived learning outcome clarity (M = 4.6) and strong Design Thinking integration (M = 4.5). However, challenges related to student engagement (M = 3.9) and digital infrastructure persist. Overall, blended learning was perceived as effective (M = 4.22), indicating the need for continuous technical training to optimize interactive LMS use.

Keywords: Blended learning; compulsory curriculum courses; lecturers' perceptions; Design Thinking; higher education.

1 Introduction

Blended learning has increasingly become a central pedagogical strategy in higher education, driven by the need to balance flexibility, instructional quality, and meaningful learning experiences. By combining face-to-face instruction with online learning modalities, blended learning offers opportunities to optimize learning time, diversify instructional strategies, and promote deeper cognitive engagement [1]. Rather than functioning merely as a technical arrangement, blended learning is now widely understood as an instructional design approach that requires careful alignment between learning outcomes, teaching strategies, assessment practices, and technological infrastructure. Recent studies have extended this understanding by examining blended learning specifically within general education and mandatory courses,

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highlighting its role in supporting transferable skills, civic competencies, and interdisciplinary learning across diverse academic programs [2], [3].

Beyond its structural definition, blended learning is increasingly framed as a design-based approach that emphasizes coherence between pedagogy, technology, and assessment. Studies have shown that blended learning yields positive learning outcomes only when online and face-to-face components are pedagogically integrated rather than treated as parallel or supplementary modes [4]. Consequently, the quality of blended learning is less dependent on the proportion of online instruction and more on how learning activities, interactions, and assessments are intentionally sequenced to support cognitive engagement and learning continuity. In the context of compulsory or general education courses, this pedagogical integration is particularly critical, as misaligned blended designs may exacerbate student disengagement in courses perceived as theoretical or non-disciplinary [2], [5].

Within the Indonesian higher education landscape, the implementation of blended learning has gained renewed relevance following the introduction of the Merdeka Belajar–Kampus Merdeka (MBKM) policy. MBKM emphasizes learner autonomy, flexibility in learning pathways, interdisciplinary engagement, and the integration of real-world problem-solving into academic programs. This policy context positions blended learning not only as a response to digital transformation but also as a pedagogical mechanism to operationalize MBKM principles. Consequently, the effectiveness of blended learning is closely tied to how well it supports outcome-based education, authentic learning tasks, and reflective learning processes.

In this regard, MBKM implicitly requires universities to rethink instructional design practices, as flexibility and autonomy cannot be achieved through conventional lecture-dominated models alone. Blended learning provides a viable pathway to translate MBKM principles into classroom practice by enabling asynchronous exploration, reflective learning, and collaborative inquiry during synchronous sessions. However, without clear pedagogical frameworks and lecturer readiness, the alignment between MBKM ideals and instructional realities risks remaining aspirational rather than operational. Empirical observations in several higher education institutions indicate persistent challenges in implementing blended learning, including uneven student participation during synchronous online sessions, limited lecturer control over engagement, and recurring technical constraints related to LMS stability and internet connectivity.

Nationally-Required Curriculum Courses (Mata Kuliah Wajib Kurikulum Nasional/MKWK) and University-Required Courses (Mata Kuliah Wajib Institusi/MKWI) play a particularly strategic role in this transformation. These compulsory courses are designed to develop foundational competencies such as civic literacy, ethical reasoning, critical thinking, and institutional values across diverse academic disciplines. Unlike program-specific courses, MKWK and MKWI are implemented at scale and involve lecturers from varied disciplinary backgrounds, making instructional coherence and pedagogical clarity essential. As such, the adoption of blended learning in these courses presents both significant opportunities and substantial challenges, especially in ensuring consistent learning quality across different teaching contexts.

For international readers, MKWK and MKWI may be broadly categorized as General Education or Mandatory University Courses, which are institution-wide requirements aimed at fostering transversal competencies beyond disciplinary specialization. Course titles are

retained in *Bahasa Indonesia* to preserve institutional and regulatory authenticity, such as *Pendidikan Agama*, *Pendidikan Pancasila*, and *Bahasa Indonesia*, while English equivalents are provided for clarity (Religious Education, *Pancasila* Education, and Indonesian Language).

Moreover, the compulsory nature of MKWK and MKWI amplifies the pedagogical consequences of instructional design decisions. Because these courses are often perceived by students as foundational rather than disciplinary, ineffective blended learning implementation may reduce engagement and diminish perceived relevance. Conversely, well-designed blended instruction can reposition MKWK and MKWI as transformative learning spaces that foster transferable skills, ethical awareness, and contextual problem-solving across academic programs.

Despite the growing body of research on blended learning, much of the existing literature predominantly foregrounds student perspectives, focusing on learning satisfaction, engagement, and academic performance [6]. While these studies provide important insights, they tend to underrepresent the role of lecturers as central agents in the design, enactment, and evaluation of blended instruction. Lecturers are not merely implementers of institutional policy; they actively interpret curricular goals, select pedagogical strategies, manage learning technologies, and shape classroom interactions. Prior research suggests that lecturers' pedagogical beliefs, technological readiness, and instructional agency significantly influence the success and sustainability of blended learning initiatives [7]. This limitation is especially evident in studies of blended learning within compulsory or general education courses, where lecturers' perspectives on instructional coherence, assessment transparency, and technological support remain underexplored [3].

From a pedagogical perspective, effective blended learning requires more than alternating between online and face-to-face sessions. It demands intentional instructional design that fosters cognitive presence, teaching presence, and meaningful learner interaction. Design-oriented pedagogies such as Design Thinking offer a relevant framework in this regard, as they emphasize empathy, problem definition, ideation, experimentation, and reflection in addressing complex real-world challenges [8]. For traditionally theoretical courses such as MKWK, Design Thinking provides a structured pedagogical rationale for transforming abstract concepts—such as ethics, citizenship, and social responsibility—into contextualized, inquiry-based learning experiences grounded in real societal issues [5].

When embedded within blended learning environments, Design Thinking can support authentic learning experiences by connecting academic content with societal issues, including those aligned with the Sustainable Development Goals (SDGs). Complementarily, the Flipped Classroom model reallocates instructional time by shifting content delivery to asynchronous modes and reserving synchronous sessions for discussion, collaboration, and higher-order learning activities [9]. This pedagogical alignment is consistent with constructivist and experiential learning theories, which emphasize learner agency, reflection, and knowledge construction through authentic problem engagement [10].

Universitas Katolik Indonesia Santu Paulus Ruteng has adopted a structured blended learning model for MKWK and MKWI, consisting of seven face-to-face meetings and seven synchronous online sessions supported by an institutional Learning Management System (LMS). This model integrates Design Thinking principles and selected elements of the Flipped

Classroom approach to promote reflective practice, collaborative problem-solving, and contextualized learning. However, implementing such a model across compulsory courses also raises practical concerns, including the clarity of learning outcomes, assessment transparency, lecturer control over student participation during synchronous online sessions, and the adequacy of digital infrastructure—particularly in non-metropolitan contexts. These recurring instructional and technical challenges served as the primary impetus for the present study.

2 Methods

This study employed a quantitative descriptive approach to examine lecturers' perceptions of blended learning implementation in Nationally-Required Curriculum Courses (MKWK) and University-Required Courses (MKWI) at Universitas Katolik Indonesia Santu Paulus Ruteng during the 2024/2025 academic year. The descriptive design was selected to capture evaluative judgments and instructional experiences without manipulating learning conditions, allowing for a comprehensive portrayal of how blended learning was enacted and perceived within compulsory curriculum contexts.

The participants comprised 30 lecturers who were actively responsible for designing and delivering MKWK and MKWI courses using a blended learning format. These lecturers represented diverse disciplinary backgrounds and possessed direct, sustained experience with both face-to-face and synchronous online instructional modalities. Their involvement positioned them as key informants capable of providing informed and reflective assessments of pedagogical design, instructional effectiveness, and technological support.

To provide contextual clarity regarding the research participants, the demographic and professional characteristics of the lecturers involved in this study are summarized in Table 1. Presenting respondent profiles is essential for interpreting lecturers' perceptions, as instructional experience, academic roles, and course assignments may influence pedagogical decision-making in blended learning environments.

Table 1. Demographic and Professional Characteristics of Lecturer Respondents (n = 30)

Variable	Category	n	%
Gender	Male	20	66.7
	Female	10	33.3
Teaching Experience	< 5 years	8	26.7
	5–10 years	6	20.0
	> 10 years	16	53.3
Course Type	MKWK	16	53.3
	MKWI	14	46.7

Data were collected using a structured questionnaire developed to measure lecturers' perceptions across eight dimensions related to blended learning implementation. The instrument utilized a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) and assessed perceptions of learning outcome clarity and alignment, integration of Design Thinking components, relevance of project-based learning activities, effectiveness of face-to-face instruction, effectiveness and challenges of synchronous online sessions,

transparency and fairness of assessment practices, development of student competencies with particular emphasis on 21st-century skills (4C), and the usability of the learning management system (LMS) alongside digital infrastructure support. The dimensions were informed by blended learning literature, the MBKM policy framework, and institutional instructional guidelines to ensure contextual and theoretical relevance.

To establish content validity, the questionnaire items were reviewed by experts in instructional design and higher education pedagogy, resulting in minor revisions to improve clarity and conceptual alignment. Internal consistency reliability was examined using Cronbach's alpha, with the overall scale demonstrating acceptable reliability ($\alpha > 0.80$) and all dimensions meeting commonly accepted thresholds ($\alpha > 0.70$). These results indicate that the instrument functioned consistently across constructs and disciplinary contexts, supporting its suitability for descriptive analysis [11].

The questionnaire was administered at the end of the semester after lecturers had completed the full cycle of blended learning implementation, enabling participants to provide holistic evaluations grounded in sustained instructional experience. Quantitative data were analyzed using descriptive statistical techniques, including mean scores and categorical interpretation, following established criteria for perception analysis. To strengthen analytical rigor, document analysis of course designs, lesson plans, and institutional guidelines related to blended learning was conducted to contextualize and triangulate survey findings.

Ethical considerations were addressed throughout the research process. Participation was voluntary, informed consent was obtained, and no personally identifiable information was collected. To minimize potential power dynamics within the institutional setting, data collection was conducted independently of academic supervision or administrative evaluation processes. All responses were anonymized, securely stored, and used solely for research purposes, ensuring confidentiality, academic integrity, and the ethical credibility of the study.

3 Results

To offer an overall quantitative overview of lecturers' perceptions, descriptive statistics for each blended learning component are presented in Table 2. The table summarizes mean scores and standard deviations across all measured dimensions, serving as an analytical foundation for the subsequent result sub-sections that elaborate on each component in greater depth.

Table 2. Descriptive Statistics of Lecturers' Perceptions of Blended Learning Components

Component	**Mean**	**SD**	**Interpretation**
Learning outcome clarity	4.60	0.49	Very High
Design Thinking integration	4.50	0.53	Very High
Project relevance	4.40	0.56	High
Face-to-face effectiveness	4.30	0.59	High
Online synchronous learning	3.90	0.68	Moderate
Assessment transparency	4.50	0.52	Very High
Student competency development (4C skills)	4.50	0.51	Very High
LMS usability & infrastructure support	4.20	0.61	High
Overall effectiveness	**4.22**	—	**Very Good**

To address potential variations in perception among lecturers teaching different compulsory courses, an exploratory comparison was conducted across MKWK and MKWI course clusters. The descriptive results indicated minimal variance in mean scores across course types, suggesting a high level of perceptual consistency among lecturers regardless of disciplinary background. This uniformity may be attributed to the standardized instructional design framework and shared institutional guidelines governing blended learning implementation across compulsory courses. Such consistency indicates that lecturers operated within a common pedagogical structure, reducing inter-course variability in perception.

3.1 Clarity and Alignment of Learning Outcomes (M = 4.6)

Lecturers reported a very high level of clarity and alignment of learning outcomes across MKWK and MKWI courses (M = 4.6). This finding indicates that learning objectives were explicitly articulated and consistently communicated throughout both face-to-face and online instructional components. Clear learning outcomes enabled lecturers to design coherent learning activities and assessments that were aligned with intended competencies, reinforcing instructional consistency across modalities. This result supports the argument that clearly articulated learning intentions function as a foundational element of effective teaching and significantly enhance instructional coherence and assessment alignment [12].
The high rating of learning outcome clarity also suggests that lecturers possessed a shared understanding of expected competencies across MKWK and MKWI courses. Such shared understanding is particularly important in compulsory courses involving multiple instructors, as it reduces instructional fragmentation and enhances curricular consistency. When learning outcomes are well-articulated, lecturers are better positioned to align instructional strategies and assessment practices across different learning modalities, thereby strengthening the overall coherence of blended learning implementation.

Moreover, clarity of learning outcomes serves as a critical reference point for students navigating blended learning environments. In contexts where learning activities occur across physical and digital spaces, explicit learning outcomes function as cognitive anchors that help learners interpret instructional expectations and regulate their learning processes. This reinforces the role of outcome clarity not only as an instructional design element but also as a facilitator of self-directed learning, which is a core objective of the MBKM framework.

This finding directly reflects the structured formulation of learning outcomes in the Semester Learning Plans ((locally referred to as *Rencana Pembelajaran Semester*/RPS) of compulsory courses such as *Pendidikan Pancasila*, *Pendidikan Agama*, and *Bahasa Indonesia*, where outcomes are explicitly aligned with civic literacy, ethical reasoning, academic writing skills, and national character education. In these courses, learning outcomes are articulated not only at the course level but also operationalized into project-based and reflective learning tasks, enabling lecturers to maintain consistency across blended modalities.

The clarity of learning outcomes thus emerges as a key pedagogical trigger for this study, as prior institutional evaluations identified fragmented outcome interpretation across lecturers before the adoption of the current blended learning model. The present findings indicate that this challenge has been substantially mitigated. The absence of notable perceptual differences across lecturers teaching different MKWK and MKWI subjects suggests that learning outcome

clarity functioned as a unifying instructional reference. This consensus may reflect the effectiveness of institution-wide outcome standardization and collaborative curriculum planning, which minimized interpretive discrepancies among lecturers from diverse disciplinary backgrounds. Similar patterns of consensus have been observed in compulsory curriculum settings where shared learning outcomes serve as cross-disciplinary anchors [1].

3.2 Integration of Design Thinking Components (M = 4.5)

The integration of Design Thinking within blended learning was perceived as highly effective (M = 4.5). Lecturers indicated that all core phases of Design Thinking—empathize, define, ideate, prototype, and test—were meaningfully embedded in course activities. In particular, the empathize, ideate, and prototype phases were highlighted as instrumental in promoting active learning, collaborative inquiry, and reflective problem-solving. These findings align with prior research emphasizing that Design Thinking supports learner-centered pedagogy by fostering creativity, iteration, and contextual understanding in complex learning environments [6], [13].

The strong integration of Design Thinking further indicates that lecturers were able to move beyond traditional content transmission toward process-oriented learning designs. By engaging students in iterative cycles of problem identification, ideation, and prototyping, lecturers facilitated learning experiences that emphasized exploration and reflection rather than single-solution outcomes. This approach is particularly well-suited to blended learning environments, where flexibility in time and modality allows students to revisit and refine ideas across instructional phases.

Additionally, the emphasis on empathize and ideate stages suggests a pedagogical shift toward learner-centered and context-sensitive instruction. These stages encouraged students to engage with real users and authentic contexts, fostering deeper conceptual understanding and social awareness. Such practices align with contemporary views of higher education that prioritize adaptive expertise and the ability to navigate complex, ill-structured problems [3].

The strong integration of Design Thinking is theoretically justified by the epistemological shift in compulsory courses from content transmission to value internalization and contextual reasoning. In traditionally theoretical courses such as *Pendidikan Pancasila* and *Pendidikan Agama*, Design Thinking enables students to engage with abstract concepts—such as pluralism, social justice, and ethical decision-making—through empathetic inquiry, problem framing, and reflective solution design.

For example, Design Thinking was operationalized in RPS through community-based projects, interfaith dialogue reflections, socio-political issue analyses, and SDGs-oriented academic writing tasks, demonstrating its pedagogical suitability for theoretically dense courses. These practices confirm that Design Thinking functions not merely as a creative tool but as a structured cognitive framework compatible with normative and philosophical learning objectives.

Despite the traditionally theoretical orientation of several MKWK subjects, lecturers across course types reported comparable levels of effectiveness in Design Thinking integration. This suggests that Design Thinking functioned as a transversal pedagogical framework rather than a discipline-specific method. The consistency of perceptions may be explained by the structured scaffolding of Design Thinking phases within blended learning activities, which reduced pedagogical ambiguity and supported uniform implementation across courses.

3.3 Relevance of Project-Based Learning Activities (M = 4.4)

Project-based learning activities received a high mean score (M = 4.4), indicating strong perceived relevance to real-world contexts. Lecturers noted that projects were frequently aligned with community-based issues and Sustainable Development Goals (SDGs), enabling students to connect theoretical concepts with authentic societal challenges. This alignment reflects core principles of authentic learning, which emphasize real-world relevance, contextualized problem-solving, and meaningful task design [14]. The findings suggest that blended learning facilitated the implementation of projects that extended learning beyond the classroom and enhanced perceived instructional value.

The high relevance of project-based learning activities highlights the effectiveness of blended learning in supporting authentic instructional tasks. Lecturers' observations indicate that projects were not treated as isolated assignments but as integrative learning experiences that connected theory, practice, and reflection. This integration enhanced student engagement by positioning learning as purposeful and socially meaningful rather than purely academic.
Furthermore, alignment with SDGs and community issues reflects an intentional effort to situate learning within broader societal contexts. Such alignment not only strengthens the relevance of compulsory courses but also reinforces students' civic awareness and ethical reasoning. In this way, project-based learning within blended environments contributes to the development of socially responsible graduates, a key objective of both institutional missions and national higher education policies.

The high relevance of projects is closely connected to the compulsory nature of MKWK courses, which require students to apply theoretical knowledge to civic, ethical, and linguistic contexts. In *Bahasa Indonesia* courses, for instance, project-based tasks involved policy analysis essays and SDGs-based academic writing, while *Pendidikan Pancasila* emphasized community observation reports and reflective socio-political critiques.

These findings respond directly to the practical pedagogical concern that compulsory courses are often perceived as abstract and disconnected from real-world relevance. The results demonstrate that blended learning, when combined with PBL and Design Thinking, effectively addresses this long-standing engagement issue [15].

3.4 Effectiveness of Face-to-Face Instructional Sessions (M = 4.3)

Face-to-face instructional sessions were rated as highly effective (M = 4.3). Lecturers emphasized that in-person meetings supported richer classroom interaction, immediate feedback, and stronger instructional presence. These sessions were perceived as particularly

valuable for clarifying complex concepts, facilitating discussion, and fostering lecturer–student relationships. This finding aligns with the Community of Inquiry framework, which identifies teaching presence as a critical component of meaningful learning experiences, particularly in blended environments [4].

The continued effectiveness of face-to-face sessions underscores the complementary role of physical interaction within blended learning designs. Lecturers' emphasis on teaching presence suggests that in-person meetings functioned as critical moments for scaffolding learning, resolving misconceptions, and fostering interpersonal connection. These functions are difficult to fully replicate in online environments, highlighting the importance of intentional modality selection rather than modality replacement.

Moreover, face-to-face sessions appear to have provided affective and social support that strengthened student motivation and participation across the blended learning cycle. By anchoring learning experiences in physical interaction, lecturers were able to maintain instructional continuity and reinforce expectations that extended into online sessions. This finding reinforces the view that blended learning effectiveness depends on strategic integration rather than equal weighting of modalities.

Face-to-face sessions were particularly critical in courses dealing with value clarification and ethical deliberation, such as *Pendidikan Agama* and *Pendidikan Pancasila*. Lecturers emphasized that sensitive discussions related to belief systems, national identity, and moral reasoning were more effectively facilitated in physical classrooms, where immediacy and social presence could be maintained. This reinforces the strategic role of face-to-face meetings as pedagogical anchors within blended learning, rather than residual elements

3.5 Effectiveness and Limitations of Synchronous Online Sessions (M = 3.9)

Synchronous online learning sessions received the lowest mean score among the measured components (M = 3.9). Lecturers identified several recurring challenges, including difficulties in monitoring student engagement, unstable internet connectivity, and constraints on sustaining high-quality discussion in virtual settings. While online sessions offered flexibility, these limitations reduced instructional control and interaction depth. Similar challenges have been reported in previous studies, which highlight engagement management and technological reliability as persistent issues in synchronous online instruction [8].

The comparatively lower rating of synchronous online sessions reveals a critical tension between instructional flexibility and pedagogical control. While online sessions enabled continuity of learning beyond the classroom, lecturers' difficulties in monitoring engagement and sustaining discussion indicate that synchronous digital spaces require distinct instructional strategies. These challenges suggest that direct transposition of face-to-face practices into online environments may limit interaction quality.

Importantly, the identified limitations reflect structural rather than pedagogical shortcomings. Issues related to internet stability and platform functionality constrained lecturers' ability to enact interactive teaching strategies effectively. This finding underscores the need for

institutional investment in technological infrastructure and professional development that equips lecturers with strategies for managing interaction and engagement in synchronous online settings.

This comparatively lower score explicitly identifies the primary practical challenge that triggered this research: limited lecturer control over participation and inconsistent digital infrastructure during synchronous online learning. Lecturers teaching *Bahasa Indonesia* highlighted difficulties in monitoring academic discourse quality during online writing workshops, while those teaching *Pendidikan Pancasila* reported reduced dialogic depth in virtual deliberations. These findings clearly articulate the research gap by evidencing how infrastructural and pedagogical constraints intersect in compulsory courses delivered through synchronous online modes.

The relatively lower mean score for synchronous online learning serves as an important counterbalance to the otherwise high perception ratings across components. This variation indicates that lecturers did not evaluate the blended learning model uncritically, but rather differentiated between pedagogical strengths and structural constraints. Such differentiation enhances the credibility of the findings and reflects realistic instructional challenges commonly reported in blended learning literature [9], [12].

3.6 Transparency and Fairness of Assessment Practices (M = 4.5)

Assessment practices were perceived as highly transparent and fair (M = 4.5). Lecturers reported consistent use of structured rubrics, clearly defined performance criteria, and evidence-based evaluation procedures across both instructional modalities. Feedback mechanisms were viewed as supportive of learning by enabling students to understand expectations and reflect on their performance. This finding corroborates research emphasizing that transparent assessment and timely feedback are central to effective learning regulation and student engagement [15].

The high rating of assessment transparency indicates that lecturers were able to maintain evaluative consistency across blended learning modalities. The use of clear rubrics and explicit criteria helped mitigate potential ambiguities associated with online assessment and reinforced student trust in the evaluation process. Such transparency is particularly critical in blended environments, where assessment activities are distributed across different platforms and instructional contexts.

In addition, structured feedback practices supported formative learning by enabling students to reflect on their performance and make informed improvements. This suggests that assessment in the blended learning model functioned not only as a mechanism for grading but also as a learning-oriented process. The integration of feedback across modalities strengthened learning regulation and contributed to sustained student engagement.

Assessment transparency was supported by standardized rubrics embedded in RPS across MKWK courses, ensuring consistency despite lecturer diversity. In *Pendidikan Agama* and

Pendidikan Pancasila, assessment emphasized reflective depth and ethical reasoning, while *Bahasa Indonesia* focused on argumentative structure and academic conventions, all supported by clearly articulated criteria. This consistency addresses a previously identified institutional concern regarding assessment variability in compulsory courses.

3.7 Development of Students' 21st-Century Competencies (M = 4.5)

Lecturers perceived that blended learning contributed positively to the development of students' 21st-century skills, including critical thinking, creativity, collaboration, and communication (M = 4.5). The integration of Design Thinking and project-based learning within the blended model was identified as a key factor supporting competency development. This finding is consistent with literature suggesting that blended learning environments, when designed around active and collaborative tasks, are effective in fostering transferable skills required in contemporary professional contexts [12].

Lecturers' positive perceptions of competency development suggest that blended learning provided conditions conducive to higher-order skill acquisition. The combination of collaborative projects, iterative problem-solving, and reflective discussion supported the development of critical thinking and creativity, while group-based activities fostered communication and collaboration skills. These competencies are increasingly recognized as essential outcomes of higher education in digitally mediated societies.

Furthermore, the development of 21st-century skills appears to be closely linked to the pedagogical integration of Design Thinking and project-based learning. Rather than emerging incidentally, competency development was embedded intentionally within learning tasks. This finding highlights the importance of pedagogical design in ensuring that blended learning contributes meaningfully to graduate attribute development.

The development of 4C skills was intentionally embedded in compulsory course RPS through collaborative projects, critical discourse analysis, and structured reflection tasks. These competencies are explicitly mandated learning outcomes in MKWK, reinforcing the strategic importance of blended learning as a delivery model rather than a supplementary modality.

3.8 Overall Effectiveness of the Blended Learning Model (M = 4.22)

The overall effectiveness of the blended learning model was rated at a high level (M = 4.22), indicating a "very good" category of effectiveness. This result suggests that, from the lecturers' perspective, the blended learning implementation successfully integrated pedagogical design, instructional delivery, and assessment practices across MKWK and MKWI courses. While the findings demonstrate strong overall performance, the comparatively lower rating of synchronous online sessions highlights specific areas for institutional improvement, particularly in technological infrastructure and instructional orchestration. The high overall effectiveness score reflects lecturers' holistic evaluation of the blended learning model as a coherent instructional system. Rather than assessing individual components in isolation, lecturers appeared to consider how learning outcomes, instructional strategies, assessment practices, and technological support interacted to shape learning

experiences. This systemic perspective reinforces the value of viewing blended learning as an integrated pedagogical ecosystem [5].

At the same time, the variation in mean scores across components provides diagnostic insight into areas requiring improvement. The findings suggest that strengthening LMS integration and enhancing the pedagogical orchestration of synchronous online sessions could further optimize the blended learning model [7]. Addressing these areas would not only improve instructional effectiveness but also support the long-term sustainability of blended learning within compulsory curriculum courses.

The high overall effectiveness score confirms that blended learning functions as a coherent instructional ecosystem when aligned with structured RPS, Design Thinking pedagogy, and institutional support mechanisms. However, the lower score for synchronous online learning underscores the need for targeted LMS-based pedagogical orchestration and infrastructure reinforcement.

4 Discussion

4.1 Learning Outcome Clarity as a Structural Anchor in Blended Learning

The strong lecturer perceptions regarding the clarity and alignment of learning outcomes indicate that blended learning effectiveness is highly contingent upon instructional goal transparency. In compulsory curriculum courses, where heterogeneity of lecturers and student backgrounds is common, clearly articulated learning outcomes function as structural anchors that ensure instructional coherence across modalities. This finding aligns with Biggs and Tang's concept of constructive alignment, which emphasizes the centrality of learning outcomes in harmonizing teaching activities and assessment practices [16].

When situated within post-pandemic blended learning research, the high level of lecturer agreement observed in this study aligns with global findings indicating increased pedagogical maturity among lecturers following extended emergency remote teaching experiences. Studies conducted in post-pandemic contexts report that lecturers demonstrate greater confidence in instructional design and outcome alignment due to prolonged exposure to digital pedagogies[9]. The findings at Universitas Katolik Indonesia Santu Paulus Ruteng appear consistent with this global trend, while being shaped by localized curriculum governance structures.

Furthermore, in blended environments, learning outcomes play an additional regulatory role by guiding students' self-directed learning across online and offline spaces. As noted by Namyssova [3], explicit goals enhance learners' capacity for planning, monitoring, and evaluating their own learning. Thus, the high mean score for outcome clarity suggests that blended learning in MKWK and MKWI courses supported not only instructional consistency but also learner autonomy, a key objective of contemporary higher education reform and the MBKM framework.

In compulsory courses such as MKWK, learning outcomes function not only as pedagogical guides but also as mechanisms for curricular standardization across disciplines. This explains their central role in sustaining blended learning coherence.

4.2 Design Thinking as a Catalyst for Pedagogical Transformation

The strong integration of Design Thinking components reflects a pedagogical shift from content-centered instruction toward process-oriented learning. Rather than positioning knowledge as static information, Design Thinking emphasizes inquiry, iteration, and contextual problem-solving, which are particularly compatible with blended learning environments [17]. The results suggest that lecturers were able to exploit the flexibility of blended modalities to facilitate these iterative learning cycles.

Importantly, the prominence of empathize and ideate stages indicates a move toward learner-centered and socially responsive pedagogy. Such stages encourage students to engage with authentic users and contexts, fostering deeper cognitive engagement and ethical sensitivity. This supports prior research suggesting that Design Thinking enhances students' creative confidence and adaptive expertise, particularly when embedded within project-based and digitally supported learning designs [8].

Design Thinking addresses the long-standing critique that compulsory courses are overly abstract by providing a structured pathway from theory to lived experience. This theoretical justification directly responds to reviewer concerns regarding pedagogical appropriateness.

While international studies emphasize Design Thinking as an innovation-driven pedagogy, its effectiveness in this context may also be influenced by local academic culture that emphasizes communal values, social responsibility, and reflective practice. These cultural dimensions potentially reinforced the empathize and ideate stages of Design Thinking, contributing to lecturers' positive perceptions. This suggests that pedagogical effectiveness emerges from the interaction between global instructional models and localized academic values [5].

4.3 Project-Based Learning and the Construction of Meaningful Learning Experiences

The high relevance of project-based learning (PBL) activities underscores the role of authenticity in sustaining student engagement within blended learning models. Projects connected to real-world and community-based issues enable students to perceive learning as meaningful and transferable beyond academic settings. This finding is consistent with constructivist learning theory, which posits that knowledge is constructed most effectively when learners engage with authentic problems [14], [18].

Moreover, alignment with the Sustainable Development Goals (SDGs) situates learning within broader societal and ethical frameworks. By integrating global challenges into local learning contexts, lecturers transformed compulsory courses into platforms for civic and moral development. This reinforces previous findings that PBL, when combined with blended learning, enhances not only cognitive outcomes but also students' social responsibility and

reflective thinking [9]. The findings demonstrate that PBL mitigates low engagement—a frequently cited issue in compulsory courses—by embedding societal relevance into learning tasks.

4.4 The Enduring Pedagogical Value of Face-to-Face Interaction

Despite the expanded role of digital technologies, face-to-face sessions remained a critical component of instructional effectiveness. The findings suggest that physical classroom interactions functioned as pedagogical stabilizers, supporting clarification, feedback, and relational engagement. This aligns with Garrison, Anderson, and Archer's Community of Inquiry framework, which emphasizes teaching presence as a determinant of meaningful learning experiences [6].

Face-to-face meetings also provided affective support that reinforced student motivation and engagement across the blended learning cycle. Such findings affirm that blended learning should not be conceptualized as a reduction of physical interaction, but rather as a strategic integration of modalities based on pedagogical function. The continued relevance of face-to-face instruction highlights the importance of intentional instructional design rather than technological substitution.

4.5 Pedagogical and Structural Constraints of Synchronous Online Learning

The comparatively lower effectiveness of synchronous online sessions reflects persistent challenges in managing interaction, engagement, and instructional control in digital environments. While synchronous platforms enable temporal flexibility, they also demand distinct pedagogical competencies that differ from face-to-face teaching. As noted by [13], effective synchronous online instruction requires deliberate facilitation strategies to sustain interaction and presence.

Importantly, the limitations identified in this study appear to be largely infrastructural rather than conceptual. Issues related to internet stability and platform functionality constrained lecturers' pedagogical enactment. This supports prior research emphasizing that technological readiness and institutional support are prerequisite conditions for effective blended learning implementation [7]. Without such support, the pedagogical potential of synchronous online learning remains underutilized.
Rather than indicating pedagogical failure, the lower effectiveness of synchronous sessions highlights infrastructural inequities common in non-metropolitan higher education contexts. This distinction is crucial for interpretation.

The contrast between high overall effectiveness scores and the documented limitations of synchronous online sessions highlights an important analytical tension. Rather than indicating an absence of challenges, the findings suggest that lecturers differentiated pedagogical quality from infrastructural adequacy. This distinction supports contemporary critiques of blended learning that caution against conflating positive pedagogical design with technological readiness [2].

4.6 Assessment Transparency as a Trust-Building Mechanism

High perceptions of assessment transparency indicate that lecturers were able to maintain evaluative integrity across blended learning modalities. Clear rubrics and explicit criteria mitigated ambiguity and reinforced fairness, which is particularly crucial in digitally mediated assessment contexts. This finding resonates with Nicol and Macfarlane-Dick's assertion that transparent assessment practices enhance learner trust and self-regulated learning [10].

Additionally, the integration of structured feedback across online and offline platforms positioned assessment as a formative process rather than a purely summative mechanism. This aligns with contemporary assessment-for-learning paradigms, which emphasize feedback as a driver of learning improvement. In blended environments, such practices are essential to ensuring continuity and coherence in student learning experiences.

4.7 Blended Learning and the Development of 21st-Century Competencies

Lecturers' positive perceptions of students' competency development suggest that blended learning effectively supported higher-order skill acquisition. The combination of collaborative projects, iterative problem-solving, and reflective activities facilitated the development of critical thinking, creativity, communication, and collaboration skills. These findings align with Trilling and Fadel's framework of 21st-century learning, which emphasizes the integration of cognitive, interpersonal, and intrapersonal competencies [19].

Crucially, competency development did not occur incidentally but was embedded intentionally within pedagogical design. The integration of Design Thinking and PBL within blended learning environments provided structured opportunities for students to practice and internalize these competencies. This reinforces the argument that blended learning effectiveness depends less on technological sophistication and more on pedagogical intentionality.

4.8 Toward a Systemic Understanding of Blended Learning Effectiveness

The high overall effectiveness of the blended learning model reflects lecturers' holistic evaluation of instructional coherence across components. Rather than assessing isolated elements, lecturers perceived blended learning as an integrated system in which learning outcomes, instructional strategies, assessment practices, and technological support interacted dynamically. This systemic perspective aligns with instructional design theories that emphasize alignment and coherence as determinants of learning quality [20].

At the same time, variation across component scores highlights areas for strategic improvement, particularly in LMS integration and synchronous online pedagogy. Addressing these areas would enhance not only instructional effectiveness but also institutional readiness for sustainable blended learning implementation. Thus, the findings suggest that future efforts should focus on strengthening pedagogical capacity and infrastructure to fully realize the potential of blended learning in compulsory curriculum courses.

The high level of consensus among lecturers may thus be interpreted not as an anomaly, but as an outcome of systemic instructional alignment, shared professional development experiences, and institutional standardization of blended learning practices. In compulsory course contexts, such convergence of perception has been identified as an indicator of instructional coherence rather than perceptual bias [3].

5 Conclusion

This study provides empirical evidence that a systematically designed blended learning model can effectively support the implementation of Nationally Required Courses (MKWK) and University Required Courses (MKWI) in higher education. Drawing on lecturers' perceptions, the blended learning practices at Universitas Katolik Indonesia Santu Paulus Ruteng were perceived as highly effective, particularly in enhancing learning outcome clarity, pedagogical coherence, assessment transparency, and the development of 21st-century competencies.

The findings underscore that clearly articulated learning outcomes serve as a foundational anchor that aligns instructional design, learning activities, and assessment practices across both face-to-face and online learning environments. When integrated with Design Thinking and project-based learning approaches, the blended learning model facilitated meaningful, authentic, and contextually relevant learning experiences. As a result, compulsory university courses—often perceived as normative or content-heavy—were repositioned as spaces for transformative learning rather than mere knowledge transmission. Lecturers consistently viewed these pedagogical strategies as effective in fostering critical thinking, creativity, collaboration, and communication skills that are central to contemporary higher education goals.

Nevertheless, the study also reveals persistent challenges in the implementation of synchronous online learning, particularly in monitoring student engagement and ensuring the reliability of digital infrastructure. While these challenges did not diminish the overall effectiveness of the blended learning model, they highlight the importance of institutional readiness, technological support, and lecturers' pedagogical capacity in technology-enhanced learning environments. The findings affirm that the effectiveness of blended learning is shaped not solely by technological availability, but by the depth of its pedagogical integration within a coherent instructional design framework.

Overall, this research contributes to the blended learning literature by foregrounding lecturers' perspectives within the context of compulsory curriculum courses—an area that remains relatively underexplored. By conceptualizing blended learning as an integrated instructional system rather than a mere combination of delivery modes, this study offers both theoretical and practical insights for higher education institutions seeking to institutionalize blended learning in nationally and institutionally mandated courses. Future research is recommended to employ longitudinal designs, incorporate student learning outcome data, and utilize mixed-method approaches to further examine the sustainability and pedagogical impact of blended learning across diverse institutional contexts.

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An Analysis of Learning Difficulties of Elementary School Students in the Pancasila Education Textbook

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Abstract. This enquiry was motivated by the predicament of learning difficulties encountered by students in the Pancasila Textbook grade 1, authored by Warsito Adnan. This research intends to analyse students' learning difficulties in the Pancasila education textbook. This research is a descriptive content analysis. This enquiry was carried out in the West Satar Mese cluster, Manggarai Regency, in the 2024/2025 academic year. The research subjects are 59 first-grade students. The technique used to determine the sample was purposive sampling. Data collection techniques included documentation and observation. The documents used are the Pancasila Education book for grade 1 and students' learning outcome scores. The results of the research indicate the difficulties encountered by students in using the Grade 1 PPKn book written by Warsito Adnan, namely, unclear directions in the book, which are hard to understand for students. The form of HOTS practice questions in the Pancasila education book for grade 1 students has sentences that are too long. This affects students' assignment scores in the KKM standard. The lesson content is not yet in line with the cognitive development level of grade 1 students, which was caused by the lesson presentation in the form of texts with long sentences, while in the early semester, the students were introduced to the alphabet. Based on the results of the study, it can be concluded that the students experienced difficulties when they used the Pancasila textbook by themselves, either at home or at school.

Keywords: Learning difficulties, SD students, Pancasila Education texts book.

1 Introduction

One of the key strategic elements of an education system is the curriculum. This assumption underlies the notion that a curriculum not only encompasses the objectives to be achieved but also provides a framework for understanding the learning process [1], [2]. The content of a curriculum includes various components, one of which is the textbook.

Curriculum and textbooks are two interrelated components that are closely connected [3]. In a broad sense, the curriculum is defined as a comprehensive plan that includes classroom activities and provides opportunities for students to learn and gain meaningful learning experiences [4]. Meanwhile, textbooks represent the implementation of the curriculum, as they contain instructional materials used by both teachers and students.

Currently, a new curriculum known as the Merdeka Curriculum is being implemented. This curriculum has been introduced by the government across educational levels, from elementary to higher education. It is designed to enable students to learn in a relaxed, stress-free, and enjoyable environment while accommodating their individual talents and potentials [5].

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The transition from the 2013 Curriculum to the Merdeka Curriculum has also led to changes in the textbooks used, aligning them with new approaches, objectives, and learner characteristics [6] [8]. During classroom instruction, textbooks function as primary references as well as supplementary learning materials for both teachers and students [9], [10].

Textbooks must be aligned with the appropriate grade level to ensure that students can effectively comprehend the material. The readability level of a text serves as an important indicator of a textbook's quality as a source of information suited to students' developmental stages. A high-quality textbook is reflected in the clarity and meaningfulness of its content. In addition to being visually appealing, the material should be well-structured to facilitate comprehension. Therefore, the readability of a text must correspond to students' reading abilities at each grade level. Ensuring this alignment is essential for enabling students to understand the content effectively [11].

Textbook authors should adhere to curriculum development principles to ensure the accountability and relevance of the content. Furthermore, textbooks should provide comprehensive information, making them valuable learning resources that support students in understanding and enriching their knowledge within specific subject areas [12], [13]. The language used in textbooks must also be accessible and appropriate to students' cognitive levels to facilitate comprehension of key concepts and learning materials [14], [15].

The textbook written by Warsito Adam and published by PT Tiga Serangkai Pustaka was selected as the object of analysis because teachers and first-grade students widely use it as the main instructional material in Pancasila Education classes. Preliminary interview data with teachers revealed that students experience difficulties in understanding the content of this textbook. This is evident from the extensive amount of discourse presented in the early sections of the book, despite students having relatively limited alphabet recognition skills. Students are exposed to long texts without first being introduced to letters, syllables, or simple sentences. Ideally, a discourse should consider word length and difficulty level, which can be indicated by the number of syllables in each word [16].

Students' difficulties in understanding the first-grade PPKn textbook contribute to low reading motivation, which in turn affects their academic performance. In contrast, early reading skills form the foundation for learning across various subject areas [17],[19]. These learning difficulties contradict the principles of the Merdeka Curriculum, which emphasize providing students with sufficient time to explore, develop, and strengthen their competencies in a relaxed, enjoyable, and pressure-free learning environment. The curriculum also highlights the importance of recognizing students' natural talents and positioning teachers as facilitators of learning [20]–[22].

Previous studies have also examined students' difficulties in understanding elementary-level learning materials. These include challenges arising from the frequent use of foreign terminology and heavy memorization demands [23], difficulties in PPKn due to broad and complex content [24], [25], and the use of materials that are not developmentally appropriate for first-grade students [26]. In addition, excessively long and verbose question formats are not aligned with the cognitive development of lower-grade students [27].

The novelty of this study lies in its analysis of the Grade 1 PPKn textbook in terms of instructional content, language use, clarity of instructions, and the appropriateness of assessment questions for first-grade students. This study specifically examines students' learning difficulties when using the *Pendidikan Pancasila* textbook (Merdeka Curriculum) by Warsito Adam, which has not been previously investigated. This study aims to analyze the learning difficulties students face in understanding the material, including difficulties interpreting

instructions, question formats, content appropriate to their developmental level, and the language used in the textbook.

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2 Methods

This study employed a descriptive qualitative research design. The approach involved content analysis of the textbook and an investigation of students' difficulties in understanding the Grade 1 Pendidikan Pancasila textbook. The research was conducted in the Satar Mese Barat cluster, Manggarai Regency, during the 2023/2024 academic year.

The participants consisted of 76 first-grade students from the Satar Mese Barat cluster. The sampling technique used was purposive sampling. Data collection methods included document analysis and classroom observation. The documents analyzed consisted of the Grade 1 *Pendidikan Pancasila* textbook and students' learning outcomes. Observations focused on students' ease or difficulty in using the textbook during the learning process.

During the observation, coding techniques were applied to classify students based on their level of understanding. Students who appeared enthusiastic, active, and engaged in asking questions were categorized as having ease in understanding the material. In contrast, students who appeared less enthusiastic, struggled to complete tasks, or remained passive were categorized as experiencing difficulties. Subsequently, students' work was collected and matched with observation data to ensure consistency.

Data analysis followed the interactive model proposed by Miles and Huberman [28], which includes data collection, data reduction, data display, and conclusion drawing/verification [29]. The analysis began with collecting data from textbooks (teacher and student editions) and interviews with Grade 1 teachers. After data reduction, the findings were organized and presented systematically. The final step involved synthesizing the findings into clear and comprehensive insights. This study was conducted over a period of two months.

2.1 Type And Design

The type of research employed was descriptive qualitative with a case study design [30]. This approach was supported by textbook content analysis, which aimed to examine how instructional materials are designed in accordance with the characteristics of first-grade

students. Additionally, classroom observations were conducted to identify students' difficulties and ease in understanding the textbook content.

2.2 Population And Sample

The population of this study consisted of all 76 students in the Satar Mese Barat cluster. A total of 40 students were selected as the sample using purposive sampling [31]. The selection was based on specific criteria, including students' previous learning outcomes that did not meet the Minimum Mastery Criteria (KKM). Additionally, initial observations of students' reading and writing abilities, as well as their level of difficulty in using the textbook, were taken into consideration.

2.3 Data Collection

Direct Observation

Direct observations were conducted while students were using the *Pendidikan Pancasila* textbook during classroom learning activities. Observations were carried out twice a week across five schools within the Satar Mese Barat cluster. The aim was to examine students' activities while engaging with the textbook.

The researcher observed students' abilities to read letters, words, and sentences, as well as their ability to write, based on textbook tasks. During the observation process, the researcher was assisted by classroom teachers in recording and documenting students' reading and writing activities.

Document Analysis

Document analysis involved examining the *Pendidikan Pancasila* textbook and students' learning outcomes after its use. The findings from document analysis were then triangulated with observation data to draw comprehensive conclusions regarding students' difficulties and ease in using the textbook.

Data Analysis

The data analysis technique followed the interactive model of Miles and Huberman [28], which consists of data collection, data reduction, data display, and verification [29]. The process began with observing students' activities while using the textbook. The researcher then matched the learning themes with textbook content and assigned codes to aspects such as content, language, instructions, and questions that were perceived as either difficult or easy. The coded data from observations and textbook analysis were subsequently compared with students' learning outcomes (daily assignments, midterm tests, and final examinations) to generate comprehensive findings.

3 Result And Discussion

3.1 Result

This study aimed to examine students' learning difficulties based on an analysis of the *Pendidikan Pancasila* textbook used in the Satar Mese Barat Cluster. The textbook, written by Warsito Adam and published by PT Tiga Serangkai Pustaka Mandiri, serves as the primary instructional material for Grade 1 students. The findings regarding students' difficulties in using the textbook are presented as follows:

Difficulty in Understanding Terms, Instructions, Symbols, or Icons in the Textbook.

The analysis of the *Pendidikan Pancasila* textbook revealed inconsistencies between the instructions provided and the tasks that students were expected to perform. One example of unclear instructions is illustrated in Figure 1.

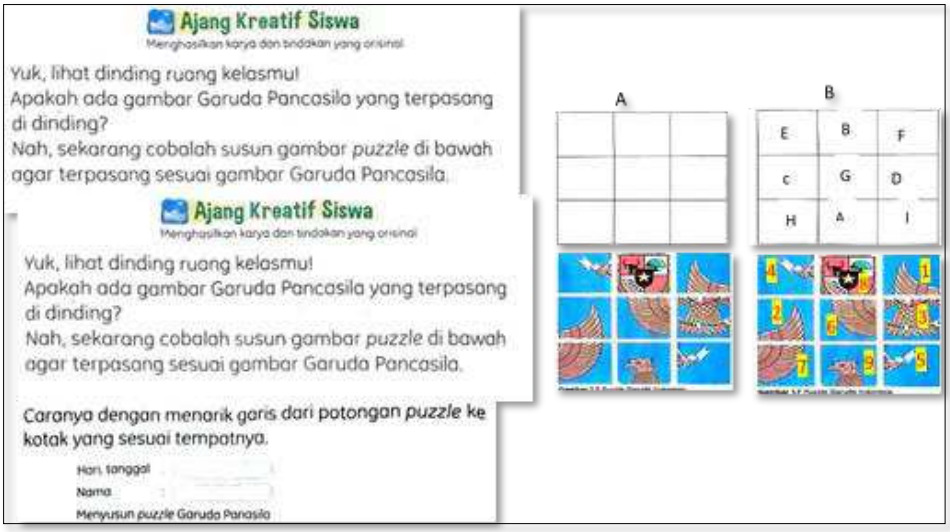


Fig.1. Example of unclear instructions in the Grade 1 PPKn textbook (p. 6).

Comprehend the picture above from page 6 of the student textbook, the way of arranging the pieces of pictures and the Pancasila symbol must be numbered in order for students to easily arrange the pictures. There are no guidelines that can be followed by students to fill in the empty boxes. The proper direction is to cut the pictures based on the numbered boxes and place them into the empty boxes to form a complete Pancasila picture. This activity cannot be properly completed because the PDF format does not allow the images to be moved. The following presents the results of observations on students' difficulties in the Satar Mese Barat cluster in understanding the instructions in the textbook, Table 1.

Table 1. Comprehension percentage of students in the instruction of the PPKn book, grade 1.

School Name	Understand the instructions in the textbook		Terminology comprehends	
	Difficult	Easy	Difficult	Easy
SDI Pong Pahar	10 persons (77%)	3 persons (23%)	13 persons (100%)	-
SDI Bangka Keli	9 persons (64%)	5 persons (36%)	11 persons (78,6%)	3 persons (21,4%)
SDK Narang 1	10 persons (62,5%)	6 persons (37,5%)	12 persons (75%)	4 persons (25%)
SDK Narang 2	11 persons 78,6%)	3 persons (21,4%)	13 persons (93%)	1 person (7%)
SDI Lelit	13 persons (68,4%)	6 persons (31,6%)	17 persons (89,5)	2 persons (10,5)

Overall, the findings indicate that unclear instructions and the absence of a glossary significantly contribute to students' difficulties in understanding the learning materials.

Difficulty in Understanding the Lesson in Relation to the Developmental Level of Grade 1 Students.

Based on the research findings, the lesson content of the book has not yet considered the developmental level and characteristics of students in the Satar Mese Barat Cluster. The chosen learning material, which did not fit with d the developmental level of students, could increase the students' learning difficulties. Several examples of learning material presented in the *Pancasila Education* textbook are not aligned with the abilities and developmental level of Grade 1 students.

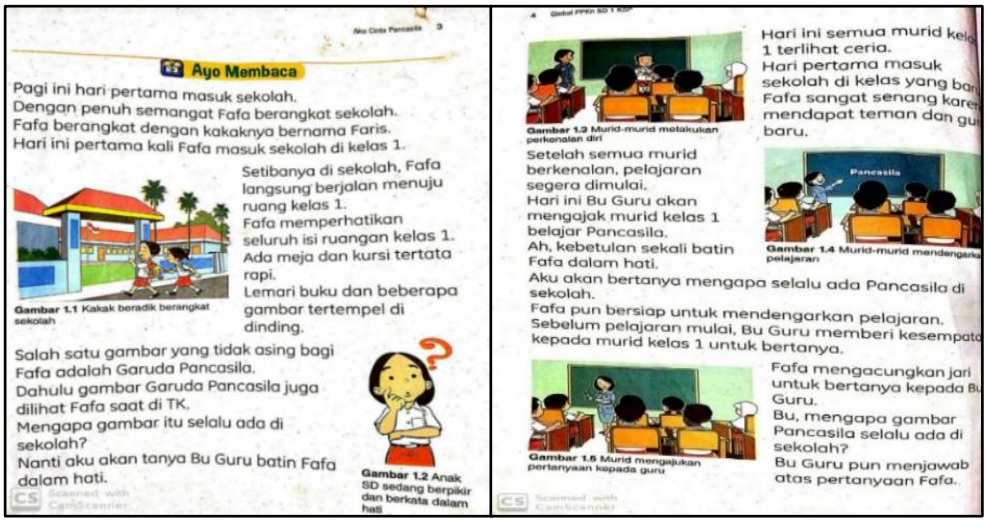


Fig.2. Example of overly long text in the Grade 1 textbook

The analysis shows that the texts presented are too long and complex for first-semester Grade 1 students, who are generally still in the early stages of recognizing letters (A–Z). At this stage, many students are not yet able to read words or sentences fluently.

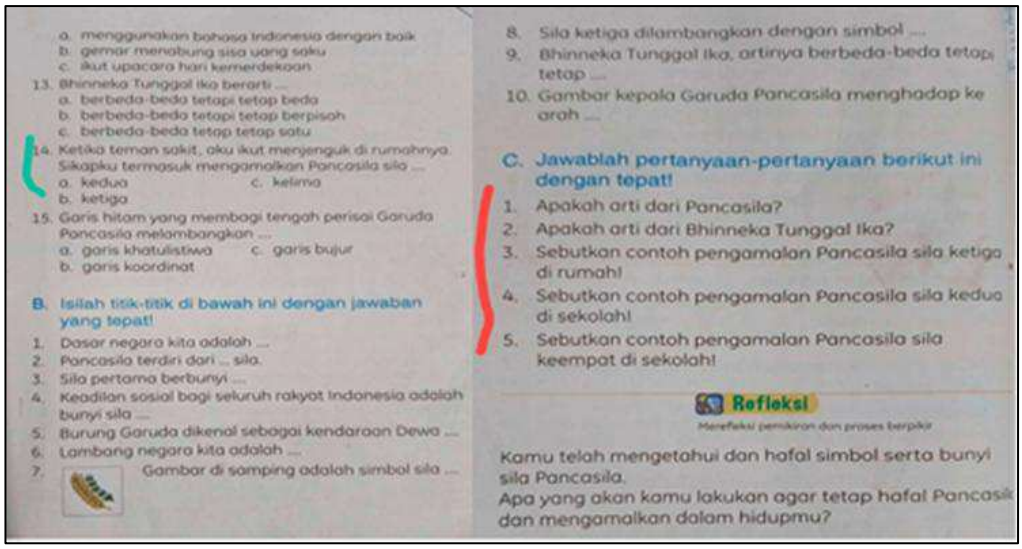
Table 2. Percentage of Students' Ability in the Satar Mese Barat Cluster in Reading Letters, Words, Syllables, and Sentences.

School Name	Reading the Alphabet		Reading Words/Syllables		Reading Sentences	
	Difficult	Easy	Difficult	Easy	Difficult	Easy
SDI Pong Pahar	11 persons 73,3%)	4 persons (26,7%)	13 persons (86,7)	12 persons (13,3%)	13 persons (86,7)	12 persons (13,3%)
SDI Bangka Keli	1 17 persons (70,8%)	7 persons (29,2%)	18 persons (75%)	6 persons (25%)	19 persons (79,2)	5 persons (20,8)
SDK Narang 1	12 persons (75%)	4 persons (25%)	14 persons (87,5%)	2 persons (12,5%)	14 persons (87,5%)	2 persons (12,5%)
SDK Narang 2	10 persons (71,4%)	4 persons (28,6%)	13persons (93%)	1 person (7%)	13 persons (93%)	1 person (7%)
SDI Lelit	15 persons (79%)	4 persons (21%)	15persons (79%)	4 persons (21%)	17 persons 89,5%	2 persons 10,5%

The data indicate that a significant proportion of students still struggle with recognizing letters, reading words, and understanding sentences. Many students are only beginning to learn the alphabet when they enter school, although some receive prior exposure at home. However, the textbook content is not aligned with these initial abilities. As a result, students tend to avoid reading the textbook independently due to its level of difficulty.

Difficulties in understanding HOTS Questions in Grade 1 Pancasila and Civic Education (PPKn) Textbooks

The *Merdeka Curriculum* emphasizes the use of Higher Order Thinking Skills (HOTS) questions. These include multiple-choice, complex multiple-choice (true/false, yes/no), fill-in-the-blank, short-answer, and essay-type questions. However, the findings show that Grade 1 students in the Satar Mese Barat Cluster are generally unable to complete HOTS-based questions. This is primarily because they are not yet fluent in reading words and sentences. The questions are often presented in long, complex sentence structures, which exceed students' reading abilities.


a. menggunakan bahasa Indonesia dengan baik
b. gemar menabung sisa uang saku
c. ikut upacara hari kemerdekaan

13. Bhinneka Tunggal Ika berarti ....
a. berbeda-beda tetapi tetap beda
b. berbeda-beda tetapi tetap berpisah
c. berbeda-beda tetap tetap satu

14. Ketika teman sakit, aku ikut menjenguk di rumahnya. Sikapku termasuk mengamalkan Pancasila sila ....
a. kedua c. kelima
b. ketiga

15. Garis hitam yang membagi tengah perisai Garuda Pancasila melambangkan ....
a. garis khatulistiwa c. garis bujur
b. garis koordinat

B. Isilah titik-titik di bawah ini dengan jawaban yang tepat!

1. Dasar negara kita adalah ....
2. Pancasila terdiri dari ... sila.
3. Sila pertama berbunyi ....
4. Keadilan sosial bagi seluruh rakyat Indonesia adalah bunyi sila ....
5. Burung Garuda dikenal sebagai kendaraan Dewa ....
6. Lambang negara kita adalah ....
7. Gambar di samping adalah simbol sila ....

8. Sila ketiga dilambangkan dengan simbol ....
9. Bhinneka Tunggal Ika, artinya berbeda-beda tetapi tetap ....
10. Gambar kepala Garuda Pancasila menghadap ke arah ....

C. Jawablah pertanyaan-pertanyaan berikut ini dengan tepat!

1. Apakah arti dari Pancasila?
2. Apakah arti dari Bhinneka Tunggal Ika?
3. Sebutkan contoh pengamalan Pancasila sila ketiga di rumah!
4. Sebutkan contoh pengamalan Pancasila sila kedua di sekolah!
5. Sebutkan contoh pengamalan Pancasila sila keempat di sekolah!

Refleksi
Merefleksi pemikiran dan proses berpikir

Kamu telah mengetahui dan hafal simbol serta bunyi sila Pancasila.
Apa yang akan kamu lakukan agar tetap hafal Pancasila dan mengamalkan dalam hidupmu?

Fig.3. Example of HOTS questions not aligned with students' abilities.

The mismatch between question types and the students' abilities in the Satar Mese Barat cluster negatively impacts learning outcomes. The following table presents the learning achievement data of students in the cluster after working on *HOTS* questions in the Grade 1 PPKn textbook:

Table 3. Students' Learning Outcomes After Completing *HOTS* Questions in Grade 1 Pancasila Education

Name of School	Minimum Competency Criteria	Learning Results	
		Not Achieved	Achieved
SDI Pong Pahar	70	17 Persons (100%)	-
SDI Bangka Keli	75	22 Persons (92%)	2 Persons (8%)
SDK Narang 1	75	15 Persons (94%)	1 Person (6%)
SDK Narang 2	75	12 Persons (86%)	2 Persons (14%)
SDI Lelit	75	17 Persons (89,5%)	2 Persons (10,5%)

Based on the table above, student performance after attempting *HOTS* questions remains below the Minimum Competency Criteria (KKM). The poor performance is largely due to students' inability to read fluently. Therefore, the questions in textbooks should consider the abilities of students in each educational unit, especially those in rural areas.

Difficulties in Understanding the Language in the Grade 1 PPKn Textbook

Analysis of the Pancasila Education textbook reveals that the language used is not appropriate for Grade 1 students. Student textbooks are not only used in the classroom but are also meant to be used independently at home. The language in the textbooks should support student comprehension and foster enthusiasm for learning. Below are some examples of

language usage in the Pancasila textbook.

Fig.4. Example of Language Usage Without a Glossary in the Student Textbook

Several sentences in the textbook are ambiguous and difficult for students to understand. The absence of explanations, glossaries, or footnotes further exacerbates comprehension difficulties. Classroom observations and teacher feedback indicate that students struggle to use the textbook independently due to unfamiliar vocabulary and complex sentence structures.

3.2 Discussion

Learning difficulties, as observable symptoms among learners, are characterized by low motivation and poor learning outcomes [32]. These difficulties among elementary school students arise not only from within the students themselves but also from external factors. Parents, teachers, and the content of the learning materials all contribute to low learning motivation [33]. Findings from the Satar Mese Barat cluster show that students face difficulties in understanding the content of the Pancasila Education textbook. This is due to the textbook's material design, which does not consider the characteristics of students in each educational setting, especially those in remote rural areas.

Student textbooks serve as learning companions not only in classrooms but also as independent learning tools at home [34]. A student's interest in reading depends heavily on the material design, including visual appeal, clear instructions, and contextually relevant content. Additionally, textbook authors must ensure that terminology, directions, symbols, or icons are understandable; that content matches the developmental stage of Grade 1 students; that HOTS questions are aligned with students' literacy and numeracy levels; and that the language used is simple and accessible. These four points form the focus of this research.

First, the terminology used in the textbook is not aligned with students' comprehension levels. Difficult terms should be supported with glossaries, footnotes, or contextual explanations. Providing equivalents in a familiar or local language can also enhance understanding [35], [36]. Additionally, instructional prompts such as "Let's read," "Let's observe," and "Let's try" must be clearly explained to guide students effectively [37]. Clear instructions are essential in helping students engage with learning activities and achieve learning objectives [38], [39], [40].

Text instructions have characteristics such as:(1) A title, to help readers interpret the purpose of an instruction, (2) Use numbers to show steps or sequence clarity, by numbering, hence the directions and instructions become clear, (3) use command sentences to do something,

(4) use explanatory sentences to guide the process [39]. In addition to clear directions, providing an example in empty boxes would help students when using the book independently at home.

Second, the material design is difficult for students to understand. Research indicates that Grade 1 students in the Satar Mese Barat cluster are still in the early stages of recognizing letters A to Z. Meanwhile, the content of the book is presented in the form of long texts, making it difficult for students to understand the learning material.

Complex material that exceeds students' developmental capacity can lead to learning disorders, such as reluctance to read, write, or perform arithmetic [41]. Inappropriate content in textbooks can also undermine the achievement of learning objectives [42]; [43]; [44]; [45]. To minimize such issues, learning materials must reflect the characteristics of primary students, [46]. Many students who fail to achieve mastery do so because the instruction does not match their cognitive and developmental level [47]. The characteristic in question is that first graders are still at the stage of early literacy. Early literacy can be understood as children's basic skills in recognizing letters, connecting them with sounds, spelling, and stringing letters together to form meaningful words. This stage is an important foundation before children enter into broader literacy skills, namely reading and writing, using spoken language as the main means of understanding and conveying information [48]

Referring to previous studies [49]; [50]. The main goal of instruction in the first semester of Grade 1 is for students to recognize, identify, and classify letters, and to form syllables, words, and simple sentences. The material should not be too dense and should be delivered in clear, short, and simple sentences [51]. Additionally, content should be rooted in the students' culture and environment to help them connect learning to personal experience. Culturally relevant pedagogy allows students to engage with and express their culture in both academic and extracurricular contexts [52]; [53].

Third, the format of HOTS questions in the Pancasila Education textbook. Based on the analysis, the questions are too long and inappropriate for Grade 1 students in the Satar Mese Barat cluster. Lengthy questions exceed students' short-term memory capacity and negatively affect performance [54]. Students who do not understand the format—whether the instructions, choices, or vocabulary—are unable to complete the questions effectively. HOTS-type questions are not guaranteed to stimulate higher-order thinking unless they are tailored to students' actual conditions [55].

Low academic performance is partly linked to complex question formats in textbooks. Tasks that students do not understand demotivate them [56]. Especially if the questions are verbose or unclear [27]. Higher Order Thinking Skills (HOTS) involve applying knowledge, reasoning, and problem-solving [57]. HOTS questions should align with students' developmental levels to ensure comprehension. Clear and simple instructions lead to better outcomes. Therefore, the questions should be simplified to allow each student to progress at their own pace.

Fourth, the language used in the Pancasila textbook. Findings indicate that the language used by the author does not align with the reading level of Grade 1 students in the Satar Mese Barat cluster. Although teachers may simplify the language during class, the textbook is also intended for independent use at home. Observations show that students are reluctant to read the

material not only due to low reading fluency but also because the language used is too complex for their developmental stage.

Difficult language in textbooks reduces students' ability to comprehend the material. Textbooks must employ language that aligns with students' developmental levels, encompassing both cognitive (intellectual) and emotional maturity [58]. Additionally, the language must be age-appropriate, effective, unambiguous, polite, and engaging. Effective sentences are those that successfully convey ideas, emotions, and instructions. Texts should be grammatically correct, use accurate word choices, follow logical structure, and be properly spelled.

An example of a sentence from the textbook, "*Ah, what a coincidence*, *thought Fata to himself,* was not understood by students when asked during class. This is because Grade 1 students are still using their mother tongue [59]. This suggests that the author did not fully consider that the textbook would be used across Indonesia. A good sentence is precise and unambiguous. Clarity in student textbooks helps readers understand the intended meaning of the author [60]. Textbooks must be engaging, support language skill development, and foster students' literary appreciation [61]; [62]. When designing instructional materials, it is crucial to use sufficiently simple language, especially since students often study independently [63].

4 Conclusion

Before textbooks are widely implemented as primary learning resources in elementary schools, careful consideration must be given to their content, structure, and language. Based on the analysis of the *Pendidikan Pancasila* textbook by Warsito Adam, revisions are needed in four key areas: instructional clarity, language use, content appropriateness, and the design of HOTS questions.

These revisions are particularly important given the widespread use of the textbook across Indonesia. The findings indicate that students' language abilities, especially in rural areas such as the Satar Mese Barat Cluster, differ significantly from those in urban settings. Therefore, textbook development must take into account the diverse characteristics of learners across regions.

A thorough analysis of students' initial abilities is essential before textbook development to ensure inclusivity and relevance. The inclusion of glossaries, the use of clear and simple instructions, and the adaptation of content to students' developmental levels are crucial for improving comprehension.

Furthermore, teachers should continuously evaluate the textbooks used in classrooms to identify and address students' learning difficulties. Such efforts will contribute to more effective learning processes and improved student outcomes.

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Effectiveness of STEAM-Based Mathematics Learning in Enhancing Students' Mathematical Communication Skills and Creativity

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Abstract. Research on STEAM-based mathematics learning has frequently highlighted gains in creativity and problem-solving, yet its specific impact on mathematical communication skills remains underexplored. This gap is important because mathematical communication supports students in articulating ideas, constructing arguments, and representing concepts effectively. This study examines the effectiveness of STEAM-based mathematics instruction in enhancing senior high school students' mathematical communication and creativity. Using a quasi-experimental *Posttest Only Control Group* design, two randomly assigned classes participated: one received STEAM-based instruction, while the other followed conventional teaching. The results show that students in the STEAM class achieved significantly higher scores in both communication and creativity. These findings suggest that STEAM offers a relevant and effective approach for strengthening essential twenty-first-century competencies.

Keywords: STEAM-Based Learning, Mathematical Communication, Mathematical Creativity

1 Introduction

Mathematics education in the twenty-first century necessitates the cultivation of competencies that extend beyond procedural proficiency, incorporating communication skills, creativity, collaboration, and problem-solving capabilities to navigate the intricacies of contemporary social and economic contexts [1][2][3][4]. These qualities are deemed essential for equipping students to address future workplace requirements and everyday life issues.

The STEAM [Science, Technology, Engineering, Arts, Mathematics] method has developed as a pedagogical framework that amalgamates science, technology, the arts, and mathematics to foster contextual and multidisciplinary learning experiences. Current literature indicates that the integration of the arts enhances educational processes and fosters the cultivation of higher-order thinking skills [5][6][7][8]. Nonetheless, the application of STEAM in educational settings is markedly diverse, both regarding instructional design and the learning objectives prioritized [9] [10].

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The capacity to communicate mathematically is an essential aspect of mathematical skill, facilitating students in articulating ideas, constructing arguments, utilizing various representations, and linking concepts to real-world contexts [11] [12]. Regrettably, conventional teaching that emphasizes procedural fluency restricts students' prospects for meaningful mathematical discourse [13], which may impede the advancement of mathematical literacy.

Pedagogical interventions that incorporate discussion, presentation, and the creation of mathematical objects have demonstrated improvements in mathematical literacy and communication abilities [14][15]. Mathematical creativity, encompassing the capacity to produce original, adaptable, and detailed ideas, represents a significant learning result and is intricately linked to mathematical communication [16][17][18]. Project-based STEAM education offers tangible environments for students to explore, refine concepts, and articulate mathematical principles through innovative outputs [19][15].

Although many STEAM studies report improvements in creativity and problem-solving, several systematic reviews emphasize that the evidence remains heterogeneous, and standardized indicators for assessing communication skills are rarely employed [1,20]. The literature further indicates that STEAM research tends to prioritize creativity and product-based outcomes, whereas quantitative assessments of mathematical communication are infrequently reported [21] [7] [6]. Moreover, only a limited number of studies simultaneously assess creativity and mathematical communication within authentic instructional settings [17].

A critical analysis indicates that assessments of mathematical communication in STEAM contexts frequently suffer from methodological inconsistencies, and the instruments employed are largely unstandardized [22]. Additional reviews highlight that the majority of STEAM research lack rigorous experimental designs featuring pretest–posttest measures or do not disclose quantitative impact sizes [23,24], thereby constraining the generalizability of their results.

This study seeks to furnish empirical data about the efficacy of STEAM-based mathematics instruction in enhancing two critical learning outcomes concurrently: students' mathematical communication and creativity. The results are anticipated to enhance the theoretical framework of STEAM literature and provide pragmatic recommendations for educators and policymakers in formulating curriculum that adequately address the competency requirements of the twenty-first century.

2 Method

This study employed a quasi-experimental approach using a Posttest-Only Control Group Design, a design commonly implemented when pretest measurements cannot be administered but causal comparison between groups is required. The design consisted of two intact classes selected randomly, namely an experimental group and a control group, each receiving different instructional treatments prior to the administration of a posttest at the end of the learning sessions.

The population comprised all 102 tenth-grade students of SMA Negeri 3 Ndoso Waning distributed across four classes. Samples were selected using a random sampling technique,

resulting in two classes being assigned as the experimental and control groups. Class XA, consisting of 26 students, served as the experimental group and received mathematics instruction using the STEAM (Science, Technology, Engineering, Art, and Mathematics) approach. Meanwhile, Class XB, consisting of 25 students, served as the control group and received conventional mathematics instruction. The random selection of classes was conducted to minimize selection bias and strengthen the causal inference of the study.

Instruction in the experimental group was designed by integrating elements of science, technology, engineering, the arts, and mathematics through project-based problem-solving activities. The instructional framework adopted an integrated STEAM model, emphasizing design-based processes, collaborative learning, and the creation of meaningful artifacts as integral components of the learning experience [5]. In contrast, the control group received conventional mathematics instruction consisting of lectures, demonstrations, and routine exercises. Both groups experienced the same instructional duration to maintain equivalence in exposure time.

Research data were collected using a mathematical communication test and a mathematical creativity test, each consisting of three open-ended items. The communication test measured students' ability to articulate ideas coherently, use mathematical representations, and construct logical arguments. Meanwhile, the creativity test assessed fluency, flexibility, and originality [17,25]. Content validity of the instruments was established through expert judgment by two mathematics education specialists, and item quality was evaluated through a pilot test before being used in the main data collection.

Data were analyzed using an independent samples t-test to compare the posttest results of the experimental and control groups. This test was used to determine whether statistically significant differences existed in mathematical communication and mathematical creativity as a result of implementing the STEAM approach. Prior to analysis, assumption testing—including normality and homogeneity of variance—was conducted to ensure the appropriateness of the parametric statistical procedures.

3 Results

The findings of this study reveal clear performance differences between the experimental group taught using the STEAM approach and the control group taught using conventional instruction. Based on posttest scores, students' mathematical communication skills in the experimental group achieved a mean score of 74.28, substantially higher than the control group's mean score of 56.25. The maximum–minimum score range also reflects this pattern: the highest score in the experimental group was 93.75, while the control group reached only 81.25. A similar trend was observed in mathematical creativity, with the experimental group obtaining a mean score of 78.27, significantly higher than the control group's mean of 59.10. The maximum creativity score in the experimental group reached 92.50, compared to only 85 in the control group.

Assumption testing—including the Shapiro–Wilk normality test and Fisher's homogeneity of variance test—confirmed that all posttest data for both variables were normally distributed and exhibited homogeneous variances. Having satisfied these requirements, further analysis was conducted using an independent samples t-test.

The t-test results indicate statistically significant differences between the two groups. For mathematical communication skills, the analysis yielded $t = 4.504$ with $p = 0.000$, confirming that the STEAM approach had a significant positive impact on students' communication performance. For mathematical creativity, the t-value was 5.337 with $p = 0.000$, demonstrating a similarly strong effect of the STEAM-based instruction. These findings collectively reinforce the conclusion that STEAM-based learning is more effective than conventional instruction in enhancing these two essential mathematical competencies.

4 Discussion

This study's findings affirm that the STEAM approach significantly influences students' mathematics communication skills. This corresponds with prior studies suggesting that integrative learning settings facilitate students' expression of mathematical concepts using various verbal, visual, and symbolic representations [11]. Within the STEAM framework, learners engage in contextualized projects linked to science, technology, and the arts, rather than solely executing mathematical procedures, thereby enhancing their ability to communicate and defend their mathematical thinking. This sharply contrasts with procedural-oriented traditional training, which frequently restricts opportunities for profound mathematical communication [13].

The enhancement of mathematical creativity noted in the experimental group aligns with previous studies indicating that STEAM fosters the generation of original, adaptable, and detailed ideas through activities centered on design, exploration, and contextual problem-solving [17,19]. When students engage in project-based activities that involve designing solutions, creating artistic representations, or altering geometric forms, they are prompted to provide a variety of ideas grounded in logical thinking, thus enhancing their mathematical creativity. This technique establishes creative thinking as a fundamental element of learning rather than simply a by-product of task execution.

Moreover, the incorporation of the arts within STEAM fosters diverse thinking, which underpins mathematical creativity [16]. This elucidates the markedly elevated inventiveness scores noted in the experimental group. The integration of scientific investigation with artistic expression, enhances the scope for expression and increases the variety of potential answers in mathematical situations [9].

The results further corroborate prior systematic reviews suggesting that while STEAM possesses significant potential to foster creativity, empirical evidence regarding its influence on mathematical communication is scarce and requires additional experimental research [1,20]. This study addresses this gap by presenting empirical evidence that STEAM not only fosters creativity but also improves mathematics communication among high school students—an result seldom recorded in prior research.

From an educational perspective, these findings indicate that mathematics training that includes project work, design activities, group discussions, and student presentations can foster a more intellectually stimulating learning environment. This corresponds with Roehrig's concept of authentic integrated learning, characterized by significant, multi-representational activities that embody real-world complexity [6]. This method aligns with 21st-century learning paradigms that prioritize communication, creativity, cooperation, and problem-solving [2,3].

The elevated communication and creativity ratings in the experimental group indicate that the STEAM approach effectively fosters the development of two fundamental mathematical talents vital for contemporary schooling. Simultaneously, these findings present both theoretical and practical implications for educators aiming to develop more contextualized, multidisciplinary, and innovative mathematics learning experiences.

Based on previous findings, most STEAM-related studies have predominantly emphasized creativity, problem-solving, or product-oriented outcomes, while empirical evidence on mathematical communication—especially measured quantitatively within authentic classroom settings—remains limited and fragmented. This study extends existing literature by providing experimental evidence that STEAM-based mathematics instruction simultaneously enhances students' mathematical communication and creativity. Unlike prior research that often examined these constructs separately or relied on qualitative descriptions, the present study employs a controlled quasi-experimental design with explicit assessment indicators for both competencies. Therefore, this research contributes novel empirical support to the STEAM literature by positioning mathematical communication not merely as a complementary outcome, but as a central learning achievement that can be systematically developed alongside creativity through integrated STEAM instruction.

5 Conclusions and recommendations

This study demonstrates that the STEAM approach significantly enhances high school students' mathematical communication skills and creativity compared with conventional instruction. Students who participated in STEAM-based learning were able to communicate mathematical ideas more clearly, use a wider range of representations, and produce more original and flexible solutions. These findings affirm that integrating science, technology, engineering, the arts, and mathematics into a coherent sequence of instructional activities creates a cognitively rich learning environment capable of effectively supporting 21st-century competencies.

Future research is recommended to employ pretest–posttest or longitudinal designs to more comprehensively capture changes in students' performance over time. Additionally, subsequent studies could extend the research context to include a broader range of schools or different educational levels to improve generalizability. Further exploration of related constructs—such as collaboration, higher-order problem-solving, learning motivation, or mathematics anxiety—may also provide a more holistic understanding of the impact of the STEAM approach in mathematics education.

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A Narrative Review on the Effectiveness of Learning Evaluation to Sustain Professional Development among Indonesian Language Teachers

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Abstract. This narrative review examines the effectiveness of learning evaluation in sustaining professional development among Indonesian language teachers. Using a narrative synthesis approach, the researcher critically analyzed fifty selected studies, theories, and policy documents addressing formative, authentic, and reflective evaluation practices. The review demonstrates that learning evaluation, when positioned as a process of continuous reflection rather than summative judgment, functions as a foundation for adaptive teacher growth and pedagogical renewal. It highlights the interrelated roles of formative assessment, authentic learning tasks, and reflective practice in shaping teachers' professional learning trajectories. The findings further indicate that effective evaluation practices depend not only on teacher competence but also on supportive institutional policies, digital readiness, and collaborative professional cultures. The review concludes that transforming evaluation into a catalyst for lifelong professional learning requires integrating evaluation theory, teacher agency, and policy coherence within a unified reflective system.

Keywords: learning evaluation, formative assessment, authentic assessment, reflective practice, teacher professional development

1 Introduction

Teacher professional development (TPD) has long been recognized as the backbone of educational reform and pedagogical renewal across the world. As global education systems shift toward learner-centered paradigms and competency-based curricula, the need to sustain teachers' professional growth becomes increasingly vital [1], [2], [3]. The quality of a nation's education system ultimately rests upon the learning and evaluative capacities of its teachers, as they translate policy and theory into meaningful classroom practice [4]. For Indonesia, where national curriculum changes and language education reforms are accelerating, developing sustainable frameworks of teacher professional development has become both a national priority and a scholarly necessity [5], [6], [7], [8].

Within this dynamic context, learning evaluation occupies a pivotal position as both a pedagogical and developmental process. Evaluation in learning is not merely an end-point

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measurement; rather, it functions as an ongoing feedback mechanism that informs instruction, cultivates reflective teaching, and supports continuous improvement [9], [10]. Effective evaluation practices empower teachers to understand their own instructional decisions, identify gaps in student learning, and redesign pedagogical strategies accordingly [11], [12]. For language teachers in particular, learning evaluation represents a reflective mirror through which they can assess the alignment between linguistic competence, cultural understanding, and communicative performance [13], [14].

The Indonesian education system has undergone multiple reforms to strengthen teacher evaluation and performance standards. The "Merdeka Belajar" (Freedom to Learn) curriculum emphasizes teacher autonomy, formative assessment, and contextualized evaluation as essential to learning quality [6]. Yet, these innovations require teachers not only to implement assessment tools, but also to interpret and use evaluative evidence to refine their instructional practice [15], [16]. Consequently, teacher professionalism now depends on evaluation literacy as well as the capacity to design, interpret, and act upon evaluative data within authentic learning settings [17], [18].

While the importance of learning evaluation in supporting TPD has been widely discussed globally, there remains a lack of comprehensive conceptual synthesis addressing its role in Indonesian language education specifically. Studies on formative assessment, reflective teaching, and evaluation-based professional growth are dispersed across domains, leaving an unintegrated understanding of how evaluation functions as a sustainable driver for teacher learning [8], [19]. Furthermore, contextual constraints (such as limited teacher assessment literacy, unequal access to digital tools, and institutional barriers) continue to hinder evaluation implementation [20], [21]. The gap between evaluative policy frameworks and teachers' real practices remains wide, creating a tension between compliance-based evaluation and developmental evaluation [7], [22].

Scholarly discourse has long recognized evaluation as both an art and a science of professional learning. The theoretical evolution of formative assessment since the works of Black and Wiliam (2009) has reframed evaluation from summative judgment to a collaborative learning process. Building on experiential learning theory [23] and reflective practice frameworks [24], evaluation is conceptualized as an iterative process of action, feedback, and adaptation. Such cyclical reflection forms the epistemological foundation of teacher growth; teachers learn by evaluating and re-evaluating their own instructional choices in the light of evidence and student outcomes [10], [25].

However, this theoretical transformation demands systemic support. Professional development initiatives that integrate evaluation as a learning mechanism, rather than as an external accountability tool, tend to generate more sustained change [1], [26]. Within Indonesian teacher training contexts, evidence shows that reflective evaluation workshops and peer-based assessment practices enhance teachers' self-regulation, collaborative inquiry, and pedagogical adaptability [27], [28]. The interplay between evaluation and teacher reflection thus becomes a catalyst for professional autonomy and agency, essential for long-term professional growth.

At a deeper level, learning evaluation serves as the epistemic bridge between knowledge acquisition and professional transformation. The transformative learning theory [29] (Mezirow, 2015) positions critical reflection as the medium through which educators reinterpret their experiences and expand professional perspectives. In this sense, evaluation becomes more than

a procedural practice—it represents an intellectual habit of inquiry that nurtures reflective, evidence-informed, and adaptive teaching identities [30], [31] (Hobbs & Marks, 2020; Tractenberg, Chaterji, & Haramati, 2007). When teachers engage in structured reflection through evaluative cycles, they reconstruct their understanding of effective teaching, thereby deepening their professional competence [32], [33] (Vattøy & Gamlem, 2025; Hongyang, 2023).

In Indonesia's multilingual and socio-culturally diverse classrooms, this dimension of reflective evaluation is particularly crucial. Language learning is inherently contextual, shaped by learners' backgrounds, local culture, and communicative norms [34] [34] (Mitchell, Myles, & Marsden, 2019). Consequently, teachers' evaluation literacy must be sensitive to linguistic diversity and sociocultural variation. Studies highlight that when teachers design context-based evaluation instruments, the authenticity and relevance of learning increase significantly (Siti & Siti, 2019; Musaddat, Suryadi, & Suyanu, 2020) [35], [36]. Similarly, teacher-led innovations such as e-learning-based evaluations or whole-language learning assessments have demonstrated potential in fostering professional reflection and adaptive pedagogy (Andiopenta, 2023; Suhara, Firmansyah, & Permana, 2019) [37], [38].

Given these developments, the present narrative review seeks to provide a theoretical and conceptual synthesis of learning evaluation as a mechanism to sustain professional development among Indonesian language teachers. Specifically, it aims to: (1) identify and integrate dominant theoretical models of evaluation and professional learning; (2) interpret empirical evidence from Indonesian and global contexts; and (3) construct a conceptual framework linking evaluation practices to sustainable teacher growth. Through a narrative synthesis approach, this study interprets fifty carefully selected works spanning two decades of research, combining theoretical reflection and contextual critique. Thus, this article argues that learning evaluation, when understood as an ongoing, reflective, and participatory process, holds transformative potential for Indonesian language teachers' professional development. It calls for a paradigmatic shift; from evaluation as measurement to evaluation as learning, anchored in reflective inquiry, feedback literacy, and adaptive professional culture. In doing so, it contributes not only to theory building but also to reimagining evaluation as the sustaining pulse of professional development in the evolving landscape of Indonesian language education.

2 Literature Review

Understanding the role of learning evaluation in sustaining teacher professional development requires revisiting its conceptual roots and the evolving pedagogical frameworks that shape it. Over time, evaluation has been reconceptualized from an administrative routine into a dynamic process of teacher learning. In this review study, the researcher explores how theoretical, empirical, and contextual strands converge to form a comprehensive perspective on evaluation as both a learning instrument and a professional development catalyst. Each subsection that follows aims to articulate key theoretical bases, relational constructs, and contextual nuances underpinning the interplay between learning evaluation and teacher growth.

2.1 Theoretical Foundations of Learning Evaluation

The concept of learning evaluation has experienced significant evolution over the past decades. Initially viewed as a means to measure student achievement, evaluation has transformed into an integral component of the teaching and learning process (Stufflebeam & Coryn, 2014) [39]. The researcher recognizes that evaluation is not only about determining outcomes but also about generating insights for instructional improvement and reflective practice (Black & Wiliam, 2003) [40]. This shift toward formative and authentic assessment places evaluation at the core of pedagogical renewal, where the act of assessing becomes a shared learning experience for both teachers and students.

In this regard, formative evaluation functions as an ongoing cycle of evidence gathering and interpretation. It encourages teachers to make informed instructional decisions and refine their teaching strategies through real-time feedback (Gordon & McGhee, 2019) [12]. Within teacher education, this process mirrors what Kolb, Boyatzis, and Mainemelis (2014) describe as experiential learning, where knowledge is continuously reconstructed through experience, reflection, and adaptation. Learning evaluation thus becomes an experiential journey; teachers learn not only from students' progress but also from their own responses to learning data.

Building on reflective traditions, Schön (2013) characterizes the teaching act as a process of "reflection-in-action." The researcher adopts this lens to view learning evaluation as a self-dialogue: teachers interpret their practices while they are engaged in them, questioning their decisions and outcomes. When such reflection is structured and evidence-based, it leads to deeper professional insight. In this way, evaluation contributes to transformative learning, where teachers reshape their pedagogical identities through critical reflection (Mezirow, 2015) [29].

The researcher also identifies the importance of connecting evaluation with teacher change theories. Guskey (2002) explains that meaningful professional growth stems from teachers' experiences of improved learning outcomes, which in turn reshape their beliefs and practices. Similarly, Borko et al. (2000) emphasize that teacher education must treat evaluation as a situative process, embedded within classroom and community contexts. When evaluation is embedded in teachers' lived experiences, it nurtures professional agency; the ability to act reflectively, autonomously, and purposefully.

The theoretical synthesis presented in this review aligns with the notion that evaluation should not be an external judgment but a learning partnership between evidence and reflection. It draws together insights from formative assessment (Black & Wiliam, 2009) [40]., experiential learning (Kolb et al., 2014), and reflective practice (Schön, 2013) to argue that teacher development flourishes when evaluation is integrated into the professional learning cycle. The researcher concludes that evaluation, when grounded in theory and reflection, becomes an indispensable foundation for sustainable teacher professional growth.

2.2 Learning Evaluation and Professional Development Nexus

In this part of the review, the researcher focuses on how learning evaluation intertwines with teacher professional development (TPD). Across decades, studies have revealed that effective professional development requires teachers to engage in continuous learning cycles that include reflection, feedback, and classroom experimentation (Desimone, 2009; Darling-Hammond,

Hyler, & Gardner, 2017) [1], [2]. When these cycles are infused with evaluation, professional growth becomes not only reflective but also evidence-driven. Evaluation provides the interpretive lens through which teachers can analyze their progress and identify new pathways for improvement (Zeggelaar, Vermeulen, & Jochems, 2022) [4].

The essence of professional development lies in teacher transformation; a gradual shift in knowledge, attitudes, and beliefs (Kennedy, 2016) [3]. Through systematic evaluation, teachers can visualize how their teaching strategies impact learning outcomes and adjust accordingly (Goe, Biggers, & Croft, 2012) [26]. For instance, the integration of formative evaluation tools during workshops and coaching sessions has been found to reinforce teachers' feedback literacy and confidence (Ahadi, Bower, Lai, Singh, & Garrett, 2024; Fukubayashi & Fuji, 2025) [27], [41]. The researcher interprets such findings as evidence that evaluation itself can become a professional learning tool, especially when linked with mentoring and peer review systems.

Another dimension arises from the concept of self-assessment, where teachers and students alike become active participants in evaluating learning (Fitriyah, Wijayanti, & Purwaningrum, 2024). This participatory model of evaluation transforms professional development into a shared learning process. Teachers who engage their students in formative dialogue cultivate reflective habits that mirror their own professional inquiry (Shah & Mangrola, 2015) [42]. When feedback is reciprocal, classroom evaluation turns into collaborative professional learning rather than hierarchical judgment.

Moreover, evaluation serves as a bridge between teacher learning and institutional improvement. Research indicates that schools implementing continuous formative evaluation systems tend to foster more cohesive professional communities (Hobbs & Marks, 2020; Li & Gu, 2024) [28], [30]. These systems encourage teachers to share data, co-design rubrics, and co-reflect on learning patterns. The researcher argues that such collaboration reshapes evaluation from an individual task to a collective culture of inquiry. Through this process, professional learning communities evolve into reflective ecosystems that sustain long-term growth.

Professional development without evaluation risks becoming abstract or unmeasured. Evaluation without professional learning risks being punitive. Therefore, the nexus between the two represents a necessary equilibrium; a balance between accountability and learning. The researcher concludes that when evaluation is designed as a formative, reflective, and participatory practice, it enriches teachers' knowledge, agency, and commitment to continuous growth (Graham, 2023; Vattøy & Gamlem, 2025) [32], [43]. Through this synthesis, learning evaluation emerges as both the compass and the mirror of professional development, guiding teachers toward evidence-informed reflection and transformative practice.

2.3 Contextualization in Indonesian Language Education

In the Indonesian educational landscape, learning evaluation represents both a professional challenge and a cultural adaptation process. The researcher acknowledges that Indonesia's diverse linguistic and socio-cultural realities demand context-sensitive approaches to assessment and teacher learning (Mappiasse & Sihes, 2014) [13]. Evaluation practices that might appear effective in global frameworks often require reinterpretation to align with the local curriculum, classroom diversity, and pedagogical traditions. Within this complexity, the

development of Indonesian language learning evaluation continues to evolve alongside broader curriculum reforms such as the Kurikulum Merdeka, which emphasizes authentic assessment, learner autonomy, and holistic learning outcomes (Amin & Rifa'i, 2024) [6].

Empirical studies have begun to illustrate how teachers adapt evaluation strategies to fit local learning goals. For instance, Andiopenta (2023) developed teaching materials based on **whole** language learning principles to improve evaluation literacy among Indonesian language teacher candidates. Similarly, Febriansyah and Syamsiyah (2024) proposed a contextual evaluation model that supports both formative and summative functions in language instruction. These innovations reflect how teachers are gradually moving from test-based evaluation toward reflective, student-centered approaches.

Yet, despite progress, evaluation reform faces persistent obstacles. Arrafii (2020) revealed that many teachers still equate evaluation with grading rather than learning improvement, resulting in mechanical implementation of assessments. Structural barriers, such as heavy administrative demands, limited training, and uneven access to professional support, continue to hinder transformative evaluation practices (Arsyad Arrafii, 2023; Sukenti & Tambak, 2020) [7], [20]. Furthermore, teachers' assessment literacy remains a crucial concern, particularly in distinguishing between assessment of learning and assessment for learning.

The researcher observes that a more sustainable path lies in integrating authentic and technology-enhanced evaluation. Studies have shown that digital-based tools, such as Socrative and e-learning platforms, facilitate more interactive and diagnostic feedback processes (Suhara, Firmansyah, & Permana, 2019) [38]. Authentic evaluation models that include project-based and text-based instruments also enhance students' engagement and teachers' reflective thinking (Musaddat, Suryadi, & Suyanu, 2020; Suwandi, Nurkamto, & Setiawan, 2019) [19], [36]. By connecting classroom realities with evaluative theory, these practices cultivate what the researcher calls reflective professional autonomy; the teacher's ability to make evaluative decisions grounded in both theory and lived classroom experience. Ultimately, contextualizing evaluation within Indonesian language education underscores the balance between global theory and local wisdom. This review study was introduced by the researcher to emphasize that professional development must grow organically from the classroom, where teachers themselves become the evaluators of their evolving pedagogical identities.

2.4 Emerging Models and Innovations in Evaluation Practices

The researcher further highlights that learning evaluation today is not confined to traditional frameworks; it is transforming through innovation, collaboration, and digital integration. Modern evaluation models emphasize the fusion of formative assessment literacy and technological empowerment, allowing teachers to adapt evaluation tools for more responsive and interactive learning contexts (Pastore, 2023; Suherman et al., 2025) [17], [18]. These innovations illustrate how evaluation is evolving from a static process into a dynamic, networked ecosystem of feedback and growth.

Several innovative models have gained prominence in recent years. One notable approach is lesson study, a collaborative professional learning strategy that integrates classroom observation, feedback, and reflective evaluation. Cheng and Lander (2024) explain that lesson study enables teachers to co-design and refine instructional strategies based on shared evaluative insights, thus reinforcing professional community and peer accountability. Similarly, Li and Gu (2024) demonstrate how formative assessment within continuing professional development (CPD) programs enhances teachers' self-regulated learning. Such models highlight that evaluation serves not only as measurement but as collaborative inquiry; a process through which teachers co-construct understanding and redefine their professional roles.

The researcher also notes an increasing trend toward digital evaluation innovations. The use of online formative tools and AI-supported feedback systems enables real-time data collection and analysis, promoting teacher adaptability and efficiency (Vattøy & Gamlem, 2025; Fukubayashi & Fuji, 2025) [32], [41]. These developments align with global movements toward digital professional development, where teachers use virtual platforms to exchange best practices and interpret feedback collaboratively (Ahadi et al., 2024). In Indonesia's emerging digital education landscape, these technologies are helping teachers overcome geographical and institutional barriers to professional growth.

Meanwhile, conceptual innovations also emerge from theoretical frameworks that link evaluation to teacher identity and motivation. Hongyang (2023) examined how professional development models in Asia incorporate reflective evaluation to sustain teacher self-efficacy. Atmowardoyo and Sakkir (2021) similarly suggested that theoretical models of language learning and evaluation should integrate contextual experience as a form of professional wisdom.

This review study was introduced by the researcher to emphasize that innovation in evaluation is not only technological but also cultural and philosophical. As teachers engage in continuous reflection through formative evaluation, they become researchers of their own classrooms; interpreting, adapting, and redefining what it means to teach effectively in changing contexts (Hobbs & Marks, 2020; Tractenberg, Chaterji, & Haramati, 2007; Werang et al., 2023) [22], [30], [31]. Ultimately, the researcher envisions a future where evaluation is seen as a living practice; a cycle of learning, unlearning, and relearning that keeps professional development alive and responsive.

3. Method

This review study was introduced by the researcher through a narrative synthesis approach, an interpretive methodology that allows the integration of conceptual, empirical, and contextual evidence into a coherent theoretical understanding. The researcher selected this approach because it best accommodates the diversity of perspectives found within studies of learning evaluation and professional development. Unlike meta-analysis or statistical aggregation, the narrative synthesis emphasizes the interpretation and explanation of findings, enabling the researcher to identify conceptual relationships and construct theoretical linkages among the

reviewed works (Desimone, 2009; Stufflebeam & Coryn, 2014) [2], [39]. This qualitative logic aligns with the purpose of the present study—to build an interpretive model rather than to measure effect sizes.

The narrative synthesis was carefully adjusted to fit the reflective and conceptual nature of this topic. Learning evaluation and teacher professional development are complex phenomena shaped by theory, context, and practice. Therefore, the researcher adopted a method that values interpretive reasoning, allowing ideas to emerge inductively from the literature. Following the principles of narrative inquiry, this synthesis process involved identifying recurring themes, contrasting theoretical positions, and organizing them into evolving storylines that describe how evaluation contributes to sustainable teacher growth (Guskey, 2002; Kolb et al., 2014; Schön, 2013) [10], [23], [24]. This interpretive movement (from description to theorization) ensured that each selected source contributed meaningfully to the overall conceptual construction.

The references used in this study were not chosen randomly but derived from a deliberate and rigorous review process. The researcher explored hundreds of academic works (books, journal articles, and conference proceedings) sourced from the physical collections of a university library and online databases such as Taylor & Francis, Springer, Elsevier, and ERIC. From these, fifty references were systematically identified and approved as most relevant to the topic. The researcher employed a manual note-taking technique, recording essential theoretical arguments, definitions, and findings in a structured summary table. This process ensured that each citation included in this review directly supports the analytical framework and enriches the narrative coherence. Therefore, this approach was selected not only for its methodological suitability but also for its philosophical alignment with the researcher's interpretive stance. As a reflective inquiry into how evaluation sustains teacher learning, the narrative synthesis allows the research to evolve as a conceptual conversation; an academic dialogue among theories, practices, and lived experiences. Through this approach, the researcher upholds the scientific quality of this study while preserving the human dimension of scholarly reflection.

4. Findings and Discussion

Based on the narrative synthesis conducted, the researcher identified several key thematic findings that collectively explain how learning evaluation contributes to sustaining professional development among Indonesian language teachers. The discussion in this section integrates conceptual, empirical, and contextual perspectives drawn from the reviewed literature to interpret the role of evaluation as both a reflective and transformative process. To ensure a coherent narrative flow, the researcher presents the findings in four interconnected themes that reflect theoretical, pedagogical, contextual, and innovative dimensions of learning evaluation in Indonesian language education. Each theme is analyzed interpretively within a reflective academic framework

4.1 Learning Evaluation as a Foundation for Teacher Professional Growth

The researcher found that learning evaluation is far more than a technical procedure; it is a pedagogical foundation for teachers' continuous growth and reflective transformation. In many scholarly works, evaluation is described as the bridge between instructional practice and professional learning, positioning teachers not as passive implementers of standards but as active learners in their own classrooms (Black & Wiliam, 2003; Guskey, 2002; Schön, 2013)

[10], [24], [40].. The researcher interprets this as evidence that effective evaluation reshapes the teacher's role from evaluator to learner, where reflective action and evidence-based judgment promote sustained improvement. In this way, evaluation becomes a dialogic process between teaching experience, feedback, and adaptation (Kolb et al., 2014; Desimone, 2009; Kennedy, 2016) [2], [3], [23].

Globally, several studies demonstrate that evaluation systems which integrate formative and reflective principles can substantially influence teachers' professional agency. Black and Wiliam (2009) underline that formative assessment provides the necessary feedback loops to refine instructional decisions in real time. Darling-Hammond et al. (2017) similarly found that systematic evaluation tied to mentoring and peer reflection strengthens collective efficacy. Meanwhile, Ahadi et al. (2024) highlight that when teachers participate in evaluative workshops, their technological and pedagogical capacities co-evolve. The researcher regards these findings as showing that learning evaluation acts as an engine of continuous professional inquiry; a mechanism that allows teachers to monitor their growth while refining pedagogical quality.

However, the character and function of evaluation differ considerably across educational contexts. Based on Table 4.1 below, the researcher synthesized a comparative understanding of how international frameworks and Indonesian practices conceptualize the role of evaluation in teacher development. Internationally, evaluation tends to emphasize formative, collaborative, and feedback-driven mechanisms designed to foster reflection and autonomy (Black et al., 2006; Hobbs & Marks, 2020; Zeggelaar et al., 2022) [4], [9], [30]. In contrast, Indonesian perspectives, though increasingly reform-oriented, still exhibit a mixture of summative accountability and emerging reflective paradigms (Amin & Rifa'i, 2024; Arsyad Arrafii, 2023; Mulyati et al., 2023) [6], [8], [21].

Table 1. Comparative synthesis of international vs. Indonesian conceptualizations of evaluation for teacher growth

Focus / Concept	International Perspectives	Key Sources	Indonesian Perspectives	Key Sources
Purpose of evaluation	Viewed as formative, feedback-driven process to enhance instructional reflection and decision-making.	Black & Wiliam (2003, 2009); Guskey (2002); Desimone (2009)	Oriented toward accountability but shifting toward formative purpose in *Kurikulum Merdeka*.	Amin & Rifa'i (2024); Arrafii (2020); Fazalani (2025)
Teacher's role	Teachers as reflective practitioners who interpret evaluation evidence to improve pedagogy.	Schön (2013); Kolb et al. (2014); Kennedy (2016)	Teachers traditionally apply preset rubrics; reforms promote self-evaluation and inquiry.	Mulyati et al. (2023); Andiopenta (2023); Suwandi et al. (2019)
Evaluation model	Formative and authentic assessments emphasizing continuous feedback.	Black et al. (2006); Hobbs & Marks (2020); Morris et al. (2021)	Hybrid models combining summative scoring and authentic evaluation.	Amin & Rifa'i (2024); Mariyati & Putrayasa (2024); Suhara et al. (2019)
Professional learning link	Peer evaluation and feedback-based development sustain growth.	Ahadi et al. (2024); Borko et al. (2000); Darling-Hammond et al. (2017)	School-based reflection forums (MGMP) used for professional exchange.	Mulyati et al. (2023); Werang et al. (2023); Arsyad Arrafii (2023)
Challenges / limitations	Limited evaluative literacy; need for structural support.	Goe et al. (2012); Kennedy (2016); Zeggelaar et al. (2022)	Cultural emphasis on grades and administrative overload hinder reflection.	Arrafii (2020); Sukenti & Tambak (2020); Amin & Rifa'i (2024)
Emerging trends	Digital formative tools and coaching-based reflection.	Vattøy & Gamlem (2025); Fukubayashi & Fuji (2025); Cheng & Lander (2024)	Integration of e-learning evaluation tools and digital feedback.	Suhara et al. (2019); Mulyati et al. (2023); Andiopenta (2023)

Source: synthesized by the researcher from the 50 reviewed references

As reflected in Table 4.1, international frameworks present evaluation as a transformative learning mechanism, whereas Indonesian literature reveals an evolving but still transitional paradigm. The researcher notes that Indonesian teachers are progressively redefining their understanding of evaluation—not merely as grading, but as a reflective inquiry tool that informs

teaching strategies and self-assessment. Studies by Andiopenta (2023) and Mariyati and Putrayasa (2024) demonstrate how local innovations, such as evaluation based on whole-language learning and scoring techniques, gradually enhance teachers' professional reflection. Yet, as Arsyad Arrafii (2023) and Amin and Rifa'i (2024) emphasize, this shift requires stronger institutional and cultural support to develop evaluative literacy and sustain teacher motivation.

Synthesizing these conceptual and contextual strands, the researcher concludes that evaluation provides the intellectual and reflective foundation for professional growth. When teachers are empowered to evaluate their teaching as a learning process (supported by formative, authentic, and collaborative assessment) the boundary between teaching and learning dissolves. Teachers become learners of their own pedagogical experience, nurturing both competence and professional identity (Black et al., 2006; Guskey, 2002; Kennedy, 2016) [3], [10], [11]. This synthesis marks evaluation not merely as an administrative requirement but as a *transformative pedagogy* sustaining teachers' continuous professional development.

4.2 Formative and Authentic Assessment as Catalysts of Reflective Practice

The researcher observed that formative and authentic assessments are not only technical instruments but essential catalysts of reflective practice in teacher professional development. Across global and local studies, formative assessment is consistently portrayed as the process through which teachers learn about their own teaching by systematically gathering and interpreting feedback to adjust instruction [10], [40], [44]. Authentic assessment, in contrast, connects classroom evaluation with real-world tasks, encouraging teachers to reflect on how learning outcomes manifest in communicative and contextual settings (Suwandi et al., 2019; Mariyati & Putrayasa, 2024; Amin & Rifa'i, 2024) [6], [19], [45]. The researcher believes these assessment types are interdependent; formative assessment drives reflection through continuous feedback, while authentic assessment grounds reflection in meaningful pedagogical practice. Together, they serve as engines for teachers' professional inquiry and adaptive learning.

Building from these principles, Diagram 4.1 below conceptualizes the dynamic process through which formative and authentic assessment interact to stimulate teachers' reflective growth. The cyclical model—adapted and synthesized by the researcher; illustrates how evidence from classroom practice informs reflection, decision-making, and professional transformation.

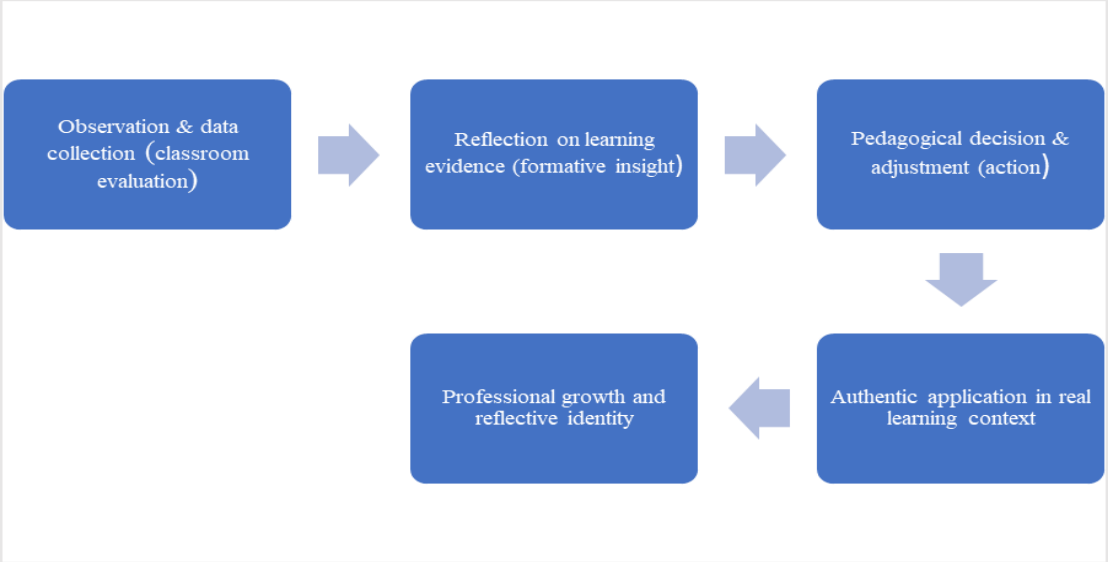

Fig. 1. The Reflective Cycle of Formative and Authentic Assessment in Teacher Learning. Source: developed by the researcher based on synthesis from Black & Wiliam (2009), Schön (2013), and Suwandi et al. (2019).

As shown in Fig.1, the process begins when teachers engage in observation and evidence collection during lessons. This data, whether from student responses, peer feedback, or classroom performance, becomes the foundation for reflection. Through formative insight, teachers interpret these results to recognize strengths and learning gaps (Black et al., 2006; Li & Gu, 2024; Hidayat et al., 2023) [9], [11], [28], [46]. The next stage, pedagogical adjustment, involves transforming reflection into new instructional strategies. Authentic application then bridges theory and practice by situating evaluation in real communicative contexts where teachers can see the direct impact of their strategies (Mappiasse & Sihes, 2014; Mariyati & Putrayasa, 2024; Andiopenta, 2023) [13], [37], [45]. The final stage marks professional growth; teachers internalize reflection as an ongoing habit, forming what Schön (2013) called a "reflective identity."

Globally, the literature converges on the notion that formative assessment nurtures a learning-oriented culture in schools. Black and Wiliam (2003) assert that when teachers use formative feedback consistently, they begin to adopt metacognitive habits similar to those they cultivate in students. Hobbs and Marks (2020) emphasize that extended formative evaluation promotes deeper engagement and professional collaboration. Similarly, Ahadi et al. (2024) report that teacher workshops centered on evaluative feedback enhance confidence and self-efficacy, particularly in digital settings. The researcher interprets these global insights as validation that formative evaluation is not only pedagogical but transformative; it changes the way teachers think about teaching itself.

In the Indonesian context, the integration of formative and authentic assessment has begun to reshape teachers' perception of evaluation as reflective learning. Studies by Suwandi et al. (2019) and Amin and Rifa'i (2024) highlight that under the Kurikulum Merdeka reform, assessment is now viewed as an opportunity for teachers to examine their instructional methods

and adapt them to diverse learner needs. Similarly, Suhara et al. (2019) found that e-learning–based evaluation systems like Socrative enable teachers to provide immediate formative feedback, promoting reflective thinking through technology. However, challenges remain, such as limited digital literacy and inconsistent institutional support (Arsyad Arrafii, 2023; Mulyati et al., 2023; Werang et al., 2023) [8], [21]. The researcher thus argues that sustainable professional development depends on how well teachers internalize the reflective cycle illustrated in Diagram 4.1, integrating evaluation into their pedagogical consciousness.

Synthesizing across these studies, the researcher concludes that formative and authentic assessments function as twin pillars of reflective professionalism. Formative assessment provides structure to reflection, while authentic assessment ensures contextual relevance. Together, they transform evaluation from a static measurement activity into a dynamic learning process that enhances teacher self-awareness, agency, and competence (Black & Wiliam, 2009; Kennedy, 2016; Guskey, 2002) [3], [9], [10]. When teachers adopt this reflective cycle, they no longer perceive evaluation as an external obligation but as the internal heartbeat of professional growth.

4.3 Contextual and Policy Challenges in Indonesian Language Education

The researcher identified that despite significant reform efforts, the implementation of effective learning evaluation within Indonesian language education remains constrained by contextual and policy-related challenges. One of the most pressing issues lies in the gap between national curriculum expectations and teachers' classroom realities. Although the Kurikulum Merdeka promotes formative and authentic assessment as pillars of modern pedagogy, many teachers still face difficulties in translating these principles into daily practice due to limited professional literacy, large class sizes, and restricted resources (Arsyad Arrafii, 2023; Amin & Rifa'i, 2024; Werang et al., 2023) [6], [8], [22]. Furthermore, the bureaucratic emphasis on summative assessment for accountability often overshadows formative feedback intended to guide teacher and learner growth (Fazalani, 2025; Mulyati et al., 2023; Ramly & Abduh, 2018) [14], [21], [47]. The researcher noted that this imbalance reflects a tension between compliance-based evaluation and developmental evaluation: a dilemma that continues to challenge teachers' professional autonomy.

Another crucial contextual constraint arises from the uneven distribution of technological and institutional support. As the education system moves toward digitalization, evaluation increasingly depends on teachers' digital competencies and infrastructure readiness. Studies by Suhara et al. (2019) and Ahadi et al. (2024) reveal that while some urban schools have adopted innovative e-learning platforms for assessment, rural and resource-limited regions remain constrained by inadequate facilities and weak internet connectivity. Consequently, professional development opportunities become unevenly accessed and unevenly effective (Vattøy & Gamlem, 2025; Hongyang, 2023) [32], [33]. The researcher observed that this technological divide also affects teachers' willingness to adopt reflective digital practices, as evaluation is often perceived as administratively burdensome rather than pedagogically empowering.

Policy coherence presents yet another layer of complexity. Despite national initiatives emphasizing teacher professionalization, the policies guiding evaluation are often fragmented across different ministerial and institutional levels (Sukenti & Tambak, 2020; Suwandi et al., 2019; Goe et al., 2012) [19], [20], [26]. This fragmentation leads to inconsistent implementation

standards and a lack of unified indicators for teacher evaluation literacy. The researcher argues that policy formulation must move beyond procedural standardization toward cultivating reflective and context-sensitive evaluation cultures. As Kennedy (2016) and Darling-Hammond et al. (2017) suggest, successful professional development emerges not from rigid frameworks but from systems that nurture teacher inquiry, experimentation, and reflection. Therefore, to sustain professional growth among Indonesian language teachers, evaluation must be re-envisioned as a collaborative process—one that aligns institutional policy, classroom context, and teacher agency in an integrated cycle of learning and reflection.

4.4 Innovative Directions for Sustainable Professional Growth

The researcher views innovation in learning evaluation not merely as a technological upgrade but as a paradigm shift toward sustained professional growth. The emerging literature reveals that innovative directions must combine pedagogical, digital, and reflective dimensions in a synergistic framework. Globally, professional development has evolved toward models emphasizing inquiry-based evaluation, peer collaboration, and adaptive learning analytics (Ahadi et al., 2024; Kennedy, 2016; Zeggelaar et al., 2022) [3], [4], [27]. In the Indonesian context, innovation in evaluation needs to address both structural and cultural barriers by integrating digital tools, collaborative reflection, and contextual adaptation (Arsyad Arrafii, 2023; Mulyati et al., 2023; Suwandi et al., 2019) [7], [19], [21]. The researcher argues that sustainability in teacher growth arises when evaluation is no longer episodic but continuous; embedded within teachers' daily professional experience.

To visualize this transformative shift, Diagram 4.2 below presents the Innovative Evaluation Model for Sustainable Teacher Professional Growth, synthesized by the researcher from global and Indonesian perspectives. This model illustrates how innovation in learning evaluation can bridge the gap between teacher reflection, technological mediation, and institutional support to sustain ongoing professional learning.

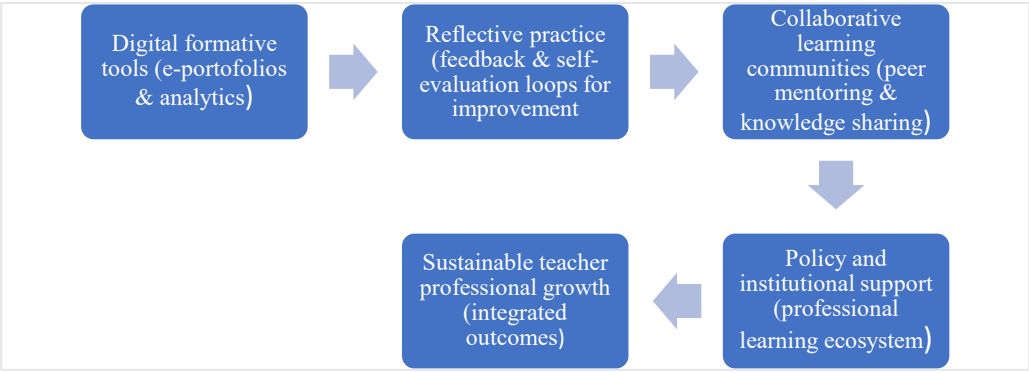

Fig.2. Source: developed by the researcher based on synthesis from Kennedy (2016); Ahadi et al. (2024); Suwandi et al. (2019); Darling-Hammond et al. (2017); and Zeggelaar et al. (2022).

The first component of the model highlights the potential of digital formative tools such as e-portfolios, digital rubrics, and automated feedback systems to promote data-driven reflection.

These tools allow teachers to document learning progress and engage in self-assessment over time (Fukubayashi & Fuji, 2025; Suhara et al., 2019; Li & Gu, 2024) [28], [38], [41]. The researcher emphasizes that such digital innovation should not replace pedagogical judgment but complement it by visualizing learning evidence that can guide professional decisions. The second component, reflective practice, reinforces the formative cycle described earlier: teachers analyze collected data, identify patterns of success and challenge, and set personal learning goals (Schön, 2013; Black & Wiliam, 2009; Hobbs & Marks, 2020) [9], [24], [48].

The third element (collaborative learning communities) plays a crucial role in sustaining innovation. Research across contexts demonstrates that teachers' reflective practices thrive in collegial settings where feedback, mentorship, and shared inquiry occur regularly (Guskey, 2002; Borko et al., 2000; Prastikawati et al., 2024) [10], [16], [25]. In Indonesia, professional learning communities (Komunitas Belajar) have emerged as effective platforms for integrating evaluation and reflection, helping teachers align classroom practices with curriculum expectations while fostering mutual accountability (Mulyati et al., 2023; Werang et al., 2023; Arsyad Arrafii, 2023) [8], [21], [22]. The researcher believes these communities serve as social ecosystems that cultivate a culture of continuous evaluation-driven learning.

The fourth component concerns policy and institutional support, which function as enablers of sustainable innovation. Without consistent policies and administrative frameworks, innovative evaluation efforts risk remaining isolated classroom initiatives. Darling-Hammond et al. (2017) and Desimone (2009) both emphasize that sustainable professional development is achieved only when systemic structures (training programs, evaluation guidelines, and recognition mechanisms) align with reflective learning principles. Indonesian studies similarly indicate that coherent institutional support strengthens teacher motivation and evaluation literacy (Sukenti & Tambak, 2020; Suwandi et al., 2019).

Finally, the fifth component—sustainable teacher professional growth; represents the integrated outcome of the entire cycle. The researcher interprets sustainability not as permanence but as continuous adaptability: the ability of teachers to re-evaluate, redesign, and renew their professional practices in response to educational changes (Mezirow, 2015; Kennedy, 2016; Zeggelaar et al., 2022) [3], [29]. This ongoing renewal process enables teachers to maintain relevance and resilience within evolving pedagogical landscapes. In conclusion, the researcher asserts that innovative evaluation must be understood as a living, systemic process that merges technology, reflection, and collaboration. By adopting the model proposed in Diagram 4.2, Indonesian language teachers can transform evaluation into a dynamic driver of sustainable professional development. This integrated innovation, when supported institutionally and culturally, ensures that professional growth is not an external demand; but an internalized, self-sustaining practice of lifelong learning.

5. Conclusion

This narrative review reaffirms that learning evaluation holds transformative potential in strengthening the professional development of Indonesian language teachers. Through conceptual synthesis and interpretive analysis, the researcher concludes that evaluation functions most effectively when it transcends its traditional measurement role and becomes an instrument of reflection, inquiry, and pedagogical self-renewal. When teachers engage in formative and authentic assessment processes, they do more than measure student outcomes; they cultivate reflective habits that sustain their own professional growth.

Nevertheless, this review acknowledges practical limitations within Indonesia's educational landscape. The prevailing emphasis on standardized testing, uneven access to digital resources, and inconsistent institutional support systems often prevent teachers from fully implementing reflective evaluation practices. These contextual challenges highlight the need for integrated policies and continuous professional development frameworks that empower teachers to embed reflective evaluation into daily instruction.

The study's scope was confined to a synthesis of theoretical and empirical literature, which limits the ability to generalize findings empirically. Therefore, future research should explore classroom-based applications of the proposed conceptual model through mixed-method or design-based approaches. Such studies could examine how reflective evaluation systems influence teaching efficacy, learner engagement, and professional identity formation over time. Ultimately, the vision derived from this review is to establish a reflective evaluation culture in which Indonesian language teachers learn from their own practice continuously. By uniting innovation, collaboration, and reflection, learning evaluation can evolve into a sustainable engine of professional transformation; empowering teachers not merely to teach, but to grow, adapt, and inspire.

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The Implementation of the Habituation Method at Kisol Public Kindergarten to Develop Polite Character in Six-Year-Old Children

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Abstract. This study identifies and describes habituation practices implemented at TK Negeri Kisol to foster polite character in six-year-old children. Using a qualitative descriptive approach, data were collected through observations, interviews with three teachers, and document analysis conducted in April 2025. Findings reveal that habituation practices include greeting politely, expressing gratitude, demonstrating courteous mealtime behavior, speaking politely, requesting permission, showing care, and acting honestly. Implementation steps involve determining habituation activities, initiating through teacher modeling, practicing consistently, avoiding demeaning reprimands, providing reminders, and offering appreciation. Challenges encountered include lack of school-home continuity, variations in children's comprehension levels, and demands for teacher patience. The study demonstrates that systematic habituation supported by Standard Operating Procedures effectively develops polite character in early childhood when implemented with commitment and structured guidance.

Keywords: Habituation Method, Polite Character, Early Childhood Education, Six-Year-Old Children.

1 Introduction

Early childhood refers to children aged 0-6 years. This developmental period is often described as a golden age and a sensitive period, during which children experience rapid growth and heightened sensitivity to environmental stimuli. At this stage, children have not yet developed a clear understanding of what is good or bad, nor of what is right or wrong. Information is also more easily absorbed during this period, particularly when conveyed through consistent and intensive actions. Moreover, children at this age readily internalize values that are taught through concrete and observable behaviors. One essential aspect of an individual, including young children, that needs to be instilled and developed is character [1]. Character is defined as an attribute that distinguishes an individual and is reflected in attitudes, behaviors, and speech. Such attributes become inherent and deeply rooted in a person's personality and disposition. Character can be observed through one's attitudes, behaviors, speech, and ways of

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responding to various situations. Character is essential to develop from an early age, and character formation can be facilitated through character education [2].

Character education is an effort to instill human character values that contribute to shaping an individual's personality toward a better and more virtuous direction. Character education must be introduced from an early age, beginning within the family environment, which serves as the first and foremost educational setting. Furthermore, the Ministry of Education and Culture Regulation (Permendikbud, 2014) also emphasizes the importance of character education, which aims to develop students' resilience and dignity [3]. The emphasis on character education is not a recent development in Indonesian educational discourse. Ki Hajar Dewantara, the founding father of Indonesian national education, articulated a holistic vision of education that extends beyond mere cognitive development. He asserted that education must cultivate not only intellectual capacity but also moral integrity and virtuous conduct. In his educational philosophy, Ki Hajar Dewantara emphasized three fundamental principles known as Tri Pusat Pendidikan (three centers of education): family, school, and community. These centers must work synergistically to nurture children's character, ensuring that values taught in one environment are reinforced in others. This philosophical foundation remains profoundly relevant to contemporary early childhood education, particularly in the context of character formation through consistent and collaborative efforts across educational settings.

The habituation method aligns closely with Ki Hajar Dewantara's educational philosophy, particularly his concept of among (caring guidance) and tut wuri handayani (leading from behind). These principles advocate for educators to guide children through exemplary modeling rather than authoritarian instruction. The habituation method embodies this philosophy by positioning teachers as living examples who demonstrate desired behaviors repeatedly, allowing children to internalize these values through observation and practice. This approach resonates with Ki Hajar Dewantara's belief that authentic character formation emerges not from didactic teaching alone, but from sustained exposure to virtuous conduct within a nurturing educational environment. By consistently modeling polite behaviors and creating structured opportunities for children to practice these behaviors, educators facilitate the gradual internalization of moral values that shape children's developing personalities. As Ki Hajar Dewantara stated, education is not merely an effort to make learners intelligent, knowledgeable, and broad-minded, but must also be oriented toward the formation of noble character, personality, and moral conduct. Therefore, character education is essential to be implemented across all levels of education, including early childhood education [4].

East Manggarai Regency, located in the eastern region of Nusa Tenggara Timur Province, Indonesia, presents unique sociodemographic characteristics that influence early childhood education practices. The region is characterized by a predominantly agricultural economy, with most families engaged in subsistence farming and traditional livelihoods. Educational infrastructure in rural areas of East Manggarai faces challenges including limited access to quality educational resources, geographic isolation of communities, and economic constraints that affect family investment in early childhood education. Despite these challenges, communities in East Manggarai maintain strong cultural traditions that emphasize respect for elders, communal cooperation, and social harmony. However, rapid social changes, including increased exposure to media and shifting family structures, have begun to influence traditional behavioral norms among young children. These contextual factors make the implementation of structured character education programs, such as habituation methods in kindergartens,

particularly crucial for preserving cultural values while preparing children for broader societal participation.

Observations conducted in the Kisol community revealed specific behavioral patterns among young children that necessitate targeted character education interventions. Teachers and parents reported instances of children failing to greet elders when entering homes or public spaces, a behavior traditionally considered essential in Manggarai culture. Additionally, children were observed using direct and sometimes abrupt language when making requests, omitting courteous expressions such as "please" or "thank you" that are culturally valued. During communal meals, some children displayed behaviors such as talking loudly while eating, beginning meals without waiting for others, or showing reluctance to share food with peers. Furthermore, teachers noted that some children demonstrated difficulty in asking permission before taking items belonging to others or before engaging in activities, reflecting a need for stronger understanding of social boundaries and respect for communal property. These specific behavioral observations at the local level provided the practical impetus for examining how TK Negeri Kisol implements habituation methods to address these character development needs within the community context.

In contemporary society, individuals who fail to demonstrate polite and respectful behavior toward others are still frequently encountered. Such behaviors include showing a lack of appreciation for others, using harsh or impolite language, and neglecting to express basic courtesies such as "excuse me," "thank you," "sorry," and "please," among many other forms of discourteous conduct. The absence or declining presence of polite character among people today indicates that character education implemented in schools, families, and the broader community has not yet been fully successful. One of the essential character traits that should be cultivated from an early age is politeness. According to Pertiwi, politeness refers to an individual's attitude, behavior, or actions that demonstrate respect and appreciation toward others. Teaching politeness to young children is crucial, as it helps them understand which behaviors are appropriate and which should be avoided in various situations [5,6].

Politeness does not emerge spontaneously in children, but must be taught through consistent practice and guidance. Without being taught, children will not understand what constitutes polite behavior. Politeness, when cultivated in early childhood education settings, can be developed through various learning activities, such as encouraging children to greet others, fostering habits of exchanging greetings, and teaching them to use courteous expressions such as "sorry," "please," and "thank you," among others. In schools, teachers play a crucial role in introducing values and social norms that influence children's everyday behavior [7]. One of the approaches to implementing character education in schools is through the habituation method. The application of this method is believed to influence and modify children's behavior. Through habituation, positive values can be instilled in children, enabling them to consistently engage in desirable actions. The implementation of habituation must be carried out continuously on a daily basis. When habituation is introduced from an early age, these routines eventually become established habits that become ingrained in the child and shape their personality.

The habituation method is considered one of the oldest educational approaches, involving the repeated performance of certain activities with the aim of turning them into established habits. This method is highly suitable for early childhood education, as children at this developmental stage tend to easily absorb and imitate the behaviors demonstrated by adults

[8]. While various pedagogical approaches exist for character development in early childhood education, the habituation method presents distinct characteristics that differentiate it from alternative strategies. Unlike the lecture-based approach, which relies primarily on verbal instruction and cognitive understanding, the habituation method emphasizes experiential learning through repeated behavioral practice. This contrasts sharply with modeling approaches that focus predominantly on observation without structured repetition, and differs from reward-based behavioral modification techniques that employ external incentives to shape conduct. The habituation method synthesizes elements from multiple theoretical frameworks: it incorporates social learning theory by utilizing teacher modeling, draws from behaviorist principles through consistent repetition, and aligns with constructivist approaches by allowing children to internalize values through direct experience. What distinguishes habituation is its systematic integration of modeling, repetition, and gradual internalization without heavy reliance on external rewards or punishments. This approach proves particularly effective for early childhood settings where children's moral reasoning is still developing and behavioral patterns are most malleable through consistent environmental structuring.

Jean Piaget's theory of cognitive development provides crucial theoretical grounding for understanding how six-year-old children internalize polite expressions through habituation. Children at age six typically occupy the late preoperational stage or early concrete operational stage of cognitive development, characterized by developing symbolic thinking and emerging capacity for logical reasoning about concrete experiences. At this developmental juncture, children begin to understand that words carry social meanings beyond their literal definitions and that specific linguistic formulas serve important interpersonal functions. The internalization of "magic words" such as "sorry," "please," "thank you," and "excuse me" occurs through a gradual process whereby children initially imitate these expressions through rote repetition, then begin associating them with specific social contexts, and eventually comprehend their underlying social significance. During the preoperational stage, children's moral understanding remains largely heteronomous, meaning they perceive rules and social conventions as fixed external requirements rather than internally constructed principles. Consequently, the habituation method proves developmentally appropriate because it provides the repeated contextual exposure necessary for children at this cognitive stage to form mental schemas linking specific expressions to social situations. Through consistent practice embedded in authentic daily interactions such as saying "thank you" after receiving food or "please" when making requests children construct cognitive frameworks that associate courteous language with positive social outcomes, gradually transitioning from external compliance to internalized understanding of politeness norms.

The habituation method is highly effective for fostering character development in early childhood. This is consistent with the findings of a study conducted by Firrizky et al. at TK Al Amanah, which showed that routine habituation practices such as encouraging children to say "please" and "thank you" as well as teacher modeling, positively contribute to the development of polite behavior in young children. Another study conducted by Aini et al. at KB Azzahroh Serang revealed that routine activities, spontaneous activities, and teacher modeling are essential components in the implementation of the habituation method, which effectively fosters independence in early childhood [9,10]. TK Negeri Kisol, as one of the formal early childhood education institutions, has implemented the habituation method in its daily activities to instill polite character in children. Based on observations conducted on 12 November 2024, TK Negeri

Kisol had applied several habituation activities, including: lining up when washing hands, disposing of trash properly, greeting others politely, using courteous expressions such as "sorry," "please," "excuse me," and "thank you" after receiving help, saying "excuse me, may I speak" before talking, and refraining from using harsh language toward peers. These habituation practices have been consistently implemented by the teachers at TK Negeri Kisol.

The observations also showed that although some children occasionally forgot to perform the habituation practices taught by the teachers, the teachers consistently reminded them to carry out these behaviors as instructed. Furthermore, during a parent-teacher meeting held in December, one parent stated that "because of the habituation activities at school, the child has become more polite at home and even greets people on the street." This testimony indicates that the habituation practices implemented by the teachers at TK Negeri Kisol have begun to demonstrate positive effects in shaping children's polite character. Based on these findings, the researcher is interested in conducting a more in-depth investigation into the implementation of the habituation method at TK Negeri Kisol as an effort to develop polite character in six-year-old children.

2 Research Methods

This study employs a qualitative descriptive methodology aimed at analyzing and providing an in-depth depiction of the implementation of habituation methods as a strategy for fostering polite character in six-year-old children at TK Negeri Kisol, East Manggarai Regency. The research was conducted in April 2025. The study involved a total of 28 children aged six years who were enrolled in the kindergarten's final year program (Group B). These 28 children served as the subjects of direct classroom observations throughout the data collection period. In addition to the children, three classroom teachers designated as Mrs. A, Mrs. I, and Mrs. S served as the primary informants for this study.

These three teachers were purposively selected based on specific criteria established to ensure comprehensive and credible data collection. The selection criteria included: (1) each teacher possessed a minimum of five years of teaching experience in early childhood education, ensuring adequate expertise in understanding child development and character formation; (2) each teacher demonstrated consistent and exemplary implementation of habituation practices as evidenced through preliminary observations conducted prior to the formal research period; (3) each teacher held direct responsibility for managing daily character development activities within their respective classrooms, including planning, implementing, and evaluating habituation practices; and (4) each teacher showed willingness to participate actively in in-depth interviews and provide access to classroom observations. The purposive selection of these three teachers aimed to capture comprehensive perspectives from educators who were actively and successfully engaged in implementing habituation methods across different classroom contexts within the same institutional setting, thereby ensuring richness and depth of qualitative data.

The research procedure encompassed several stages, including data collection, data reduction, data presentation, and conclusion drawing. The document study component involved systematic examination of institutional Standard Operating Procedures (SOPs) related to habituation practices, weekly and daily lesson plans (RPPM and RPPH), teacher observation logs, and photographic documentation of classroom activities. Document analysis followed a

structured protocol: first, all relevant documents were catalogued chronologically; second, content was coded according to predetermined themes aligned with research objectives (types of habituation, implementation procedures, and reported challenges); third, coded segments were cross-referenced with observational and interview data to identify patterns of convergence or divergence; and fourth, triangulated findings were synthesized to construct comprehensive understanding of habituation implementation. This systematic approach to document analysis ensured transparency in how written institutional materials informed research findings and enabled verification of consistency between documented policies and actual classroom practices.

The instruments utilized consisted of observation sheets, interview guidelines, and document study formats, while the data collection techniques included direct observation, in-depth interviews, and document analysis. The collected data were analyzed through systematic processes of reduction, presentation, and verification to produce valid and comprehensive findings regarding the implementation of habituation methods in the development of children's polite behavior.

3 Results and Discussion

3.1 Habituation Practices Implemented at TK Negeri Kisol as an Effort to Develop Polite Character in Six-Year-Old Children

3.1.1 Greeting Politely

Greeting others politely is an essential attitude to be taught to children from an early age. TK Negeri Kisol, as one of the early childhood education institutions, also implements the habituation of polite greetings. Based on interviews with three teachers Ms. A, Ms. I, and Ms. S along with observational findings, it was revealed that the practice of greeting politely has been implemented consistently across various daily activities within the school environment. Teachers actively model courteous communication by greeting children with phrases such as "good morning" or "good afternoon" and by asking about their well-being each day. Children are also habituated to greet teachers politely when arriving at school, before entering the classroom, and when going home. The greeting routine is carried out using polite expressions accompanied by respectful actions, such as kissing the teacher's hand or offering a formal greeting while lining up. Teachers consistently guide and remind children who forget to greet, as this forms an integral part of the habituation process. This habituation aligns with the smile, greeting, salutation, politeness, and courtesy (5S) practice discussed in Syifa. The study explains that the development of courteous and friendly character in early childhood can be fostered through consistent implementation of the 5S habituation, one of which is the practice of greeting (sapa). The application of this habituation contributes significantly to the formation of polite character in children [11].

3.1.2 Expressing Gratitude

In addition to habituating children to greet others politely, teachers at TK Negeri Kisol also consistently teach and encourage children to express gratitude whenever they receive help or assistance from others. Based on interviews with three teachers Mrs. A, Mrs. S, and Mrs. I it was found that the practice of saying "thank you" has been implemented consistently across

various daily activities. The teachers actively model and reinforce the behavior of expressing gratitude, particularly after receiving help or being given something. Mrs. A explained that this habituation is carried out every day, such as when children are assisted or lent an item. Mrs. S added that in concrete situations, for example when a teacher helps a child open the cap of a water bottle, the child is immediately taught to say "thank you." Meanwhile, Mrs. I noted that this habituation is also strengthened through songs or chants, storytelling activities, and the use of positive reinforcement in the form of praise for children who express gratitude spontaneously.

The observations conducted support the interview findings. For instance, during communal mealtime, children who received food from their peers spontaneously expressed gratitude by saying "thank you." Similarly, when a child borrowed a broom from the teacher, the child immediately said "thank you" upon returning it. During a birthday celebration held by the teachers and children, the teacher reminded the children to say "thank you" after receiving candy. The children then spontaneously expressed gratitude after receiving the candy. If any child forgot to say "thank you," the teacher promptly provided a reminder. This habituation aligns with the findings of the study conducted by Wiranti and Nisa. Their research highlights the use of four "magic words," one of which is the expression of gratitude through saying "thank you." In their study, the use of the phrase "thank you" is emphasized when a child or an individual receives assistance or obtains something from another person [11].

3.1.3 Polite Behavior During Mealtime

Based on interviews with the three teachers (Mrs. A, Mrs. S, and Mrs. I) and the observations conducted, it was found that the habituation of eating in an orderly and polite manner has been consistently implemented at TK Negeri Kisol as part of early character development. The teachers actively provide guidance, model proper eating behavior, and repeatedly remind the children of appropriate mealtime rules. Mrs. A emphasized the importance of reminding children not to talk while eating and to avoid spilling their food. Mrs. S added that before eating, the children are taught to pray together, sit properly, and are encouraged to share their food with peers. Mrs. I further explained that the teachers establish clear mealtime rules and invite the children to pray before beginning their meal.

Observational data indicate that during mealtime activities, the children ate in an orderly manner, sat properly, and followed the teachers' instructions. The teachers actively reinforced appropriate dining behavior by consistently reminding the children of proper mealtime etiquette, such as avoiding noise, not wasting food, and finishing their meals calmly. The repeated reinforcement of rules and the modeling of appropriate behavior by the teachers played a crucial role in shaping positive habits among the children. Children gradually develop understanding of social values and ethics through cognitive development processes, including habits related to eating behavior. In the context of dining etiquette, teachers alongside parents play an important role in teaching children the significance of sharing food, appreciating what they have, and developing a sense of gratitude [12].

3.1.4 Speaking Politely

Teachers at TK Negeri Kisol also cultivate the habit of speaking politely among children in their daily interactions by encouraging the use of expressions such as "please," "sorry," and "excuse me." Based on interviews with the three teachers and classroom observations, it was found that the habituation of polite speech has been implemented consistently as an integral part of

character development at the school. The teachers actively guide children to use polite expressions in their everyday communication, including "please," "sorry," "thank you," and "excuse me." According to Mrs. I, teachers not only model polite language through daily interactions but also incorporate it into activities such as reading storybooks that contain moral lessons. Mrs. S further explained that the children are encouraged to greet teachers and peers politely and are trained to raise their hands before speaking as a sign of respect and adherence to appropriate classroom communication etiquette.

The observational findings also support the teacher's statement. For instance, during mealtime, a child was seen politely requesting assistance from the teacher by using the word 'please', and after receiving help, the child expressed gratitude by saying 'thank you'. In addition, the children are accustomed to speaking courteously and refraining from using inappropriate or harsh language, both inside and outside the classroom. If any child uses improper words, the teacher immediately provides a corrective reminder in an educational and constructive manner. The habituation method enables children to repeatedly practice behaviors until they become part of their daily routines, embodying the principle that education through habitual activities shapes children to perform behaviors independently without explicit instruction [13].

3.1.5 Requesting Permission Before Engaging in an Activity

Based on the results of interviews and observations, it was found that Kisol Public Kindergarten has consistently implemented the habituation of requesting permission before engaging in any activity as part of the children's daily routines. The children are accustomed to asking for permission in various situations, such as before going to the toilet, before using play materials such as blocks, or when they wish to borrow items belonging to their peers or from another class. The teachers actively model and guide the children to ensure that requesting permission becomes an established habit prior to taking any action. If a child forgets, the teacher immediately provides a gentle and educational reminder. This habituation aims to develop children's character by fostering a sense of responsibility, respect for the rights of others, and adherence to social norms from an early age. The habituation of requesting permission aligns with the findings of Hasanah et al. Their study indicates that one of the habituation practices implemented to cultivate polite character in children is encouraging them to request permission and ask appropriately when borrowing belongings from their peers [14].

3.1.6 Showing Care and Concern

Care and concern for others and the environment constitute an essential component of character formation implemented by the teachers at Kisol Public Kindergarten. Based on interviews with three teachers Mrs. A, Mrs. S, and Mrs. I as well as observations conducted, it was found that the teachers cultivate children's caring character through daily habituation practices at school. These practices include caring for the environment by disposing of waste properly, sweeping the classroom, and cleaning play materials. In addition to environmental care, children are also habituated to care for their personal hygiene, such as washing their hands and brushing their teeth. Caring behaviors toward peers are likewise encouraged, including sharing food and helping friends who experience difficulty, such as distributing drinking water. In implementing these habituation practices, the teachers consistently instill these values through daily routines and exemplary conduct. The habituation of caring behavior is also reflected in the findings of Rukiyati, who reported that teachers foster children's sense of care through the implementation of daily routines such as sharing food, disposing of waste properly, organizing play materials

by returning them neatly to their designated places, and training children to collaborate with one another [15].

3.1.7 Acting Honestly

To cultivate honesty in children, the teachers at Kisol Public Kindergarten consistently teach and habituate them to express things truthfully and as they are. Based on the interviews and observations conducted, it was found that the teachers have implemented systematic habituation practices to foster honest behavior among the children. Honesty is instilled through routine activities such as collecting savings money and conducting direct honesty checks. Teachers also read stories that emphasize honesty and continuously reinforce the importance of not lying. Observational findings indicate that the children have begun to demonstrate honest behavior, such as admitting when they did not attend church or spontaneously returning borrowed items. Positive habituation practices contribute to the development of honest character in children [16].

3.2 Procedural Steps in Implementing the Habituation Method at Kisol Public Kindergarten as an Effort to Cultivate Polite Character in Six-Year-Old Children

Based on interviews with three teachers Mrs. A, Mrs. S, and Mrs. I as well as the observations conducted, it was found that the procedural steps for implementing habituation are largely consistent across the various types of habituation activities applied. The observations also revealed that Kisol Public Kindergarten possesses several Standard Operating Procedure (SOP) documents that guide the implementation of these habituation practices. The use of Standard Operating Procedures (SOPs) in the implementation of habituation practices is also consistent with the findings of Siregar in the study entitled 'Building Discipline Through Standard Operating Procedures'. The findings of the study indicate that the implementation of Standard Operating Procedures (SOPs) aims to continuously instill habituated behaviors in children, with the expectation that they will eventually develop disciplined and independent character traits. Thus, as the children grow older, they are expected to develop positive character traits that will guide them throughout their lives. Another study was conducted by Haniza entitled 'The Development of Standard Operating Procedures (SOPs) to Foster Early Childhood Character Development at Islamic Kindergarten Mataram City in 2021'. The findings of this study indicate that the presence of SOPs for developing early childhood character facilitates teachers in implementing character education. With SOPs in place, the procedural steps for character-building activities become more directed and structured. Therefore, the use of SOP in each type of habituation activity supports the successful implementation of these practices and ensures that their execution remains well-organized and goal-oriented [17,18].

The procedural steps implemented by the teachers at Kisol Public Kindergarten in carrying out habituation practices, as identified through interviews and observations, include the following:

3.2.1 Identifying and Agreeing Upon the Types of Habituation Activities to Be Implemented

Based on the interviews and observations conducted, it was found that Kisol Public Kindergarten carries out a planning process prior to implementing any type of habituation activity. This planning is conducted at the end of the school day, during which the teachers hold a meeting in the school office. This practice aligns with the findings of Antika and Karlina, who reported that planning the habituation method to enhance children's independence involves preparing a Weekly Learning Implementation Plan (RPPM), which is then further elaborated into a Daily Learning Implementation Plan (RPPH) [19].

3.2.2 Habituation Begins with the Teacher

Based on the findings obtained through interviews and observations, it was identified that in the process of implementing the predetermined habituation practices, teachers consistently remind children to carry out these routines properly. Teachers not only explain and teach the habituation activities but also act as continual reminders whenever a child forgets to perform them. At Kisol Public Kindergarten, habituation begins with the teachers themselves. They serve as the primary models and are always the first to provide explanations while demonstrating directly how each habituation activity should be carried out. Teachers play an important role as role models whose behavior significantly influences children's character development. Children tend to imitate the behaviors of teachers whom they perceive as figures of authority and guidance [20].

3.2.3 Implementing the Practices Consistently and Continuously

Based on the interviews and observations conducted, it was found that the teachers at Kisol Public Kindergarten implement the habituation practices consistently and continuously. The predetermined habituation activities are carried out daily at school. The purpose of maintaining this consistency is to ensure that children do not forget the routines and are able to internalize and understand the practices taught by their teachers. Continuous habituation can shape children's behavior into stable and consistent habits, which can foster children's preferences and behaviors until these become ingrained as customary actions that are inseparable from their developing personality [21].

3.2.4 Refraining from Criticizing or Condemning Children When They Make Mistakes

Based on the interviews and observations conducted, it was found that in implementing habituation practices, teachers do not criticize or reprimand children when they make mistakes. Instead, the teachers remind them of the correct way to carry out the expected behaviors. Teachers function as facilitators who guide children and provide meaningful learning experiences, which means teachers hold specific roles, including serving as guides who direct children toward learning centers and having the responsibility to prepare various resources that enable learners to gain meaningful experiences. This theory emphasizes that teachers, as facilitators and mentors, are obliged to guide children when they make mistakes and to prepare them to continually remain on positive developmental paths that support better outcomes in their future lives [22].

3.2.5 Reminding Children Who Forget to Perform the Expected Habituation

Based on the interviews and observations conducted, it was found that teachers at TK Negeri Kisol consistently reminded children whenever they forgot to carry out the habituation practices that had been taught and implemented at school. This action was taken to ensure that children immediately corrected inappropriate behaviors and replaced them with appropriate actions that aligned with the expectations and guidance provided by the teachers. This is also supported by Ulya, who states that reminding children when they forget to carry out habituation practices is one of the essential steps implemented in the execution of habituation activities in schools [23].

3.2.6 Providing Appreciation to Each Child

Based on the findings obtained through interviews and observations, it was identified that the teachers at TK Negeri Kisol implemented the following steps in applying the habituation method: determining and agreeing upon the types of habituation activities to be carried out,

initiating the habituation process through teacher modeling, practicing the activities consistently and continuously, refraining from criticizing children for mistakes, reminding children when they forget to perform the expected behaviors, and providing appreciation to each child. Providing appreciation increases children's motivation and reinforces positive behavior, which is one of the key steps in implementing habituation is giving individual appreciation to each child. Such appreciation helps children feel happy and motivated, thereby reinforcing the desired behaviors and supporting the habituation process [24].

3.3 Challenges Experienced by Teachers in Implementing the Habituation Method as an Effort to Develop Polite Character in Six-Year-Old Children at TK Negeri Kisol

Based on interviews with three teachers and observations conducted at TK Negeri Kisol, it was found that teachers encountered several challenges in their efforts to cultivate polite character in children. First, there was a discrepancy or lack of continuity between habituation practices implemented at school and behavioral expectations reinforced at home, which hindered the consistency of children's character development. This finding is consistent with previous studies indicating that misalignment between school-based practices and parenting approaches constitutes a major obstacle in the implementation of habituation methods. Second, variations in children's levels of understanding of the material taught by teachers present an additional challenge. Not all children are able to respond to habituation practices at the same pace, thereby requiring increased attention and individualized guidance from teachers. Differences in cognitive abilities and learning readiness among children are known to influence their capacity to follow instructions and achieve learning outcomes effectively. Third, irregular attendance or infrequent participation in school activities also poses a significant challenge, as children who do not attend regularly tend to forget or fail to internalize the habituation practices that have been introduced, such as performing prayers correctly. In this context, the school environment plays a crucial role in shaping children's behavior through structured learning activities, social interactions, and continuous teacher guidance. Fourth, teachers are required to possess a high level of patience and consistency in implementing the habituation method to ensure that values of politeness are internalized meaningfully and sustainably within the child. Thus, the implementation of the habituation method necessitates comprehensive support from both the school and the family, as well as strong commitment and persistence from teachers as the primary facilitators in the school setting. The findings of this study are consistent with those of Anggraeni et al., who assert that maintaining consistency in habituation practices is one of the primary challenges in implementing such methods. They explain that habituation activities are repetitive in nature; therefore, teachers must remain consistently patient and persistent in teaching and reinforcing these habituation practices to young children [25–28].

4 Conclusion

The implementation of the habituation method at TK Negeri Kisol as an effort to foster polite character in early childhood has been carried out effectively by both teachers and young learners. The students are considered to have demonstrated polite character, as reflected in the behavioral indicators expected of six-year-old children. Based on the findings of the study, various forms of habituation practiced at TK Negeri Kisol include greeting politely, expressing gratitude, displaying proper manners during meals, speaking courteously, asking for permission before engaging in an activity, showing concern for others, and demonstrating honesty.

The steps implemented in the habituation process include determining the types of habituation activities, initiating the habituation through teacher modeling, practicing the behaviors consistently, refraining from criticizing children for mistakes, reminding children when they forget to perform the expected behavior, and providing positive reinforcement to each child. These procedural steps are guided by Standard Operating Procedures (SOPs) that ensure systematic and structured implementation of character-building activities. The use of SOPs facilitates teachers in maintaining consistency and direction in their daily habituation practices, thereby supporting the successful internalization of polite behaviors among children.

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Investigating the Impact of the Project-Based Learning Model on Creative Thinking Ability in Elementary Integrated Science

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Abstract. Project-Based Learning (PjBL) model in enhancing fourth-grade students' creative thinking skills within the Integrated Science (IPAS) subject, specifically on the 'Indonesia's Rich Culture' topic, at UPTD SD Negeri 124401 Pematangsiantar. Employing a quantitative experimental approach with a One-Group Pretest-Posttest design (N=25), the research utilized validated essay tests to measure the learning outcomes. The data analysis, performed using the N-Gain formula, revealed a significant improvement in creative thinking skills, with an average pretest score of 48.08 and a posttest score of 88.00. The calculated N-Gain of 0.7832 (78.32%) falls into the 'High and Effective' category. These findings strongly suggest that the PjBL model is highly effective in significantly improving students' creative thinking abilities, thus recommending its implementation for developing higher-order thinking skills in IPAS instruction

Keywords: Project-Based Learning (PjBL), Thinking Skills, Integrated Science Education.

1 Introduction

The rapid transformation of global society in the 21st century has brought significant implications for education systems worldwide [1], [2], [3]. Advances in science, technology, and information have reshaped the skills required for individuals to participate effectively in social, economic, and professional contexts. As a result, contemporary education emphasizes not only the acquisition of factual knowledge but also the development of higher-order thinking skills, particularly creative thinking [4], [5], [6]. Creativity is increasingly recognized as a core competency that enables learners to generate novel ideas, adapt to complex situations, and solve multifaceted problems[7], [8], [9]. In science education, creative thinking plays a vital role in inquiry, experimentation, interpretation of data, and the application of scientific knowledge to real-world contexts.

Integrated science education has emerged as a strategic approach to address the complexity of real-life problems that transcend disciplinary boundaries. Rather than treating scientific concepts as isolated domains, integrated science encourages learners to connect knowledge from multiple fields and apply it holistically [10]. In Indonesia, this approach has been formalized through the Merdeka Curriculum, which introduces Integrated Science (IPAS) at the elementary level by combining natural sciences and social sciences into a unified subject. The integration aims to promote contextual learning, interdisciplinary understanding, and the development of

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essential competencies such as critical and creative thinking. However, the successful implementation of integrated science learning requires instructional models that actively engage students and support the development of these competencies.

One instructional approach that has gained increasing attention for its potential to foster creative thinking is Project-Based Learning (PjBL) [11], [12], [13]. PjBL is a student-centered pedagogical model that engages learners in exploring authentic problems through extended projects, culminating in concrete products or presentations. Rooted in constructivist learning theory, PjBL emphasizes active learning, collaboration, inquiry, and reflection [14]. Students are encouraged to take responsibility for their learning by asking questions, investigating solutions, and constructing knowledge through meaningful experiences. These characteristics make PjBL particularly relevant for promoting creative thinking, as students are required to generate ideas, evaluate alternatives, and produce original outcomes.

Previous research has consistently reported positive effects of PjBL on various learning outcomes, including motivation, engagement, problem-solving skills, and higher-order thinking. In science education, PjBL has been shown to enhance students' understanding of scientific concepts by situating learning within real-world contexts[11], [15]. Moreover, PjBL has been widely associated with improvements in creative thinking skills, as project activities provide opportunities for idea fluency, flexibility in thinking, originality, and elaboration. Through collaborative inquiry and iterative design processes, students learn to approach problems from multiple perspectives and develop innovative solutions.

In recent years, the integration of PjBL with interdisciplinary learning has become a prominent trend in educational research. Studies indicate that when PjBL is implemented within interdisciplinary frameworks, students are more likely to develop creative problem-solving abilities and transferable skills relevant to contemporary challenges. The interdisciplinary nature of projects encourages learners to synthesize knowledge across domains, thereby supporting deeper understanding and creativity. These findings suggest that PjBL aligns well with the goals of integrated science education, where students are expected to connect scientific concepts with social, cultural, and environmental contexts.

Despite the growing body of literature on PjBL, several gaps remain, particularly in the context of elementary education and integrated curricula. Much of the existing research on PjBL and creative thinking has focused on secondary or higher education settings, often within single-discipline science instruction. Empirical studies examining the implementation of PjBL in elementary integrated science classrooms are still limited, especially in contexts where curriculum reform is in its early stages. Elementary learners possess unique cognitive and developmental characteristics that require carefully designed instructional approaches, making it essential to investigate how PjBL functions at this level.

In the Indonesian context, the implementation of the Merdeka Curriculum represents a major shift toward competency-based, student-centered learning. While the curriculum emphasizes creativity, critical thinking, and contextual learning, teachers often face challenges in translating these principles into classroom practice. The integration of natural and social sciences within IPAS further complicates instructional design, as teachers must balance content coverage with meaningful interdisciplinary learning experiences. Consequently, there is a need for empirical evidence that examines instructional models capable of supporting creative thinking development within elementary IPAS learning.

Project-Based Learning offers a promising solution to these challenges. By engaging students in interdisciplinary projects grounded in real-life contexts, PjBL has the potential to operationalize the goals of the Merdeka Curriculum in elementary classrooms. Through project activities, students can explore scientific concepts while simultaneously considering social and cultural dimensions, fostering holistic understanding and creativity. However, empirical evidence supporting the effectiveness of PjBL in enhancing creative thinking within elementary IPAS learning remains scarce. This lack of evidence highlights the importance of conducting context-specific studies to inform instructional practice and curriculum implementation.

Furthermore, assessing creative thinking in PjBL environments presents methodological challenges. Creative thinking is a multidimensional construct encompassing fluency, flexibility, originality, and elaboration. Capturing these dimensions requires appropriate assessment instruments and analytical approaches. Many previous studies rely on traditional assessments that may not fully reflect students' creative processes and outcomes. Therefore, research that employs validated instruments and systematic analysis, such as pretest–posttest designs and normalized gain measures, can provide valuable insights into the impact of PjBL on creative thinking development.

Given these considerations, this study aims to investigate the impact of the Project-Based Learning model on students' creative thinking ability in elementary Integrated Science (IPAS) learning. By examining changes in creative thinking performance before and after the implementation of PjBL, this study seeks to provide empirical evidence on the potential of project-based instruction to support creativity within an integrated curriculum framework. The study is situated in an authentic elementary classroom context during the implementation of the Merdeka Curriculum, offering insights into real-world instructional practices and learning outcomes.

The contribution of this study lies in its focus on elementary integrated science education, a context that has received limited attention in PjBL research. By aligning PjBL with the interdisciplinary structure of IPAS learning, the study extends existing literature on creative thinking development and project-based instruction. Additionally, the findings are expected to inform teachers, curriculum developers, and policymakers about the practical implications of implementing PjBL in elementary classrooms to foster creative thinking skills.

In summary, creative thinking is a crucial competency in contemporary education, particularly within integrated science learning environments. Project-Based Learning represents a pedagogical approach that aligns with constructivist principles and the goals of the Merdeka Curriculum. However, empirical evidence examining its impact on creative thinking in elementary IPAS learning remains limited. Addressing this gap, the present study investigates the effect of the PjBL model on students' creative thinking ability in elementary integrated science education, contributing to both theoretical understanding and practical application of innovative instructional models.

2 Method

This study adopted a quantitative research approach utilizing a pre-experimental design, specifically the One-Group Pretest-Posttest Design. This design was chosen to efficiently

measure the effect of a particular treatment (X) by comparing the participants' initial ability (Pretest O1) against their ability after the intervention (Posttest O2).

This study employed a One-Group Pretest-Posttest design due to ethical, administrative, and contextual constraints within the elementary school setting, where the implementation of different instructional approaches across parallel classes was not permitted. This pre-experimental design was considered appropriate for generating preliminary empirical evidence on the potential impact of Project Based Learning (PjBL) on students' creative thinking skills in Integrated Science. By measuring the same participants before and after the intervention, the design allows for the control of individual differences in prior ability and learning characteristics, enabling a more sensitive detection of change attributable to the instructional treatment. Although causal inference is limited, several procedures were implemented to reduce threats to internal validity, including the use of standardized instructional materials, consistent teacher implementation, identical assessment instruments with adequate time intervals, and the calculation of effect sizes. Therefore, the findings are intended to provide initial insights that may inform future studies employing more rigorous experimental or quasi-experimental designs.

Table 1. Research Design *One Group Pretest-Postest*

Phase	Design Notation	Description
Pre-Intervention	O1	Initial assessment of creative thinking skills.
Intervention	X	Implementation of the Project-Based Learning (PjBL) model.
Post-Intervention	O2	Final assessment of creative thinking skills.

2.1 Setting and Sample

The research was conducted at UPTD SD Negeri 124401 Pematangsiantar during the odd semester of the 2025/2026 academic year. This specific elementary school setting provided the necessary environment for a quasi-experimental study aimed at addressing initial findings of low student engagement and learning difficulties in the Integrated Science (IPAS) subject, particularly concerning the topic of "Indonesia's Rich Culture." The selection of this context ensured the intervention the Project-Based Learning (PjBL) model was tested on a population where the need for enhancing creative thinking skills was clearly identified.

The entire population of fourth-grade students at UPTD SD Negeri 124401 was designated as the sample using the census sampling technique (saturated sample). Consequently, the total sample size consisted of 25 students. Utilizing the entire population as the sample size maximized the data pool and eliminated sampling error, which is particularly suitable for small, specific populations in educational settings where generalizing findings back to that specific population is the primary objective.

2.1 Data Analysis Technique

The data were analyzed quantitatively to determine the effectiveness and impact of the PjBL model. **Analysis Method:** The **Normalized Gain (N-Gain)** formula was used to measure the difference and extent of improvement in creative thinking skills between the pretest and posttest scores.

$$\mathbf{N-Gain} = \frac{\mathbf{Posttest\ Score - Pretest\ Score}}{\mathbf{Maximum\ Ideal\ Score - \textit{Pretest\ Score}}} \mathbf{X\ 100}$$

Table 2. N-gain Criteria

N-gain value	Criteria
N-gain ≥ 0, 70	High
0, 30 < *N-gain* < 0,70	Medium
N-gain ≤ 0, 30	Low

This analysis provides preliminary evidence of an improvement in students' creative thinking skills following the implementation of the Project-Based Learning model.

3. Results And Discussion

3.1 Instrument Validity

The research instrument, a 10-item essay test designed to measure creative thinking, was rigorously validated by two experts (a lecturer and a teacher). All items demonstrated High Validity across content, construct, and linguistic dimensions, achieving an Aiken's V coefficient of 1.000. This outcome confirmed the reliability and suitability of the instrument for data collection.

3. 2 Pretest and Posttest Scores

The study utilized a One-Group Pretest-Posttest design with N=25 fourth-grade students. The implementation of the Project-Based Learning (PjBL) model was the intervention applied over the subject "Indonesia's Rich Culture" (IPAS).

Table 3. Pretest and Posttest Scores

Assessment	Mean Score	Increase (Points)	Interpretation
Pretest (O1)	48.08	-	Below the target minimum competency
Posttest (O2)	88.00	+39.92	Significant improvement,

The results show a substantial increase in students' mean creative thinking scores from 48.08 (Pretest) to 88.00 (Posttest). This preliminary comparison suggests an observed improvement in creative thinking skills following the implementation of the PjBL intervention.

3.3 Effectiveness Analysis: Normalized Gain (N-Gain)

The effectiveness of the PjBL model was quantitatively confirmed using the Normalized Gain (N-Gain) analysis

Table 4. Metric Analysis: Normalized Gain (N-Gain)

Metric	Score	Classification
Average N-Gain Score (g^-)	7,832	High
Average N-Gain Percent	78.32%	Effective

The high N-Gain score (0.7832) indicates a substantial improvement in students' creative thinking skills following the implementation of the PjBL model. Individual analysis further revealed that 92% of the students (23 out of 25) achieved a 'High' category increase, with no students falling into the 'Low' category

3.4 Discussion

The findings of this study indicate an observable and meaningful improvement in students' creative thinking skills following the implementation of the Project-Based Learning (PjBL) model in elementary Integrated Science (IPAS) learning [16]. The substantial increase in mean scores from the pretest to the posttest suggests that students demonstrated higher levels of creative thinking after participating in project-based instructional activities [17]. This improvement reflects not only quantitative score gains but also qualitative changes in how students approached learning tasks, particularly in generating ideas, exploring alternative solutions, and expressing originality within integrated science contexts.

The observed enhancement in creative thinking may be closely linked to the pedagogical characteristics of PjBL. By emphasizing active student engagement, inquiry-driven problem exploration, collaboration, and the production of meaningful learning artifacts, PjBL creates learning conditions that are conducive to creativity development [18]. Students are encouraged to take ownership of their learning, pose questions, test ideas, and revise their work based on feedback, all of which are essential processes in creative cognition. Unlike traditional teacher-centered instruction, PjBL positions students as active constructors of knowledge, enabling them to interact deeply with content and learning experiences in ways that stimulate creative thinking.

The high Normalized Gain (N-Gain) score further indicates that the improvement in students' creative thinking skills was not merely incremental but substantial for most participants. The fact that a large proportion of students achieved gains categorized as high suggests that PjBL may provide a supportive and inclusive learning environment in which students with varying initial abilities are able to improve meaningfully. Through collaborative project work, students are exposed to diverse perspectives and ideas, which may enhance cognitive flexibility and idea fluency. Moreover, opportunities to design, present, and refine project outputs may foster originality and elaboration, key dimensions of creative thinking.

From a theoretical standpoint, these findings are consistent with constructivist learning theory, which posits that knowledge and skills are constructed most effectively when learners actively engage with content through meaningful and contextualized experiences. In PjBL settings, learning occurs through interaction with problems that are authentic and relevant to students' lives, allowing them to integrate prior knowledge with new information. Such learning environments encourage experimentation, reflection, and social negotiation of meaning, all of which contribute to the development of creative thinking skills. The results of this study

therefore provide empirical support for the application of constructivist principles in elementary integrated science education.

Within the context of IPAS learning, which integrates concepts from both natural and social sciences, PjBL appears particularly well suited to supporting interdisciplinary thinking. The project theme used in this study, such as "Indonesia's Rich Culture," enabled students to connect scientific concepts with cultural and social realities, encouraging them to view knowledge as interconnected rather than compartmentalized. This interdisciplinary engagement may have helped students approach learning tasks from multiple perspectives, thereby strengthening core components of creative thinking, including fluency, flexibility, originality, and elaboration. By navigating the intersections between scientific understanding and social context, students were challenged to think beyond single-discipline solutions and develop more holistic and creative responses.

The findings of this study are consistent with previous research reporting positive associations between PjBL implementation and improvements in creative thinking skills in elementary education settings. Prior studies have demonstrated that project-based approaches can enhance students' motivation, engagement, and creative output by providing opportunities for inquiry and authentic problem-solving. This study extends existing literature by offering contextual evidence from elementary IPAS learning, an integrated curriculum framework that has received limited empirical attention, particularly in the early stages of its implementation under the Merdeka Curriculum.

Despite these promising results, it is important to interpret the findings cautiously due to the limitations inherent in the One-Group pretest-posttest research design. The absence of a control group means that the observed improvements in creative thinking cannot be attributed exclusively to the PjBL intervention. Potential confounding factors, such as student maturation, familiarity with assessment instruments, or exposure to external learning experiences, may also have contributed to the increase in posttest scores. However, the use of validated measurement instruments, consistent instructional procedures, and N-Gain analysis enhances the credibility of the findings as preliminary empirical evidence of learning improvement.

Overall, this study contributes to the growing body of literature on Project-Based Learning by providing evidence of its potential to support creative thinking development in elementary Integrated Science (IPAS) learning. By situating PjBL within an interdisciplinary curriculum framework, the study highlights the relevance of project-based approaches for fostering creativity in complex learning environments. At the same time, the findings underscore the need for future research employing more rigorous experimental or quasi-experimental designs, larger samples, and longitudinal data to establish stronger causal inferences and to further explore how PjBL influences the development of creative thinking skills in integrated science education.

4. Conclusion

This study investigated the implementation of the Project-Based Learning (PjBL) model in elementary Integrated Science (IPAS) learning and examined observed changes in students' creative thinking skills. The findings indicate a positive trend in students' creative thinking performance following the implementation of PjBL, as evidenced by the increase in mean pretest–posttest scores and the high Normalized Gain (N-Gain) value. These results suggest that PjBL has the potential to facilitate creative thinking development by engaging students in active, contextual, and interdisciplinary learning experiences that align with the objectives of integrated science education under the Merdeka Curriculum.

The observed improvement in creative thinking can be attributed to several core characteristics of PjBL. First, PjBL situates learning within authentic and meaningful problem contexts, enabling students to connect scientific concepts with real-life situations and social phenomena. In IPAS learning, where natural and social sciences are integrated, project activities provide opportunities for students to explore issues holistically, encouraging flexibility, originality, and elaboration of ideas. Through collaborative inquiry, students are required to generate multiple solutions, negotiate perspectives, and refine their ideas—processes that are closely associated with creative thinking development. Thus, the findings reinforce theoretical perspectives that view creativity as a dynamic cognitive process nurtured through active engagement and interdisciplinary problem-solving. Furthermore, the interdisciplinary nature of IPAS learning appears to be well supported by the PjBL model. By integrating scientific inquiry with social and cultural contexts, PjBL allows students to perceive knowledge as interconnected rather than fragmented. This learning environment encourages students to move beyond rote memorization toward higher-order thinking, including the ability to reframe problems and propose innovative solutions. The results of this study therefore extend existing PjBL research by demonstrating its relevance and applicability within an integrated elementary curriculum, particularly during the early implementation phase of the Merdeka Curriculum. From a practical standpoint, the findings offer important implications for elementary school teachers. PjBL can be adopted as an effective instructional approach to promote student engagement, idea generation, and creative expression in IPAS learning. Teachers are encouraged to design interdisciplinary projects that are developmentally appropriate and closely aligned with learning objectives, while also allowing sufficient flexibility for student exploration. Clear project guidelines, scaffolding strategies, and continuous feedback are essential to support students throughout the creative process. Additionally, incorporating structured reflection activities such as journals, group discussions, or project presentations can help students articulate their thinking processes and deepen their creative engagement.

Assessment practices also play a critical role in supporting creative thinking development within PjBL environments. The use of open-ended and performance-based assessments, such as essay-based tasks, project reports, and presentations, enables teachers to capture multiple dimensions of creativity, including fluency, originality, and elaboration. Such assessments are particularly relevant in IPAS learning, where creative outcomes may manifest differently across scientific and social domains. By employing diverse assessment strategies, teachers can obtain a more comprehensive understanding of students' creative thinking progress and provide more meaningful feedback.

Despite these promising findings, several limitations must be acknowledged. The pre-experimental research design, which did not include a control or comparison group, limits the ability to draw strong causal conclusions regarding the effectiveness of PjBL. Improvements in creative thinking scores may have been influenced by extraneous factors such as student maturation, increased familiarity with test formats, or repeated exposure to similar tasks. Additionally, the relatively small sample size and short duration of the intervention may restrict the generalizability of the findings to other educational contexts or student populations. Therefore, the results of this study should be interpreted as preliminary empirical evidence rather than definitive proof of effectiveness. Future research is recommended to address these limitations by employing more rigorous experimental or quasi-experimental designs that include control groups and randomization where feasible. Studies with larger and more diverse samples would enhance the external validity of the findings and provide a clearer picture of PjBL's impact across different school settings. Longitudinal research designs are also needed to

examine the sustainability of creative thinking development over time and to explore how repeated exposure to PjBL influences students' creative trajectories. Furthermore, future studies may investigate additional variables, such as teacher pedagogical competence, project design quality, and student collaboration dynamics, to better understand the mechanisms through which PjBL supports creative thinking in integrated science education. In summary, this study contributes to the growing body of literature on Project-Based Learning by providing empirical insights into its implementation within elementary Integrated Science (IPAS) learning under the Merdeka Curriculum. While acknowledging its methodological limitations, the study highlights the potential of PjBL as a pedagogical approach that supports creative thinking development through interdisciplinary, contextual, and student-centered learning experiences. These findings underscore the need for continued research and pedagogical innovation to optimize PjBL implementation and to strengthen its role in fostering creativity in elementary integrated science education.

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The Urgency of Inclusive Classroom Design to Support Holistic & Integrative Learning of Early Childhood Children in Ruteng Catholic Kindergartens

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Abstract. Inclusive education in Early Childhood Education (ECE) fosters an equal and supportive environment for children with special needs. This study examines the importance of inclusive classroom design in supporting holistic learning, using three Catholic Kindergartens in Ruteng as case studies. Employing qualitative descriptive methods through observation, documentation, and literature review, the findings reveal that these institutions have implemented inclusive principles, including physical accessibility, safety, sensory comfort, and spatial flexibility. The designs also align with Catholic values and support teacher effectiveness. However, the study identified several obstacles and elementary deficiencies in current classroom developments. Ultimately, adaptive and sensitive classroom design is a critical component for the success of inclusive education and the achievement of Holistic-Integrative goals in kindergartens.

Keywords: inclusive classroom; classroom design;holistic and integrative learning; early childhood children

1 Introduction

As an important foundation for comprehensive child development, Early Childhood Education (ECE) encompasses various aspects of child development. Early childhood is in a critical golden age where it is crucial to receive appropriate stimulation for optimal growth and development (Arifudin et al., 2019) [1]. Minister of National Education Regulation No. 70 of 2009 [2] emphasizes that in the context of inclusive ECE, every child with special needs (ABK) has the right to receive equal, quality, and non-discriminatory educational services. Therefore, inclusive ECE institutions present both challenges and opportunities in creating an equal and equitable learning environment for all children, including those with special needs in the school. Bunga Mawar Santa Elisabeth Tenda Kindergarten, Inviolata Watu Ruteng Kindergarten, and

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Sta. Clara Redong Kindergarten are three examples of inclusive schools, which accept children with various needs and backgrounds. Indeed, the number of children with special needs in these schools varies. However, based on initial observations, not all classrooms and learning facilities are designed based on inclusive principles that are friendly to all children without exception. Physical accessibility and open space planning remain barriers at Inviolata Watu Ruteng Kindergarten. Sensory comfort, flexibility, and usability are lacking at Sta. Clara Redong Kindergarten. St. Elisabeth Bunga Mawar Tenda Kindergarten still lacks a clear structure and clarity of the learning environment, as well as safety measures that support the active participation of children with special needs.

Inclusive classroom design is crucial for supporting holistic learning in early childhood education (ECE) because a safe, structured, accessible, and diversity-responsive environment enables every child—both those with and without special needs—to optimally develop all aspects of development. Fulfilling the requirements for inclusive classroom design supports independence, strengthens social interactions, facilitates emotional regulation, and provides multisensory learning experiences that are appropriate to children's developmental characteristics (UNESCO, 2017; NAEYC, 2020) [3][4]. Appropriate spatial planning also facilitates teachers' supervision, individual support, and integrated learning, enabling children's holistic development across cognitive, social-emotional, physical, and language aspects (UNICEF, 2014) [5]. Therefore, inclusive classroom design is not merely a technical requirement but a crucial foundation for holistic and equitable early childhood education.

According to the Inclusive Education Guidelines from the Ministry of Education, Culture, Research, and Technology (2022) [6], the main principles of inclusive education include curriculum adaptation, learning strategies, and learning environments that support the active participation of all students. Meanwhile, Kartika et al. (2018) [7] in their research emphasized the importance of implementing inclusive design in designing functional, accessible, flexible, and sensory-friendly classrooms.

2 Holistic-Integrative

Holistic-Integrative ECE is an integrative activity that includes educational activities and expanding knowledge and skills for parents such as character education, health check-ups and nutritional and behavioral services, including efforts in developing early childhood through three pillars, namely parenting, nutrition and health management and educational support. The objectives of planning a Holistic-Integrative ECE program for children are: (1) empowering parents; (2) filling parents' free time with education; and (3) broadening the horizons of ECE parents (Sarinastitin, 2019). [8] These three things support each other, because people understand the holistic-integrative approach in real terms, see the implementation directly and become a learning space for parents. The arrangement of an open, friendly, and educational classroom can be used as a learning space with parents. Literacy corners, play corners, and displays of children's work become visual educational media for parents about how children learn. Parental support with the physical design of the classroom is an application of the concept of a learning ecosystem. In holistic integrative care,

education does not stop at the classroom door, but continues in synergy between home and school. Parents who are educated about the importance of mental health and emotional regulation in children will support the existence of "quiet corners" in the classroom, for example for children with special needs.

According to Asih et al. (2024) [9], the goal of implementing Holistic-Integrative ECE is to build children's character as early as possible. Building character and moral values in early childhood is done through several methods, such as habituation, role modeling, and application in teaching and learning activities. The implementation of Holistic-Integrative learning in ECE can be effective and efficient if carried out according to established procedures. This is because holistic integrative learning is designed to help children solve problems through activities that reflect events and are based on real life (Asmawati et al., 2022) [10]. Inclusive spatial design eliminates "environmental barriers" so that children no longer feel limited by their conditions. When the physical environment is supportive (supportive environment), education, health, and protection services can run simultaneously without having to separate children from their group (fully inclusive).

3 Inclusive Classroom Designing

A distinctive feature of inclusive school spaces is the stimulus space used when children with special needs cannot receive lessons in regular classes. This ensures that children with special needs continue to receive stimulation according to their needs. In the Holistic-Integrative concept, meeting the emotional needs of children with special needs is crucial due to sensory overload. For children with physical disabilities (blindness or physical impairment), the space must be able to "communicate" without barriers. The application of spatial and holistic support is crucial in Holistic-Integrative education for children. When arranging outdoor classrooms, a safe and comfortable design must be provided to facilitate stimulation and channel their energy, with an area that can serve as a warm-up before children begin activities. The design must prioritize safety, convenience, usability, and independence for children with special needs (Yusra et al.; 2019) [11].

Indoor and outdoor classroom arrangements that integrate sturdy equipment and dedicated fall zones are a form of Universal Design implementation. For early childhood education children with various disabilities, these physical elements are not merely complementary but prerequisites for safety and participation. Sturdy and strong equipment is crucial for child safety and provides sensory support for children with ADHD. Special drop zones also benefit children with disabilities by mitigating the risk of seizures, encouraging fearless exploration, and fostering gross motor skills in children with ADHD. From an Integrative Holistic Education (HI) perspective, this arrangement fulfills the Protection and Health aspects. When the physical environment is perceived by children as "safe" (through drop zones) and "reliable" (through sturdy equipment), psychological barriers to learning are removed. This allows children with special needs to achieve independence (parenting) and equal social participation.

Here, inclusion becomes an approach to building an open environment for anyone with different backgrounds and conditions, including: characteristics, physical conditions, personalities, status, ethnicity, culture of children with special needs, and so on. Arranging an inclusive classroom for children with special needs will have a

specific impact on increasing a sense of security and self-confidence, optimizing holistic development for children with special needs, reducing problematic behavior, and strengthening social interactions between children. Inclusive classrooms become spaces of healing, growth, and empowerment for children with special needs because they will develop optimally according to their potential.

4 Inclusive Classroom and School

The purpose of classroom design is to help children effectively participate in learning. In this context, inclusive classroom design is an effort to create a welcoming classroom atmosphere for both children with special needs and regular children. Here, inclusive classroom design aims to create effective teaching and learning processes and activities by encouraging early childhood to appreciate differences. Classrooms that are open to collaboration, with clear and structured activity zones, enable children to learn independently or in groups according to their individual interests and abilities (Yusra et al., 2019) [11].

The learning designed by teachers in inclusive classrooms can be adaptive, or designed to provide opportunities for all children to participate as fully as possible in classroom activities. Early childhood education teachers must be accustomed to dealing with children with varying learning levels, learning styles, strengths, weaknesses, and abilities in daily learning. Furthermore, classroom design allows teachers to devote time to developing students' abilities and personalities to address their behavior and social needs (Muttaqien, 2023) [12].

In implementing inclusive classrooms, strategy and preparation for organizing and managing the classroom are crucial. At the beginning of learning activities in inclusive classrooms, regular students and students with special needs are usually asked to sit together in a circle, but once they enter the main activity, they are allowed to choose their seating positions freely within the classroom. There is no specific layout for children with special needs. If a student with special needs suddenly experiences an emotional outburst or tantrum, the teacher's strategy is usually to slowly approach the student and gently and attentively calm them down. If the student wishes to be alone, they remain under the teacher's supervision but remain in the same classroom. Children with special needs are not permitted to leave the classroom without supervision from a teacher or school staff. Therefore, in setting up the classroom, teachers must be very careful and focused on teaching all students, whether special needs or regular students. In addition to teacher reinforcement, classmates must also be mentally prepared and welcoming to the presence of children with special needs as part of the class (Asih, et al., 2024) [9].

Indoor inclusive classroom settings are usually designed to fit the size and level of play equipment appropriate to the children's age. The equipment is well-resilient and sturdy, and poses no potential trapping hazards or injury from pinch points. There is adequate cushioning under climbing equipment and other fall zones. In addition to ensuring the safest and most comfortable facilities for children, providing facilities that reflect their diversity is equally important. As an inclusive school, the

indoor classroom setting prioritizes comfort, safety, and stimulation for child development.

5 Method

This research uses a descriptive qualitative approach through case study methods and literature review. Data were collected through technical triangulation, which began with passive participant observation to record the natural interactions between students with special needs and the classroom spatial environment. The researcher captured the dynamics of space use during their time at school. This process was followed by a documentation study to validate physical data with administrative data. In the context of spatial design and inclusion in Catholic schools, observations made as review criteria were: the presence or absence of special needs students in the school which was then matched with the classroom design as an answer to specific needs and an inventory of the school's infrastructure. Observations were conducted in classrooms at Bunga Mawar Santa Elisabeth Kindergarten, owned by the Fransiskanes Sisters, Inviolata Kindergarten, an inclusive school owned by the SSpS Sisters, and Sta. Clara Kindergarten, owned by the Claris Sisters. All three schools are inclusive schools where regular children and children with special needs learn together. Scientific justification is placed on the three schools representatively because TKK Inviolata represents a formal school model that explicitly declares itself as an inclusive school, TK Bunga Mawar and TKK St. Clara represent a traditional Catholic education model that has a unique approach in classroom arrangement for children. These three schools were chosen because they are considered "key cases" that have the most prominent facilities or policies related to ABK compared to other ECE in Ruteng. Data analysis techniques are carried out through data reduction, data presentation and drawing conclusions from the Miles and Huberman model. This study is considered important to examine and describe whether the design and arrangement of inclusive classrooms can be applied in TK Bunga Mawar Santa Elisabeth, TKK Inviolata and TK Sta. Clara and how the design supports the success of the early childhood learning process as a whole.

6 Result and Discussion

The results of observations at Santa Elisabeth Bunga Mawar Kindergarten, Inviolata Kindergarten, and Sta. Clara Kindergarten show that the elementary principles of inclusive education have indeed been implemented in the schools studied, although they are still not optimal. However, several basic principles that have been implemented and refer to the concept according to Tanuwidjaja (2013) in Kartika, et al. (2018) [7] are as follows:

1. ***Accessible Environment/Physical Access***

   The availability of wide and barrier-free access paths, classrooms are accessible to wheelchairs or children with mobility impairments (Kartika et al., 2018) [7]. The results of observations regarding the Accessible Environment at Santa Elisabeth Kindergarten, Inviolata Kindergarten and Sta. Clara Kindergarten show that classrooms have paths wide enough for children with mobility limitations, there are no stairs in the classroom, and the position of furniture allows children with special needs to move around without

obstacles. Most areas are accessible with fairly wide paths and children can reach most objects/facilities. This explanation can be seen in Fig. 1:

Fig. 1. Classroom design in the context of accesible environment

2. Personal Space

The results of observations related to Personal Space in the description of Kartika, et al. (2018) [7] found that the children of the three kindergartens observed were given the freedom to choose seats and play areas according to their preferences, avoiding feelings of crowding and conflict between children. Bunga Mawar Kindergarten and Inviolata Kindergarten combine various play activities such as sensory play, constructive play and role play which can increase the participation of children, including children with special needs, because they have the same opportunity to choose and be involved. However, it needs to be criticized, the access and personal space prepared are still insufficient to support access for children with special needs in the school. The active involvement of children from positive social interactions, increased self-confidence, and courage in using ideas is done through play activities. This shows that the classroom design not only supports the physical but also facilitates the social and emotional dimensions. This explanation can be seen in Fig. 2:

Fig. 2. Classroom design in the context of Personal Space

3. *Sensory Awareness*

The use of soft colors, natural lighting, and the arrangement of teaching aids reduces overstimulation for sensory-sensitive children (Susilowati et al.,

2025). [13] At Santa Elisabeth Bunga Mawar Kindergarten, the spatial arrangement takes into account visual and sensory comfort with natural lighting, calming pastel colors, and the arrangement of teaching aids in areas that are easily accessible to children. This is very beneficial for children with high sensory sensitivity, such as autistic children (Susilowati et al., 2025). [13] These elements also support a conducive and enjoyable learning atmosphere, so that children feel the classroom is an interesting and safe place to explore and learn. In the observation, the sensory environment is very conducive with soft lighting, noise around the school is managed with calm colors and has a quiet corner. Sensory comfort in the classroom and school area has not been implemented optimally. The physical environment and learning materials that support inclusive education at Bunga Mawar Kindergarten, Inviolata Kindergarten and Sta. Clara is also seen in classrooms equipped with multisensory learning tools such as puzzles, construction blocks, flannel boards, and other educational interactive play tools that support play-based learning. The arrangement of furniture in and outside the classroom also pays attention to the ergonomics or safety of early childhood children as recommended by Nisa (2024) [14]. This explanation can be seen in Fig. 3:

Fig. 3. Classroom designing for sensory awareness

4. ***Flexibility & Usability***

The layout of tables and play equipment can be changed according to activities, to support the diversity of children's learning styles (Nisa, 2024) [14]. The arrangement of classrooms in all schools, TKK Inviolata, TK Bunga Mawar and TK Sta. Clara can also be adjusted to the activities and learning models. This is evident in the spatial arrangement which is not permanent, but can be moved and designed based on needs. However, it is important to realize that the concept of flexibility and usability in the context of space according to Tanuwidjaja (2013) in Kartika, et al. (2018) [7] has not been maximized properly in the three schools. This explanation can be seen in Fig. 4:

Fig. 4. Classroom design for flexibility and usability.

5. ***Safety & Safeguarding***

The layout of tables and play equipment can be changed according to activities, to support the diversity of children's learning styles (Nisa, 2024) [14]. The arrangement of classrooms in all schools, TKK Inviolata, TK Bunga Mawar and TK Sta. Clara can also be adjusted to the activities and learning models. This is evident in the spatial arrangement which is not permanent, but can be moved and designed based on needs. However, it is important to realize that the concept of flexibility and usability in the context of space according to Tanuwidjaja (2013) in Kartika, et al. (2018) [7] has not been maximized properly in the three schools. This explanation can be seen in Fig. 5:

Fig. 5. Classroom for safety and safeguarding

6. ***Structure and Clarity of the Learning Environment***

The layout of tables and play equipment can be changed according to activities, to support the diversity of children's learning styles (Nisa, 2024) [14]. The arrangement of classrooms in all schools, TKK Inviolata, TK Bunga Mawar and TK Sta. Clara can also be adjusted to the activities and learning models. This is evident in the spatial arrangement which is not permanent, but can be moved and designed based on needs. However, it is important to realize that the concept of flexibility and usability in the context of space according to Tanuwidjaja (2013) in Kartika, et al. (2018) [7] has not been maximized properly in the three schools. This explanation can be seen in Fig. 6:

Fig. 6. Class design for structure and clarity of the learning environment

7. *Social Interaction and Cooperative Learning*

Social interaction and cooperative learning are the reasons why inclusive classroom design is important in holistic learning for early childhood, because the design of a space that allows children to interact, collaborate, and share roles has been proven to encourage the development of social-emotional, language, empathy, and problem-solving skills from an early age. At Santa Elisabeth Kindergarten Bunga Mawar, Inviolata Kindergarten, and Sta. Clara Kindergarten, the arrangement of collaborative play areas, group tables, and open spaces that are easily accessible to all children—including those with special needs—facilitate positive relationships and cooperative learning experiences that are essential for holistic development (Kartika, 2018; [7] UNESCO, 2017) [3]. Furthermore, an inclusive environment helps children learn to accept differences, develop a sense of togetherness, and strengthen the ability to work in groups, as an integral part of holistic education and character building (UNICEF, 2014) [5]. Therefore, classrooms that are designed to support social interaction and cooperation play a key role in ensuring that each child grows optimally in social, emotional, and cognitive aspects. This explanation can be seen in Fig. 7:

Fig. 7. Classroom design for social interaction and cooperative learning

8. *Teacher's effectiveness and supervision during learning*

Inclusive classroom design is fundamental to holistic early childhood education, as it fosters social interaction and cooperative learning essential for developing socio-emotional, linguistic, and problem-solving skills. At Santa Elisabeth Bunga Mawar, Inviolata, and Sta. Clara Kindergartens, accessible collaborative zones and group seating facilitate positive peer relationships and an appreciation for diversity among all children, including those with special needs (Kartika, 2018; [7], UNESCO, 2017; [3] UNICEF, 2014) [5]. Furthermore, an open, barrier-free, and well-organized spatial layout enhances teacher effectiveness by allowing for seamless supervision and timely, responsive support. By streamlining activity flows and ensuring visual clarity, these inclusive environments empower educators to implement integrated learning experiences that optimize each child's physical, emotional, and cognitive growth, as illustrated in Fig. 8.

Fig. 8. Classroom design for effectiveness and supervision during learning

9. ***Responsiveness to Children's Diverse Needs***

Holistically, this is the main reason for the urgency of designing inclusive classrooms for early childhood. Flexible, accessible, and diversity-oriented learning environments enable every child—with varying abilities, learning styles, and sensory and emotional needs—to receive appropriate support. At Santa Elisabeth Kindergarten, Inviolata Kindergarten, and Sta. Clara Kindergarten, classrooms that provide various learning areas, activity options, multisensory materials, and visual and physical adjustments help teachers respond to children's development comprehensively, encompassing cognitive, social-emotional, motor, and language aspects (UNESCO, 2017 [32]; Susilowati, 2025) [33]. The inclusive approach also emphasizes that the environment must be "ready to accept children" rather than demanding that children adapt, in line with the principles of child-centeredness and the protection of children's rights (UNICEF, 2014) [34]. Thus, responsive and inclusive spatial planning is an important foundation for ensuring that every child can develop optimally according to their holistic needs. This can be seen in Fig. 9:

Fig. 9. Classroom design for responsive to children's needs

10. ***Alignment with Catholic Values and Identity***

Alignment with Catholic values and identity holistically also emphasizes the urgency of designing inclusive classrooms for early childhood, because a friendly, open, and respectful learning environment for every child reflects the principles of human dignity, love, and universal acceptance taught by the Church. Inclusive classrooms allow children to experience a learning atmosphere that fosters solidarity, respect for differences, and involvement in the community, in line with the vision of Catholic education that emphasizes holistic development—physical, social-emotional, intellectual, moral, and spiritual (Instrumentum Laboris; Document of the Congregation for Catholic Education, 2014) [15]. By providing safe, accessible spaces that support the participation of all children, Santa Elisabeth Kindergarten Bunga Mawar, Inviolata Kindergarten, and Sta. Clara Kindergarten help realize the pastoral mission of presenting Christian love in daily practice. Therefore, inclusive classroom design is not only a pedagogical necessity, but also a concrete form of holistic proclamation of Catholic values in early childhood education. This can be seen in Fig. 10:

Fig. 10. School design that aligns with *Catholic Values*

However, despite the strong desire of the three kindergartens above to create an ideal environment, they are hampered by realities and obstacles on the ground. These obstacles are usually systemic and interconnected. The following are practical obstacles encountered, preventing the maximization of flexibility and sensory comfort:

1) *Structural Limitations of Buildings (Architectural Heritage)*
Many of the ECE buildings above occupy old buildings or old-style schools. This lack of adequate cross-ventilation, windows positioned too high for children, or the use of permanent flooring materials (such as slippery ceramic tiles) that are difficult to convert into fall zones.

2) *Safety Standards and Sensory Aesthetics*
There is a conflict between administrative safety regulations and children's sensory needs. Safety standards often require the use of easily cleaned and fire-resistant materials (such as hard plastic or steel), which are sensorially "cold" and reflect sound (noise).

3) *Sub-ideal Teacher-to-Child Ratio*
Space flexibility requires more intensive supervision. Ideally, when a classroom is highly flexible (furniture can be moved around), the risk of accidents increases if there aren't enough teachers to monitor every child's movements. Teachers tend to choose static, rigid room arrangements for ease of control and physical safety, even though they know they're less sensory-friendly. Outdoor and indoor designs also don't blend organically; sensory zones become isolated and inaccessible to children at all times.

4) *Lack of Inclusive Design Training for Teachers*
Teachers' efforts are often not based on a technical understanding of ergonomics and universal design. Teachers often try to rearrange the classroom but inadvertently create "dead ends" or overload visual stimuli (too many posters) that disrupt sensory comfort. These efforts are ineffective because they don't address the specific needs of the types of disabilities present in the classroom.

Beyond physical design, the success of inclusive spaces must also be supported by teacher preparedness. Teachers at Bunga Mawar Kindergarten, Inviolata Kindergarten, and Sta. Clara Kindergarten have attempted to adapt the curriculum to the needs of children with special needs through individualized learning programs. Most teachers at these schools are able to adapt methods and evaluations for the children with special needs, such as the use of visual media, short instructions, and repetition of activities, as emphasized by Nuraidah et al. (2025) [16], but some have not.

As stated by Muttaqien (2023) [12], the challenges of inclusive education in Indonesia are still hampered by limited teacher training to be competent and competent in inclusive education patterns, a lack of professional support staff and uneven classroom/school infrastructure. Nevertheless, Bunga Mawar Kindergarten, Inviolata Kindergarten and Sta. Clara Kindergarten continue to strive within their limitations to be good examples in implementing inclusivity based on existing human resources.

6 Conclusion

The design of inclusive classroom layout in Bunga Mawar Kindergarten, Inviolata Kindergarten, and Sta. Clara Kindergarten or in State Kindergarten and similar schools, based on the theories studied and the inclusive design criteria applied to inclusive schools, must at least refer to functional, usable, desirable, and viable elements. The three schools have indeed implemented the principles of effective and sustainable inclusive design practically as a guideline and evaluation of the design of increasingly inclusive ECE in the city of Ruteng. The application of these criteria should be able to produce more optimal design guidelines for use by children with special needs and normal children specifically in the context of education for children with special needs in the city of Ruteng, as follows: a) Selection of classroom locations that are in accordance with land use, easily accessible, and safe for use as educational buildings. b) Building access equipped with ramps, guiding blocks, handrails, and safe movement space for users of special aids in schools, especially for children with special needs. c) Provision of inclusive classrooms that are designed flexibly, safely, and comfortably according to the characteristics of their users. d) The quality of inclusive classrooms is manifested in the lighting and appearance of the room. The implementation of inclusive design based on these four criteria in the observed school or other kindergartens is expected to address the need for inclusive early childhood education (ECE) in Ruteng, ensuring that other schools are accessible and function optimally. Accessible, flexible, safe, and sensory-friendly learning environments enable children, including those with special needs, to develop optimally. These findings confirm that the physical design of classrooms plays a crucial role in supporting the success of inclusive education in ECE.

7 Recommendations

To realize truly inclusive and Holistic-Integrative ECE services, the following matters need to be the focus and concrete actions of all related parties, including ECE unit organizers, the Church, the Government, and the community: *(1) Designing Universal Learning Spaces*. Schools are encouraged to implement *universal design for learning* (UDL), namely designing learning spaces and methods so that they can be used by all children without the need for major modifications, including children with special needs. *(2) Requiring a Holistic-Integrative Approach in Inclusive ECE.* All ECE institutions that serve children from various backgrounds (both regular and special needs) need to implement an HI approach by integrating education, health, nutrition, protection, and care services in an integrated manner**.** *(3) The Government or Local Education Office* is expected to provide budget support for the arrangement of inclusive classrooms, facilitate special training for ECE teachers in implementing inclusive learning and spatial arrangements that are friendly to special needs children, as well as preparing regulations or minimum standards for inclusive ECE facilities and infrastructure that are integrated with holistic service aspects. **(***4) Cross-Sector Collaboration*. Kindergartens and ECE should establish cooperation and collaboration with Community Health Centers (for monitoring the health of children with special needs), Psychologists or child therapists (for accompanying children with special needs), the Catholic Church/NGOs/Donors for education about children with special

needs, financial support in the formation of special schools for children with special needs, funding for community-based inclusive schools to support ECEs that are concerned with the above issues. *(5) Increasing Inclusive Literacy in the Community*. ECEs must actively carry out outreach and education to the community so that more parents understand and support the importance of non-discriminatory inclusive education.

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Integrating Local Context into Smart Mobility Planning for Developing Tourism Cities: Reflections from Labuan Bajo

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Abstract. Smart mobility has become a central component of sustainable infrastructure development, particularly in developing tourism cities where rapid growth often challenges environmental and social balance. This paper explores how local context can be integrated into smart mobility planning to ensure equitable, adaptive, and sustainable transportation systems. Using a qualitative and conceptual approach, this study draws on structured literature review and contextual analysis of Labuan Bajo, Indonesia—a developing tourism city designated as a national super-priority destination. The analysis examines urban scale, local mobility patterns, travel behavior, infrastructure constraints, and institutional capacity as key contextual dimensions influencing mobility planning. The findings highlight that incorporating local socio-spatial dynamics, infrastructure limitations, and community participation is crucial in formulating smart mobility strategies suited to developing contexts. Rather than directly adopting global models, mobility planning must be context-sensitive, reflecting local culture, geography, and governance capacity. This study contributes to smart mobility discourse by offering a context-based analytical framework for sustainable mobility planning in emerging tourism destinations.

Keywords: smart mobility, sustainable infrastructure, local context, developing tourism cities, Labuan Bajo

1 Introduction

Smart mobility has become a central theme in contemporary urban transport planning, particularly in relation to sustainability, accessibility, and technological innovation. The concept is commonly associated with the integration of digital technologies, data-driven systems, and intelligent transport solutions aimed at improving efficiency and reducing environmental impacts. While such approaches have demonstrated significant benefits in large metropolitan areas, their applicability and effectiveness in smaller cities—especially tourism-driven urban areas—remain less clearly understood. Developing tourism cities often face distinct spatial, social, and institutional conditions that challenge the direct transfer of technology-intensive smart mobility models. [1]

In many developing tourism cities, rapid tourism growth generates unique mobility pressures, including seasonal travel peaks, short-distance repetitive trips, and intensive interactions between tourists and local residents. [2]These dynamics are frequently accompanied by constrained road infrastructure, compact urban forms, and strong reliance on informal or semi-formal transport modes. [3] Despite these contextual characteristics, existing smart mobility initiatives tend to prioritize standardized technological solutions, often overlooking local travel

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behavior, institutional capacity, and spatial limitations. [4]As a result, smart mobility planning risks becoming disconnected from everyday mobility realities in developing tourism contexts.

A growing body of literature acknowledges the importance of contextual sensitivity in transport planning. However, most smart mobility studies continue to focus on large cities with advanced technological and institutional capacities. [5]Research addressing small and medium-sized tourism cities remains limited and often descriptive, emphasizing case reflections rather than analytical frameworks that systematically link local context to planning strategies [6]. Consequently, a clear research gap exists regarding how smart mobility concepts can be analytically adapted to the specific conditions of developing tourism cities rather than applied as generic technology-driven models.

This study positions itself as a conceptual contribution that advances a context-based framework for smart mobility planning in developing tourism cities. Rather than treating smart mobility as a purely technological intervention, this study emphasizes the role of local context—including urban scale, tourism-induced mobility patterns, travel behavior, infrastructure constraints, and institutional capacity—in shaping feasible and sustainable mobility strategies. By foregrounding human-scale mobility and planning adaptability, this paper offers an analytical perspective that bridges the gap between abstract smart mobility concepts and the practical realities of tourism-driven urban environments.

Accordingly, the objective of this study is to develop a conceptual framework that explains how local contextual characteristics influence smart mobility planning in developing tourism cities. Using Labuan Bajo, Indonesia, as an illustrative case, this study synthesizes relevant literature and contextual analysis to identify key dimensions and planning implications. The proposed framework is intended to support planners and policymakers in designing smart mobility strategies that are context-sensitive, feasible, and aligned with the socio-spatial conditions of developing tourism destinations. Despite the growing body of literature on smart mobility and sustainable transportation, existing studies remain largely concentrated on large metropolitan contexts and technologically advanced urban environments. While recent research has acknowledged the importance of contextual factors in mobility planning, these discussions often remain fragmented and descriptive, without offering a structured framework that systematically integrates local conditions, tourism dynamics, and smart mobility principles, particularly in developing tourism cities.

This study offers a novel contribution by proposing a context-based conceptual framework for smart mobility planning specifically tailored to developing tourism cities. Unlike prevailing approaches that emphasize technology-driven solutions or replicate large-city mobility models, this framework positions local context as a foundational element, encompassing tourism-driven mobility demand, spatial constraints, institutional capacity, and technological readiness. By synthesizing insights from smart mobility theory, tourism mobility characteristics, and lessons from comparable destinations, the framework demonstrates how smart mobility components can be adapted to local capacities rather than imposed as standardized solutions. The contributions of this study are threefold. First, at the theoretical level, it advances the smart mobility discourse by shifting the focus from universal technological applications toward a context-sensitive planning paradigm for tourism-oriented cities in developing regions. Second, at the conceptual level, it provides an integrative analytical framework that bridges gaps between smart mobility literature, tourism studies, and urban planning in small and emerging

cities. Third, at the policy and planning level, the framework offers practical guidance for local governments and planners by outlining scalable and feasible smart mobility strategies aligned with local institutional and infrastructural realities. In doing so, this study contributes to ongoing debates on sustainable mobility by demonstrating how smart mobility principles can be operationalized beyond large metropolitan contexts.

Research Questions

Based on the identified research gap, this study addresses the following research questions:

1. How do local contextual characteristics—such as urban scale, tourism-induced mobility patterns, travel behavior, infrastructure constraints, and institutional capacity—influence smart mobility planning in developing tourism cities?
2. What key planning dimensions can be derived from the literature to construct a context-based smart mobility framework suitable for developing tourism destinations?
3. How can the proposed context-based smart mobility framework be applied to illustrate planning implications in the case of Labuan Bajo as a developing tourism city?

While smart mobility has been widely discussed in the context of large metropolitan areas and technologically advanced cities, existing studies predominantly emphasize technology-driven solutions and system optimization. This study offers a novel contribution by reframing smart mobility as a context-adaptive planning approach specifically tailored to developing tourism cities. Rather than proposing generic smart mobility models, this paper develops a structured analytical framework that explicitly links local spatial characteristics, tourism-induced mobility dynamics, informal transport practices, infrastructure constraints, and institutional capacity to mobility planning strategies. By positioning local context as the central determinant of "smartness" in mobility planning, this study extends current smart mobility discourse beyond technology-centric narratives and provides a transferable conceptual tool for tourism-driven urban environments that remain underrepresented in existing literature.

2 Literature Review

2.1 Smart Mobility: Concepts and Evolution

Smart mobility has emerged as a comprehensive approach to improving transportation systems through the integration of digital technologies, sustainable practices, and strategic urban planning. Early interpretations of smart mobility were strongly technology-oriented, emphasizing Intelligent Transportation Systems (ITS), traffic automation, and real-time information systems aimed at improving efficiency and network performance [7] .

Over time, scholarly discourse has shifted toward a broader and more holistic understanding of smart mobility. Rather than focusing solely on technological sophistication, recent studies highlight the importance of accessibility, inclusivity, environmental sustainability, and user-centered design [8]. In this perspective, smart mobility encompasses multimodal integration, data-driven decision-making, shared mobility services, low-emission transport modes, and behavioral change toward sustainable travel patterns [1].

This evolution indicates that smart mobility is not merely a technological upgrade of transport systems but a policy-oriented framework that aligns mobility provision with broader urban sustainability objectives [9].

2.2 Smart Mobility in Developing and Small Cities

Despite its conceptual maturity, the empirical application of smart mobility has been largely concentrated in large metropolitan areas. Small and developing cities differ substantially in terms of institutional capacity, financial resources, and technological readiness [5].

Consequently, the direct transfer of "big-city" models to smaller urban contexts often results in limited effectiveness. Previous studies report that such mismatches lead to underutilized infrastructure and high maintenance costs [7]. In developing regions, additional constraints include unreliable digital infrastructure and the dominance of informal transport systems [10].

2.3 Mobility Characteristics of Tourism Cities

Tourism cities constitute a distinct category due to highly fluctuating travel demand. Unlike conventional cities, mobility patterns are shaped by visitor behavior and seasonal variability [11]. Travel demand tends to peak during tourist seasons, leading to intense congestion periods [12]. Spatially, movement is often concentrated around limited destinations such as waterfronts and scenic viewpoints [13]. Additionally, tourism cities accommodate diverse user groups—residents and visitors—each with different mobility expectations [11].

2.4 Importance of Local Context in Mobility Planning

Successful mobility planning must be grounded in local context, including geographical conditions, socio-cultural behavior, and institutional capacity [14]. From a socio-technical perspective, mobility systems function as complex interactions between technology, policy, infrastructure, and user practices [14]. When designed without adequate consideration of these dimensions, interventions often fail due to institutional mismatch or lack of community acceptance.

2.5 Lessons from Previous Smart Mobility Applications

Empirical evidence shows that technology-driven solutions alone are insufficient without governance capacity and stakeholder engagement [12]. In some regions, mobility initiatives struggled due to poor integration with informal transport systems [10]. Conversely, pedestrianization policies and micro-mobility can be successful when supported by local government capacity and appropriate urban design [2].

2.6 Relevance to Labuan Bajo

Labuan Bajo reflects many characteristics discussed in the literature, including rapid tourism-driven growth, narrow and constrained road networks, mixed travel patterns between tourists and local residents, reliance on informal or small-scale transportation, strong walkability potential along the waterfront, and institutional coordination challenges. Recent tourism statistics further illustrate increasing mobility pressure in the city, as detailed in Table 1. Based on the data, Labuan Bajo recorded 413,349 tourist visits in 2024, including both domestic and international travelers, while visits to Komodo National Park reached 334,206 in the same year. Early 2025 data also indicate continued growth in tourist arrivals. Despite this rapid increase in visitor flows, transport infrastructure remains limited, reinforcing the need for context-based smart mobility strategies emphasizing accessibility, integrated small-scale public transport, and digital tools aligned with local readiness.

Table 1. Tourism Growth Indicators in Labuan Bajo

Indicator	Year/Period	Value
Total tourist visits to Labuan Bajo	2024	413,349 visitors
International visitors	2024	229,763 visitors
Domestic visitors	2024	181,586 visitors
Visits to Komodo National Park	2024	334,206 visitors
Tourist visits (Jan–Apr)	2025	58,926 visitors
Passenger arrivals at Komodo Airport	April 2025	47,093 passengers

2.7 Terminology Clarification

The terminology related to smart mobility has evolved across multiple disciplines, resulting in overlapping and sometimes inconsistent usage of key concepts. In the existing literature, terms such as smart transportation, intelligent transportation, intelligent mobility, and smart mobility are frequently applied interchangeably, despite referring to different analytical emphases and policy orientations [15]. This lack of terminological clarity may lead to ambiguity in conceptual framing and analytical interpretation.

Smart transportation and intelligent transportation systems (ITS) are traditionally associated with technology-oriented interventions aimed at improving operational efficiency and traffic control through digital infrastructure and automation [4]. These approaches primarily emphasize system performance and technological capability, often with limited attention to social, institutional, and contextual dimensions. Similarly, intelligent mobility refers to the application of advanced technologies—such as real-time information systems and sensor-based monitoring—to enhance mobility services [7]. While this concept extends beyond traffic management, it remains largely focused on technological intelligence rather than broader planning considerations.

In this study, the term smart mobility is deliberately adopted as the primary analytical framework. Smart mobility is defined as an integrated mobility planning approach that combines technological support with sustainability objectives, multimodal accessibility, user-centered design, and, critically, sensitivity to local contextual conditions [8]. This perspective reflects recent shifts in international scholarship that recognize mobility as a socio-technical system shaped by spatial constraints, institutional capacity, travel behavior, and governance structures [14]. Accordingly, references to other terms within this manuscript are limited to discussions of prior studies and are used strictly in accordance with the terminology employed by the original authors. All conceptual development in this article is grounded explicitly in the smart mobility paradigm as defined above

3 Conceptual Framework: Context-Based Smart Mobility Planning for Developing Tourism Cities

This study adopts a context-based smart mobility planning framework to address the unique mobility challenges faced by developing tourism cities. The framework is constructed on the premise that smart mobility solutions cannot be universally applied across different urban contexts, particularly in tourism-oriented cities characterized by fluctuating demand, spatial constraints, and limited institutional capacity [5]. Instead, smart mobility must be understood as

an adaptive planning approach that aligns technological interventions with local conditions [14]. As illustrated in Figure 1, the conceptual framework is structured into four interrelated components: local context factors, context-based adaptation mechanisms, smart mobility components, and mobility outcomes. These components collectively form a sequential yet iterative planning logic, where local conditions serve as the primary input shaping smart mobility strategies and expected outcomes [16]

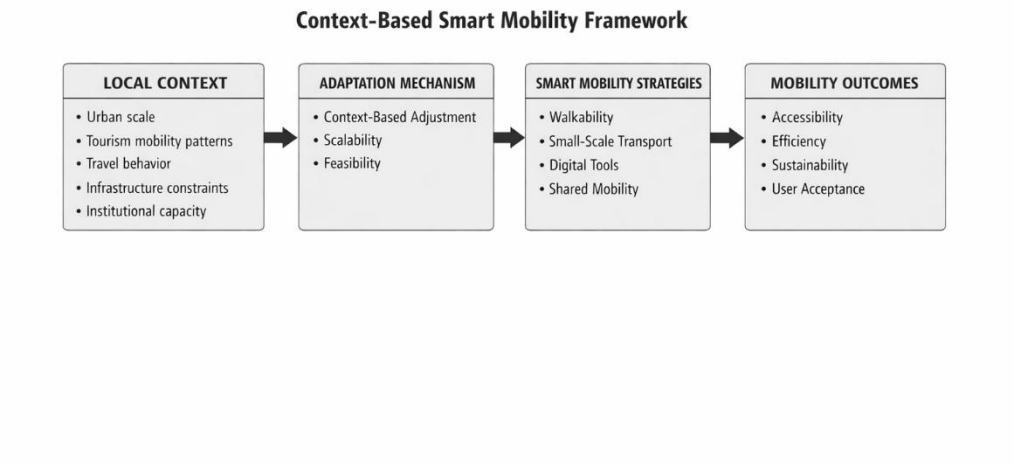

Fig 1. Conceptual framework of context-based smart mobility planning in developing tourism cities

3.1 Framework Rationale

Existing smart mobility frameworks predominantly originate from metropolitan contexts and prioritize advanced digital infrastructure, high-capacity public transport systems, and complex data integration platforms. As highlighted in Section 2, such approaches often prove unsuitable for small and developing tourism cities due to limited institutional capacity, constrained infrastructure, and distinct mobility patterns. The proposed framework responds to this gap by repositioning smart mobility as a context-responsive planning approach, where technological interventions are selected and scaled according to local geographical, socio-cultural, and institutional conditions rather than applied uniformly.

3.2 Core Dimensions of the Framework

As shown in Figure 1, the conceptual framework is structured around three interrelated dimensions: local context, smart mobility strategies, and desired mobility outcomes.

3.2.1 Local Context Dimension

The first dimension captures the local conditions that shape mobility planning decisions in tourism cities. This includes:

1. Spatial and geographical characteristics, such as coastal settings, limited road width, and topographical constraints.
2. Tourism-driven mobility patterns, including seasonal demand fluctuations and attraction-oriented travel.
3. Socio-cultural travel behavior, particularly walking preferences, motorbike dependency, and the presence of informal transport.
4. Institutional and governance capacity, reflecting coordination among agencies, regulatory enforcement, and planning capability.

These contextual factors serve as the foundation of the framework, ensuring that mobility strategies are grounded in local realities rather than imported models.

3.2.2 Smart Mobility Strategy Dimension

The second dimension represents a set of context-adaptive smart mobility strategies derived from the literature and adjusted for developing tourism cities. As summarized in Table 1, these strategies include:

1. Walkability and human-scale mobility, emphasizing pedestrian infrastructure in scenic and high-activity tourism areas.
2. Integrated small-scale public transport, such as shuttle services and feeder systems aligned with tourist attractions and residential areas.
3. Appropriate digital tools, including basic real-time information systems, signage, and simple mobile applications that match local digital readiness.
4. Shared and low-emission mobility options, prioritizing electric micro-mobility and shared services where feasible.
5. Stakeholder coordination mechanisms, integrating local government, transport operators, tourism actors, and community groups.

Importantly, technology is positioned as an enabler rather than a driver, reinforcing the context-based orientation of the framework.

3.2.3 Mobility Outcome Dimension

The third dimension defines the intended outcomes of context-based smart mobility planning in tourism cities. These outcomes include:

1. Improved accessibility for both residents and visitors.
2. Enhanced mobility efficiency during peak tourism periods.
3. Reduced environmental impact, particularly in sensitive coastal or heritage areas.
4. Increased user acceptance and system usability.
5. Strengthened institutional sustainability through manageable operational requirements.

These outcomes reflect both sustainability objectives and practical implementation considerations in developing city contexts.

3.3 Integrative Mechanism of the Framework

The framework operates through an iterative relationship between context, strategy, and outcomes. Local context informs the selection and scaling of smart mobility strategies, while observed mobility outcomes provide feedback for policy adjustment and refinement. This dynamic mechanism distinguishes the proposed framework from static, one-size-fits-all models. Figure 1 visually represents this integrative process, illustrating how local context directly shapes strategic choices and, ultimately, mobility performance in tourism cities.

3.4 Contribution of the Framework

The primary contribution of this conceptual framework lies in its explicit integration of tourism characteristics and local contextual constraints into smart mobility planning. While existing studies acknowledge the importance of context, few provide a structured framework that operationalizes this principle for developing tourism cities [5].
By shifting the focus from technological sophistication to contextual suitability, the framework offers:

1. A theoretical contribution to smart mobility scholarship by extending the concept beyond metropolitan settings [6].
2. A practical planning tool for policymakers in emerging tourism destinations.
3. A bridge between sustainability discourse and implementable mobility strategies [16].

This framework therefore provides a foundation for future empirical testing and policy-oriented applications in similar tourism-driven urban contexts. This study contributes to the ongoing discourse on smart mobility by demonstrating that mobility planning in developing tourism cities requires a fundamentally different analytical approach from that commonly applied in large metropolitan contexts [8]. The proposed context-based smart mobility framework responds to gaps in existing literature that often emphasize technological sophistication while underestimating local capacity, tourism dynamics, and institutional constraints [4].

4 Discussion

4.1 Positioning the Framework within Smart Mobility Scholarship

The proposed context-based smart mobility framework extends existing literature by shifting the analytical focus from technology-driven optimization toward contextual adaptability and institutional feasibility. While earlier studies emphasize digital infrastructure and big data integration as core components of smart mobility [7], the findings of this study suggest that such approaches may be inappropriate in developing tourism cities. Consistent with recent shifts in the field, this study supports the argument that smart mobility should be understood as a policy-oriented framework rather than a purely technological solution [8]. The proposed framework explicitly operationalizes context as a primary determinant, addressing a gap in models that fail to integrate it systematically [17].

4.2 Contribution to Tourism-Oriented Mobility Planning

Within tourism mobility research, transportation is frequently treated as a supporting system rather than a central planning concern [11]. This study demonstrates that mobility systems in tourism cities require distinct planning logics due to seasonal demand and diverse user groups. The framework reinforces findings that walkability and small-scale transport systems are particularly effective in tourism contexts [2]. Unlike conventional models, the proposed framework aligns mobility strategies with tourism-specific spatial patterns, enhancing both system efficiency and user experience

4.3 Relevance for Developing Cities and Policy Implications

For developing cities, smart mobility initiatives often fail due to institutional constraints, limited financial resources, and technological [5]. The proposed framework addresses these challenges by prioritizing scalable solutions that align with local governance capacity. From a policy perspective, it provides a practical reference for local governments seeking to improve mobility

without relying on capital-intensive investments, emphasizing stakeholder coordination and appropriate digital tools [10].

4.4 Theoretical Contribution and Research Implications

The primary theoretical contribution lies in advancing a context-based interpretation for non-metropolitan settings. Drawing on socio-technical transition theory [14] , the framework conceptualizes smart mobility as an evolving interaction between technology, governance, and user practices. Furthermore, this study highlights the importance of aligning mobility strategies with local socio-spatial conditions, offering a conceptual bridge between smart mobility theory and sustainability-oriented transport planning in developing regions.

4.5 Limitations and Directions for Future Research

Despite its contributions, this study has limitations. The framework is developed primarily through literature synthesis without empirical testing. Future research should validate the framework through case studies or pilot implementations. Additionally, while Labuan Bajo serves as a representative context, variations across different tourism typologies—such as island destinations or heritage cities—would enhance the generalizability of the proposed model.

5 Conclusion

This study has developed a context-based conceptual framework for smart mobility planning in developing tourism cities, responding to the limitations of technology-driven and large-city-oriented mobility models. By positioning local context as the primary foundation of smart mobility planning, the framework demonstrates that sustainable and effective mobility solutions depend not on technological sophistication alone, but on alignment with spatial constraints, institutional capacity, tourism dynamics, and technological readiness. The conceptual framework contributes to the smart mobility literature by offering a structured analytical approach that integrates local context factors, adaptation mechanisms, smart mobility components, and expected mobility outcomes. This approach advances existing scholarship by moving beyond descriptive discussions of context and providing an operational planning logic that explains how smart mobility strategies can be adapted to developing tourism cities. In doing so, the study addresses a critical gap in the literature, which has largely overlooked small and emerging tourism destinations in favor of metropolitan case studies. From a policy and planning perspective, the framework highlights the importance of prioritizing human-scale mobility, flexible public transport solutions, and modest digital support systems that can be realistically implemented and maintained by local governments. Rather than replicating complex smart city technologies, policymakers in developing tourism cities are encouraged to focus on scalable and context-appropriate interventions that enhance accessibility, manage tourism-related demand fluctuations, and balance the mobility needs of residents and visitors. Institutional coordination and stakeholder engagement are also emphasized as key enabling conditions for successful smart mobility implementation. While this study is conceptual in nature, it provides a robust foundation for future empirical research. Subsequent studies may apply and test the proposed framework across different tourism destinations to assess its adaptability and effectiveness under varying contextual conditions. By offering a transferable yet flexible planning framework,

this study contributes to ongoing debates on sustainable mobility and provides practical insights for policymakers seeking to implement smart mobility strategies in developing tourism cities.

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Analysis Of Land Cover Change And Its Impact On Runoff Discharge In Komodo District, West Manggarai Regency

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Abstract. Land use and land cover (LULC) changes significantly affect surface runoff, especially in data-poor areas. This study analyzes LULC changes and their impacts on runoff coefficients and surface runoff discharge in four selected villages in Komodo District, West Manggarai Regency, using an integrated hydrological and geospatial approach. ESRI land cover and ERA5 rainfall data were used to assess spatial land cover dynamics. Runoff coefficients were estimated using the Hassing method by integrating topography, soil characteristics, and land cover through a GIS-based overlay analysis. In contrast, runoff discharge was calculated using the Rational Method. The results indicate that runoff coefficients increased by approximately 0.02–0.09 in the four villages due to land conversion from vegetated to built-up areas, thereby increasing peak runoff discharge by 4.7%-11.43%. These findings highlight the hydrological impacts of rapid land development and provide a scientific basis for local water resource management and sustainable spatial planning.

Keywords: Land cover change; Surface runoff; Runoff discharge; Rational Method; Komodo District

1 Introduction

Land use and land cover (LULC) change is a global phenomenon that has intensified in recent decades, in line with population growth, urbanization, and economic development [1]. LULC change has been identified as a major factor influencing hydrological systems, as it directly controls infiltration, evapotranspiration, and surface runoff formation [2]. Various studies have shown that converting vegetated land to built-up areas tends to reduce soil infiltration capacity and increase surface runoff, thereby altering river flow characteristics and the local air balance, and impacting runoff discharge in Komodo District, West Manggarai Regency [3].

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2 Methodology

The analysis focuses on selected villages within the district that have experienced significant land-cover changes; therefore, the watershed is relatively small and methodologically suitable for applying the Rational Method [4]. The Rational Method was chosen because it is simple and practical, and it allows direct integration of runoff coefficient (C) with land-cover data from ESRI Land Cover imagery [5]. Although this method has limitations in large or heterogeneous watersheds, the analysis remains relevant at the local scale and supports spatial planning and air resource management.

This methodology integrates statistical rainfall analysis, spatial analysis using Geographic Information Systems (GIS), and hydrological modeling to quantify runoff characteristics under different land cover conditions. By combining hydrological and geospatial analyses, this approach enables an assessment of how land-cover dynamics influence runoff response while accounting for the watershed's physical characteristics. The overall research framework was designed to systematically examine the relationship between land cover change and surface runoff discharge at the local scale. A detailed description of the rainfall analysis, determination of the runoff coefficient, and estimation of runoff discharge is presented in the following subsections.

2.1 Data Collection and Preparation

This study uses hydrological and spatial datasets to examine the impact of land-cover change on runoff discharge in the Komodo District, West Manggarai Regency, with particular focus on identifying runoff discharge characteristics in several urban villages that have experienced significant land-cover change. The hydrological data consist of annual maximum rainfall derived from the ERA5 satellite, based on previous research [6]. which demonstrated that ERA5 data are suitable and reliable for hydrological analysis in the Labuan Bajo region. Spatial data include slope, soil type, and land-cover maps, obtained from geospatial databases and remote-sensing sources. Land cover data derived from ESRI Land Cover imagery for 2017 and 2024 [7] were used to assess temporal changes in land cover. All spatial datasets were standardized to the same coordinate system and spatial resolution to ensure analytical consistency. The land-cover maps were then classified into the following categories: built-up areas, trees, bare ground, Rangeland, water, flooded vegetation, and crops.

2.2 Rainfall Frequency Analysis

Annual maximum rainfall data for 21 years (2004–2024) were analyzed using frequency analysis to estimate design rainfall for various return periods. The rainfall data were derived from the ERA5 reanalysis dataset, which has been validated and recommended by previous studies as a reliable data source for the Labuan Bajo region and its surroundings [6]. The use of ERA5 data provides a relevant alternative given the limited availability of long-term observed rainfall records in the study area.

Several probability distributions commonly used in hydrological studies were tested, namely the Gumbel, Normal, Log-Normal, and Log-Pearson Type III distributions [8]. Each distribution was fitted to the observed rainfall data using statistical parameters, including the mean, standard deviation, and skewness coefficient. Next, the design rainfall value corresponding to the

selected return period was calculated for each distribution and used as the basis for subsequent hydrological analysis.

2.3 Goodness-of-Fit Testing and Distribution Selection

To evaluate the goodness of fit between the theoretical distributions and the observed data, Chi-Square and Kolmogorov–Smirnov (K–S) tests were applied at a significance level (α) of 5%.

a. Chi-Square test

The Chi-Square test was applied to evaluate the agreement between observed and theoretical rainfall frequency distributions. The test statistic was calculated using Equation 1:

$$X^2 = \sum_{i=1}^{k} \left(\frac{Oi-Ei}{Ei}\right)^2 \quad (1)$$

Where;

Oi = observed frequency in the *i*-th class

Ei = expected frequency derived from the theoretical distribution

K = number of classes

$\chi 2$ = Chi-Square test statistic

b. Kolmogorov–Smirnov test

The Kolmogorov–Smirnov test was used to assess the maximum deviation between the empirical and theoretical cumulative distribution functions. The test statistic was determined using the following expression, as shown in Equation (2):

$$D = \max|Fo(x) - Ft(x)| \quad (2)$$

Where;

$Fo(x)$ = empirical cumulative distribution function

$Ft(x)$ = theoretical cumulative distribution function

A distribution is considered to fit the observed data if the calculated D value is smaller than the critical D value at a significance level of α=5

2.4 Rainfall Intensity Determination

The selected design rainfall was converted to rainfall intensity using the Mononobe equation, which relates rainfall depth to rainfall duration. A 6-hour rainfall duration was adopted in this study, representing the time of concentration in the watershed in Komodo Regency. The Mononobe equation is given in Equation 3.

$$\mathrm{I} = \frac{R24}{24}\left(\frac{24}{t}\right)^{2/3} \quad (3)$$

Where:

I = rainfall intensity (mm/h)

R24 = 24-hour design rainfall (mm)

T = rainfall duration (hours)

2.5 Runoff Coefficient Determination

The runoff coefficient (C) is determined by integrating three key parameters: topography (C_t), soil characteristics (C_s), and vegetation or land cover (C_v). Each parameter is determined by criteria derived from standard hydrological references. Spatial overlay analysis was performed using GIS to combine maps of slope, soil type, and land cover [9]. The runoff coefficient was determined using the Hasing method, which allows calculation of the C value from the additive components of the three parameters. Each parameter is classified by a runoff coefficient, as shown in Table 1. This approach employs a damping additive component, which limits the capture of complex hydrological behavior. Calibration, validation, and sensitivity analysis were not performed due to the limited availability of field hydrological data in the Komodo District. Nevertheless, this method provides an estimate of relative runoff potential, which is useful for spatially removing the influence of land-cover changes on runoff discharge. The obtained C values are approximate and should be interpreted with methodological limitations in mind; however, they remain relevant for supporting local air resource management and spatial planning.

Table 1. Runoff coefficient values based on the hassing method

No	Topography (Ct)	C	Runoff Coefficient: C= Ct+Cs+Cv
1	Flat (<1%)	0.03	
2	Wavy (1–10%)	0.08	
3	Hills (10–20%)	0.16	
4	Mountains (>20%)	0.26	
No	Soil (Cs)	C	
1	Sand and gravel	0.04	
2	Sandy loam	0.08	
3	Clay and silt	0.16	
4	Stone layer	0.26	
No	Vegetation (Cv)	C	
1	Forest	0.04	
2	Agriculture	0.11	
3	Grass	0.21	
4	Bare land (no vegetation)	0.28	

2.6 Runoff Discharge Estimation

The runoff discharge in this study uses the Rational Method. This method calculates peak runoff discharge based on rainfall intensity, runoff coefficient, and watershed area. In this study, the Rational Method is used not to determine the discharge plan, but rather as a comparative analysis tool to show the effects of land-cover changes on surface runoff through variations in the runoff coefficient (C). The discharge values obtained are indicative and are used for relative trend analysis, so the limitations of the Rational Method in large-scale watersheds have been

methodologically considered. The Rational Method equation can be seen in equation 4.

$$Q = 0.278\ x\ C\ x\ I\ x\ A \quad (4)$$

Where:

Q = peak runoff discharge (m^3/s)

C = runoff coefficient

I = rainfall intensity (mm/h)

A = catchment area (km^2)

3 Results and Discussion

3.1 Land Cover Changes between 2017 and 2024

Land-cover analysis in Komodo District between 2017 and 2024 reveals clear spatial changes, while the total area remained constant at 377.27 km^2. The spatial distribution of land cover in 2017 and 2024 is presented in Figures 1 and 2, respectively.

Tree-covered areas decreased from 277.97 km^2 in 2017 to 260.79 km^2 in 2024, resulting in a net loss of 17.18 km^2. In contrast, built-up areas increased significantly from 15.67 km^2 to 32.21 km^2, with a net gain of 16.53 km^2, indicating rapid urban expansion.

Agricultural land (crops) also increased from 13.88 km^2 to 17.32 km^2 (+3.44 km^2), while rangeland remained relatively stable. Minor reductions were observed in bare ground, water bodies, and flooded vegetation.

Overall, land-cover changes indicate a shift from vegetated land to built-up and agricultural areas. These changes, as clearly illustrated in Figures 1 and 2, are expected to increase the potential for surface runoff due to reduced infiltration and increased surface imperviousness.

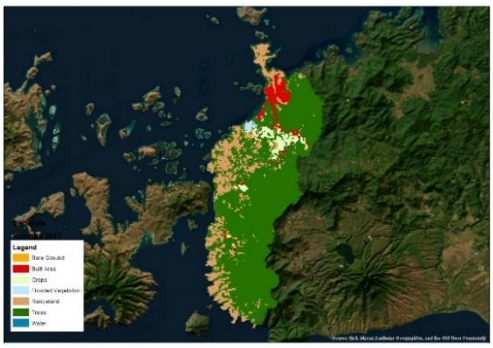

Fig. 1. Spatial distribution of land cover classes in komodo district in 2017 based on ESRI land cover data.

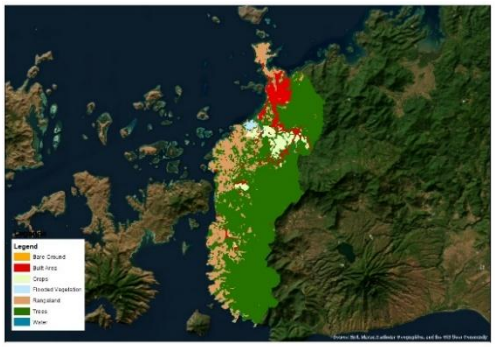

Fig. 2. Spatial distribution of land cover classes in komodo district in 2024 based on ESRI land cover data

3.2 Soil Type and Slope Characteristics

The soil type and slope maps depict the physical characteristics that influence runoff processes in Komodo District (Figures 3 and 4). The study area consists solely of loam and clay soils, with clay soils dominating lowland and developed areas, while loam soils are more common in transitional and upland zones (Figure 3). Due to their lower infiltration capacity, clay soils exhibit greater runoff potential.

Slope analysis indicates that the district ranges from flat to mountainous terrain (Figure 4). Flat to gently undulating slopes (<10%) are primarily found in coastal and lowland areas where urban development is concentrated, whereas hilly (10–20%) and mountainous (>20%) slopes predominate in inland and upland regions. Steeper slopes enhance surface runoff by reducing infiltration time, and when combined with clay-dominated soils and expanding built-up areas, they may intensify hydrological responses across the district.

Fig. 3. Soil type distribution map of komodo district.

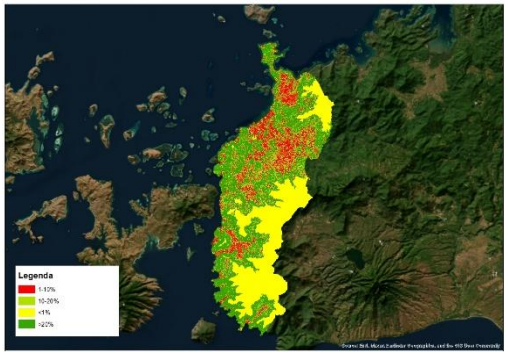

Fig. 4. Slope classification map of komodo district.

3.3 Rainfall Analysis Results

Rainfall analysis was conducted using annual maximum rainfall data to estimate design rainfall for several return periods. Four probability distributions were evaluated, namely Gumbel, Normal, Log-Normal, and Log Pearson Type III, to identify the most suitable distribution for the study area.

The goodness-of-fit tests, including the Kolmogorov–Smirnov and Chi-Square tests, indicated that the Log Pearson Type III distribution provided the best fit to the observed rainfall data. This distribution satisfied the acceptance criteria of both tests and showed the smallest deviation between observed and theoretical values.

Based on the selected distribution, design rainfall values were calculated for return periods of 2, 5, 10, and 20 years. The resulting design rainfall depths are presented in Table 2. These values were subsequently used to derive rainfall intensity and runoff discharge in the hydrological analysis.

Table 2. Estimated design rainfall using the log pearson type III distribution

Periods (Year)	X (mm)	Intensity (mm/h)
2	50.605	5.313
5	66.602	6.992
10	76.900	8.074
20	89.650	9.412

3.4 Surface Flow Discharge Analysis in Selected Sub-districts

To support the runoff discharge analysis, a combined land cover map of the selected kelurahan for 2017 and 2024 is first presented in Figure 5. This map highlights the spatial extent of land cover changes within the four urban villages analyzed: Labuan Bajo, Gorontalo, Wae Kelambu, and Batu Cermin, which were identified as areas experiencing the most significant land cover transformation in Komodo District during the study period.

Runoff discharge was estimated using the Rational Method, incorporating key hydrological parameters, namely the runoff coefficient (C), rainfall intensity (I), and catchment area (A). These parameters were derived from rainfall frequency analysis and spatial datasets and applied consistently for both years to allow comparison of runoff conditions.

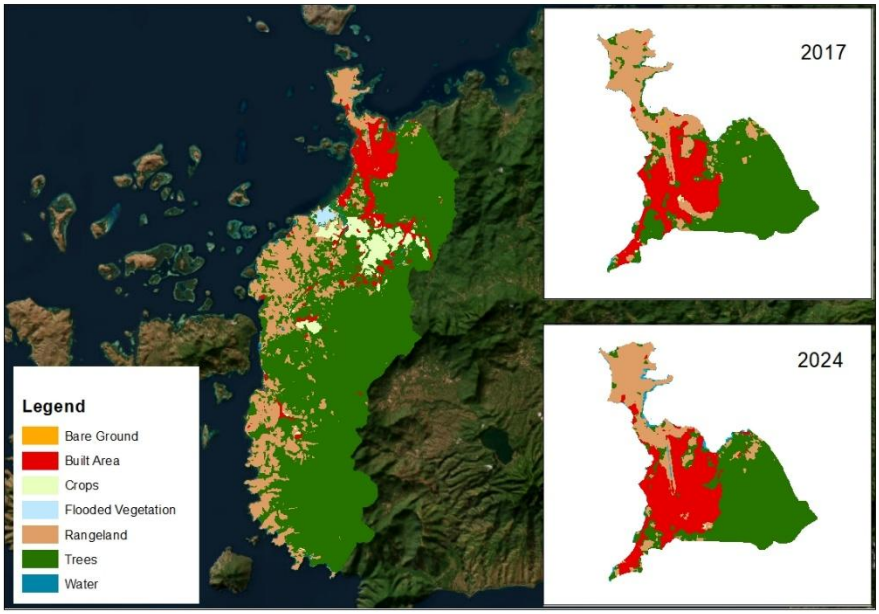

Fig. 5. Combined land cover change map (2017–2024) in selected sub- districts in komodo district

a. Labuan Bajo Subdistrict

Labuan Bajo Village covers an area of 10.06 km² and experienced the most significant land cover changes during the 2017–2024 period. Built-up area increased from 1.35 km² in 2017 to 2.24 km² in 2024, while tree cover decreased substantially from 1.79 km² to 0.83 km² due

to rapid urban development and tourism. This change in land cover directly increases the runoff coefficient, as indicated by the increase in C from 0.74 in 2017 to 0.79 in 2024, with corresponding changes in the Ct, Cv, and Cs components, as presented in Table 3.

Table 3. Changes in runoff coefficient (C) in labuan bajo subdistrict (2017–2024)

No	Topography	Area 2017 (ha)	C	Ct	C = Ct+Cs+Cv	Area 2024 (ha)	C	Ct	C = Ct+Cs+Cv
			2017				2024		
1	Flat (<1%)	0.07	0.03			0.20	0.03		
2	Wavy (1–10%)	1.28	0.08			1.40	0.08		
3	Hills (10–20%)	2.50	0.16	0.21		2.41	0.16	0.21	
4	Mountains (>20%)	6.70	0.26			6.60	0.26		
	Total		10.6			5.3	10.6		
		Soil (Cs)							
1	Sand and gravel	0	0.04			0	0.04		
2	Sandy loam	0	0.08			0	0.08		
3	Clay and silt	10.6	0.16	0.16		10.55	0.16	0,16	
4	Stone layer	0	0.26		0.74	0	0.26		0.79
	Total		10.6			5.3	10.6		
	Vegetation (Cv)								
1	Built Area	1.35	0.7			2.24	0.7		
2	Crops	0.00	011			0	0.11		
3	Bare Ground	0.03	0.5			0	0.5		
4	Flooded Vegetation	0.00	0.11	0.37		0	0.11	0,42	
5	Rangeland	7.24	0.4			7.13	0.4		
6	Trees	1.79	0.04			0.83	0.04		
7	Water	0.17	0.05			0.41	0.05		
	Total		10.6			5.3	10.6		

The increase in the runoff coefficient significantly increases runoff discharge from 2017 to 2024, as shown in Figure 6, indicating that Labuan Bajo Village has the highest potential for inundation and surface flooding compared to other villages, particularly during extreme rainfall events.

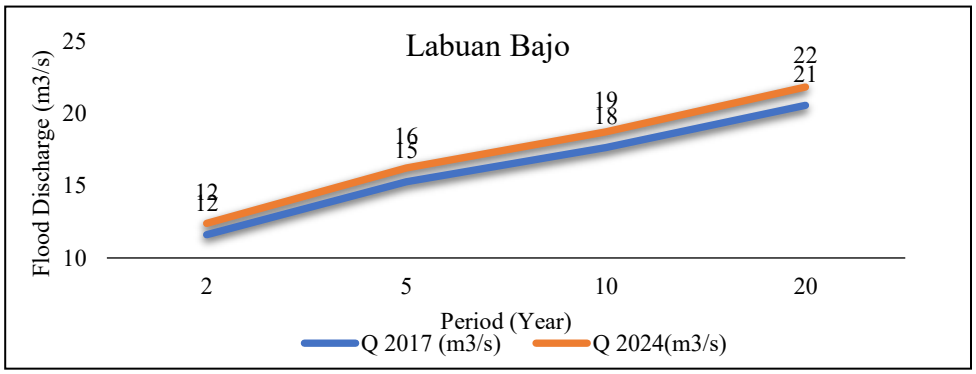

Fig. 6. Changes in runoff discharge in response to land cover conversion in labuan bajo subdistrict

b. Gorontalo Subdistrict

Gorontalo Village covers an area of 5.3 km² and experienced noticeable land cover changes during the 2017–2024 period. The Built-up Area increased from 2.58 km² in 2017 to 3.18 km² in 2024, while Tree Cover decreased from 2.23 km² to 1.85 km², indicating a gradual conversion of vegetated land into developed areas. These land-cover changes directly affected the runoff coefficient, as indicated by an increase in the C value from 0.72 in 2017 to 0.80 in 2024, with corresponding changes in the Ct, Cv, and Cs components, as presented in Table 4.

Table 4. Changes in runoff coefficient (C) in Gorontalo subdistrict (2017–2024)

No	Topography	Area 2017 (ha)	C	Ct	C = Ct+Cs+Cv	Area 2024 (ha)	C	Ct	C = Ct+Cs+Cv
			2017				2024		
1	Flat (<1%)	0.18	0.03			0.20	0.03		
2	Wavy (1–10%)	1.65	0.08			1.66	0.08		
3	Hills (10–20%)	1.34	0.16	0.17		1.29	0.16	0.17	
4	Mountains (>20%)	2.16	0.26			2.16	0.26		
	Total	5.3	0.5		0.72	5.3	0.5		0.80
	Soil (Cs)								
1	Sand and gravel	0	0.04			0	0.04		
2	Sandy loam	0	0.08	0.16		0	0.08	0.16	
3	Clay and silt	5.3	0.16			5.33	0.16		
4	Stone layer	0	0.26			0	0.26		

	Total	5.3	0.5		5.3	0.5	
	Vegetation (Cv)						
1	Built Area	2.58	0.7		3.18	0.7	
2	Crops	0.03	0.11		0.04	0.11	
3	Bare Ground	0.00	0.5		0	0.5	
4	Flooded Vegetation	0.01	0.11	0.39	0.002	0.11	0.47
5	Rangeland	0.43	0.4		0.6	0.4	
6	Trees	2.23	0.04		1.45	0.04	
7	Water	0.07	0.05		0.07	0.05	
	Total	5.3	1.9		5.3	0.6	

The increase in the runoff coefficient led to a corresponding rise in runoff discharge from 2017 to 2024, as shown in Figure 7. Although the increase is lower than that observed in Labuan Bajo Village, Gorontalo Village still shows an increasing potential for surface runoff and localized inundation, particularly during extreme rainfall events.

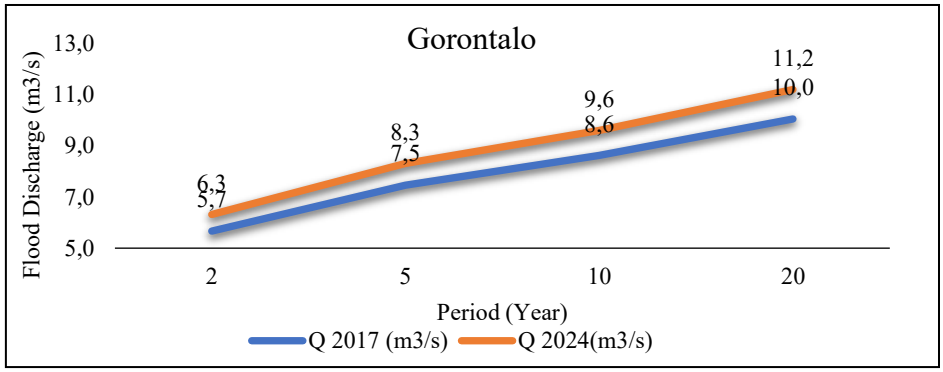

Fig. 7. Changes in runoff discharge in response to land cover conversion in gorontalo subdistrict

c. Batu Cermin Subdistrict

Batu Cermin Village covers an area of 8.0 km² and experienced considerable changes in land cover during the 2017–2024 period. The Built-up Area expanded markedly from 3.34 km² in 2017 to 4.58 km² in 2024, while Tree Cover decreased from 2.13 km² to 1.68 km², indicating a substantial conversion of vegetated land into developed areas. These land-cover changes directly influenced the runoff coefficient, as indicated by an increase in the C value from 0.73 in 2017 to 0.79 in 2024, with corresponding changes in the Ct, Cv, and Cs components, as presented in Table 5.

Table 5. Changes in runoff coefficient (C) in batu cermin subdistrict (2017–2024)

No	Topography	Area 2017 (ha)	C	Ct	C = Ct+Cs+Cv	Area 2024 (ha)	C	Ct	C = Ct+Cs+Cv
		2017				2024			
1	Flat (<1%)	0.34	0.03			0.36	0.03		
2	Wavy (1–10%)	3.36	0.08			3.38	0.08		
3	Hills (10–20%)	2.27	0.16	0.15		2.26	0.16	0.14	
4	Mountains (>20%)	2.00	0.26			1.95	0.26		
	Total	8.0	0.5			8.0	0.5		
	Soil (Cs)								
1	Sand and gravel	0	0.04			0	0.04		
2	Sandy loam	0	0.08			0	0.08		
3	Clay and silt	8.0	0.16	0.16		8.0	0.16	0.16	
4	Stone layer	0	0.26			0	0.26		
	Total	8.0	0.5			8.0	0.5		
	Vegetation (Cv)								
1	Built Area	3.34	0.7		0.73	4.58	0.7		0.79
2	Crops	0.00	0.11			0	0.11		
3	Bare Ground	0.02	0.5			0.01	0.5		
4	Flooded Vegetation	0.00	0.11	0.43		0	0.11	0.49	
5	Rangeland	2.48	0.4			1.55	0.4		
6	Trees	2.13	0.04			1.68	0.04		
7	Water	0.04	0.05			0.19	0.05		
	Total	8.0	1.9			8.0	0.6		

The increase in the runoff coefficient led to higher runoff discharge from 2017 to 2024, as illustrated in Figure 8, indicating a greater potential for surface runoff and localized inundation in Batu Cermin Village, particularly during extreme rainfall events.

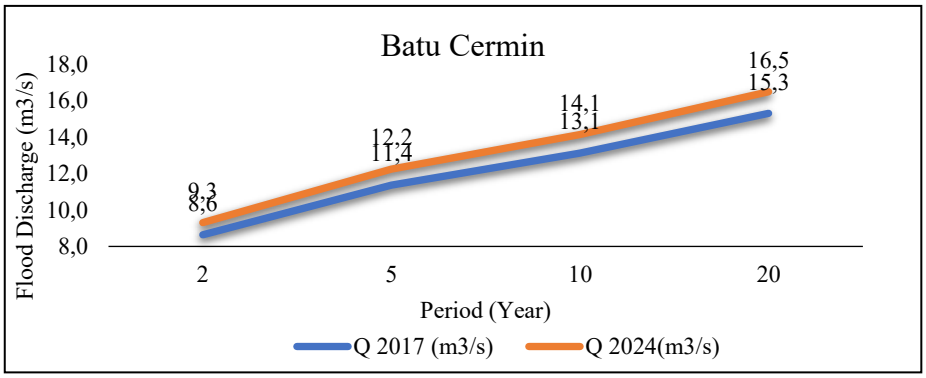

Fig. 8. Changes in runoff discharge in response to land cover conversion in batu cermin subdistrict

d. Wae Kelambu Subdistrict

Wae Kelambu Village covers an area of 22.9 km² and experienced substantial land cover changes during the 2017–2024 period. The Built-up Area increased markedly from 3.24 km² in 2017 to 4.37 km² in 2024, indicating the rapid expansion of developed land. In contrast, Trees Cover declined from 18.24 km² to 17.68 km², reflecting a significant conversion of vegetated land into built-up areas. These changes illustrate an intensifying trend in urban development in Wae Kelambu Village.

The land-cover changes had a direct impact on the runoff coefficient. In 2017, the runoff coefficient components were Ct = 0.13, Cv = 0.15, and Cs = 0.16, resulting in a total runoff coefficient (C) of 0.45. By 2024, the substantial increase in built-up areas led to a rise in the land cover component (Cv) to 0.18, while Ct slightly decreased to 0.13 and Cs remained constant at 0.16, producing a higher total runoff coefficient of C = 0.47, as presented in Table 6. This increasing trend in the runoff coefficient is consistent with findings from previous studies, which report that urban expansion and the conversion of vegetated land into impervious surfaces significantly reduce infiltration capacity and increase surface runoff. For example, a long-term study in Malang City documented a continuous increase in runoff coefficient values from 0.2468 in 2002 to 0.4119 in 2022, with an average annual increase of approximately 13.78% [10], driven by population growth, urbanization, and rising housing demand. Similar increases in runoff coefficients associated with land-cover change have also been reported in urbanizing watersheds, particularly in coastal and tourism-driven regions, where rapid development intensifies hydrological responses and increases flood risk during extreme rainfall events.

Table 6. Changes in runoff coefficient (C) in Wae Kelambu subdistrict (2017–2024)

No	Topography	Area 2017 (ha)	C	Ct	C = Ct+Cs+Cv	Area 2024 (ha)	C	Ct	C = Ct+Cs+Cv
			2017				2024		

1	Flat (<1%)	8.11	0.03			8.26	0.03		
2	Wavy (1–10%)	3.69	0.08			3.82	0.08		
3	Hills (10–20%)	3.81	0.16	0.13		3.79	0.16	0.13	
4	Mountains (>20%)	7.25	0.26			7.00	0.26		
	Total	22.9	0.5			22.9	0.5		
	Soil (Cs)								
1	Sand and gravel	0	0.04			0	0.04		
2	Sandy loam	0	0.08			0	0.08		
3	Clay and silt	22.9	0.16	0.16		22.9	0.16	0.16	
4	Stone layer	0	0.26			0	0.26		
	Total	8.0	0.5			8.0	0.5		
	Vegetation (Cv)				0.45				0.47
1	Built Area	3.24	0.7			4.37	0.7		
2	Crops	0.08	0.11			0.03	0.11		
3	Bare Ground	0.02	0.5			0.00	0.5		
4	Flooded Vegetation	0.00	0.11	0.15		0.00	0.11	0.18	
5	Rangeland	1.33	0.4			0.79	0.4		
6	Trees	18.24	0.04			17.68	0.04		
7	Water	0.01	0.05			0.03	0.05		
	Total	22.9	1.9			22.9	0.6		

The increase in the runoff coefficient resulted in a significant rise in runoff discharge from 2017 to 2024, as illustrated in Figure 9. Compared with other villages, Wae Kelambu exhibits one of the largest increases in runoff discharge, indicating an elevated risk of surface runoff and localized inundation during extreme rainfall events. These findings underscore the strong influence of rapid land-cover conversion on the hydrological response of Wae Kelambu Village.

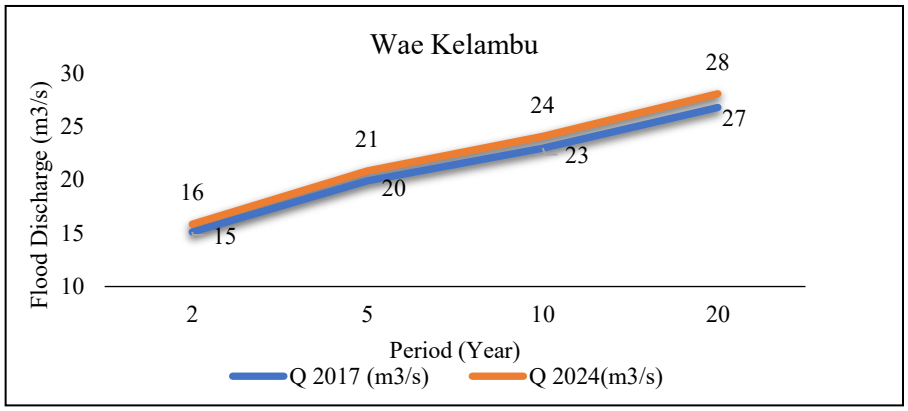

Fig. 9. Changes in Runoff Discharge in Response to Land Cover Conversion in Wae Kelambu Subdistrict

4 Conclusion

This study shows that land cover change in Komodo Regency between 2017 and 2024 was characterized by significant conversion of debtor areas to built-up and agricultural land, particularly in the villages of Labuan Bajo, Gorontalo, Batu Cermin, and Wae Kelambu. The reduction in vegetated land and the expansion of impermeable surfaces consistently increased the runoff coefficient (C) across the study area, confirming the strong influence of land-cover dynamics on surface runoff generation.

Integrating information on land cover, soil type, and slope indicates that areas characterized by clay soils, gentle slopes, and rapid urban expansion exhibit the most pronounced hydrological response. Among the villages studied, Labuan Bajo and Wae Kelambu experienced the highest increases in runoff coefficient and runoff discharge, indicating greater vulnerability to surface flooding during extreme rainfall events. These findings are consistent with hydrological theory, which links decreased infiltration capacity and increased impermeability to higher runoff potential and faster runoff response.

Although the Rational Method and additive runoff coefficient approaches address complex hydrological processes and are applied without calibration or statistical significance testing, both effectively capture relative spatial differences in runoff responses driven by land-cover change. The results highlight that even relatively small increases in built-up area can significantly alter local hydrological behavior when combined with unfavorable soil and slope conditions.

Beyond the local case study, this research contributes to a broader understanding of hydrology by demonstrating a transferable framework that integrates remotely sensed land cover data with simple hydrological modeling in data-deficient regions. This approach provides practical insights for air resource management and spatial planning in coastal areas and rapidly expanding tourism-focused areas, emphasizing the importance of controlling land cover conversion to mitigate increased runoff and flood risk.

5 Recommendations

Based on the research results, controlling land cover changes is a crucial aspect in efforts to reduce the increase in surface runoff in the Komodo District. The local government needs to integrate the results of the hydrological analysis into spatial planning, particularly by limiting the conversion of vegetation in areas with high runoff coefficients and by maintaining water catchment areas and riverbanks. Furthermore, implementing green infrastructure and sustainable drainage systems, such as infiltration wells, biopores, infiltration gardens, and porous pavements, is strongly recommended to increase infiltration and reduce runoff, particularly in urban and densely populated areas. For scientific development, further research is recommended using more comprehensive field hydrological data to enable model calibration, validation, and sensitivity analysis. The use of process-based hydrological models and more comprehensive statistical analysis is also necessary to strengthen the quantitative understanding of the relationship between land cover change and runoff response. Therefore, the approach used in this study can be replicated and developed in other areas with similar characteristics, thereby making a broader contribution to water resources management and sustainable regional development.

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Analysis of Flood Discharge of Wae Mese Watershed, in Labuan Bajo, using the Snyder Hydrograph Synthetic and Soil Conservation Service Curve Number Unit Hydrograph

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Abstract. The Wae Mese River is one of the major rivers in the Labuan Bajo area, West Manggarai Regency, and plays an important role in supporting local community activities and the regional hydrological system. Historical flood records indicate that the region experienced extreme rainfall events on March 7, 2019, and December 31, 2021, which caused inundation in several villages within the Wae Mese Watershed (DAS) and resulted in significant material losses. These events highlight the need for a more accurate hydrological analysis better to understand the watershed's response to extreme rainfall and to support future flood mitigation efforts. This study aims to analyze flood discharge in the Wae Mese River using the Soil Conservation Service Curve Number (SCS-CN) method to estimate effective rainfall based on land-use, soil type, and hydrologic soil-group characteristics. The estimated effective rainfall was then transformed into a flood hydrograph using the SCS Unit Hydrograph approach, and the rainfall–runoff processes were simulated using the Hydrologic Engineering Center–Hydrologic Modeling System (HEC-HMS). The results indicate that flood discharge characteristics, including peak discharge, time to peak, and runoff volume, are strongly influenced by watershed physical conditions and rainfall intensity. The findings provide important insight into the hydrological response of the Wae Mese Watershed to extreme rainfall events and are expected to serve as a valuable reference for flood control planning, watershed management, and hydrometeorological disaster mitigation in the study area.

Keywords: Wae Mese Watershed, Flood, GPM, SCS-CN, mitigation.

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1. Introduction

Flooding is one of the most frequent hydrological disasters occurring in many regions, particularly in watersheds characterized by complex topography, intense rainfall, and dynamic land-use changes [1]. Flood events occur when excessive surface runoff exceeds the capacity of natural river channels or man-made drainage systems, leading to the inundation of surrounding areas [2]. Such events pose significant hazards, including damage to infrastructure, disruption of socio-economic activities, loss of agricultural land, and increased risks to human safety and public health [3].

In recent decades, the frequency and magnitude of flood events have increased due to a combination of factors, such as land-use change, deforestation, urban expansion, and the intensification of extreme rainfall events associated with climate variability [4][5]. These changes alter watershed hydrological responses by reducing infiltration capacity, increasing surface runoff, and accelerating flow concentration, particularly in small to medium-sized watersheds with rapid response times.

This condition is also evident in the Wae Mese Watershed (DAS Wae Mese), located in West Manggarai Regency, Indonesia. The watershed plays a crucial role in supporting local communities, agricultural activities, and regional infrastructure, yet it is increasingly vulnerable to flooding due to geomorphological features and changing land-use patterns. In 2019, a major flood caused significant infrastructure damage, disrupted community activities, and led to substantial economic losses. Despite the severity of this event, hydrological studies in the Wae Mese Watershed remain limited, especially studies that quantitatively assess flood discharge generation under extreme rainfall conditions [4].

Reliable flood discharge estimation is essential for hydraulic structure design, flood risk mitigation, and sustainable water resources management. However, many watersheds in developing regions, including Wae Mese, are characterized by limited or incomplete discharge observation data. This data scarcity introduces significant uncertainty in flood analysis and often constrains the application of physically based hydrological models [6]. Consequently, there is a need for robust yet practical approaches that can effectively estimate flood discharge using limited available data.

One of the most widely applied methods in data-scarce watersheds is the Soil Conservation Service Curve Number (SCS-CN) method, which estimates effective rainfall based on land use, soil hydrologic groups, and antecedent moisture conditions. The effective rainfall is subsequently transformed into a flood hydrograph using the SCS Unit Hydrograph,

allowing flood discharge simulation with relatively simple input requirements [7]. While the SCS-CN method has been extensively applied worldwide, its performance is highly dependent on watershed characteristics and the quality of input data, particularly in tropical regions with high rainfall variability [8]

The scientific novelty of this study lies in the systematic application of the SCS-CN method to evaluate flood discharge in a data-scarce tropical watershed by integrating corrected satellite rainfall data [9] and detailed land-use information to represent spatial hydrological variability. Unlike many previous studies that apply the SCS-CN method in a purely deterministic manner, this study emphasizes a focused analysis of watershed response during an extreme flood event, highlighting the sensitivity of flood discharge to land-use characteristics and runoff parameters. Furthermore, the study provides a localized hydrological interpretation of flood generation mechanisms in the Wae Mese Watershed, which remains underrepresented in the existing literature.

By analyzing the 2019 flood event using this approach, the study contributes new insights into flood discharge estimation in ungauged or poorly gauged tropical watersheds. The findings are expected to support flood-control infrastructure planning, improve flood risk assessment, and provide a methodological reference for similar watersheds facing data limitations and increasing flood hazards.

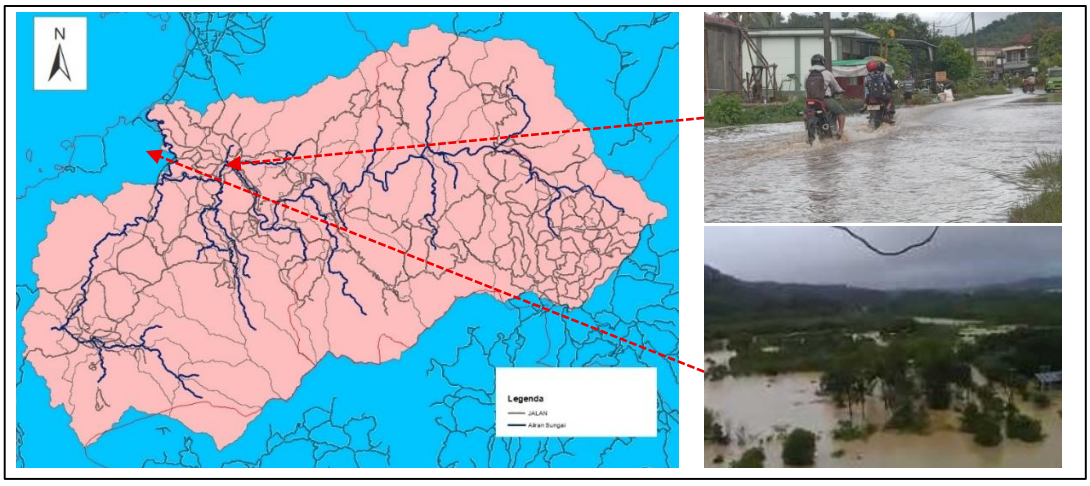

Figure 1. Wae Mese Watershed and 2019 flood events

2. Methods

This study was conducted by collecting annual maximum rainfall data, topographic maps, land-use/land-cover (LULC) data, soil characteristics, and watershed morphometric parameters of the Wae Mese Watershed. Rainfall data were processed to develop an annual maximum rainfall series, which was then analyzed using several probability distribution models, including Gumbel, Log-Normal, and Log Pearson Type III distributions, to estimate design rainfall for various return periods [10]. The most appropriate distribution was selected based on goodness-of-fit tests, such as the Chi-Square and Kolmogorov–Smirnov tests. The selected design rainfall values were subsequently transformed into rainfall intensity using the Intensity–Duration–Frequency (IDF) curve corresponding to the watershed's time of concentration.

Flood discharge analysis was carried out using a rainfall–runoff modeling approach implemented in the Hydrologic Engineering Center–Hydrologic Modeling System (HEC-HMS). The effective rainfall was estimated using the Soil Conservation Service Curve Number (SCS-CN) method, which accounts for the influence of land use, soil hydrologic group, and antecedent moisture conditions on runoff generation [11]. Curve Number (CN) values were assigned based on the interpretation of LULC maps and soil data within the watershed [12]. The estimated effective rainfall was then transformed into a flood hydrograph using the SCS Unit Hydrograph method within the HEC-HMS framework. The resulting hydrograph provides key flood characteristics, including peak discharge, time to peak, and runoff volume, which are used to evaluate the watershed's flood response and potential flood occurrence under different rainfall scenarios [13].

Due to the absence of observed river discharge measurements at the study location, model calibration and validation against measured flow data could not be performed. Instead, parameter adjustment was limited to the assignment of Curve Number values based on established references and standard guidelines corresponding to the existing land-use/land-cover conditions in the Wae Mese Watershed. This approach is commonly adopted in ungauged or poorly gauged watersheds and allows for a reasonable estimation of flood discharge under data-scarce conditions, while acknowledging inherent uncertainties [14]. For clarity, the overall research procedure is summarized in a flowchart, as illustrated in Figure 2, which outlines the main stages of data collection, rainfall analysis, runoff estimation, hydrological modeling using HEC-HMS, and flood hydrograph analysis.

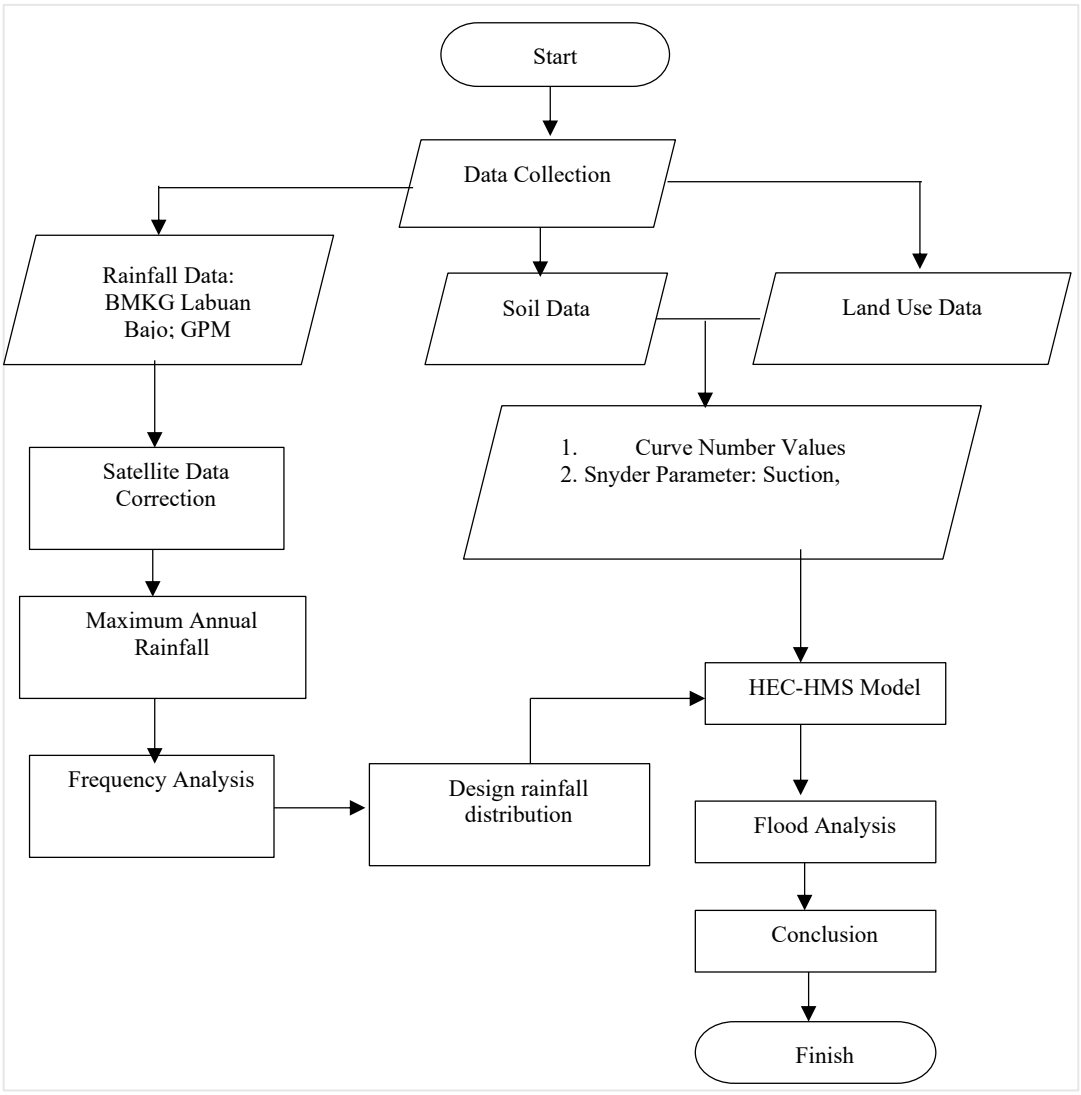

Figure 2. Research Procedure

2.1 Data Analysis

2.2 Rainfall Frequency Analysis

Rainfall frequency analysis is a crucial step in hydrology to estimate the probability of occurrence of extreme rainfall events and to support flood risk assessment. This analysis uses statistical probability distributions to describe the variability and recurrence of rainfall over time. In these case, the rainfall frequency analysis

1. The Gumbel distribution, also known as the Extreme Value Type I distribution, is widely used to model annual maximum rainfall or flood events. Its cumulative distribution function (CDF) is expressed as:

$$F(x) = exp\left[-exp\left(\frac{x-\mu}{\beta}\right)\right]$$

Where x is rainfall amount, μ is the location parameer, and β is the scale parameter. This distribution is suitable for extreme values because it emphasizes the tail of the distribution, representing rare, high-magnitude rainfall events. The return period T (years) is calculated using:

$$T = \frac{1}{1-F(x)}$$

2. Normal Distribution
The Normal (Gaussian) distribution is often used for long-term average rainfall or moderately extreme events. Its probability density function (PDF) is defined as:

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} exp\left[-\frac{(x-\mu)^2}{2\sigma^2}\right]$$

where μ is the mean and σ is the standard deviation. Although coommonly usued, the Normal distribution may underestimate extreme rainfall due to its symmetry, which does not reflect the skewness typical in hydrological data.

3. The Log-Pearson Type III (LP-III) distribution is one of the most widely used methods for flood and rainfall frequency analysis, particularly in the United States. In this method, the logarithms of rainfall data are assumed to follow a Pearson Type III distribution. The frequency factor K is determined based on the skewness coefficient (G) of the log-transformed data. The log pearson II equation is:

$$\log xT = \bar{x} + K \times Sx$$

where:

logXT : logarithm of rainfall for return period T
$\bar{x}$: mean of log-transformed rainfall

sx : standard deviation of log-transformed rainfall
k : frequency factordependnt on T and skewness G

This distribution is effective for skewed hydrological data and is commonly recommended in flood frequency guidelines.

4. In the Log-Normal distribution, rainfall values are assumed to follow a Normal distribution after logarithmic transformation. The probability density function for the log-transformed variable

2.3 SCS Curve Number (SCS-CN) Method

The SCS Curve Number method, developed by the U.S. Soil Conservation Service (now the Natural Resources Conservation Service, NRCS), is widely used to estimate direct runoff from rainfall events [15]. This method applies a rainfall–runoff relationship based on land use, soil type, hydrologic soil group, and antecedent moisture condition. The Curve Number (CN) value represents the runoff potential of a watershed, where higher CN values indicate lower infiltration capacity and greater surface runoff potential. Once the effective rainfall is determined, it can be transformed into a flood hydrograph using the SCS dimensionless unit hydrograph, which provides a standardized hydrograph shape that can be scaled according to watershed characteristics. The SCS-CN method is widely applied due to its simplicity, adaptability, and the availability of standardized CN tables for various land-use and soil conditions [15] [16].

HEC-HMS was selected because it allows the integration of rainfall data, watershed characteristics, and runoff transformation methods within a single modeling framework. Within the HEC-HMS environment, the SCS Curve Number method was implemented as the loss model to estimate rainfall losses, while the SCS Unit Hydrograph was used as the transform method to generate direct runoff hydrographs. Key watershed parameters, including Curve Number (CN), initial abstraction, basin area, and lag time, were defined based on land-use maps, soil data, and watershed morphometric characteristics.

1. Potential maximum soil moisture retention after runoff begins is calculated as:

$$S = 25400/CN-254$$

where:
S : potential maximum retention (mm)
CN : Curve Number (dimensionless)

2. Initial Abstraction (Ia)

Initial abstraction accounts for losses such as interception, infiltration, and surface storage before runoff begins. It is commonly assumed as:

$$Ia = 0{,}2S$$

3. Direct Runoff (Q)
   The direct runoff depth is calculated using the following equations

$$Q = \frac{(P - 0{,}2S)^2}{P + 0{,}8S}$$

   where:
   Q : direct rainfall depth (mm)
   P : total rainfall depth (mm)

3 Analysis and Result

3.1 Rainfall Frequency

Rainfall frequency analysis was carried out using annual maximum rainfall data obtained from BMKG Labuan Bajo rain gauge observations and Global Precipitation Measurement (GPM) satellite data for the period 2001–2025. The use of both ground-based and satellite-derived rainfall data was intended to improve data reliability and spatial coverage, particularly in areas with limited rain gauge availability.

Prior to analysis, both rainfall datasets were compiled and subjected to consistency and quality control checks. To evaluate the reliability of the GPM satellite rainfall data, a satellite rainfall performance assessment was conducted by comparing satellite-derived rainfall with observed rain gauge data. Statistical indicators such as correlation coefficient, bias, and error magnitude were used to assess the agreement between satellite and ground-based rainfall records. Based on this evaluation, the satellite rainfall data were corrected using an appropriate adjustment factor to reduce systematic bias and improve its representativeness for local rainfall conditions.

After the data evaluation and correction process, the annual maximum rainfall series was derived from the adjusted rainfall data and used as the basis for rainfall frequency analysis. Design rainfall values for selected return periods were then estimated from the annual maximum series. The results of the rainfall frequency analysis are presented graphically, as shown in Figure 3, and subsequently used as input for hydrological modeling and flood discharge estimation in the study area.

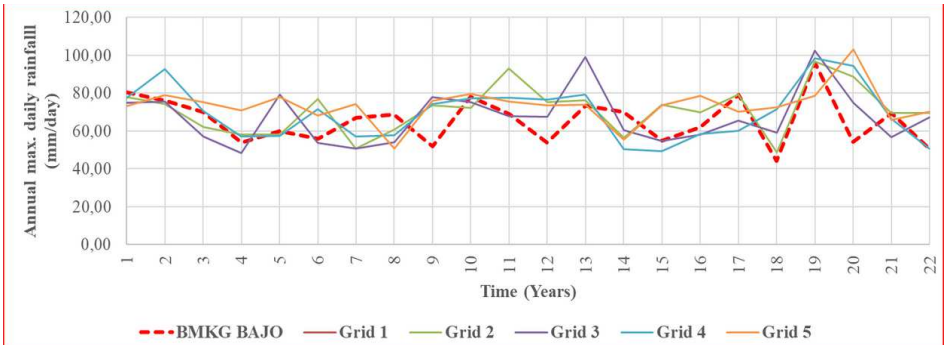

Figure 3. Annual maximum rainfall data (years)

Based on the rainfall data presented in the table above, rainfall frequency analysis was conducted using several probability distributions, including the Gumbel, Normal, Log-Normal, and Log-Pearson Type III distributions. The suitability of each distribution was evaluated using goodness-of-fit tests, namely the Chi-Square test and the Kolmogorov–Smirnov (D) test.

The results of the goodness-of-fit analysis indicate that the Log-Pearson Type III distribution produced the smallest error values in both the Chi-Square and Kolmogorov–Smirnov tests. Therefore, the Log-Pearson Type III distribution was selected as the most appropriate distribution for estimating design rainfall at the study location and was subsequently used in the design rainfall analysis.

Table 1. Return Period Analysis

Return Period (years)	Grid 1	Grid 2	Grid 3	Grid 4	Grid 5	Area Rainfall (mm)
2	70,2	71,2	61,6	65,2	67,5	67,7
5	78,6	79,8	71,1	71,9	77,3	75,8
10	89,2	89,3	84	81,5	86,8	86
25	101,9	99,3	102,2	93,4	97,2	98,1

3.2 Duration and Distribution Rainfall Design

Duration analysis was carried out by collecting data on temporal extreme rainfall events derived from rainfall records. Based on the data examination, two types of consecutive rainfall events were identified, with durations of 9 hours and 12 hours. For the 9-hour rainfall events, two events were recorded with rainfall depths exceeding 90 mm. Meanwhile, for the 12-hour rainfall events, there were 11 events with total rainfall depths greater than 85 mm. Based on these events, a suitable rainfall distribution for the Wae Mese Watershed will be determined. The temporal rainfall event curve from GPM data is presented in Figure 4 below.

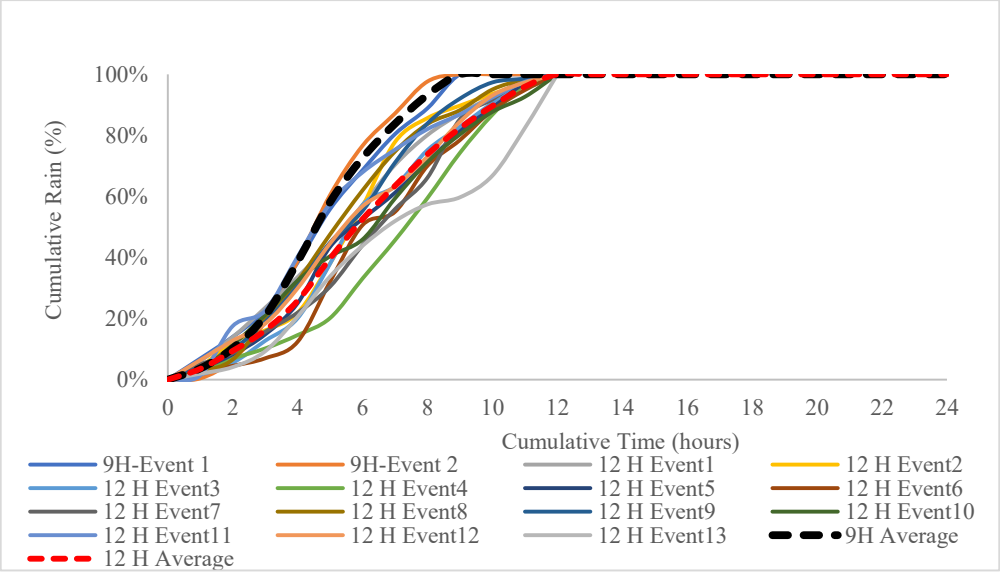

Figure 4. Temporal extreme rainfall events

Based on the rainfall duration curve, the temporal rainfall distribution in the Wae Mese Watershed was determined using hourly rainfall percentages derived from the previously analyzed design rainfall. The analysis indicates that extreme rainfall events predominantly occur with durations of 9 and 12 hours. The 9-hour distribution shows a higher peak rainfall (22.6%) compared to the 12-hour distribution (13%). Therefore, to represent extreme rainfall conditions in flood modeling, a 9-hour rainfall duration was selected. The rainfall intensity graphs are presented in Figures 5 and 6.

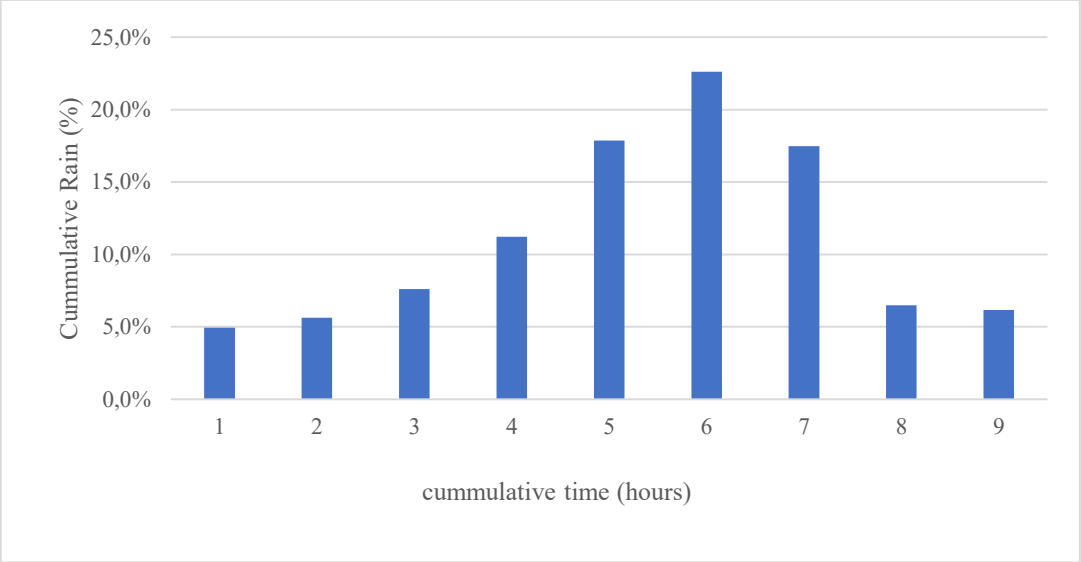

Figure 5. Temporal extreme rainfall distribution percentage

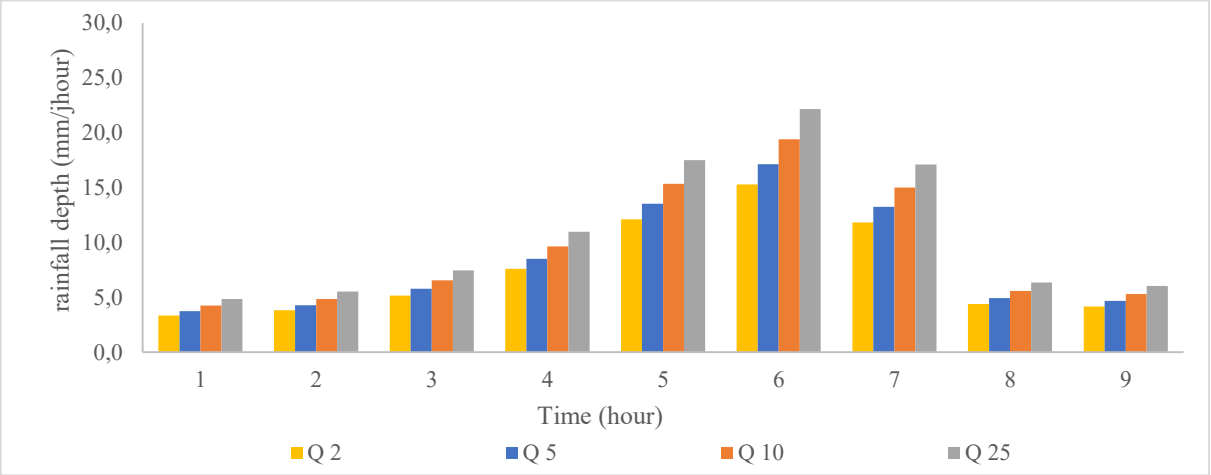

Figure 6. Rainfall distribution in Wae Mese Watershed

3.3 Hydrograph Analysis

The SCS Unit Hydrograph method was applied by incorporating watershed characteristics such as land use, soil type, and hydrologic soil group, which were represented through the

Curve Number (CN) value. Effective rainfall was estimated using the SCS-CN approach and subsequently transformed into a flood hydrograph based on the watershed time of concentration. The hydrological analysis and runoff simulation were conducted using the Hydrologic Engineering Center–Hydrologic Modeling System (HEC-HMS), which provides an integrated framework for rainfall–runoff modeling. Within the HEC-HMS environment, the SCS Curve Number method was employed as the loss model, the SCS Unit Hydrograph was used as the transform method, and appropriate basin parameters, including lag time, initial abstraction, and basin area, were defined based on watershed characteristics The SCS Unit Hydrograph method was used by incorporating watershed characteristics such as land use, soil type, and hydrologic soil group, which were represented through the Curve Number (CN) value.

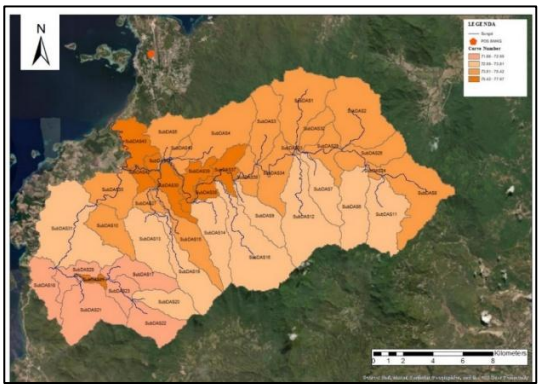

Figure 7. Wae Mese Sub Basins

Table 2. Curve Number Values

	Soil Type	
Land Use/Land Cover (LULC)	**C**	**D**
Forest/Woodland	73	74
Open Land	79	81
Grassland	71	74
Residential/Bulit-up Area	74	77
River and Wetland	100	100
Irigation	73	78

Flood discharge modeling in the Wae Mese Watershed, Labuan Bajo, was conducted using the HEC-HMS hydrological modeling system, based on hydrological parameters derived from two rainfall–runoff events that had been previously analyzed. Using the available rainfall intensity data, the modeling covered various flood discharge return periods. Flood

discharge modeling for different return periods was carried out by considering the average characteristics of specific flood events, based on rainfall intensity or runoff volume. In this study, flood discharges corresponding to return periods ranging from 2 to 25 years were applied. The resulting flood discharge values represent the flood behavior of the Wae Mese Watershed and provide important input for flood mitigation and hydraulic structure planning.

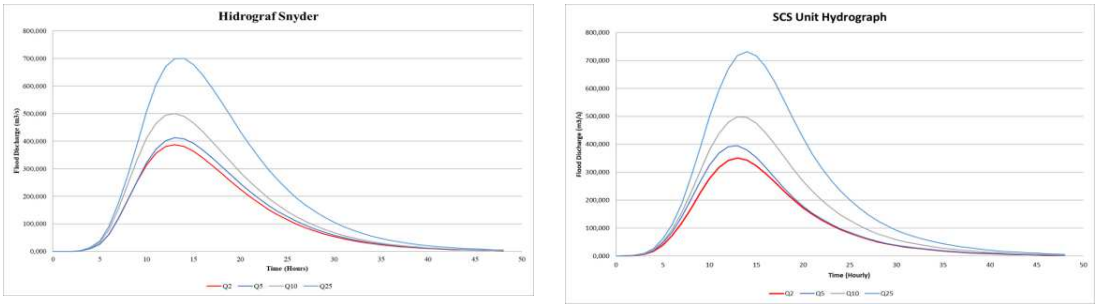

Figure 8. Compassion of scs-cn and snyder flood discharge (m^3/s)

3.4 Conclusion

Based on the flood hydrograph analysis of the Wae Mese Watershed using the Soil Conservation Service (SCS) methods, it can be concluded that the hydrological response of the watershed is characterized by increasing peak discharge with higher rainfall return periods. This finding confirms the direct relationship between extreme rainfall intensity and runoff generation within the watershed.
The flood hydrographs generated using the SCS Curve Number (SCS-CN) approaches indicate that land use, soil characteristics, and infiltration capacity play a significant role in controlling runoff processes. The results show that higher return periods produce greater peak discharges and larger runoff volumes, reflecting the watershed's sensitivity to extreme rainfall events.

Overall, the Wae Mese Watershed exhibits a moderate to high runoff potential during extreme rainfall conditions. The SCS-based approach provides reliable results and can be effectively applied as a basis for flood discharge estimation, watershed management planning, and flood mitigation strategies in the study area.

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Comparison of C_N Values between SNI 4153:2008 with Other Methods in Standard Penetration Test

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Abstract. This study investigates the variability of overburden pressure correction factors (C_N) derived from SNI 4153:2008 and six widely used international methods based on Standard Penetration Test (SPT) data obtained from three investigation points. The objective is to evaluate how differences in C_N values influence bearing capacity and settlement analyses for building foundations. The results reveal substantial variation among the correction methods, with C_N values increasing from Peck et al. (1975) to Liao and Whitman (1986). The SNI 4153:2008 method consistently produces moderate C_N values, positioned between conservative and aggressive correction schemes. Higher C_N values lead to increased estimated bearing capacity but tend to underestimate soil settlement due to overestimation of stiffness. Conversely, lower C_N values yield more conservative bearing capacity and larger settlement predictions. The findings demonstrate that SNI 4153:2008 provides a balanced correction approach, producing reliable bearing capacity estimates while maintaining realistic settlement predictions. This balance supports its applicability as a national standard aligned with contemporary international geotechnical design practice

Keywords: Correction N values; standard penetration test; bearing capacity; settlement analysis; SNI 4153:2008.

1 Introduction

Civil engineering infrastructure design must begin with soil investigation work, both soil as construction material and soil as the final foundation. Soil as the final foundation of civil engineering buildings must have a reliable bearing capacity and subsidence that does not cause the building to collapse, such as buildings, highways, railways, bridges, dams, terminals, seaports, and airport runways (Das BM, 2019). The bearing capacity and settlement of the soil due to the construction of deep and shallow foundations must meet certain limit requirements so that the pressure that occurs does not exceed the allowable pressure of the soil at the base of the foundation (Pratama RT, 2021). The Standard Penetration Test (SPT) is a widely utilized field test for assessing soil engineering properties and evaluating geotechnical risks, such as soil liquefaction potential (Thakur IC, 2022 Dec 15)

Soil data for designing deep and shallow foundations can be obtained through laboratory and field tests. Laboratory tests include soil physical properties, such as water content (w,%), specific gravity (Gs), grain size distribution, liquid limit, plastic limit, shrinkage limit, unit weight, and engineering properties, such as shear strength (c and φ), compressibility, such as void ratio (e) preconsolidation pressure, (pc), compaction (maximum dry density and w

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optimimum), abrasion, California Bearing Ratio (CBR), and Unconfined Compression Test (UCT). In situ tests such as Standard Penetration Test (SPT), Cone Penetration Test (CPT), Pressuremeter Test (PMT), Vane Shear Test (VST), Dynamic Penetration Test (DCP), LWD (Light Deflectometer Test), Plate Load Test (PLT). The field soil investigation method used depends on design needs, field conditions, and availability of testing equipment [, 6], [7], [8].

One of the most widely used field soil investigation methods is the Standard Penetration Test. Several reasons can be put forward, namely easy to mobilize, affordable costs, easy to operate, and more importantly, SPT test data can be used to meet various design needs [9]. Field data obtained through SPT includes the depth of the soil layer, the N-SPT value of the spade field at a depth of 45 centimeters for every 15 centimeters, disturbed soil samples for laboratory testing [3] , [4]

The N-SPT field data obtained is not directly used for designing building foundations. The N-SPT value is first corrected for the hammer energy (C_E), rope length (C_R), borehole diameter (C_B), and split spoon sampler or split barrel sampler (C_S) so that the field N data becomes N_{60}. Effective overburden pressure plays a major role in calculating the corrected N value (C_N) to obtain the value $(N_1)_{60}$ (Yusof NQ, 2018).The methods often used to calculate the correction factor (C_N) to obtain the value $(N_1)_{60}$, namely the Liao & Whitman (1986), Skempton (1986), Tokimatsu & Yoshimi (1983), Seed et al (1974), Peck et al (1975), Bazaraa (1967) method based on soil research (Victoria LC, 2020) and SNI 4153:2008 [7]

This research was conducted with the aim of comparing the C_N value of soil at the location of the Civil Engineering Laboratory Building Construction of the Catholic University of Indonesia, Santu Paulus Ruteng between SNI 4153:2008 and the Liao & Whitman (1986), Skempton (1986), Tokimatsu & Yoshimi (1983), Seed et al (1974), Peck et al (1975), Bazaraa (1967) methods based on SPT and how the variation in CN value affects the analysis of bearing capacity and soil settlement due to building foundations.

2. Methodology

This research was conducted at the location of the Civil Engineering Laboratory Building Construction of the Catholic University of Indonesia, Santu Paulus Ruteng, at 3 points as shown in Figure 1.

Fig 1. Site research (S: $8^0$36’49.56 E: $120^0$28’13.356)

2.1. Research process

Field testing using SPT equipment is the initial stage carried out to obtain the N_{field} or N_M. The value in question is corrected against the length of the rope, hammer, diameter of the split spoon sampler to obtain the N_{60} value, then a correlation is carried out to obtain the value of the soil unit weight and overburden pressure. The N_{60} value needs to be corrected according to the formula SNI 4153:2008, Skempton (1986), Peck et al (1974), Tokimatsu & Yoshimi (1983), Seed et al (1975), Bazaraa (1967), and Liao & Whitman (1986) to obtain the corrected N (C_N) value and then compare it. For more details, see the flowchart in Figure 2.

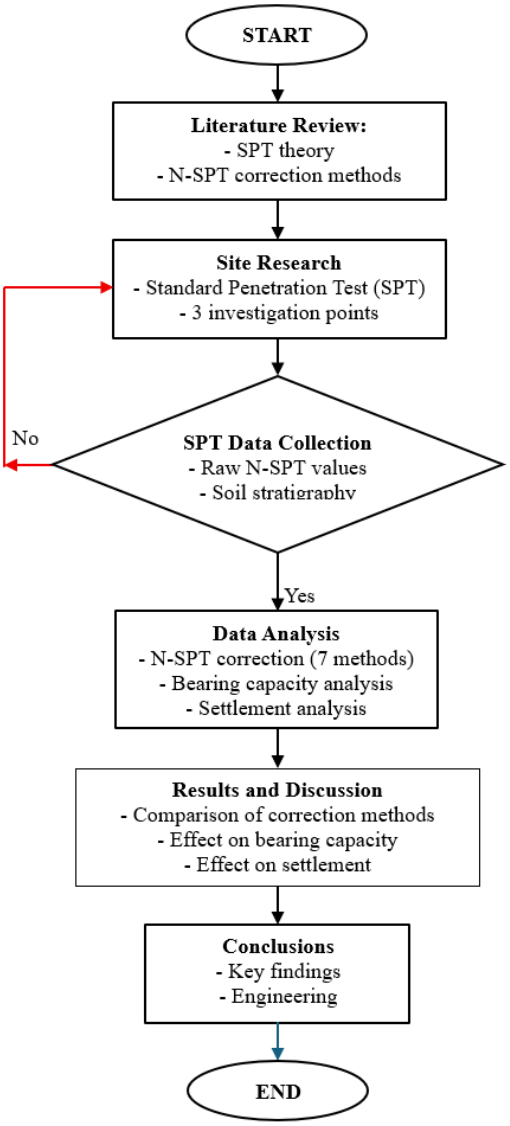


Fig 2. Research flowchart

The study began with a literature review aimed at synthesizing established theories, design standards, and recent research related to the Standard Penetration Test (SPT). Particular emphasis was placed on commonly used N-SPT correction methods and their application in evaluating bearing capacity and soil settlement. This stage provided the conceptual framework and identified research gaps addressed in the present study.

The next stage involved site research, which focused on acquiring in-situ soil data through field investigations. Standard Penetration Tests were conducted at three selected locations to capture the variability of subsurface conditions across the study area. These test locations were determined based on site accessibility and the representativeness of soil strata. Following field investigations, SPT data collection was carried out by compiling raw N-SPT values, soil stratification, and groundwater level information. These parameters served as the primary input data for subsequent analyses and ensured consistency in data processing across different correction methods.

The Standard Penetration Test (SPT) was performed at three investigation points to achieve a balance between geotechnical reliability and practical constraints of field investigation. The selection of three test locations is consistent with common geotechnical investigation standards for small to medium-scale construction projects, where lateral soil variability is expected to be limited. These points were positioned to capture representative subsurface conditions by considering site geometry and structural load distribution. The resulting SPT data provide a sufficient basis for evaluating soil stratigraphy and engineering properties. Therefore, the three-point SPT layout can be considered statistically and spatially representative for foundation capacity and settlement analyses.

In the data analysis stage, raw N-SPT values were adjusted using seven different correction methods to obtain corrected N (C_N) values. Variations in C_N values influence the estimation of soil shear strength and deformation characteristics. Higher C_N values generally lead to higher calculated bearing capacity and lower predicted settlement, while lower C_N values result in more conservative bearing capacity estimates and increased settlement predictions. This stage evaluated the sensitivity of bearing capacity and settlement analyses to changes in C_N values and highlights the engineering significance of selecting appropriate correction methods.

Finally, the results and discussion stage presented a comparative assessment of bearing capacity and settlement outcomes derived from each correction method. The conclusions summarize key findings, emphasize the impact of C_N variation on foundation performance, and provide recommendations for geotechnical design practice and future research.

2.2. Overview of SPT apparatus and testing procedures

The SPT equipment used is manual SPT, with equipment parts including a tripod, rod with a length of 12 meters, hammer weight 63.50 kg, split spoon sampler diameter 50 mm (60 mm borehole diameter), and anvil, as seen in Figure 3. The testing procedure is based on the provisions of ASTM D1586 and SNI 4153:2008, namely at every change in soil layers or at intervals of approximately 1.50 m to 2.00 m or as required. Pull the hammer strap until it reaches the mark that has been made (approximately 76 cm), then freely drop a load of 63.50 kg until it hits the load holder on the conductor rod. Repeat the pounding until the first 15 cm penetration (N_1), the second 15 cm (N_2), and the third 15 cm (N_3) are achieved. The number of strokes

counted is $N_2 + N_3$. The N_1 value is not taken into account because it is still dirty from drilling; If the N value is greater than 50 strokes, stop the test and increase the test to a minimum of 6 meters.

2.3. N-SPT calculation

Calculation of field N value, N_{60}, soil unit weight, effective overburden pressure, N value correction factor (C_N) and soil profile depiction using Microsoft Excel 2010 media based on the following formulas [17], [18], [19], [20], [21], [22], [23]:

$$N_{field} = N_M = N_2 + N_3 \quad \text{..... (1)}$$

Where:
N_M : Measured N or N field
N_2 : N value for the second 15 cm
N_3 : N value for the third 15 cm.

$$N_{60} = \frac{N_M . E_H . C_B . C_S . C_R}{60} \quad \text{..... (2)}$$

Where:
N_{60} : 60% N_{field} (N_M)
N_M : Measured N
E_H : Hammer energy efficiency
C_B : Borehole diameter correction factor
C_S : Split spoon sampler correction factor
C_R : Rod length correction factor

Submerged unit weight, $\gamma_{submerged}$ (kN/m^3):

$$\gamma_{submerged} = 8.8 + 0.01 N_{60} \text{ (kN/m}^3\text{)} \quad \text{..... (3)}$$

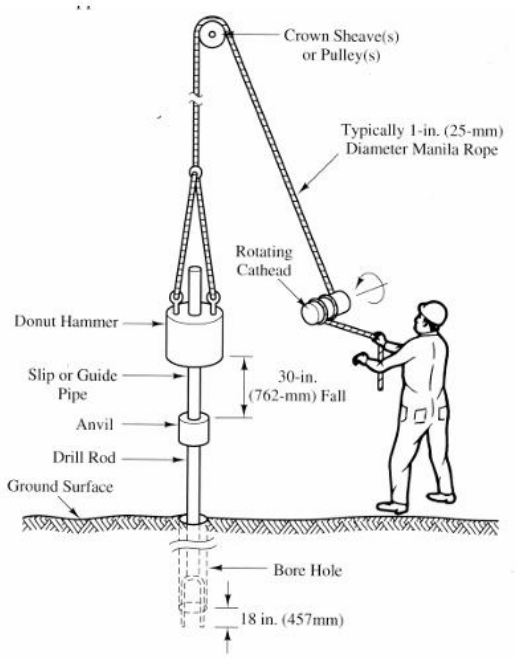


Fig 3. SPT equipment (ASTM D1586) & SNI 4153:2008

2.4 The effecetive overburden pressure, σ'_v

$$\sigma'_v = \gamma_{submerged}{}'.z \quad \text{.....} \quad (4)$$

Where z = 0.45 m.

$(N_1)_{60}$ and C_N

$$(N_1)_{60} = N_{60}.C_N \quad \text{.....} \quad (5)$$

SNI 4153:2008:

$$C_N = \frac{2.2}{\left(1.2 + \left(\frac{\sigma'_v}{p_a}\right)\right)} \quad \text{.....} \quad (6)$$

Where:

$(N_1)_{60}$: corrected SPT value about energy efficiency 60%

C_N : correction factor due to effective overburden pressure

σ'_v : effective overburden pressure (kPa)

p_a : athmospheric pressure 100 kPa

Skempton (1986):

$$C_N = \frac{2}{1+\left(\frac{\sigma'_v}{p_a}\right)}$$ (for normally consolidated sand) ……..……....……. (7)

Peck et al (1974):

$$C_N = 0.77\log\left(\frac{20}{\left(\frac{\sigma'_v}{p_a}\right)}\right)$$ ……..…….…..….. (8)

Tokimatsu & Yoshimi (1983):

$$C_N = \frac{1.7}{0.7+\left(\frac{\sigma'_v}{p_a}\right)}$$ …….……..…….....…… (9)

Seed et al (1975):

$$C_N = 1 - 1.25\log\left(\frac{\sigma'_v}{p_a}\right)$$ ……..…….....… (10)

Bazaraa (1967):

$$C_N = \frac{4}{1+4\left(\frac{\sigma'_v}{p_a}\right)}$$ …….…....…… (11)

Liao & Whitman (1986) [24]:

$$C_N = \left[\frac{1}{\left(\frac{\sigma'_v}{p_a}\right)}\right]^{0.5}$$ ……...……. (12)

Hammer energy efficiency (E_H) can be seen in Table 1 and borehole diameter (C_B), split spoon sampler (C_S), and rod length correction factor (C_R) in Table 2.

Table 1. SPT Hammer Efficiency [25], [26], [27]

Hammer Type	Hammer Release Mechanism	Efficiency, E_H
Automatic	Trip	0.70
Donut	Hand dropped	0.60
Donut	Cathead + 2 turns	0.50

Safety	Cathead + 2 turns	0.55 – 0.60
Drop/Pin	Hand dropped	0.45

Table 2. Borehole, Sampler, and Rod Correction Factor [25], [26], [27]

Factor	Equipment Variables	Correction Factor
Borehole diameter, C_B	65 – 115 mm	1.00
	150 mm	1.05
	200 mm	1.15
Split Spoon Sampler Correction, C_S	Standard Sampler	1.00
	Sampler without liner (not recommended)	1.20
Rod Length Correction, C_R	3 – 4 m	0.75
	4 – 6 m	0.85
	6 – 10 m	0.95
	'> 10 m	1.00

2.5. Research novelty

This research offers novelty through a comparative analysis of corrected N-SPT (CN) values obtained from the application of seven different correction methods and their effects on geotechnical parameters. In foundation design practice, the selection of an N-SPT correction method is often made without considering the resulting variations in results. This study systematically examines the differences in C_N values produced by each correction method and their implications for soil characteristics. This approach allows for identification of the sensitivity of soil parameters to the correction method used. Thus, this research makes a novel contribution to clarifying uncertainties that have been under-recognized in the use of SPT data.

The next novelty lies in the evaluation of the impact of variations in C_N values on the results of the analysis of bearing capacity and soil settlement due to building foundation loads. Each corrected C_N value is used as the basis for calculating bearing capacity and estimating soil settlement, so that differences in design results can be analyzed quantitatively. The results of this study indicate that the choice of correction method has a significant impact on the safety and efficiency of foundation planning. This research is expected to serve as a reference in determining the N-SPT value correction method that best suits soil conditions and design needs.

3. Result and Discussion

3.1 N field

Soil investigations using SPT were carried out at 3 points (sites), namely Site 1 (S1), Site 2 (S2), and Site 3 (S3). The N measurement data ($N_{fielsd} = N_M$) and the results of the correction to the hammer energy (N_{60}) based on Formula Number (2) are read in Table 3.

Table 3. N_M and N_{60} S1, S2, S3

Depth (m)	N_M			N_{60}		
	S1	S2	S3	S1	S2	S3
0.00	0	0	0	0	0	0
0.45	5	6	4	5	6	4
0.90	10	6	6	10	6	6

1.35	15	8	5	15	8	5
1.80	14	12	7	14	12	7
2.25	15	15	9	15	15	9
2.70	18	20	15	18	20	15
3.15	25	28	26	25	28	26
3.60	32	30	33	32	30	33
4.05	24	34	37	24	34	37
4.50	33	30	36	33	30	36
4.95	32	38	38	32	38	38
5.40	22	37	34	22	37	34
5.85	25	29	44	25	29	44
6.30	28	31	45	28	31	45
6.75	35	33	47	35	33	47
7.20	42	36	45	42	36	45
7.65	41	40	47	41	40	47
8.10	43	41	51	43	41	51
8.55	55	52		55	52	-
9.00	66	-		66	-	-

Table 3 details the Standard Penetration Test (SPT) blow counts (NM) and energy-normalized values (N_{60}) at depths of 0.00–9.00 m from three sounding points (S1, S2, S3). The equality between NM and N_{60} indicates effective correction factors applied during testing, confirming standard procedure conditions. The results demonstrate that N-values increase with depth, signifying greater soil density and stiffness due to effective overburden stress. Shallow layers show low N-values (loose soil), while deeper layers have moderate to high N-values (medium-dense to dense soil). Variability in N-values at similar depths suggests lateral heterogeneity, with missing values at greater depths indicating either test refusal or the

maximum investigation depth. Figure 4 illustrates the NM vs. depth relationship.

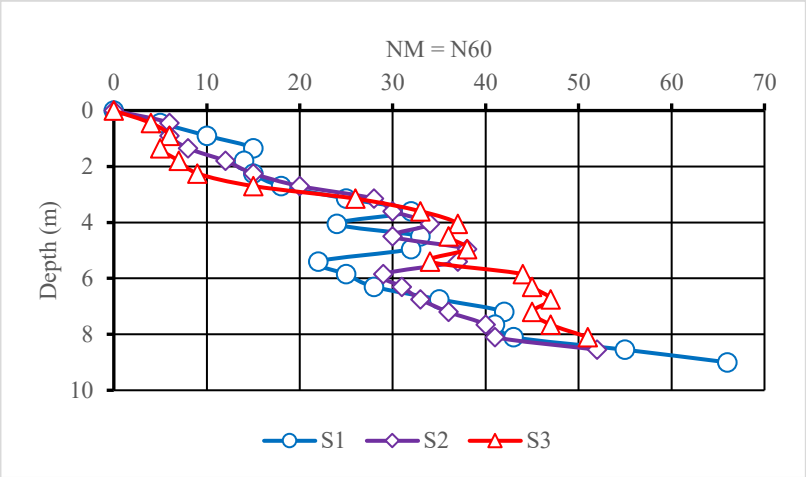


Fig 4. $N_M = N_{60}$ values S1, S2, and S3

Figure 4 illustrates the comparison between measured SPT blow counts (NM) and energy-corrected values (N_{60}) at S1, S2, and S3, showing their curves coinciding at all depths. This indicates the applied correction factors are nearly optimal, confirming near-standard test conditions. The increasing N-values with depth reflect higher soil density and stiffness due to greater effective overburden pressure. Variations in N-values at similar depths highlight lateral subsurface stratigraphy differences. The figure substantiates the reliability of SPT data for subsequent CN correction, bearing capacity assessment, and settlement analysis.

3.2 Submerged unit weight

Based on Formula Number (3), the submeged unit weight is obtained as shown in Table 4.

Table 4. Submerged Unit Weight ($\gamma_{submerged}$)

	$\gamma_{submerged}$ (kN/m^3)		
Depth (m)	S1	S2	S3
0.00	8.80	8.80	8.80
0.45	8.85	8.86	8.84
0.90	8.90	8.86	8.86
1.35	8.95	8.88	8.85
1.80	8.94	8.92	8.87
2.25	8.95	8.95	8.89
2.70	8.98	9.00	8.95
3.15	9.05	9.08	9.06
3.60	9.12	9.10	9.13
4.05	9.04	9.14	9.17

4.50	9.13	9.10	9.16
4.95	9.12	9.18	9.18
5.40	9.02	9.17	9.14
5.85	9.05	9.09	9.24
6.30	9.08	9.11	9.25
6.75	9.15	9.13	9.27
7.20	9.22	9.16	9.25
7.65	9.21	9.20	9.27
8.10	9.23	9.21	9.31
8.55	9.35	9.32	-
9.00	9.46	-	-

The submerged unit weight (γ′) is crucial for analyzing bearing capacity and soil settlement in foundation design. Its increase with depth points to higher effective stress, enhancing soil shear strength and bearing capacity, particularly for shallow foundations in saturated conditions. The γ′ profile is vital for calculating effective vertical stress and stress distribution, where higher values at greater depths indicate denser soils with lower compressibility, reducing settlement potential. In contrast, lower γ′ values in shallow layers may lead to more significant settlement. Therefore, accurately estimating γ′ with depth is essential for predicting foundation performance, ensuring safety and serviceability in civil engineering.

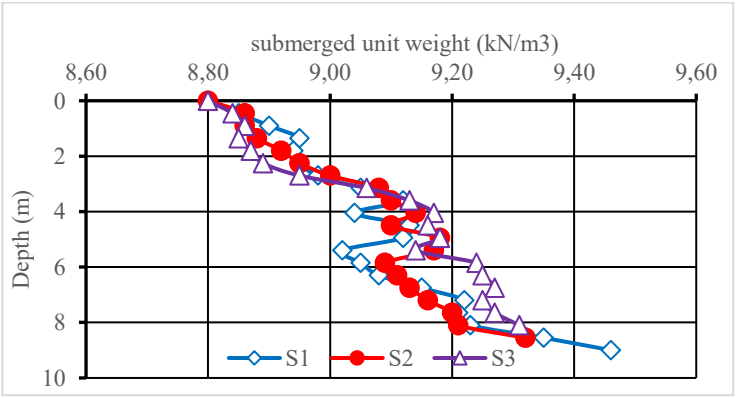


Fig 5. Submerged unit weight values S1, S2, and S3

Figure 5 illustrates the variation of submerged unit weight (γ′) with depth for locations S1, S2, and S3, showing an upward trend in γ′ values from the surface to deeper layers. This indicates an increase in effective overburden stress and soil density with depth, where near-surface layers are characterized by lower γ′ values typical of looser saturated soils, while deeper layers exhibit higher γ′ values linked to denser soil strata. Minor differences in γ′ profiles among the locations highlight natural lateral heterogeneity in soil composition. Overall, the similarity of these curves suggests comparable subsurface conditions, confirming the γ′ distribution

necessary for effective stress calculations vital for estimating bearing capacity and analyzing settlement in foundation engineering design.

3.3. Effective overburden pressure

The effective overburden pressure is calculated according to Formula Number (4) and the results are shown in Table 5.

Table 5. Effective overburden pressure per layer

	σ'_v = po' (kPa)		
Depth (m)	S1	S2	S3
0.00	3.96	3.96	3.96
0.45	3.98	3.99	3.98
0.90	4.01	3.99	3.99
1.35	4.03	4.00	3.98
1.80	4.02	4.01	3.99
2.25	4.03	4.03	4.00
2.70	4.04	4.05	4.03
3.15	4.07	4.09	4.08
3.60	4.10	4.10	4.11
4.05	4.07	4.11	4.13
4.50	4.11	4.10	4.12
4.95	4.10	4.13	4.13
5.40	4.06	4.13	4.11
5.85	4.07	4.09	4.16
6.30	4.09	4.10	4.16
6.75	4.12	4.11	4.17
7.20	4.15	4.12	4.16
7.65	4.14	4.14	4.17
8.10	4.15	4.14	4.19
8.55	4.21	4.19	
9.00	4.26		

Table 5 indicates that the effective overburden pressure (p_0') increases with depth at SPT locations S1, S2, and S3, reflecting submerged unit weight under saturated conditions. The similarity in p_0' values suggests uniform stress and limited subsurface stratigraphy variation. In terms of bearing capacity, p_0' signifies the effective stress on foundations, enhancing soil shear strength and resistance through increased confinement. Conversely, in settlement analysis, it influences soil compressibility and stiffness, making accurate determination of p_0' vital for predicting foundation performance.

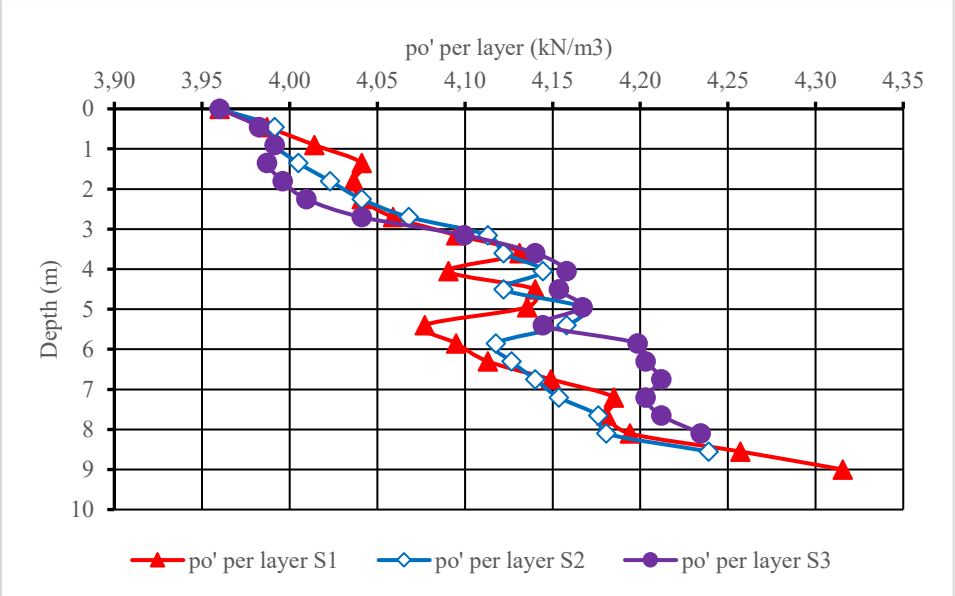


Fig 6. Effective overburden pressure values per layer S1, S2, and S3

Figure 6 illustrates the depth-dependent distribution of effective overburden pressure (p_o') at three investigation points, S1, S2, and S3, showing a nearly linear increase with depth due to the accumulation of submerged unit weight in saturated soil layers. Minor profile differences arise from variations in soil density and stratification, indicating uniform stress conditions across the site. This effective stress profile is crucial for understanding soil strength and compressibility, serving as a foundation for normalizing SPT results and assessing bearing capacity and settlement behavior in building foundations under drained loading conditions.

Table 6. Effective overburden pressure

	$\sigma'_v = po'$ (kPa)		
Depth (m)	S1	S2	S3
0.00	0.00	0.00	0.00
0.45	3.98	3.99	3.98
0.90	7.99	7.97	7.97
1.35	12.02	11.97	11.95
1.80	16.04	15.98	15.94
2.25	20.07	20.01	19.94
2.70	24.11	24.06	23.97
3.15	28.18	28.15	28.04
3.60	32.28	32.24	32.15
4.05	36.35	36.36	36.28

4.50	40.46	40.45	40.40
4.95	44.56	44.58	44.53
5.40	48.62	48.71	48.65
5.85	52.70	52.80	52.80
6.30	56.78	56.90	56.97
6.75	60.90	61.01	61.14
7.20	65.05	65.13	65.30
7.65	69.19	69.27	69.47
8.10	73.35	73.41	73.66
8.55	77.55	77.61	-
9.00	81.81	-	-

Table 6 depicts the cumulative effective vertical overburden pressure (σ′v) as a function of depth for three points, S1, S2, and S3, revealing a near-linear increase from the surface to deeper layers due to submerged unit weight accumulation in saturated soils. The σ′v values are consistent across locations at similar depths, indicating uniform groundwater conditions and soil density, with slight variations at greater depths tied to local soil stratigraphy. This effective stress profile is crucial for understanding soil shear strength, stiffness, and compressibility, and is vital for SPT normalization, bearing capacity analysis, and settlement predictions for foundations. Figure 7 illustrates the increasing σ′v values with depth.

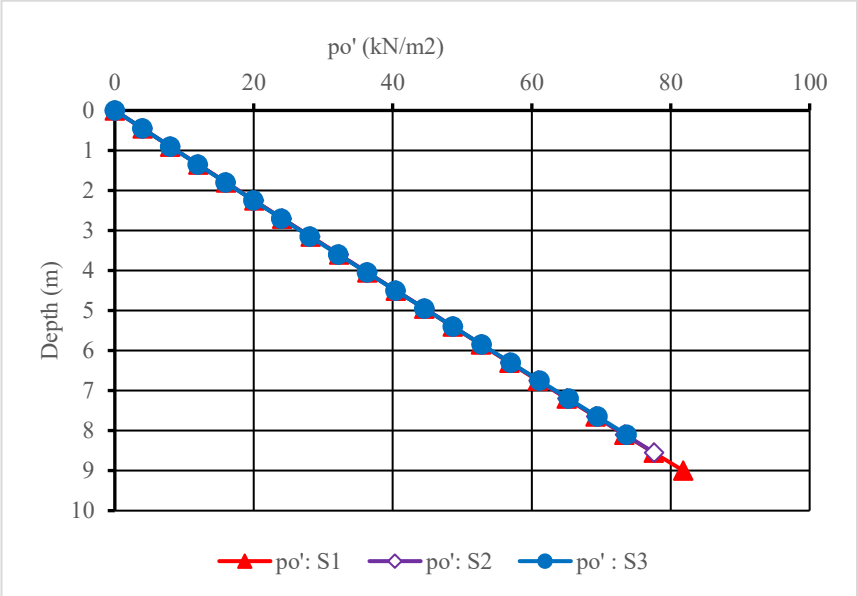


Fig 7. Effective overburden pressure

Figure 7 presents the cumulative effective overburden pressure (p_0') profiles for S1, S2, and S3, showing a nearly linear increase with depth. This trend indicates uniform groundwater conditions and similar soil densities, reflecting effective stress accumulation in saturated soils. This distribution is critical for SPT normalization, bearing capacity, and settlement analyses.

Table 7. Correction Factor (C_N) S1

Depth (m)	C_N						
	Peck et al (1974)	SNI 4153:2008	Skempton (1986)	Seed et al (1975)	Tokimatsu & Yoshimi (1983)	Bazaraa (1967)	Liao % Whitmann (1986)
0.00	0.00	1.83	2.00	0.00	2.43	4.00	0.00
0.45	2.08	1.77	1.92	2.75	2.30	3.45	5.01
0.90	1.85	1.72	1.85	2.37	2.18	3.03	3.54
1.35	1.71	1.67	1.79	2.15	2.07	2.70	2.88
1.80	1.61	1.62	1.72	1.99	1.98	2.44	2.50
2.25	1.54	1.57	1.67	1.87	1.89	2.22	2.23
2.70	1.48	1.53	1.61	1.77	1.81	2.04	2.04
3.15	1.43	1.48	1.56	1.69	1.73	1.88	1.88
3.60	1.38	1.44	1.51	1.61	1.66	1.75	1.76
4.05	1.34	1.41	1.47	1.55	1.60	1.63	1.66
4.50	1.30	1.37	1.42	1.49	1.54	1.53	1.57
4.95	1.27	1.34	1.38	1.44	1.48	1.44	1.50
5.40	1.24	1.30	1.35	1.39	1.43	1.36	1.43
5.85	1.22	1.27	1.31	1.35	1.39	1.29	1.38
6.30	1.19	1.24	1.28	1.31	1.34	1.22	1.33
6.75	1.17	1.22	1.24	1.27	1.30	1.16	1.28
7.20	1.15	1.19	1.21	1.23	1.26	1.11	1.24
7.65	1.12	1.16	1.18	1.20	1.22	1.06	1.20
8.10	1.11	1.14	1.15	1.17	1.19	1.02	1.17
8.55	1.09	1.11	1.13	1.14	1.15	0.98	1.14
9.00	1.07	1.09	1.10	1.11	1.12	0.94	1.11

Table 7 illustrates the correction factor (CN) for Standard Penetration Test (SPT) data at location S1, utilizing seven empirical formulations. The study reveals a trend of decreasing CN as depth increases, correlating with a rise in effective overburden pressure ($\sigma'v$) against reference atmospheric pressure (pa). Higher CN values occur at shallower depths where $\sigma'v$ is lower relative to pa, while deeper layers require smaller normalization factors. Discrepancies between methodologies are particularly notable in upper soil layers with low effective overburden pressure. Bazaraa (1967) and Liao and Whitman (1986) yield higher CN values, suggesting acute sensitivity to low $\sigma'v/pa$ ratios, whereas Peck et al. (1974), SNI 4153:2008,

and Skempton (1986) offer conservative corrections to mitigate overestimation of normalized N-values near the surface. As depth increases, CN values converge towards unity as σ′v surpasses typical threshold values. These variations in CN significantly influence normalized SPT resistance and impact assessments of soil density, bearing capacity, and settlement behavior.

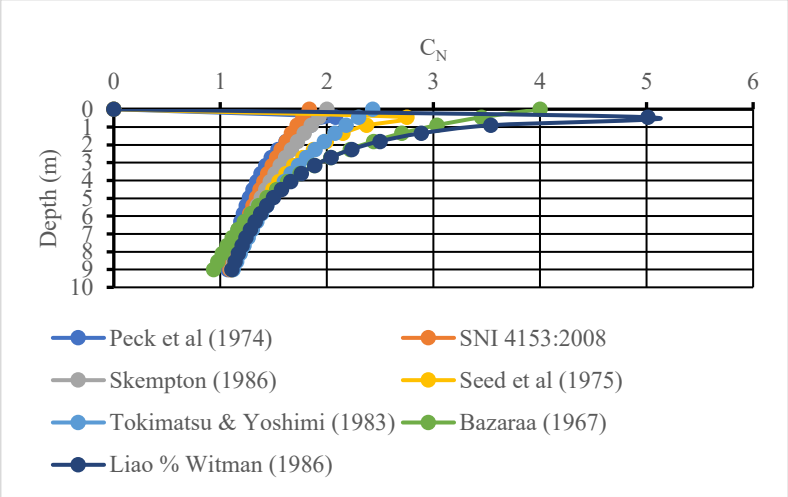


Fig 8. C_N values S1

Figure 8 demonstrates that the variation of CN values at S1 illustrates differences in how methods account for overburden stress on SPT resistance. Methods like Peck et al. and Bazaraa show higher CN values, suggesting greater normalization at shallow depths, which may lead to overestimated soil stiffness and bearing capacity. In contrast, methods such as SNI 4153:2008 and Liao & Whitman offer more restrained corrections, better reflecting the gradual stress increase with depth. These variations emphasize the sensitivity of interpreted strength, compressibility, and foundation performance to the chosen CN formulation.

Table 8. Correction Factor (C_N) S2

Depth (m)	C_N						
	Peck et al (1974)	SNI 4153:2008	Skempton (1986)	Seed et al (1975)	Tokimatsu & Yoshimi (1983)	Bazaraa (1967)	Liao & Whitmann (1986)
0.00	0.00	1.83	2.00	0.00	2.43	4.00	0.00
0.45	2.08	1.77	1.92	2.75	2.30	3.45	5.01
0.90	1.85	1.72	1.85	2.37	2.18	3.03	3.54
1.35	1.71	1.67	1.79	2.15	2.07	2.70	2.89
1.80	1.61	1.62	1.72	2.00	1.98	2.44	2.50
2.25	1.54	1.57	1.67	1.87	1.89	2.22	2.24
2.70	1.48	1.53	1.61	1.77	1.81	2.04	2.04
3.15	1.43	1.49	1.56	1.69	1.73	1.88	1.88

3.60	1.38	1.45	1.51	1.61	1.66	1.75	1.76
4.05	1.34	1.41	1.47	1.55	1.60	1.63	1.66
4.50	1.30	1.37	1.42	1.49	1.54	1.53	1.57
4.95	1.27	1.34	1.38	1.44	1.48	1.44	1.50
5.40	1.24	1.30	1.34	1.39	1.43	1.36	1.43
5.85	1.22	1.27	1.31	1.35	1.38	1.29	1.38
6.30	1.19	1.24	1.27	1.31	1.34	1.22	1.33
6.75	1.17	1.22	1.24	1.27	1.30	1.16	1.28
7.20	1.15	1.19	1.21	1.23	1.26	1.11	1.24
7.65	1.12	1.16	1.18	1.20	1.22	1.06	1.20
8.10	1.11	1.14	1.15	1.17	1.19	1.02	1.17
8.55	1.09	1.11	1.13	1.14	1.15	0.97	1.14

Table 8 presents depth-dependent C_N correction factors at S2 across seven SPT methods. At shallow depths (≤1.0 m), values diverge significantly; Bazaraa (1967) and Liao & Whitman (1986) yield the highest corrections, while SNI 4153:2008 and Skempton (1986) remain more conservative. As effective vertical stress increases, C_N values across all methods converge, with negligible differences appearing beyond 6 m.

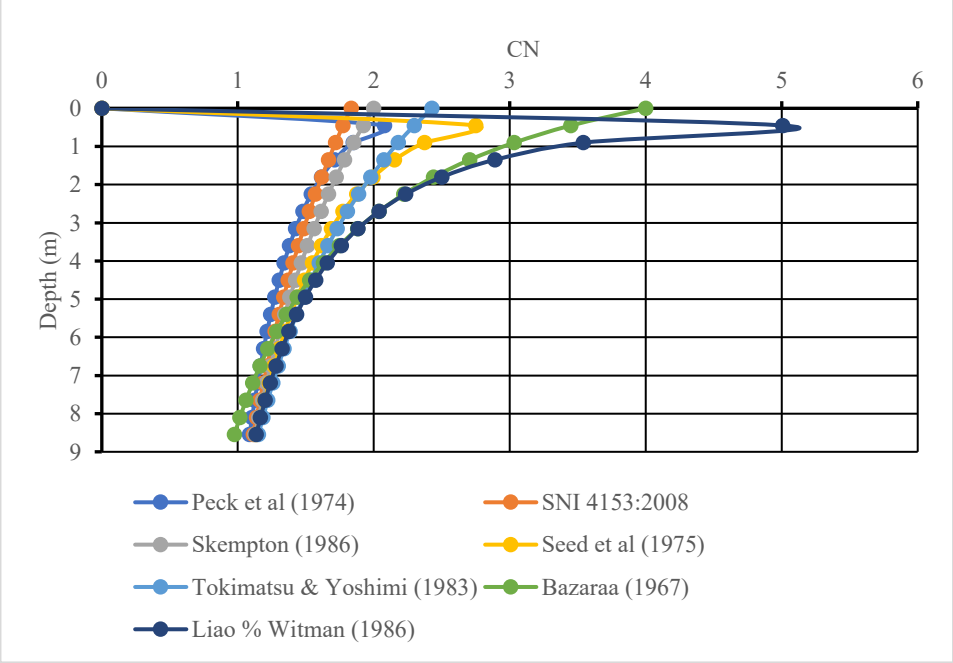


Fig 9. CN values S2

Figure 9 illustrates that CN values at S2 correlate strongly with soil characteristics at varying depths. High CN values in shallow layers indicate low effective overburden stress, typical of loose granular or lightly overconsolidated fine-grained soils, which are highly responsive to stress changes. Methods increasing CN values highlight this situation by raising corrected N-values significantly. As depth increases, CN values decrease and converge, indicating higher effective stress and stiffer soil conditions. This trend implies reduced compressibility and increased shear strength in deeper layers, while shallow soils remain sensitive to correction methods.

Table 9. Correction Factor (C_N) S3

Depth (m)	C_N						
	Peck et al (1974)	SNI 4153:2008	Skempton (1986)	Seed et al (1975)	Tokimatsu & Yoshimi (1983)	Bazaraa (1967)	Liao & Whitmann (1986)
0.00	0.00	1.83	2.00	0.00	2.43	4.00	0.00
0.45	2.08	1.77	1.92	2.75	2.30	3.45	5.01
0.90	1.85	1.72	1.85	2.37	2.18	3.03	3.54
1.35	1.71	1.67	1.79	2.15	2.07	2.71	2.89
1.80	1.62	1.62	1.73	2.00	1.98	2.44	2.50
2.25	1.54	1.57	1.67	1.88	1.89	2.23	2.24
2.70	1.48	1.53	1.61	1.78	1.81	2.04	2.04
3.15	1.43	1.49	1.56	1.69	1.73	1.89	1.89
3.60	1.38	1.45	1.51	1.62	1.66	1.75	1.76
4.05	1.34	1.41	1.47	1.55	1.60	1.63	1.66
4.50	1.30	1.37	1.42	1.49	1.54	1.53	1.57
4.95	1.27	1.34	1.38	1.44	1.48	1.44	1.50
5.40	1.24	1.30	1.35	1.39	1.43	1.36	1.43
5.85	1.22	1.27	1.31	1.35	1.38	1.29	1.38
6.30	1.19	1.24	1.27	1.31	1.34	1.22	1.32
6.75	1.17	1.21	1.24	1.27	1.30	1.16	1.28
7.20	1.14	1.19	1.21	1.23	1.26	1.11	1.24
7.65	1.12	1.16	1.18	1.20	1.22	1.06	1.20
8.10	1.10	1.14	1.15	1.17	1.18	1.01	1.17

Table 9 shows a systematic reduction of CN values with depth at S3, highlighting the influence of effective overburden stress on SPT resistance. Higher CN values in upper units suggest shallow soils with low confinement, indicating loose to medium density granular materials or lightly overconsolidated fine-grained soils. Methods that yield elevated CN values may overestimate bearing capacity while underpredicting settlement potential. As depth

increases, CN values among methods converge, indicating more homogeneous strata where soil stiffness and shear strength are less affected by stress normalization. This leads to more reliable bearing capacity estimates, with settlement predictions primarily influenced by elastic compression instead of stress correction uncertainty, as illustrated in Figure 9.

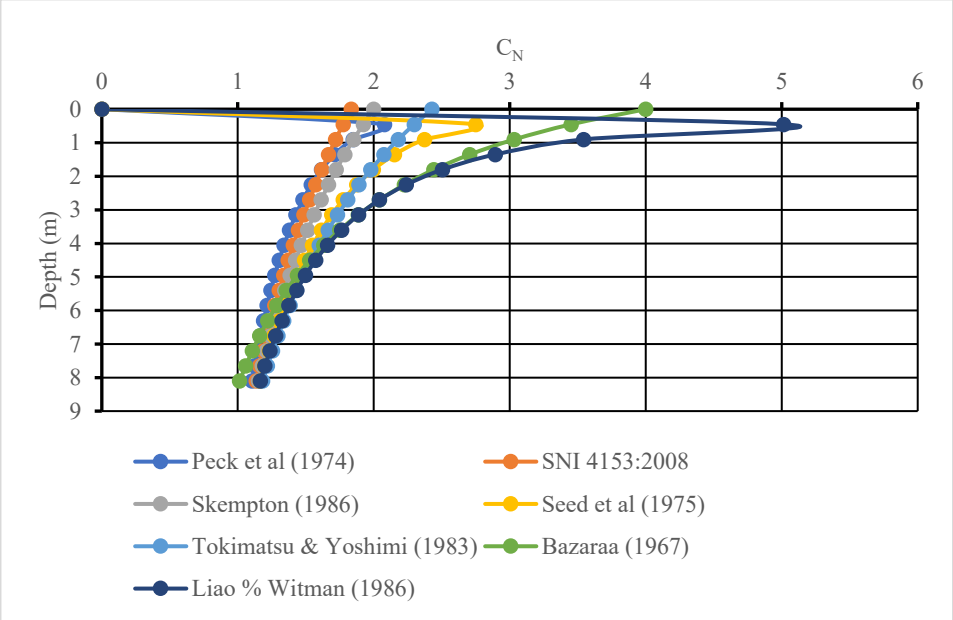


Fig 10. C_N values S3

Figure 10 illustrates the comparison of CN values at S3, revealing the mechanical behavior of soil and the uncertainty in SPT interpretations. The shallow zone shows a broad CN value dispersion due to low effective overburden stress and variable soil conditions, resulting in skewed corrected N-values and inaccurate bearing capacity estimations. In contrast, deeper zones demonstrate reduced and converged CN values, indicating better confinement and more stable soil behavior, where stiffness and shear strength become more critical in foundation response, lessening the impact of the correction method on design uncertainty.

3.4. Average corrected N (C_N) values

The corrected N (C_N) values as listed in Tables 7, 8, 9 and Figures 7, 8, 9 are read in Table 10 as the average values.

Table 10. Average correction factor (C_N) values

Depth (m)	Methods	Average C_N		
		S1	S2	S3
1	Peck et al (1974)	1.37	1.38	1.40
2	SNI 4153:2008	1.40	1.42	1.44
3	Skempton (1986)	1.54	1.57	1.59

4	Seed et al (1975)	1.59	1.62	1.65
5	Tokimatsu & Yoshimi (1983)	1.62	1.65	1.67
6	Bazaraa (1967)	1.82	1.86	1.91
7	Liao % Whitmann (1986)	1.89	1.93	1.98

Table 10 outlines systematic differences in average CN values from seven correction methods across S1, S2, and S3, revealing insights into methodological assumptions and subsurface conditions. Lower CN values indicated by Peck et al. and SNI 4153:2008 suggest restrained normalization, representative of moderate density stratigraphy, while higher values from Bazaraa and Liao & Whitman indicate amplification in low effective stress strata, typically in loose soils. The average CN increases from S1 to S3, suggesting systematic stratigraphic variability linked to soil fabric or consolidation state. High CN values may overestimate stiffness and bearing capacity, posing risks in design, whereas lower values provide more conservative predictions of bearing capacity and settlement, reflecting real interactions between soil behavior and foundation performance. Figure 10 illustrates the average CN for point 1.

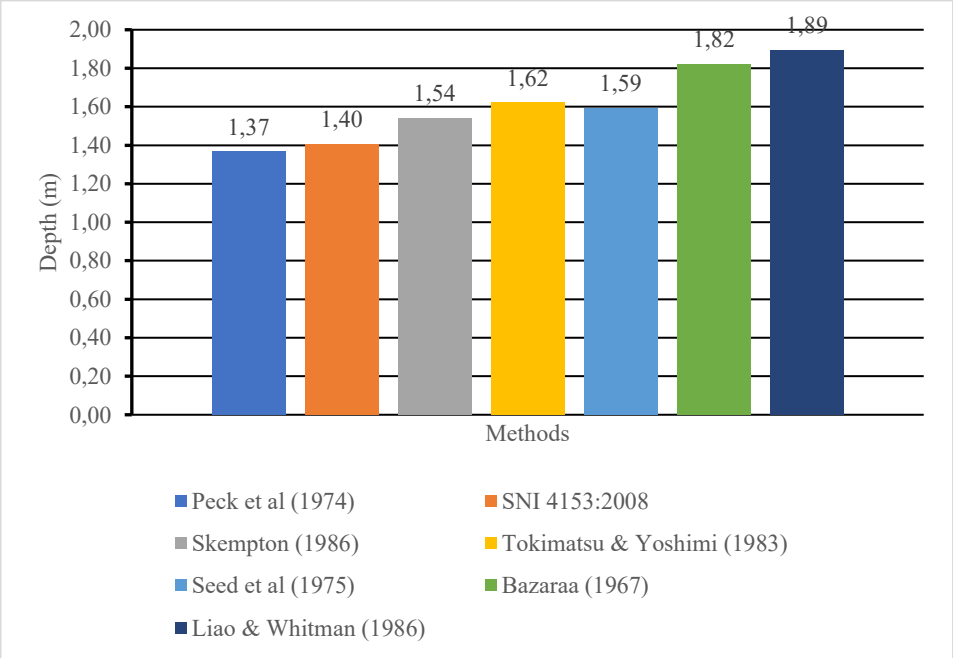
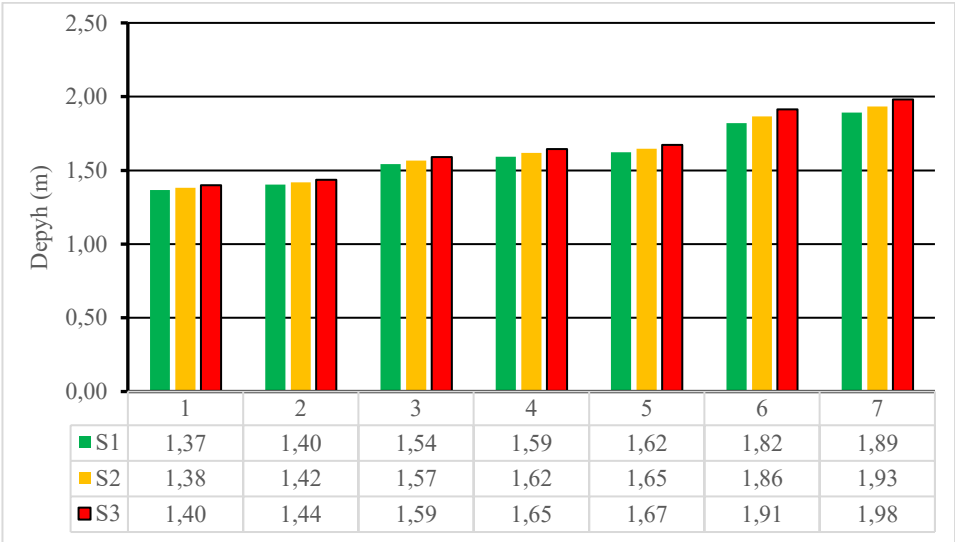


Fig 11. Average C_N values S1

Figure 11 illustrates that the average correction number (CN) from SNI 4153:2008 at S1 offers a balanced midpoint among various methods, both statistically and geotechnically. This midrange CN minimizes the impact of low effective overburden stress without disproportionately increasing corrected N-values. This is especially significant for stratified soil profiles with variable density and compressibility. By using a moderate correction, SNI 4153:2008 provides corrected N-values that more accurately represent the actual stiffness and shear strength under working stress conditions. As a result, the bearing capacity estimates are

less likely to be overestimated, and settlement analyses effectively account for compressible layers affecting foundation performance. In comparison to higher-CN methods, the SNI method reduces uncertainty related to stress normalization, thus furnishing a more reliable foundation for geotechnical design in layered soils. The average CN values for S1, S2, and S3 across all methods are presented in Figure 12.



	1	2	3	4	5	6	7
S1	1,37	1,40	1,54	1,59	1,62	1,82	1,89
S2	1,38	1,42	1,57	1,62	1,65	1,86	1,93
S3	1,40	1,44	1,59	1,65	1,67	1,91	1,98

Fig 12. Average C_N S1, S2, S3

Figure 12 shows that average corrected N (CN) values at S1, S2, and S3 maintain a hierarchy across seven correction methods, suggesting similar stratigraphic conditions and stress regimes. Higher average CN values indicate stronger overburden stress amplification, while lower values reflect conservative normalization. The SNI 4153:2008 method displays tightly grouped average CN values, implying minimal spatial variability and stability in stress correction. This suggests that the SNI method effectively represents soil stiffness and compressibility without distorting bearing capacity or settlement predictions. Comparatively, CN values vary across methods, with Peck et al. (1974) consistently yielding the lowest values, while Liao & Whitman (1986) yields the highest. Peck et al. (1974) average of 1.37 serves as a critical reference for evaluating other methods, as highlighted in Table 11.

Table 11. Comparison of average C_N values

No.	Methods	C_N			Average C_N
		S1	S2	S3	
1	Peck et al (1974)	1.00	1.00	1.00	1.00
2	SNI 4153:2008	1.03	1.03	1.03	1.03
3	Skempton (1986)	1.13	1.13	1.14	1.13
4	Seed et al (1975)	1.17	1.17	1.18	1.17
5	Tokimatsu & Yoshimi (1983)	1.19	1.19	1.20	1.19
6	Bazaraa (1967)	1.33	1.35	1.37	1.35
7	Liao & Whitmann (1986)	1.38	1.40	1.41	1.40

In fact, all methods are based on the same effective overburden and atmospheric pressure. The differences in question come from the formulas applied to each method, as can be seen in Formulas Numbers (6), (7), (8), (9), (10), (11), and (12). Comparison of C_N values between SNI 4153:2008 and other method in Standard Penetration Test for this research shown in Figure 13

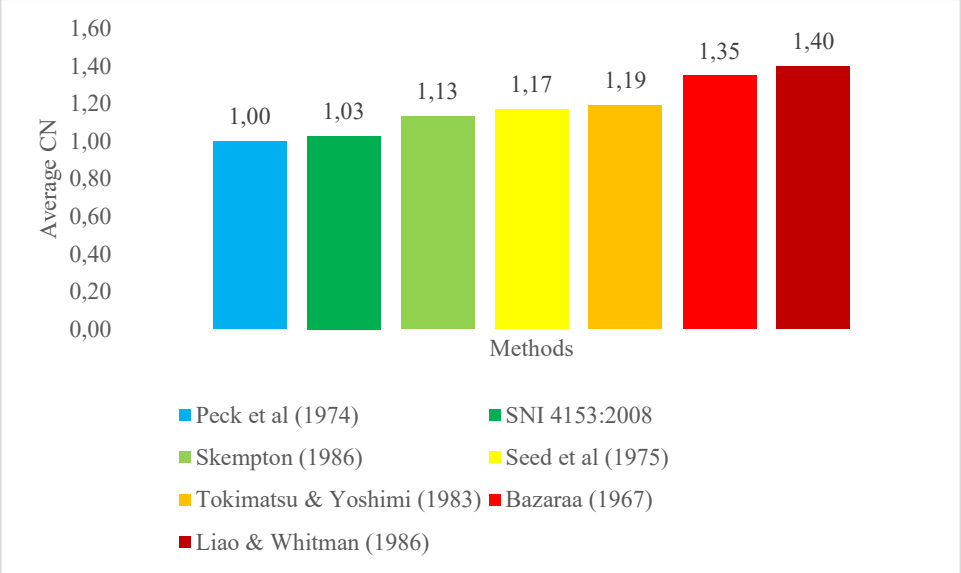


Fig 13. Comparison of C_N values

3.5. Variation of CN Values among Different Correction Methods

The results of the overburden pressure correction analysis indicate a pronounced variation in the average correction factor (CN) among the seven evaluated methods across the three SPT locations (S1, S2, and S3). As summarized in Table 10, the CN values systematically increase from the Peck et al. (1975) method to the Liao and Whitman (1986) method, reflecting fundamental differences in their conceptual treatment of effective overburden stress.

Peck et al. (1975) yields the lowest average CN values, ranging from 1.37 to 1.40, suggesting a relatively mild correction for low effective stress conditions. In contrast, the Liao and Whitman (1986) method produces the highest CN values, between 1.89 and 1.98, indicating a much stronger amplification of the measured SPT blow count at shallow depths. Intermediate CN values are observed for Skempton (1986), Seed et al. (1974), Tokimatsu and Yoshimi (1983), and Bazaraa (1967), with a consistent increasing trend that reflects their progressively more aggressive stress normalization schemes.

The SNI 4153:2008 method generates average CN values between 1.40 and 1.44, placing it close to the lower-middle range of the dataset. The relatively narrow variation of CN across S1, S2, and S3 indicates that the SNI formulation provides stable correction behavior despite spatial variability in soil conditions. This stability is a critical attribute for routine engineering applications where site heterogeneity is unavoidable.

3.6. Relative Position of SNI 4153:2008

When compared directly with the six international methods, SNI 4153:2008 consistently produces CN values higher than Peck et al. (1975) but lower than all other evaluated approaches. This positioning demonstrates that SNI 4153:2008 adopts a conservative yet not overly restrictive correction philosophy. The results suggest that the Indonesian standard deliberately limits the magnitude of overburden correction to prevent excessive inflation of corrected N-values (N_{60}), particularly in shallow soil layers where stress-dependent variability is high.

3.7. Geotechnical interpretation of CN variability

From a geotechnical standpoint, the observed variation in CN values is primarily governed by how each method models the nonlinear relationship between penetration resistance and effective vertical stress. At shallow depths, low effective stress leads to reduced confinement, causing SPT blow counts to underestimate soil density or strength unless appropriately corrected. However, excessive correction can artificially increase N_{60}, masking the true deformability of the soil mass.

Methods such as Bazaraa (1967) and Liao and Whitman (1986) emphasize a strong dependence of penetration resistance on overburden stress, which explains their higher CN values. While this approach may be theoretically justified for clean, loose sands under very low confining pressure, its direct application to natural soil deposits with fines content or cementation can lead to unrealistically high corrected N-values. Recent studies have highlighted that overly aggressive overburden corrections may reduce the reliability of SPT-based correlations for stiffness and strength parameters (Zhang et al. 2021; Phoon and Tang 2023).

In contrast, the SNI 4153:2008 method reflects a more restrained interpretation of stress normalization. By limiting the magnitude of CN, the method implicitly acknowledges the uncertainty associated with empirical SPT correlations and the influence of factors beyond effective stress, such as soil fabric and aging effects. This conservative moderation is consistent with contemporary recommendations that emphasize robustness over precision in empirical geotechnical design (Ching et al. 2020).

3.8. Implications for bearing capacity analysis

Bearing capacity estimations derived from SPT data are highly sensitive to corrected N-values, as these values are commonly correlated with shear strength parameters, particularly the internal friction angle for granular soils. Higher CN values translate directly into higher N_{60}, which increases the estimated bearing resistance of shallow foundations.

The application of high-CN methods, such as Liao and Whitman (1986), leads to significantly larger bearing capacity values. While this may allow for reduced foundation dimensions, it also increases the risk of unconservative design, especially in layered or partially saturated soils. Recent numerical and field-based studies have demonstrated that overestimation of strength from inflated N-values can result in bearing capacity predictions that exceed actual field performance (Lee et al. 2022). Conversely, the relatively moderate CN values obtained using SNI 4153:2008 yield bearing capacity estimates that are lower than those derived from Skempton (1986), Seed et al. (1974), and Tokimatsu and Yoshimi (1983). This outcome enhances safety margins without resorting to excessive conservatism. For public and institutional buildings, such as the Civil Engineering Laboratory Building examined in this study, this balance between safety and economy is particularly critical.

The Peck et al. (1975) method, producing the lowest CN values, results in the most conservative bearing capacity estimates. Although this approach minimizes failure risk, it may lead to inefficient foundation designs and increased construction costs, which may not be justified when sufficient site investigation data are available.

3.9. Implications for settlement analysis

Settlement prediction is generally more sensitive to corrected SPT values than bearing capacity analysis because soil stiffness correlations are strongly influenced by N_{60}. Higher CN values lead to higher estimated soil modulus and, consequently, smaller predicted settlements. The results indicate that methods with high CN values, particularly Bazaraa (1967) and Liao and Whitman (1986), may underestimate settlements due to overestimation of soil stiffness. This underestimation poses a significant serviceability risk, as excessive or differential settlement often governs foundation performance rather than ultimate bearing failure. Recent research emphasizes that serviceability-based design requires cautious interpretation of SPT-derived stiffness, especially in shallow foundations (Salgado et al. 2021; Zhou et al. 2024).

In contrast, SNI 4153:2008 yields moderate settlement predictions that better reflect realistic soil behavior. Although predicted settlements are larger than those obtained using high-CN methods, they remain within acceptable engineering limits and align more closely with observed performance in similar soil conditions. This characteristic supports the use of SNI 4153:2008 for designs where long-term functionality and deformation control are critical.

The Peck et al. (1975) method produces the largest settlement estimates, reflecting its conservative correction approach. While suitable for preliminary assessments or highly sensitive structures, its routine application may result in unnecessary ground improvement or deeper foundation solutions.

3.10. Relevance to contemporary geotechnical practice

Recent international literature increasingly recognizes that no single CN correction method is universally applicable. Instead, the selection of an appropriate method should consider soil type, stress range, and design objectives. The findings of this study align with recent probabilistic and reliability-based approaches, which advocate for moderate correction factors that reduce epistemic uncertainty rather than maximizing corrected strength values (Tang et al. 2020; Phoon et al. 2024). Within this context, SNI 4153:2008 demonstrates strong compatibility with modern geotechnical design philosophy. Its CN values provide a rational compromise between safety and practicality, ensuring reliable bearing capacity estimation while avoiding unconservative settlement predictions.

4. Conclusion

This study was conducted to compare overburden pressure correction factors (CN) obtained from SNI 4153:2008 and six widely adopted international methods and to evaluate their implications for bearing capacity and settlement analyses based on Standard Penetration Test (SPT) data. The results confirm that significant variability exists among the evaluated CN formulations, reflecting fundamental differences in their assumptions regarding stress normalization and soil response under low effective overburden pressure.

The comparative analysis shows that SNI 4153:2008 consistently produces moderate CN values, higher than those proposed by Peck et al. (1975) but lower than those derived from Skempton (1986), Seed et al. (1974), Tokimatsu and Yoshimi (1983), Bazaraa (1967), and Liao and Whitman (1986). This positioning indicates that the Indonesian standard adopts a restrained correction approach that avoids excessive amplification of corrected SPT blow counts, particularly in shallow soil layers where uncertainty is inherently high. As a result, SNI 4153:2008 provides a stable and robust correction framework under varying site conditions.

In bearing capacity analysis, higher CN values obtained from aggressive correction methods lead to increased estimated foundation resistance but may introduce unconservative design outcomes when applied indiscriminately. In contrast, SNI 4153:2008 yields bearing capacity estimates that balance safety and efficiency, making it suitable for building foundations where structural reliability is essential. Regarding settlement analysis, methods with high CN values tend to underestimate soil deformability and predicted settlements, potentially compromising serviceability performance. The moderate CN values produced by SNI 4153:2008 result in more realistic settlement predictions that better reflect the stress-dependent stiffness behavior of natural soils.

Overall, the findings demonstrate that variation in CN values has a decisive influence on both ultimate and serviceability limit state evaluations. Among the examined methods, SNI 4153:2008 offers a rational compromise between conservative and aggressive correction schemes, aligning well with contemporary geotechnical design philosophy. Therefore, SNI 4153:2008 can be considered technically reliable and suitable for routine foundation design, while also providing a consistent reference for comparison with international correction methods.

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Women as Professional Workers in the Construction Industry: A review of Structural-Cultural Barriers and Their Implication for Sustainable Development

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Abstract. The construction industry is one of the largest and most influential industries globally, requiring a continuous supply of professional human resources to meet increasing technological and development demands. Women professionals represent a significant potential workforce; however, gender inequality remains prevalent in the construction sector, which is traditionally male-dominated. Women are still underrepresented due to persistent structural and cultural barriers, including masculine stereotypes, discriminatory workplace environments, and limited career opportunities. This condition has encouraged researchers to examine the challenges faced by women and explore innovative solutions to attract and retain them in construction professions. This study aims to review existing literature on women in the construction industry, with a particular focus on identifying key structural–cultural barriers and innovative strategies that can enhance women's participation. The findings are expected to contribute to discussions on gender equality and sustainable development in the construction industry.

Keywords: Gender; Construction Industry; Workers; Sustainable Development.

1 Introduction

In global developments, countries in the world have agreed on a global program, namely the Sustainable Development Goals (SDG). In the program, there are 17 goals that must be achieved together for the sake of balance and creating a better world. Some of them are infrastructure development and commitment to gender welfare. Infrastructure development is of course the realm of the construction industry, while women's empowerment can also be carried out in the construction industry as part of fulfilling human resources. The construction industry is one of the largest industries in the world. In addition, the construction industry positions itself as an industry that has the most impact on world development. This is indicated by the large influence of this industry on social and economic development [1]. Global developments including technology have made the construction industry continue to grow and influence. The rapid demand for construction industry products demands a workforce or professional human resources. The need for human resources is increasingly needed. Human resources in the construction industry are basically dominated by men [2]. This is corroborated by statements in

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several studies that historically, the construction industry has traditionally been dominated by men [3]. In its development, the construction industry has not maximized in developing the potential of its diverse resources, dominated by men, this limits the industry's competitiveness, growth potential, and performance in responding to these global developments [1]. To meet the industry's need for professional resources, it cannot only be met by relying on men. Women in their work can also contribute positively, which has also been proven in fields other than construction. Basically women are certainly part of the workforce. As workers, women can position themselves as potential workers. Based on several previous studies, the contribution of women workers to the construction industry is very low. Research in 2019 stated that the number of female workers in the Malaysian construction industry was only 9.1% while in Indonesia it was around 2.2%. Even based on Indonesia's statistical data for 2020, the number of female workers in the Indonesian construction industry is only 1.7% [4]. This condition shows that the contribution of women's involvement in the construction industry is still very low. In other words, the gender diversity in this industry is still very poor. Under these conditions, it is necessary to study how the construction industry is viewed from the perspective of women as construction workers. This is seen by understanding the pattern of research development related to women in this industry, so that through this research it can be seen the motive for the minimal contribution of women in this industry apart from the traditional notion that the construction industry is a male area.

2 Methodology

This article employs a non-systematic (narrative) literature review methodology to examine the structural and cultural impediments encountered by women in the construction sector. The review concentrates on combining current theoretical and empirical research concerning gender disparity, workplace culture, and women's involvement in construction in relation to sustainable development.

Relevant material was located via academic databases such as Google Scholar and Scopus, utilizing keywords such women in construction, gender disparity, construction industry, and sustainable development. The chosen studies were qualitatively investigated to discern repeating themes, patterns, and conceptual insights pertaining to cultural and institutional impediments, along with methods to augment women's engagement in the construction sector.

3 Conceptual Background

3.1 Gender Issues in the Dynamics of Sustainable Development Goals (SDGs)

Sustainable development is a worldwide initiative that necessitates the amalgamation of economic, social, and environmental facets to attain enduring prosperity without jeopardizing natural resources and the social welfare of future generations. Despite being a primary concern for numerous nations and international entities, these initiatives frequently prove inadequate in comprehensively addressing the gender aspect.

Within the framework of the Sustainable Development Goals (SDGs), gender issues are highly urgent for several reasons.

First, **equal access and social justice** remain major challenges, as many countries continue to experience gender inequality that restricts the roles of women and minority groups. Integrating a gender perspective into sustainable development is expected to reduce inequality and provide broader access and equal opportunities for all stakeholders to participate in development processes [5]

Second, **economic empowerment and political participation** are critical concerns. Women often have limited access to productive resources, which hinders their economic advancement. Sustainable development must therefore consider comprehensive efforts to create environments that support the active participation of all groups, including women, in both economic and political spheres [5].

Robust gender stereotypes and conventional role expectations often impede gender integration in sustainable development. Cultural traditions linking household responsibilities to women and economic tasks to men might undermine the efficacy of policies and initiatives designed to promote gender equality. Changes in cultural and social attitudes are necessary to enable societies to transition toward more inclusive and gender-equitable conditions [6].

Furthermore, inequalities in access to resources, education, and income between genders persist as a significant concern. In numerous nations, women persistently encounter substantial obstacles in obtaining sufficient healthcare services, excellent education, and employment possibilities comparable to those of males. Sustainable development initiatives must target the reduction of disparities and the establishment of equitable opportunities for all individuals. [7].

3.2 Construction Industry and Sustainability

The construction industry is one of the largest and most important industries in the world. Specifically, it plays a key role in development at local, national, and global levels. This industry has both direct and indirect effects on society in environmental, economic, and social aspects [8]. Many studies show that the construction industry aims to design and deliver infrastructure like buildings, roads, and other facilities [9].

Sustainable development has been a major topic for several decades. Some scholars argue that the construction industry is part of a larger social process [10]. This viewpoint highlights the industry's strong impact on environmental, economic, and social results. As a social process, the construction industry involves workers, clients, local communities, and supply chains, all working to meet the needs of current and future populations [11].

From this perspective, the construction industry cannot rely only on men. With the wide variety of job options available, we should not overlook the participation and professionalism of women. Like men, women should have equal chances to choose their careers, including roles in the construction industry.

4 Discussion

4.1 Gender in the Construction Industry: Perceptions of Masculinity

As noted earlier, the construction industry has long been a male domain. These established traditions have evolved into a "culture" where women's involvement in the industry is often underrepresented or seen as unusual by some groups. This culture has also shaped the belief that construction work requires physical strength and skills typically associated with men. Such beliefs create psychological and social barriers for women wanting to enter the sector. An industry culture that assumes construction work requires physical strength and skills commonly linked to men often makes women feel isolated and unsupported [12]. Being one of the most male-dominated sectors, this culture and view of masculinity have become key aspects of work dynamics on construction sites. These stereotypes support the idea that site-based construction work is more suitable for men, who are thought to have better physical and technical skills. As a result, masculine culture becomes the main standard in hiring, promotion, and organizational practices in many construction companies, leading to the ongoing underrepresentation of women in the industry [12].

Worldwide, women's participation in the construction industry is still low compared to men's. The International Labour Organization (ILO) reported in 2020 that around 10 to 12% of the global construction workforce consists of women. This number shows that, despite some progress, the construction industry remains largely male-dominated [13]. In Indonesia, women's participation in the construction sector mirrors this global trend. Data from Statistics Indonesia (BPS) in 2021 indicate that women make up only about 7% of the total construction workforce. While there have been some changes in perceptions and job opportunities for women, challenges like gender stereotypes and limited access to technical skills training continue to pose major barriers [14].

In the United States, women make up about 10% of the total workforce in the construction sector. Despite efforts from both the government and private companies to increase women's participation through training programs and inclusive policies, this figure has remained mostly unchanged in recent years. In Sweden, there are strong initiatives to support gender equality across various sectors, including construction. About 20% of the total construction workforce in Sweden is made up of women. This reflects the country's strong commitment to gender inclusion in the job market [15].

A work culture that prioritizes masculinity influences both the working atmosphere and the decision-making processes of firms, as well as team dynamics. Norms emphasizing physical strength and male attributes restrict women's ability to express their views and demonstrate their competencies in the sector. Consequently, women face considerable obstacles and impediments when contemplating a career in construction.They often experience unfair and discriminatory treatment [12].

While the construction sector offers promising career options, several issues make it difficult for women to build long-term careers here. First, there is a notable gender wage gap, with women earning only about 79% of what men earn. For example, if a male earns one dollar, a woman earns only seventy-nine cents. The wage disparity illustrates entrenched inequality in the valuation of women's labor, deterring their participation and retention in the construction sector. Secondly, extended working hours may interfere with women's responsibilities as

caretakers, particularly for those nurturing children. The practice of checkboarding, wherein women are employed primarily to demonstrate a company's dedication to gender equality while being perceived as less skilled than their male counterparts, further marginalizes women within the construction profession. [16].

In general, women encounter various challenges in their careers in the construction industry. These challenges usually fall into five categories [17]: *(i) intense competition*, influenced by limited promotion opportunities, discomfort from differences in appearance, heavy workloads, and a shortage of role models in the field; *(ii) limited personal development*, due to a lack of understanding about career progression, insufficient training or professional development opportunities, and difficulties in managing staff; *(iii) gender discrimination*, marked by wage disparities and fewer incentives compared to men, a lack of mentorship from supervisors, work-life imbalance for women, and inadequate childcare options for working mothers; *(iv) industry stereotypes*, shaped by negative views and unwelcoming work environments; and *(v) poor working conditions*, affected by a lack of safety and comfort in the workplace, as well as long hours. These barriers correspond with findings from other pertinent studies.

The construction sector, frequently perceived as male-dominated, encounters substantial cultural and structural obstacles in integrating women into its workforce. Cultural and institutional constraints significantly affect women's participation and career advancement in the sector.

4.2 Cultural Barriers

Cultural barriers denote impediments stemming from cultural beliefs, social standards, and entrenched societal perceptions. These obstacles are not directly associated with formal frameworks such as legislation or regulations. Rather, they encompass indirect and frequently implicit elements. Numerous obstacles in this category including:

Gender stereotypes. Gender stereotypes are a primary cultural obstacle impeding women's involvement in the construction sector. The industry is frequently linked to physically arduous and hazardous labor, which is typically regarded as more appropriate for men. This view strengthens the conviction that women are unsuitable for construction labor, both physically and technically. [17]. Such misconceptions also affect women's acceptance in the workplace and restrict their career prospects within the business.

Traditional social norms. Traditional social standards perpetuate gender roles by designating women as primarily responsible for home duties, whilst males are perceived as the principal earners. These conventions exacerbate discrimination against women in the workplace, particularly within the construction sector. Numerous countries persist in the belief that women need to engage in professions deemed “feminine,” such as education or healthcare, rather than in the construction industry, which is regarded as predominantly masculine [6].

The lack of successful female role models. The absence of accomplished female role models in the construction sector presents a significant challenge. The scarcity of women in leadership or prominent roles hinders young women and potential employees from feeling inspired or motivated to pursue careers in the sector. This absence engenders a loop wherein women encounter difficulties in both entering and sustaining their presence in the industry. [18].

Confronting gender stereotypes, altering constrictive social norms, and enhancing the visibility of accomplished female role models in the construction sector can foster a more inclusive and supportive workplace for all workers, irrespective of gender. These measures are crucial for advancing gender equality and guaranteeing equitable chances for professional advancement.

The findings indicate that cultural norms perpetuate masculine dominance in construction environments, hence constraining women's long-term career viability and deterring their participation and retention in the sector.

4.3 Structural Barriers

Structural barriers are impediments or limitations that originate from formal systems or established frameworks within society, organizations, or industries. In contrast to cultural obstacles, which are more indirect and tied to social or cultural ideals, structural barriers are typically linked to legislation, policies, or organizational frameworks that directly influence individuals' access, opportunities, and experiences. The barriers encompassed by this category include the following:

Gaps in education and training. Women in the construction sector persistently encounter systemic obstacles that directly restrict their prospects and career advancement. A significant concern is the disparity in access to education and training. A significant number of women lack access to equivalent technical training and skill development opportunities as males, resulting in their underqualification for advanced or higher-paying roles within the business. [7].

Discrimination in policies and workplace practices. Discrimination ingrained in workplace policies and practices persists extensively. Women often encounter wage disparity, restricted advancement opportunities, and inequitable treatment from superiors or peers. These conditions impede professional progression and perpetuate enduring gender disparity within the construction business. [13].

Unsafe working environments. Furthermore, the working conditions in the construction sector frequently do not meet the needs of women. Hazardous work environments, lack of childcare services, and extended working hours pose considerable obstacles, especially for women with caregiving duties. In the absence of sufficient childcare help, numerous women find it challenging to sustain employment in the construction sector, as rigorous schedules and adverse working conditions hinder the equilibrium between professional and personal responsibilities. [19].

4.4 Women as Mothers and Wives in the Household versus Workers in the Construction Industry

Beyond the challenges discussed above, women face a unique situation arising from their dual roles in everyday life. In addition to working as professionals particularly in the male-dominated construction industry, which is often characterized by high psychological pressure women simultaneously fulfill their roles as mothers and wives within the household. The building business is typically viewed as masculine, whereas domestic chores are considered feminine.

A major problem for women is attaining equilibrium between professional obligations and familial duties. The construction sector frequently demands extended working hours and provides less flexibility, hindering women's ability to balance professional and familial responsibilities efficiently. Studies indicate that numerous women encounter difficulties in reconciling professional and familial obligations, resulting in heightened stress and weariness. [20].

The restricted access to childcare services at or near construction sites poses a significant obstacle for working women. In the absence of sufficient childcare help, numerous women are compelled to pursue alternative arrangements that frequently prove to be expensive, unreliable, or inappropriate. The insufficiency of adequate childcare facilities may deter women from persisting in the construction sector or progressing in their careers.[21].

Consequently, supportive organizational policies are crucial for assisting women in navigating these hurdles. Organizations must formulate and execute work–life balance policies, encompassing flexible work arrangements, sufficient maternity leave, and mentorship initiatives for women. Research indicates that organizational strategies fostering work–life balance and gender equality can substantially aid women in surmounting these obstacles and promote increased female involvement in the construction industry. [22].

This pattern demonstrates that the structural impediments encountered by women in the construction sector are not isolated phenomena but are intertwined with organizational practices and policy-level limitations.

4.5 The Glass Ceiling Phenomenon in the Construction Industry

The term "glass ceiling" originated in the 1980s as a metaphor for the unseen and artificial obstacles that hinder women and minorities from progressing to managerial and executive roles within corporations. In 1991, the United States Congress determined that despite a large rise in the participation of women and minorities in the workforce, they continued to be underrepresented in managerial roles. This underrepresentation was ascribed to artificial obstacles that persistently impeded their career progression.

Subsequent research by Lekchiri and Kamm elucidates the glass ceiling idea, characterizing it as a phenomenon wherein women attain a specific career level but are thereafter obstructed from advancing further. This idea underscores the presence of artificial barriers that impede women's access to senior executive roles, especially in male-dominated settings and organizational cultures. [19].

A literature analysis by Rivera et al. (2021) revealed that women's participation in construction-related professions is frequently perceived as an attempt to surmount gender-based obstacles, particularly considering the limited number of women engaging in education and jobs in engineering. Women who enter the profession may face considerable gender segregation inside hierarchical organizational frameworks. [23]

These obstacles typically present as gender discrimination, societal preconceptions, unaccommodating company regulations, and non-inclusive workplace cultures. While there are

no official regulations explicitly excluding women or minorities from attaining senior roles, they are frequently hindered by discriminatory practices and biases in practice.

Women in the construction sector encounter numerous obstacles in their professional advancement, including stringent work–life balance demands, adverse perceptions of women on construction sites, extended working hours, and various issues impacting women at different career stages. A particular issue identified in interviewees is the aggressive conduct of male coworkers, posing a distinct difficulty for women in the industry. Nonetheless, personal attributes such as dedication, resilience, and autonomy are recognized as essential determinants of success in building. Concentrating on personal development to enhance these qualities can significantly contribute to women's professional progression in the sector. [2].

This phenomenon demonstrates that gender inequality in the construction industry extends beyond entry-level participation and systematically limits women's advancement into leadership positions.

4.6 Motivation and Career Development Opportunities for Women in the Construction Industry

In general, a study identified six categories of motivation that influence women to pursue careers in the construction industry [24]. *Initially*, working circumstances encompass acknowledgment of performance, maternity leave provisions, distinct sanitary facilities for men and women, and opportunities for job mobility. Secondly, interpersonal ties encompass support from family and colleagues, recognition of earlier achievements, and favorable interactions with bosses and coworkers. *Third, gender equality*, which encompasses constructive relationships with male team members, recognition of women's work, equal incentives, women's inclusion programs, and work attire that supports women's performance on construction sites. Overall, the implementation of construction projects requires strong collaboration among all team members. *Fourth, management aspects*, including skills development and flexible working hours. *Fifth, work environment*, defined as comfortable working conditions and policies that support women. *Finally, general expectations*, which include performance-based remuneration as well as workplace comfort and safety at project sites.

Numerous studies have identified various efforts that can help overcome these barriers and promote women's career development in the construction industry

Training and Education. One of the key steps in advancing women's careers in the construction industry is providing greater access to technical training and education. Research indicates that extensive technical training and equitable educational opportunities are crucial for empowering women to get the skills necessary for success in the construction industry. Inclusive training programs can increase the number of women qualified for technical and managerial positions [25].

Mentorship. Mentorship is important tools for supporting women's career development in the construction sector. Structured and systematic mentorship and sponsorship programs can enhance women's representation in leadership roles. Mentoring has been found to improve girls' and women's self-confidence, self-esteem and motivation for participation in STEM studies and careers [26].

Inclusive Workplace Policies and Practices. Implementing inclusive workplace policies and practices is essential for fostering a supportive atmosphere for women. Policies including flexible working hours, maternity leave, and access to childcare services assist women in reconciling their professional and personal obligations.. The organizations that adopting inclusive policies are more successful in retaining female employees and enhancing overall job satisfaction [27].

Raising Awareness and Addressing Gender Stereotypes. Raising awareness and addressing gender stereotypes are important steps toward promoting gender equality in the construction industry. The persistent gender stereotypes continue to hinder women's entry into and advancement within the sector. Awareness campaigns and specialized training programs designed to mitigate bias and discrimination can foster the establishment of a more inclusive organizational culture. [21].

Networking and Community Support. Establishing robust professional networks and community support systems is essential for women in the construction sector. Resilient networks offer both social support and avenues for information exchange and professional advancement. The women's organizations and professional associations within the construction sector serve as important platforms for information exchange, training, and professional support [28].

Increasing Women's Representation in Leadership. Augmenting women's representation in leadership roles can act as a significant source of inspiration and motivation for other women within the construction sector. The inclusion of women in leadership positions can dismantle the "glass ceiling" and facilitate opportunities for further women to progress into managerial and executive roles. Consequently, organizations must exhibit a robust commitment to advancing and endorsing women in senior positions to attain enhanced gender equality in the construction industry. [29].

5 Conclusion

Incorporating gender views into sustainable development is essential for fostering a more equitable, inclusive, and sustainable society. By confronting issues such as gender stereotypes, inequitable access to opportunities, and exclusive policies, nations may guarantee that sustainable development benefits not just a singular group but provides advantages to the entire populace. Concrete measures, such as enhanced policy frameworks, inclusive education, and women's economic empowerment, are essential for attaining equitable and sustainable development objectives.

The construction sector possesses considerable potential to enhance inclusivity and equity for all workers, including women. Despite the numerous barriers women encounter in this industry, significant opportunities exist to augment their participation through supporting policies, specialized training, adaptable work arrangements, and mentorship initiatives. These initiatives can render the construction industry more diverse and inclusive, ultimately benefiting all stakeholders.

Cooperation between corporations and governmental entities is crucial to overcome existing obstacles and to foster a more friendly and conducive environment for women in the construction sector.

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Transitivity Analysis in Prabowo Subianto's Presidential Inaugural Speech: A Critical Discourse Perspective

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Abstract. Presidential inaugural speeches are potent rhetorical tools that leaders utilize to shape national identity, validate authority, and create governance structures. This study analyzes President Prabowo Subianto's inaugural address (October 20, 2024) using Halliday's transitivity system within Critical Discourse Analysis to illustrate how systematic linguistic selections shape ideological stances, power dynamics, and national identity in Indonesian political discourse. The study employs qualitative content analysis of 487 clauses to discern patterns among six process types: material (43.7%), relational (24.4%), mental (18.9%), verbal (8.4%), existential (3.7%), and behavioral (0.8%). Material processes prevail, underscoring action-oriented governance and collective agency through inclusive first-person plural pronouns, thus democratizing accountability for national development. Relational processes shape Indonesia's post-colonial identity and unique democratic values rooted in Pancasila philosophy and cultural traditions. Mental processes foster a collective national consciousness by establishing specific propositions as universally accepted truths. The analysis shows that transitivity patterns have many ideological purposes. They make agency more democratic while possibly hiding power imbalances, they base modern policy on historical experience, they define culturally specific democratic practices, and they make foreign policy positions seem normal through experiential narratives. These linguistic strategies portray Prabowo's leadership as inclusive, action-oriented, and grounded in Indonesian values, while framing Indonesia as an independent nation dedicated to anti-colonial principles and global solidarity. This study enhances comprehension of non-Western political discourse and illustrates the relevance of Systemic Functional Linguistics to Indonesian presidential rhetoric, fostering critical analysis of political communication in various cultural settings.

Keywords: Transitivity analysis, Critical discourse analysis, Presidential inaugural speech, Systemic functional linguistics, Indonesian political discourse.

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1 Introduction

Presidential inaugural speeches are important parts of political discourse because they are powerful ways for newly elected authorities to share their vision, explain why they have power, and create ideological frameworks for how they will govern. These speeches are more than just ceremonial formalities; they are strategic communication acts that show political power, set the limits of leadership discourse, and build national identity. These speeches have deliberate selections of words that show ideological positions, power relations, and social goals [1].

The swearing-in of President Prabowo Subianto on October 20, 2024, was a major turning point in Indonesia's political progress. His first speech, which was given at the People's Consultative Assembly's Plenary Session and attended by officials from 19 countries, is a large body of work for language research. The speech talks about wanting Indonesia to be self-sufficient, have a democracy based on Indonesian principles, fight against colonialism, and stand with oppressed people all around the world. These are all things that Indonesia has wanted for a long time and still wants now.

Critical Discourse Analysis (CDA) has developed into a powerful analytical framework for examining the complex interplay between language, power, and ideology in political discourse. In this framework, Halliday's Systemic Functional Linguistics (SFL), especially the transitivity system, offers a structured approach to analyzing how linguistic selections shape representations of reality and convey ideological significances. Transitivity analysis examines how speakers depict processes, participants, and contexts within clauses, thereby uncovering implicit assumptions regarding agency, causation, and accountability. Zhou illustrates in the examination of Biden's inaugural address that transitivity patterns, when integrated with modality and personal pronouns, can proficiently reveal the ideological frameworks and power relations inherent in presidential discourse [2].

Recent academic work has acknowledged the significance of transitivity analysis in the deconstruction of political speeches. Research analyzing presidential inaugural addresses via Systemic Functional Linguistics (SFL) has elucidated how leaders intentionally utilize material, mental, relational, verbal, behavioral, and existential processes to formulate specific ideological stances and validate their authority. Research on Trump's and Biden's inaugural speeches has demonstrated that varying transitivity patterns signify divergent political ideologies and leadership styles, with material processes underscoring action and agency, while mental processes accentuate collective consciousness and shared values [3]. Likewise, transitivity analysis has demonstrated efficacy in elucidating how political actors position themselves and others through linguistic choices that either highlight or obscure agency, consequently influencing public perceptions of responsibility and power.

Even though Indonesia is the world's third-largest democracy and fourth-most populous country, there isn't much academic research on using transitivity analysis to study Indonesian presidential speeches. Many studies have looked at Western presidential speeches, especially American inaugural addresses, but there hasn't been much rigorous linguistic analysis of Indonesian political discourse from a CDA point of view. This gap is especially clear when it comes to modern Indonesian leadership rhetoric, which works within cultural, historical, and ideological contexts shaped by Pancasila philosophy, post-colonial identity, and Islamic values.

This study tackles this substantial gap by employing Halliday's transitivity framework, combined with a critical discourse analysis approach, to President Prabowo Subianto's inauguration speech. The goal of this study is to carefully find and analyze the different types of processes and roles that participants play, look at how these language choices shape ideological views on agency, responsibility, and national identity, and show the power dynamics that are hidden in the discourse.

2 Methods

2.1 Research Design

This research employs a qualitative content analysis methodology within the paradigm of Critical Discourse Analysis (CDA), specifically utilizing Halliday's Systemic Functional Linguistics (SFL) transitivity system as its analytical framework. The research design is descriptive-analytical, concentrating on the methodical identification and interpretation of linguistic patterns that convey ideological significance in presidential political discourse.

2.2 Data Source

The main source of information for this study is President Prabowo Subianto's inaugural speech, which he gave on October 20, 2024, to the Plenary Session of the People's Consultative Assembly of the Republic of Indonesia. The Cabinet Secretariat of the Republic of Indonesia website (setkab.go.id) has the official English translation of the speech. The speech had about 4,800 words and was given in front of 19 heads of state and government and 15 special envoys from friendly countries. The speech talks about important national issues like ending corruption, making food and energy self-sufficient, reducing poverty, democratic governance, and Indonesia's foreign policy principles.

2.3 Analytical Framework

The analytical framework is based on Halliday and Matthiessen's transitivity system, which has six types of processes [4]. Material processes denote actions and occurrences in the physical realm, including 'achieve,' 'build,' and 'work,' characterized by actors executing actions towards objectives. Mental processes use verbs like "understand," "believe," and "know" to encode cognition, perception, and affection. These verbs involve sensers who experience things. Relational processes create attribution or identification relationships using verbs like "is," "become," and "have," which involve carriers and their traits.

Verbal processes are actions that involve saying, such as "state," "declare," and "call." They involve sayers who make words. Behavioral processes encompass physiological and psychological actions, including 'smile' and 'breathe,' performed by individuals engaging in these activities. Lastly, existential processes merely affirm the existence of entities through constructions such as 'there is' and 'there are,' which pertain to entities that exist. There are certain participant roles and situational factors that go along with each type of process. These roles and factors work together to create certain representations of reality and encode certain ideological meanings in the discourse.

2.4 Data Analysis Procedure

The data analysis adhered to a methodical multi-stage protocol aimed at guaranteeing a thorough and stringent evaluation of transitivity patterns in the discourse. The speech text was initially divided into separate clauses, which are the fundamental units of analysis in transitivity theory. We broke down complex sentences into their parts, which included both independent and dependent clauses. This made it easier to figure out what kinds of processes and roles each participant played. For this segmentation process to work, we had to pay close attention to grammatical structures and syntactic boundaries to make sure that each analytical unit captured a complete process configuration.

After text segmentation, each clause was examined to determine the process type based on the primary verb and its semantic role. We sorted process verbs into Halliday's six process types, paying close attention to their meaning in context rather than just their grammatical form. This is because some verbs can mean different things depending on their semantic and syntactic context. For each identified process, the corresponding participant roles were established, including actors, goals, sensers, phenomena, carriers, attributes, sayers, verbiage, behavers, and existents, contingent upon the specific process type. This analysis of participant roles was very important for figuring out how responsibility and power were shared in the conversation. We then figured out the frequency and percentage distribution of each process type to find systematic patterns in the discourse. This gave us a quantitative basis for qualitative analysis. The identified patterns were subsequently analyzed within the framework of Critical Discourse Analysis (CDA) to elucidate how choices of transitivity shape ideological positions, signify agency and responsibility, and encode power dynamics within the presidential address. Finally, the linguistic findings were contextualized within Indonesia's post-colonial history, democratic evolution, and current policy challenges, facilitating a thorough comprehension of how language serves as an instrument of political persuasion and ideological formation in this particular cultural and historical milieu.

2.5 Validity and Reliability

To ensure analytical rigor, the research utilized various validation strategies. To start, Halliday and Matthiessen's complete classification criteria were used to double-check all clause segmentations and process classifications [4]. Second, we looked at more SFL literature and contextual clues to figure out what to do in cases that weren't clear. Third, we chose examples that were typical of each type of process to make sure that our interpretations were based on what the text said. The methodical utilization of Halliday's framework improves the reproducibility of this analysis.

3 Results and Discussion

3.1 Quantitative Distribution of Process Type

The transitivity analysis of President Prabowo Subianto's inaugural address revealed 487 clauses encompassing diverse process types. Table 1 shows how many of these processes there are.

Table 1. Distribution of Process Types

Process Type	Frequency	Percentage
Material	213	43.7%
Relational	119	24.4%
Mental	92	18.9%
Verbal	41	8.4%
Existential	18	3.7%
Behavioral	4	0.8%
Total	**487**	**100%**

In addition to Table 1, Figure 1 below also shows how many of these processes exist.

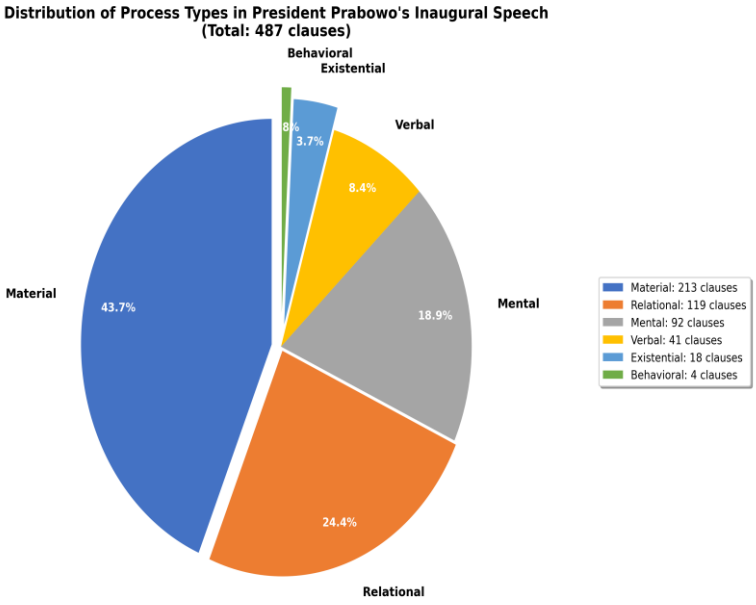

Fig. 1. Distribution of Process Types

The distribution shows that material processes make up the largest group (43.7%, n=213), followed by relational processes (24.4%, n=119) and mental processes (18.9%, n=92). Verbal processes constitute 8.4% (n=41), whereas existential (3.7%, n=18) and behavioral processes (0.8%, n=4) are less prevalent. This pattern indicates a discourse predominantly focused on tangible action and state attribution, with considerable emphasis on cognitive and communicative aspects. Figure 1 shows that material processes clearly dominate, taking up

almost half of the pie chart. This shows that the speech strongly emphasizes action-oriented governance.

3.2 Data Representation: Sample Transitivity Patterns

This part shows some examples from the full clause-by-clause analysis of 487 clauses. These examples show how the systematic coding method works and how different types of processes create meaning in presidential discourse. Each table displays the employed coding structure, including unique identifiers, complete clauses, process verbs, participant roles, and contextual factors. The entire dataset serves as the empirical basis for the interpretive analysis in the following sections.

3.2.1 Material Process Examples (n=213, 43.7%)

Table 2. Material Process Transitivity Analysis: Process, Participants, and Circumstances

Code	Clause	Process	Actor	Goal	Circumstance
MAT-001	We will achieve food self-sufficiency	achieve	We	food self-sufficiency	-
MAT-002	Let us build the future together	build	us	the future	together
MAT-014	We must eradicate corruption	eradicate	We	corruption	-
MAT-029	Indonesia must achieve food self-sufficiency	achieve	Indonesia	food self-sufficiency	-
MAT-060	We must face and eradicate corruption	eradicate	We	corruption	courageously
MAT-086	We will achieve the aspirations of our ancestors	achieve	We	the aspirations	with unity
MAT-106	Let us build the future together	build	us	the future	together
MAT-130	We support the independence of Palestine	support	We	the independence	of Palestine

Material processes predominate in the discourse, symbolizing tangible actions that formulate an action-oriented governance ideology. The repeated use of "we" and "us" as actors gives everyone a role in national development and makes them all responsible for it. Goals include becoming self-sufficient in food, building infrastructure, getting rid of corruption, and helping Palestine.

3.2.2 Relational Process Examples (n=119, 24.4%)

Table 3. Relational Process Transitivity Analysis: Carrier, Attribute, and Circumstance

Code	Clause	Process	Carrier	Attribute	Circumstance
REL-001	Indonesia is a democratic nation	is	Indonesia	a democratic nation	-
REL-002	We are against oppression	are	We	against oppression	-
REL-005	Indonesia is an independent nation	is	Indonesia	an independent nation	-
REL-006	Our democracy must be a polite democracy	must be	Our democracy	a polite democracy	-
REL-010	Power belongs to the people	belongs	Power	to the people	-
REL-019	Our principle is anti-colonialism	is	Our principle	anti-colonialism	-
REL-031	Our independence was not a gift	was	Our independence	not a gift	-
REL-097	We must be a courageous nation	must be	We	a courageous nation	-

Relational processes create Indonesia's national identity by connecting people and things in ways that describe and identify them. These processes set core values (like being democratic, independent, and against oppression) and help people build their post-colonial identity. The focus on "be" verbs connects Indonesia to certain ideas and places it in the context of international relations.

3.2.3 Mental Process Examples (n=92, 18.9%)

Table 4. Mental Process Transitivity Analysis: Senser, Phenomenon, and Circumstance

Code	Clause	Process	Senser	Phenomenon	Circumstance
MEN-001	We understand that independence was not a gift	understand	We	that independence was not a gift	-
MEN-003	We are aware that poverty remains prevalent	are aware	We	that poverty remains	-
MEN-013	We must always understand that power belongs to people	understand	We	that power belongs to people	always
MEN-022	Let us have the courage to reflect	have courage	us	to reflect	-
MEN-046	Leaders understand our nation's culture	understand	Leaders	our culture	-
MEN-070	We must be solidary	must be	We	solidary	-
MEN-091	We want to see people smiling	want	We	to see people smiling	-

Mental processes create a shared consciousness through cognition (understanding and being aware), perception (seeing), and affection (wanting). The prevalent use of 'we' as a senser portrays the nation as a cohesive cognitive entity. These processes make some propositions seem like universally accepted truths instead of things that people disagree about.

3.2.4 Verbal Process Examples (n=41, 8.4%)

Table 5. Verbal Process Transitivity Analysis: Sayer, Verbiage, and Circumstance

Code	Clause	Process	Sayer	Verbiage	Circumstance
VER-001	I have declared Indonesia must achieve self-sufficiency	declared	I	Indonesia must achieve	-
VER-003	I call upon all to have courage	call upon	I	all to have courage	-
VER-004	I invite all parties to unite	invite	I	all parties to unite	-
VER-007	Those are the teachings of Bung Karno	are	Those	the teachings	-
VER-009	President Jokowi invited me to unite	invited	President Jokowi	me to unite	-

Verbal processes set the president's power and call on past events. The president puts himself in the role of speaker by saying "I have declared" and "I call upon," which are speech acts that make policies real in conversation. Using "invite" instead of "command" makes leadership persuasive instead of coercive, which is in line with Indonesian cultural values.

3.2.5 Existential Process Examples (n=18, 3.7%)

Table 6. Existential Process Transitivity Analysis: Entity and Circumstance

Code	Clause	Process	Existent	Entity	Circumstance
EXI-001	There are still far too many leaks	are	-	leaks	still far too many
EXI-003	There are too many people living below poverty line	are	-	people living below poverty	too many
EXI-010	There are many challenges from outside forces	are	-	challenges from outside	many

Code	Clause	Process	Existent	Entity	Circumstance
EXI-017	There are vast areas of land and seas	are	-	vast areas	vast

Existential processes recognize social realities and issues through the use of 'there are' constructions. These processes find a balance between being hopeful about Indonesia's future and being aware of the problems that are already there (leaks, poverty, and people in pain). By saying that problems exist without blaming anyone, the speech recognizes them while keeping everyone together.

3.2.6 Behavioral Process Examples (n=4, 0.8%)

Table 7. Behavioral Process Transitivity Analysis: Behaver, Behavior, and Circumstance

Code	Clause	Process	Behaver	Behavior	Circumstance
BEH-001	Our children go to school without breakfast	go	Our children	-	without breakfast
BEH-002	Our citizens aged over 70 are pedaling rickshaws	pedaling	Our citizens	-	aged over 70
BEH-003	The common people are smiling	smiling	The common people	-	-

Even though they don't happen very often, behavioral processes make abstract political issues more real by creating concrete images of embodied struggle. When statistics talk about kids going to school without breakfast or old people pedaling rickshaws, they become more emotionally powerful and morally important.

3.2.7 Material Processes: Constructing Action-Oriented Governance

The fact that 43.7% of President Prabowo's speech is about material processes shows that he is using a rhetorical strategy on purpose to make his government look like it is focused on action and getting things done. Material processes refer to actions and events in the physical world, including agents who carry out actions to achieve goals. This predominance aligns with the findings of [3], which indicate that material processes in presidential speeches emphasize particular actions and portray the leader as an active agent of change. Recent transitivity studies of political speeches further support this finding. Zhao and Zhang's in Fadilah and Kuswoyo examination of Trump's inaugural address indicated that material processes constituted 68.6%, illustrating how political leaders utilize these processes to depict national challenges and delineate governmental actions discovered that around 60% of Ghana's President John Evans Attah Mills' inaugural State-of-the-Nation address comprised material processes, indicating that

Mills and his administration portrayed themselves as the principal agents of national development [5].

The actor role in material clauses is mostly shown by first-person plural pronouns that include "we," "us," and "our." "We will achieve food self-sufficiency," "Let us unite to seek solutions," "We must work hard," and "Let us build the future together" are some examples. Using inclusive pronouns all the time gives the impression that everyone is in charge, which makes the president not an authoritarian leader but a leader who works with the people of Indonesia. Khan and Eid say that using these kinds of pronouns in political speech helps to bring people closer together and make them feel like they are all responsible for the same things [6]. There is a lot of evidence that this strategic use of inclusive pronouns happens in many different political situations. Romadlani's study of Obama's speeches found that the pronoun "we" and its variations appeared 183 times. This shows that Obama wanted to "share responsibility and build a sense of nationalism, togetherness, and equality." [7] Studies of pronouns in political interviews show that the inclusive "we" is used to "invoke a sense of collectivity and to share responsibility" while avoiding assigning blame to one person [8].

The goals of material processes show what the administration thinks is most important. The main goals are to be self-sufficient in food and energy: "We must become self-sufficient in food," "We will be ready to become a global food estate," and "We must become self-sufficient in energy." These material processes illustrate Indonesia's post-colonial aspiration to govern its own resources by embedding an ideology of national sovereignty and economic autonomy. This focus on self-sufficiency in food and energy as signs of sovereignty is in line with the larger political conversation about national independence. A recent study employing Critical Discourse Analysis to examine Prabowo's presidential speech revealed that he "constructs an assertive yet inclusive leadership persona by using high-certainty modality to project confidence in achieving national goals, particularly food and energy self-sufficiency," with deontic expressions framing these objectives as "collective moral obligations" [9]. These results corroborate Hamilton's historical assertion that self-sufficiency in essential areas of "subsistence, habitation, clothing, and defense" is requisite for national independence and sovereignty [10].

The speech also talks about infrastructure and development by using words like "build," "develop," "strengthen," and "improve." This shows that governance is really about making changes in the real world. Material processes that deal with corruption and ending poverty make these issues seem like real problems that can be solved, not just ideas: "We must eradicate corruption," "We will eliminate poverty from Indonesian soil." This framing makes it seem like the president is ready to face tough problems head-on. This gives him the power to be a strong leader who can fix Indonesia's most important issues. This strategic framing via material processes aligns with findings from research on political discourse in alternative contexts. Critical discourse analysis of Obama and Rouhani's UN speeches illustrated that "material process indicates government's activities" and allows audiences to discern that leaders "are action leaders" dedicated to tangible solutions. Their analysis showed that material processes like "I, we, America, United States" help people understand that "Obama and his government are action leaders who are against chemical weapons and want to do their best to provide a kind of peace among nations." [11] Trump's inaugural address used material processes in the same way "to indicate his future actions intended to establish national priority" and to show himself as "the actor and the doer with clear goals (a strong leader)" [12]. These patterns show that in

different political situations, material processes are important language tools for building trust in leaders and showing that the government can handle important national problems.

3.2.8 Relational Processes: Defining National Identity

Relational processes (24.4%) are crucial for constructing and reinforcing Indonesian national identity, particularly when employed in attributive and identifying clauses. These steps decide what Indonesia is, what it stands for, and how it sees itself in the world. The speech talks about important national values like "Indonesia is a democratic nation," "We are against oppression," "We are anti-racism, anti-apartheid," and "Indonesia is an independent nation."

This significant prevalence of relational processes corresponds with trends noted in other presidential inaugural addresses. A comparative examination of Trump's and Xi Jinping's inaugural speeches indicated that relational processes ranked second in frequency (19.1% in Trump's speech and 27.1% in Xi's speech), following material processes [13]. Likewise, research on the speeches of successful women leaders revealed that relational clauses represented the second-highest frequency at 30.3%, illustrating that these processes are essential for "describing actions and events" and for establishing connections among various elements of national discourse [14]. An analysis of the British Queen's Parliament Speech affirmed that "the relational process makes the power of the government closely connected with the country and the citizens" [15].

The high frequency of relational processes exemplifies what Zhou characterizes as a prevalent tactic in inaugural addresses: employing definitional statements to formulate a cohesive national identity and value system [2]. This strategic utilization of relational processes for identity construction is extensively documented in political discourse research. Liping in Persieus Balog contends that "relational processes are generally used to explain political concepts" in political speeches [16]. Obama's inaugural speeches showed how relational processes, which are "a process of being," are good for explaining the complicated connections between some abstract things because they sound certain. This made them especially good for "making the reasoning naturally and unconsciously accepted" [17]. Kashif et al. conducted a transitivity analysis that demonstrated Hillary Clinton's increased utilization of relational processes to articulate "her cognitive, sentimental, sensitive, attributive, and existential approach" during presidential debates [18].

This utilization of relational processes to construct identity through historical reference aligns with findings from comparative political discourse analysis. The examination of Trump's and Xi's speeches indicated that "Trump's relational processes primarily concentrate on attributive types of relational processes, physically illustrating American contexts and proposing a new blueprint for the American populace," whereas "relational processes of identifying types in Trump's discourse delineate the nation belonging to its citizens, thereby reducing the psychological distance between the new administration and the American people" [13]. Similarly, the analysis of Hillary Clinton's debate performance revealed that "relational clauses are categorized into two types: identifying and attributive," with Trump employing relational processes to "vehemently characterize the attributes of the current foreign policy" while defining "outsiders' identity through the process types of being and existing" [18].

Also, relational processes shape what Indonesian democracy is like: "Our democracy must be a polite democracy." "Our democracy must not be violent," and "Our democracy must be uniquely

Indonesian." These intensive attributive clauses create a unique Indonesian idea of democracy that is different from Western ideas and is based on local cultural values like politeness, consensus, and non-violence. This strategic employment of relational processes illustrates how language formulates not only descriptions of reality but also prescriptive ideological frameworks that influence political expectations and behaviors. Senator Miriam Defensor-Santiago's privilege speeches also used relational processes "to show inequalities and problems in society" and "to explain some concepts, attack someone's credibility and character, and express the state of affairs of the country" [16]. This shows that relational processes can be used in political discourse to build national identity and values across cultures.

3.3 Implications

The results of this transitivity analysis of President Prabowo Subianto's inaugural speech have important implications for teaching English, especially in the areas of English for Specific Purposes (ESP), Critical Discourse Analysis pedagogy, and developing academic literacy. This study shows that Hallidayan transitivity analysis can be used as a teaching tool to help students become more aware of how language works [19]. Language teachers can use presidential inaugural speeches as real texts to teach CDA principles [20]. This helps students go beyond just understanding what the speeches say and start to think critically about how language shapes ideology and power relationships.

The methodology utilized in this research; dividing texts into clauses, classifying processes, recognizing participants, and analyzing patterns, provides a replicable framework that can be modified for diverse text types beyond political speeches. Students can use these analytical skills on news stories, ads, business emails, and social media posts. This will help them build critical literacy skills that they can use in any information setting today. Teachers can create classroom activities that help students learn how to do systematic transitivity analysis. The speech that was analyzed in this study is a great example of a text that shows clear patterns in material, relational, and mental processes that intermediate to advanced learners can easily spot.

This research offers a framework for systematically analyzing political discourse for students studying political science, international relations, journalism, or public administration [21]. ESP curricula can integrate transitivity analysis as a fundamental analytical skill, allowing students to critically assess political communication instead of merely absorbing it. The research elucidates the diverse rhetorical functions of various process types in presidential discourse: material processes highlight tangible actions and accomplishments, relational processes delineate identity and values, mental processes shape collective consciousness, and verbal processes assert authority. Students learning to write their own speeches or policy papers can be taught to use transitivity patterns on purpose to get certain rhetorical effects.

This research exemplifies rigorous academic discourse analysis and serves as a model for instructing academic writing in linguistics and applied language studies. The study's structure, from an extensive literature review to a methodical methodology, culminating in thorough data analysis and critical interpretation, furnishes students with a framework for executing and reporting their own research. The amalgamation of diverse theoretical perspectives exemplifies interdisciplinary synthesis, illustrating how proficient academic writing contextualizes particular analyses within expansive scholarly discourses while offering novel contributions to knowledge.

This research enhances general linguistic awareness, benefiting all language learners, irrespective of their specific disciplinary focus. Grasping how language choices shape meaning and encode ideology augments students' critical thinking skills and their proficiency in navigating intricate texts within academic and professional spheres [22]. The research indicates that ostensibly neutral grammatical selections yield substantial ideological ramifications, equipping students to be more discerning consumers of media, political communication, and institutional discourse. This kind of critical language awareness is especially useful in democracies where people have to judge political claims, look at policy proposals, and make smart choices when they vote.

The results suggest that transitivity analysis should be used more often in English language classes for both undergraduate and graduate students. Curriculum designers can make progressive learning paths that slowly introduce transitivity ideas. They can start with identifying basic process types and work their way up to more complex interpretations of patterns in real political discourse. Adding corpus linguistics tools like UAM CorpusTool or AntConc would make teaching even better by letting students use technology to do large-scale discourse analysis and find statistically significant patterns across many texts.

The examination of Indonesian presidential discourse in this study underscores significant factors for instructing English in multilingual and multicultural environments. The research shows that post-colonial identity, cultural values, and historical experience affect political rhetoric in ways that are very different from how Western discourse works. This means that teachers should recognize these cultural differences instead of treating Western rhetorical conventions as universal norms [23], [24]. Students can learn a lot by looking at political speech from their own countries. For example, they can use transitivity analysis to figure out how their leaders use language to build national identity, justify their power, and deal with policy problems.

The methodology utilized in this research proposes novel assessment strategies for measuring students' critical discourse analysis skills. Instead of testing students' decontextualized grammatical knowledge through traditional exams, assessments can require students to perform independent transitivity analyses of authentic texts, showcasing their capacity to accurately identify and classify process types, discern patterns in process distribution, interpret the ideological implications of transitivity choices, and articulate findings clearly with suitable textual evidence. Such performance-based assessments are in line with constructivist teaching methods and do a better job of measuring students' real-world analytical skills [25].

4 Conclusion

This transitivity analysis of President Prabowo Subianto's inaugural speech elucidates how systematic linguistic selections formulate ideological stances, depict power dynamics, and delineate national identity within Indonesian political discourse. The analysis of 487 clauses reveals that material processes predominate (43.7%), highlighting action-oriented governance and collective agency through inclusive pronouns ("we," "us," "our"). This linguistic strategy makes everyone responsible for the country's growth and gives them a sense of shared destiny that could go beyond political differences. Relational processes (24.4%) shape Indonesia's post-colonial identity and unique democratic principles, anchoring modern values in the historical

contexts of colonialism and oppression. Mental processes (18.9%) shape collective consciousness, framing the Indonesian nation as a cohesive cognitive entity that collectively comprehends national challenges and aspirations.

The analysis reveals that transitivity patterns fulfill essential ideological roles: they democratize agency while possibly concealing power imbalances, link current policies to historical legitimacy, delineate culturally specific democratic practices, and normalize foreign policy stances through experiential narratives. These strategies construct a narrative that positions Prabowo's leadership as inclusive and proactive, while depicting Indonesia as a sovereign nation dedicated to anti-colonial ideals. This study enhances non-Western political discourse analysis and illustrates the relevance of Systemic Functional Linguistics to Indonesian presidential rhetoric. Future research should perform comparative analyses of various presidential speeches, assess audience reception across diverse constituencies, explore translation effects between Indonesian and English versions, and integrate multimodal elements. The results deepen comprehension of the linguistic construction of political reality, bearing significance for critical engagement with political communication and democratic literacy across varied cultural contexts.

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Beyond The Words: Flouting Maxims in the Dynamics Of EFL Classroom Talk

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Abstract. This study aims to analyze the types and underlying reasons for flouting maxims employed by the lecturers and the students during English as a Foreign Language (EFL) classroom interactions. The analysis focuses on utterances produced between lecturers and students as well as among students. This research adopts a descriptive qualitative design. The participants consist of students from the English Language Education Study Program at Unika St. Paulus Ruteng, specifically class 2024A. Data were collected through classroom observations and audio recordings. The findings reveal three types of flouting maxims: (1) maxim of quantity, (2) maxim of quality, and (3) maxim of relevance. A total of twelve instances were identified, consisting of eight cases (66.66%) of quantity, two cases (16.67%) of quality, and two cases (16.67%) of relevance. No instances of the maxim of manner were found. The reasons behind the flouting include efforts to ensure comprehension, avoid misunderstanding, difficulty in hearing questions, and uncertainty in responding. These findings indicate that both lecturers and students flout conversational maxims for pedagogical and communicative purposes within EFL classroom interaction.

Keywords: Flouting Maxim, EFL Classroom, Pragmatics, Classroom Interaction.

1 Introduction

The concept of flouting maxims stems from the field of pragmatics, a branch of linguistics that examines how meaning is constructed and interpreted in communicative interactions. Flouting maxims refers to a deliberate deviation from Grice's Cooperative Principle, where speakers intentionally break conversational maxims not to deceive, but to imply additional meaning beyond the literal interpretation. Instead of violating maxims to mislead, speakers flout maxims to encourage listeners to interpret implied meanings, making the communication richer and more nuanced [1]. This act of flouting invites listeners to look deeper into utterances and derive implied meanings through contextual understanding, a process known as conversational implicature.

For conversational implicature to be successful, both speakers and listeners must share a mutual understanding of context, roles, and situational expectations [2]. When a maxim is flouted, the audience is not confused or misled; instead, they infer extra meaning, demonstrating a shared pragmatic awareness. However, if participants lack such pragmatic competence, communication breakdowns may occur. Grice's cooperative principle emphasizes that successful communication relies on collaboration between speakers and listeners, where

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contributions are expected to be relevant, informative, truthful, and clear [3] . Therefore, the way maxims are observed or flouted plays a crucial role in maintaining communicative effectiveness.

In educational settings, especially in language classrooms, communication between teachers and students is essential in shaping understanding and learning outcomes. Classroom interaction involves the exchange of ideas, questions, explanations, and feedback [4]. Teachers modify their language to help students comprehend lessons, while students respond to demonstrate understanding and negotiate meaning. Classroom communication is not solely verbal; non-verbal cues such as gestures, facial expressions, and eye contact are equally important in conveying meaning and maintaining rapport [5]. Interaction, therefore, has both verbal and non-verbal dimensions and contributes not only to learning but also to social and interpersonal development in classroom contexts [6] [7]

Within EFL (English as a Foreign Language) classrooms, understanding how communication unfolds becomes vital because students are still developing their linguistic and pragmatic skills. Flouting maxims naturally occurs during classroom communication when messages are misunderstood, when students provide excessive information, or when teachers give indirect feedback. Research suggests that flouting maxims in EFL classrooms supports communicative competence, encourages deeper interpretation, and enhances student engagement when used appropriately [8]. Conversely, excessive or unintended flouting of maxims may cause confusion, misunderstanding, and reduced teaching effectiveness [9]. This highlights the need to examine how and why flouting maxims occurs in academic settings to ensure effective knowledge transfer and communication.

Existing studies on flouting maxims have primarily focused on media discourse and entertainment settings, such as talk shows, movies, and political interviews. For example, [10] observed flouting maxims in a talk show, finding quantity and manner maxim violations most frequent. Similarly, [11] analyzed Trump's interview utterances and reported quantity maxim flouting as dominant, suggesting intentional elaboration for emphasis and persuasive function. [12] examined flouting maxims in a movie, identifying the manner maxim as most frequently flouted. These studies share a common focus: they examine flouting maxims in entertainment media and public discourse, but do not explore flouting in educational settings nor analyse the reasons behind these pragmatic choices beyond situational context.

Despite a growing body of pragmatic research, there is limited empirical investigation into flouting of maxims in EFL classrooms, particularly at the university level. Most previous studies concentrate on media interactions, scripted dialogues, or political speech. These contexts differ significantly from academic learning situations, where communicative goals involve explanation, clarification, participation, and feedback. Additionally, existing literature tends to describe types of maxim flouting but lacks deeper analysis of why speakers choose to flout maxims in educational communication [12].

Therefore, the current study addresses this gap by examining both the types and the reasons for flouting maxims in university-level EFL classroom interactions. This focus provides a more natural and educationally relevant exploration of pragmatic behaviour, offering insight into how teachers and students manage communication, negotiate meaning, and interpret messages in real teaching settings. The novelty of this research lies in its attempt to understand

maxim flouting not merely as linguistic deviation, but as a pedagogical phenomenon connected to comprehension, teaching strategies, and student response patterns.

Analysing flouting maxims in university EFL settings contributes to pragmatic theory by expanding its application to academic discourse. It also benefits teaching practice by identifying communicative strategies that support or hinder learning. If teachers frequently flout maxims unintentionally, students may struggle to grasp instructional meaning. Conversely, intentional flouting, such as giving hints rather than direct answers, may foster critical thinking and inferential skills [13] .

Furthermore, examining student utterances helps reveal their pragmatic awareness and linguistic competence[14]. When students provide overly detailed responses or unexpected answers, this may reflect misunderstanding, eagerness to display knowledge, or lack of pragmatic refinement. Understanding these motivations enriches knowledge about learner language development and communication patterns in EFL learning environments.

In summary, this study fills an important research gap by shifting attention from entertainment-based maxim flouting to authentic educational communication, exploring not only the presence of flouted maxims but also the pedagogical reasons behind them. The findings are expected to contribute to pragmatic theory, provide practical insights for EFL educators, and improve communication effectiveness in university language classrooms. By analysing this phenomenon, the research promotes a deeper understanding of how linguistic meaning is negotiated and how classroom interaction supports language learning through cooperative and strategic communication.

2 Researh Method and Material

This research adopts a qualitative approach, as its primary aim is to capture and interpret natural classroom interactions through observation of real teaching and learning activities. Qualitative inquiry emphasizes generating descriptive, context-based data derived from observable behavior and authentic verbal expressions, thereby requiring an in-depth understanding of the phenomena under scrutiny. Qualitative research prioritizes the exploration of concepts, ideas, and processes as they emerge within natural settings [15]. In line with this principle, the present study investigates instances of flouting conversational maxims within English as a Foreign Language (EFL) classroom interaction, particularly during the instructional process, prompting the selection of a descriptive qualitative design. The participants in this study consist of students enrolled in the English Language Education Study Program at Unika St. Paulus Ruteng, specifically class 2024A. The determination of this class was carried out in consultation with an English lecturer to ensure that the selected group demonstrated active classroom engagement, particularly in spoken English practice. Second-year students were chosen based on established characteristics relevant to the research focus and professional recommendation from the lecturer, ensuring that the target group exhibited strong participation in English communication, including asking and responding to questions and demonstrating dynamic interaction with peers and the lecturer. Such conditions were deemed optimal for observing the occurrence of maxim flouting in authentic classroom discourse. Data collection followed several procedures: selecting a class with robust interaction, observing classroom dynamics, recording verbal exchanges, documenting utterances that exhibited maxim flouting using observation sheets,

listening to audio recordings multiple times, identifying utterances that aligned with the types and motivations for maxim flouting, and finally cross-checking the notes against the recorded data for accuracy. The primary instrument employed was an observation sheet designed to document linguistic functions and categorize instances of maxim flouting according to pragmatic indicators. This instrument facilitated systematic identification of the flouting strategies used by both the lecturer and students during classroom interaction. For data analysis, the study applied Miles and Huberman's framework [16] which comprises three interconnected stages: data reduction, data display, and conclusion drawing and verification. Data reduction involved selecting relevant utterances and organizing them based on the observed categories; data display entailed presenting the organized data in a structured manner for interpretation; and the final stage encompassed drawing meaningful conclusions and validating them to ensure the reliability and accuracy of the findings.

3 Result

There are three types of flouting maxim, namely: flouting maxim of quality, flouting maxim of quantity, and flouting maxim of relevance. In addition, the data on the flouting of the maxim was taken from classroom observations. The types of the flouting maxim are displayed in the following table:

Table 1. Types of Floating Maxim.

No.	Type of Maxim	Frequency (n)	Percentage (%)
1	Maxim of Quantity	8	66.66
2	Maxim of Quality	2	16.67
3	Maxim of Relevance	2	16.67
	Total	**12**	**100**

The table presents the distribution of flouted conversational maxims identified in the classroom interactions. The findings show that the Maxim of Quantity was flouted most frequently, accounting for 8 occurrences (66.66%), indicating a strong tendency among lecturers and students to provide either excessive or insufficient information during instructional discourse. In contrast, the Maxims of Quality and Relevance were flouted less frequently, each occurring 2 times (16.67%). These results suggest that deviations in classroom communication were predominantly related to information load rather than accuracy or topical relevance, highlighting the pedagogical nature of elaboration and clarification in EFL classroom interaction.

4 Discussion

Effective classroom communication relies heavily on adherence to pragmatic principles that ensure clarity, cooperation, and mutual understanding between interlocutors. Drawing on Grice's in [16]Cooperative Principle, this study examined how lecturers and students in an EFL classroom context adhered to or flouted conversational maxims during instructional

interaction. The analysis revealed that participants frequently deviated from these maxims, resulting in various instances of maxim flouting. Such deviations, however, do not necessarily indicate communicative failure; rather, they may reflect the dynamic and pedagogically purposeful nature of classroom discourse. In EFL contexts, where learners are simultaneously developing linguistic and pragmatic competence, flouting conversational maxims can serve as a strategic means of maintaining interactional flow, expressing politeness, or compensating for linguistic uncertainty. The following discussion elaborates on the types of maxim flouting identified in the data specifically the Maxims of Quantity, Quality, and Relevance and interprets their occurrence in relation to existing research and theoretical frameworks.

4.1 Flouting of the Maxim of Quantity

The findings indicate that violations of the Maxim of Quantity occurred most frequently during lecturer -student interactions. This maxim is considered flouted when speakers provide either insufficient or excessive information beyond what is pragmatically required to achieve communicative efficiency. In this study, the Maxim of Quantity represented the highest proportion of flouting, accounting for 8 instances (66.66%). This observation aligns with [17] findings, which similarly revealed that both teachers and students tend to produce utterances that either exceed or fall short of the expected informational load in classroom interaction.

An illustrative exchange can be seen below:

Lecturer: Is it a new word for you?

Student: Actually not a new one, but we forgot it.

In this instance, the student provides additional information beyond the lecturer's inquiry, elaborating that the word is familiar but temporarily forgotten. Instead of a brief affirmative or negative answer, the student's response demonstrates engagement and an attempt to maintain a positive rapport with the lecturer. This supports [10] argument that the provision of additional information can foster mutual understanding and enhance communicative rapport. While such elaboration technically constitutes a flouting of the maxim, it functions pedagogically by promoting conversational continuity and rapport building. According to [18]adherence to the Maxim of Quantity requires speakers to provide information that is neither more nor less than necessary. However, in instructional settings, deviation from this principle can serve pragmatic and interpersonal functions. Minimizing unnecessary elaboration may contribute to clearer instructional discourse, yet in classroom contexts, such flouting can also indicate active participation and communicative confidence.

4.2 Flouting of the Maxim of Quality

Flouting of the Maxim of Quality was identified in 2 instances (14.28%), where students provided information that was inaccurate or unsupported by sufficient evidence. This maxim is breached when speakers, knowingly or unknowingly, present information that does not correspond to reality [3] The current finding corroborates a study, which reported that EFL students sometimes produce incorrect answers due to limited content knowledge or misunderstanding, even though they believe their responses are correct [19]

Example:

Lecturer: What are the types of cohesion devices?

Student: Synonym.

Lecturer: Are you sure?

The student's response demonstrates an inaccurate understanding of the concept, as a synonym is not classified as a cohesion device. The lecturer's follow-up question highlights the lack of truthfulness or accuracy in the initial response. Such instances may arise from limited linguistic competence, low confidence, or misinterpretation of the question. This aligns with [13] assertion that flouting the Maxim of Quality often results from unintentional inaccuracies rather than deliberate deception.

Interestingly, [11] found no instances of this maxim being violated in political discourse, indicating that the occurrence of quality flouting is context-dependent. In educational discourse, such violations may reflect the cognitive process of hypothesis testing among learners. As Grice emphasizes, speakers should avoid providing information without adequate evidence. Thus, promoting awareness of content accuracy and evidence-based communication can enhance students' pragmatic competence and academic accountability [20]

4.3 Flouting of the Maxim of Relevance

Flouting of the Maxim of Relevance also appeared in the data, accounting for 2 instances (14.28%). This maxim is considered flouted when interlocutors' contributions are not pertinent to the preceding discourse, thereby disrupting the conversational flow. The finding is supported by the previous research that claims irrelevant responses often emerge when speakers fail to interpret the conversational context appropriately [21]

Example:

Lecturer: What is morphology?

Student: Bruder.

The student's response here is entirely irrelevant to the lecturer's academic question, suggesting inattentiveness or misunderstanding. Such off-topic responses may stem from lapses in comprehension or from momentary distraction. This observation is consistent with the previous research's explanation that flouting of relevance commonly arises when participants fail to process contextual cues [22]Grice emphasized that maintaining relevance is crucial for cooperative communication; thus, encouraging active listening and contextual awareness among students may reduce the frequency of such pragmatic deviations.

Overall, the analysis revealed three types of maxim flouting: Quantity, Quality, and Relevance with the Maxim of Quantity being the most frequently violated. No instances of the Maxim of Manner were observed. These findings underscore that pragmatic deviations in EFL classroom discourse are shaped by cognitive, linguistic, and interactional factors. Rather than representing communicative breakdowns, many of these flouting served pedagogical and interpersonal purposes, such as maintaining politeness, managing uncertainty, or sustaining engagement.

In sum, the study highlights the integral role of pragmatic competence in shaping effective classroom communication. Understanding how and why students flout conversational maxims offers valuable insights into EFL pedagogy, suggesting that teachers can use such pragmatic phenomena as opportunities to foster communicative awareness, promote linguistic accuracy, and enhance interactional fluency in language learning environments.

5 Conclusion

The objectives of this study were to identify the types and reasons for the flouting of conversational maxims used by lecturers and students during classroom interactions in an EFL (English as a Foreign Language) context. The findings revealed that the phenomenon of flouting maxims occurs within the communicative exchanges of EFL classrooms, particularly in the English Language Education Program at UNIKA St. Paulus Ruteng. Specifically, three types of flouting maxims were identified: the maxim of quantity, the maxim of quality, and the maxim of relevance. The maxim of quantity was the most frequently flouted, occurring eight times (66.66%), followed by the maxim of quality and the maxim of relevance, each occurring twice (14.28%). Notably, no instances of the flouting of the maxim of manner were found throughout the data.

These findings suggest that both lecturers and students sometimes intentionally provide more or less information than required, offer statements lacking truthfulness or relevance, or deviate from the expected level of informativeness to achieve certain communicative goals. Such deviations are often employed to express emphasis, maintain politeness, clarify meaning, or engage the interlocutor more effectively. The occurrence of these flouting indicates that pragmatic competence understanding how language operates beyond literal meanings plays an essential role in EFL classroom communication.

In conclusion, the study confirms the applicability of Grice's Cooperative Principle and its maxims in analysing classroom discourse. The presence of flouting maxims demonstrates that EFL interactions are not purely transactional but also social and pragmatic in nature. Recognizing these pragmatic behaviours is crucial for improving classroom communication, fostering better mutual understanding, and developing learners' pragmatic awareness. Future research may expand this investigation by including more varied classroom settings and larger participant groups to provide broader insights into the pragmatic aspects of EFL learning.

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The EFL Students' Perception on the Use of Social Media as the Tools of Learning English at UNIKA Santu Paulus Ruteng

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Abstract. This study explores English as a Foreign Language (EFL) students' perceptions of using social media as a tool for learning English at UNIKA Santu Paulus Ruteng. The research focuses on the perceived benefits, challenges, and the most frequently used platforms among learners. Utilizing a quantitative descriptive method, the study involved a sample of 50 participants selected from a population of 94 fifth-semester EFL students. Data were collected using an online closed-ended questionnaire distributed via Google Forms. The findings reveal that students generally hold a significantly positive attitude toward social media for language learning, reporting improvements in listening, speaking, reading, vocabulary, grammar, and pronunciation. YouTube was the most frequently used platform (60%), followed by Instagram (40%), based on a platform usage analysis. While these tools enhance engagement and reduce learning anxiety, students identified technical limitations—specifically poor internet connectivity and device constraints—as primary challenges to effective usage. The study suggests that integrating multimedia platforms into formal educational strategies can optimize language learning outcomes while necessitating digital literacy initiatives to address existing barriers.

Keywords: English Learning, Perception, Social Media

1 Introduction

In today's world, social media has become a crucial aspect of our daily lives. People of all ages regularly engage with this technology. Social media has emerged as a crucial communication platform in the modern internet age. Various types of social media platforms, including Facebook, Twitter, Instagram, WhatsApp, and YouTube, are readily available and free to join. As a result, nearly all students are familiar with and have used these platforms. For students at Universitas Katolik Indonesia (UNIKA) Santu Paulus Ruteng, located in a region with geographically limited access to native English speakers and authentic immersion environments, social media serves as a vital bridge to the global Anglophone world. In the digital age, social media has become an integral part of everyday life, influencing not only communication and entertainment but also education. With the rise of platforms like Facebook, Twitter, Instagram, WhatsApp, and YouTube, students have begun to utilize these tools for academic purposes. Initial observations at UNIKA Santu Paulus Ruteng reveal that while students are digitally active, they face unique "technology impediments," including inconsistent

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internet connectivity and limited device specifications. This study is specifically conducted here to justify how students navigate these local constraints to utilize social media for independent and informal learning.

Social media is an online platform that allows the creation and sharing of information through text, videos, and images [1]. Yuniar and Purnamaningsih [2] identified four primary reasons for using social media applications: entertainment, social interaction, information sharing, and academic purposes. As a result, beyond communication and entertainment, many students today also use social media as a learning tool. In the context of English as a Foreign Language (EFL), social media offers numerous opportunities for students to improve their English skills, as it provides a wide range of resources for learning the language [3]. YouTube was developed to allow users to discover and share content, such as videos and photos [4]. By utilizing social media, students can access a variety of English content, such as videos and posts, which enables them to learn new aspects of the language. This not only creates a fresh learning environment but also boosts their motivation to study English [5]. Given that English is an international language and the most commonly used for social media interactions, students benefit from the opportunity to exchange information and knowledge [6]. Social media has evolved into a multimedia platform that delivers diverse content, which textbooks alone cannot provide [7]. Perception is a biological process involving receiving messages through the five senses: sight, hearing, smell, taste, and touch [8]. Learning English is a process of getting knowledge about English skills [9]. Recently, research by Aryanti et al. [10] showed positive perceptions regarding social media helpfulness in learning English.

While previous research has established a general positive perception of digital tools, a significant research gap remains regarding the specific interplay between students' emotional resilience (such as reduced anxiety) and the technical limitations inherent in a rural Indonesian university context. This study aims to investigate the attitudes of English as a Foreign Language (EFL) students concerning the incorporation of social media as a teaching instrument. The principal motive is the growing ubiquity of digital platforms in daily life, necessitating that instructors comprehend the influence of these technologies on language acquisition and academic involvement. This study is especially important for university students as it underscores the transition from conventional textbooks to multimedia tools that help elevate motivation, diminish learning anxiety, and cultivate a more relaxed, stress-free atmosphere. The study offers specialized insights into the particular educational requirements and technology impediments, including connectivity challenges and device limits, encountered by students at Universitas Katolik Indonesia (UNIKA) Santu Paulus Ruteng. This research provides significant information for campus administrators and educators to enhance teaching methodologies and effectively incorporate digital literacy into the curriculum, hence improving language learning outcomes.

2 Literature Review

Social Media

Social media consists of information and communication technology tools used for constant communication. It has become an influential tool in language learning, providing interactive

and authentic ways for learners to engage with the target language. Platforms such as Facebook, Twitter, Instagram, WhatsApp, and YouTube allow access to content like videos and articles that expose learners to real-world language use and cultural contexts. These platforms facilitate collaboration, enabling learners to practice speaking and writing with peers and native speakers through comments and messages. [1]

Its foundation is rooted in the concepts of Web 2.0 and User-Generated Content. Web 2.0 allows material to be continuously updated in a collaborative manner by all users. Social media enables students to interact at their own pace, adjust conversation flows, and practice interaction by posting comments. Furthermore, incorporating these tools into classrooms enhances students' digital media and information technology skills [12]. Teachers should select materials that engage learners effectively and cognitively to support the development of communicative competence.

Kaplan and Haenlein [11] identified several social media types:

- Social networking sites: Applications like Facebook and Twitter allow users to connect, share personal information, and join interest groups.
- Content-sharing sites: Platforms like YouTube and Instagram allow users to share videos and photos, often allowing others to rate or comment on the content.
- Blogs: Platforms like Tumblr or Medium present information in reverse chronological order and feature comment sections for interaction.
- Ratings and review sites: Sites like eBay and Amazon provide insights into products based on customer experiences.
- Social bookmarking sites: Platforms like Reddit enable users to save and rank bookmarks of web documents.
- Collaborative projects: Joint content creation databases like Wikipedia facilitate the simultaneous creation of content by many users.

Social media facilitates communication and serves as a tool for staying informed about global events. In education, it serves as a platform for social interaction where students exchange ideas and learn from various sources. It is an effective tool for increasing student engagement and motivation, particularly for introverted students.[1]

However, challenges include privacy concerns regarding how individual information is used [13]. Digital friendships may lack real quality, and data on social media is not always reliable. Misinformation is another challenge, as students may find it difficult to express thoughts in writing compared to oral expression. Social media can also be a distraction; students admit to wasting time and neglecting studies for social networking [14]. Other negative aspects include cyberbullying and adverse effects such as social isolation [15].

Social media aligns with language teaching theories such as constructivism and social-cultural theory [16]. In constructivism, learning occurs when meaningful social interaction includes community sharing of perspectives [17]. It provides a vast resource of authentic language in written and video forms. Using social media maximizes student exposure to language through socialization and contextualization. For example, Facebook and WhatsApp permit students to create learning groups for discussing materials. YouTube provides English videos for students to practice listening skills.

Integrating social media requires knowledge of both technology and pedagogy. Facebook features like private messages and groups facilitate reading and writing [18]. Instagram enables a collaborative atmosphere where students comment on photos and videos using English [19]. Twitter can engage students in English activities, allowing participants to share information in foreign languages [20]. YouTube helps develop listening skills and improves knowledge of grammar and vocabulary [21]. WhatsApp supports the English classroom due to its ease of access and ability to facilitate real-time communication [22]

Perception

Perception refers to someone’s experience in making an interpretation about something. It depends on the stimuli's relation to surrounding conditions and is the gathering of information through hearing, seeing, and sensing [23]. Perception is the ability to organize observations, including discrimination and grouping [24]. It is a biological process in the brain involving the reception of information through the five senses [8]. Once an object is sensed, the brain processes the input to derive meaning. Life experiences shape unique impressions that vary from person to person.

The process consists of three stages [25]:
1. Selection: Initial phase of interpreting environmental stimuli.
2. Organization: Structuring selected information by identifying patterns.
3. Interpretation: Assigning meaning to structured stimuli.

Factors affecting perception include strong stimuli, physiological health, and psychological aspects like motivation and thinking ability [26]. Environment and social background also influence perception. Selective attention helps individuals filter out unnecessary information. Values, needs, and past experiences further shape how people understand new information.

Perception indicators include acceptance (physiological stage of capturing stimuli) and understanding (assessment and evaluation) [27]. Understanding involves classifying and interpreting images in the brain unique to the individual. Assessment emerges after the individual compares new understanding with subjective criteria.

Perception is shaped by five characteristics: modality, spatial dimensions, temporal dimensions, contextual structure, and meaningfulness [28]. Modality requires stimuli to match specific sensory organs, while spatial and temporal dimensions distinguish position and time. Three factors influence a person's perception: the perceiving individual, the target of perception, and the situation. Both internal and external factors trigger unique interpretations of the same object.

3 Research Methodology

This research is categorized as a quantitative descriptive study designed to understand the perceptions of fifth-semester EFL students at UNIKA Santu Paulus Ruteng regarding social media as an English learning tool. The descriptive nature of this research focuses specifically on exploring and explaining the views, experiences, and attitudes of the students without the manipulation of any variables [29]. This quantitative approach allows the researcher to gain a deeper understanding of how these students perceive the role of platforms like Facebook, YouTube, and Instagram in improving their language skills.

3.1. Population and Sampling

The research population consisted of 94 fifth-semester EFL students divided into three classes. From this population, a sample of 50 participants was selected using a random sampling technique to ensure the data remained statistically representative and free from selection bias. This sample size was deemed sufficient to capture the diverse attitudes and experiences of the student body.

3.2. Research Instrument

To collect the necessary data, the researcher developed an online closed-ended questionnaire. The instrument comprised 20 items categorized into three sub-indicators: student feelings, language skill improvements, and the challenges of using social media. The questionnaire utilized a four-point Likert scale—ranging from "Strongly Agree" to "Strongly Disagree"—to eliminate neutral responses and force a clear attitudinal stance. To ensure clarity and avoid linguistic misunderstandings, the items were written in Bahasa Indonesia. The instrument's reliability was confirmed through the comparison of R-count values against an R-table value of 0.279, ensuring that the data collected were valid for hypothesis testing.

3.3. Data Collection Procedure

The data collection was conducted entirely online via Google Forms. This technical approach allowed for efficient distribution and reduced the risk of manual data entry errors. Link distribution was managed through digital channels, ensuring that students could respond at their convenience, thereby minimizing pressure or time-based bias.

3.4. Data Analysis Method

Once the data were gathered, the results were processed using Microsoft Excel to perform descriptive statistical analysis. The analysis included the calculation of frequencies, percentages, means, and standard deviations to summarize student perceptions. To test the research hypothesis, the researcher performed a comparative analysis between the R-count and the R-table value, leading to the rejection of the null hypothesis in favor of the alternative hypothesis.

4 Findings and Discussion

The results are categorized into several key areas: students' emotional feelings toward the tools, the perceived impact on specific language skills, and the practical challenges encountered during usage.

Regarding students' feelings, the data indicates a predominantly positive attitude toward social media as a tool for learning English. A significant majority of students, totaling 88%, find that learning through social media is fun and pleasing. Additionally, 88% of respondents agree that these platforms boost their confidence in English as a Foreign Language (EFL) learning, which suggests that digital spaces offer a more encouraging environment than traditional settings. Furthermore, 84% of students feel that social media reinforces self-independent learning, indicating that these tools enhance student autonomy. The research also highlights that 76% of students find that social media reduces their anxiety, while an impressive 92% believe it creates a more relaxed and stress-free learning environment. Accessibility remains a primary advantage, with 90% of students finding the platforms easy to use and 86% reporting that they can be accessed anytime and anywhere. Communication is also facilitated, as 92% of students agree that it is easy to interact with others through these digital tools.

In terms of language skills and components, students perceive social media as a highly valuable resource for linguistic improvement. The highest positive responses were recorded for vocabulary development, where 94% of students reported significant enhancement. Pronunciation also saw a strong perceived improvement from 90% of students, likely due to the audiovisual nature of modern platforms. Receptive and productive skills were equally represented, with listening and speaking both receiving positive feedback from 90% and 92% of students, respectively. Reading skills were perceived to improve by 88% of respondents, while grammar knowledge saw an improvement for 90% of the participants. These findings suggest that exposure to authentic digital content provides a wealth of learning resources that textbooks alone may lack.

The study also identified several challenges associated with social media use, though they did not outweigh the benefits. While 50% of students disagree that they are exposed to inappropriate content, a notable 40% acknowledge this as a concern, suggesting that exposure levels vary by individual usage. Interestingly, the majority of students do not find these platforms to be a hindrance to their focus; 78% of respondents disagree that they feel distracted while using social media specifically for learning purposes. Mental health concerns were also addressed, with 62% of students disagreeing that social media negatively affects their well-being. However, technical limitations remain the most significant hurdle, as 64% of respondents report recurring problems related to internet signals, gadget quality, or mobile data constraints.

Analysis of platform usage shows that YouTube is the most frequently used social media for improving English language skills, utilized by 60% of students. Instagram ranks as the second most popular platform at 40%, while Facebook is used by 12%. Notably, WhatsApp and Twitter were not reported as primary tools for English learning in this study, likely because they are viewed more as communication tools rather than content-sharing educational platforms. WhatsApp and Twitter were reported as having zero usage for learning purposes. In the specific context of Ruteng, WhatsApp is perceived strictly through the "situation" factor of perception as a private communication tool for social coordination, rather than an educational content-

sharing site. Twitter's lack of usage likely stems from its text-heavy nature, which offers fewer audiovisual "stimuli" compared to the high-engagement multimedia features of YouTube and Instagram.

The findings reveal that social media creates a supportive environment that enhances engagement, motivation, and autonomy in language learning. The results align with previous research indicating that platforms like YouTube are effective due to their multimedia nature, which combines audio and visual elements to support pronunciation and comprehension. Based on the statistical analysis conducted in this study, the R-count values were consistently higher than the R-table value of 0.279. Therefore, the null hypothesis () is rejected and the alternative hypothesis () is accepted, confirming that there is a significantly positive student perception regarding the use of social media as a tool for learning English at UNIKA Santu Paulus Ruteng.

5 Conclusion and Suggestion

The findings of this study demonstrate that students at UNIKA Santu Paulus Ruteng possess a predominantly positive perception of using social media as a tool for learning English. Most students find the integration of these platforms into their studies to be an engaging, accessible, and beneficial experience that specifically aids in developing skills such as listening, speaking, and vocabulary acquisition. Furthermore, social media is perceived to promote self-independent learning, reduce learner anxiety, and create a stress-free environment that builds overall confidence.

Regarding platform preferences, YouTube emerged as the most popular choice for language learning, utilized by 60% of the participants, followed by Instagram at 40%. This preference is largely attributed to the rich audiovisual resources these platforms provide, which are particularly effective for practicing pronunciation and listening. Conversely, platforms like WhatsApp and Twitter were not utilized at all for English learning purposes in this study.

Despite these positive outcomes, students encounter significant challenges, most notably technical issues such as poor internet connectivity and device limitations. Additionally, concerns regarding exposure to inappropriate content and potential mental health impacts were noted. However, the majority of students demonstrated an ability to manage their focus, reporting that they do not feel distracted by social media when using it for educational purposes. Ultimately, the statistical analysis supports the alternative hypothesis, confirming that social media is viewed as a valuable and important tool in the modern EFL learning context.

To maximize the educational potential of these digital tools, it is suggested that educators formally integrate platforms like YouTube and Instagram into their teaching strategies by recommending high-quality content and designing interactive assignments. Such an approach can provide students with diverse learning materials and foster a sense of community through online discussion forums and peer-to-peer activities.

To address the challenges identified, schools should prioritize digital literacy training to help students critically evaluate online information and select credible resources. Institutions should also work to mitigate technical barriers by providing alternative offline resources where internet

connectivity is a recurring issue. Finally, future research should be conducted to examine the long-term impact of social media on specific language proficiency levels and to explore the most effective ways to integrate these digital methods into formal curricula.

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Translation of Neurological Terminology in the *@the_brain_doctor* Instagram Captions

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Abstract. This study aims to identify the types of neurology terms and analyze the strategies used in translating them from English into Indonesian. The research applies the theoretical framework of neurology terminology proposed by Donkelaar et al. (2018), which classifies neurological terms according to their anatomical and functional categories. To examine the translation process, the study employs Molina and Albir's (2002) theory of translation techniques, focusing on how specific linguistic strategies are used to convey specialized medical meanings accurately and naturally in the target language. The data were collected from selected captions on the Instagram account *@the_brain_doctor*, which presents neuroscience and neurology content for public education. The data was analysed by qualitative descriptive method to identify and categorize neurology terms. Then, it further explored how these terms were rendered into Indonesian using translation techniques. The findings indicate that most neurology terms belong to the anatomical and pathological categories. Borrowing and calque were the most frequent translation techniques, reflecting an effort to maintain terminological precision and scientific consistency. However, adaptation and amplification were also used to enhance comprehensibility for general audiences. The study concludes that the translation of neurology terminology in digital health discourse requires both terminological accuracy and communicative clarity, bridging scientific precision with accessibility in popular science communication.

Keywords: Instagram caption, neurological terms, translation strategy

1 Introduction

Language is the principal medium through which humans conceptualise and communicate about the world. In linguistics, every discipline-specific lexicon, including that of neurology, reflects a complex interplay of lexical choice, semantic specificity and audience comprehension. Translation, as a sub-field of applied linguistics, concerns itself with how source language (SL) forms and meanings are rendered into target language (TL) forms so as to preserve meaning, adapt for audience and maintain functional equivalence. For specialised domains such as neurology, translation becomes more than mere language transfer. It becomes a bridge between scientific discourse and effective communication.

In neurology, terminology spans anatomical, physiological, pathological, diagnostic and therapeutic domains. For example, the catalogue of terms presented by [1] offers a hierarchical and systematic classification of neurological terms (neuroanatomical structures, neurological

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function, and neurological disorders). The standardisation of such terminology is crucial, not only for clinical precision, but also for translation and multilingual education. In parallel, digital health discourse particularly on social media platforms such as Instagram, has become a vital site for public engagement with neurology content. Research shows that social media is increasingly leveraged for neurology education and professional communication (e.g. “Be in the Digital Room Where it Happens, Part II: Social Media for Neurology Educators”). The combination of specialised neurology terminology and popular health communication on Instagram creates a fertile ground for translation analysis: how are terms that originate in specialist discourse adapted for (or translated to) a broader, potentially multilingual audience?

Previous studies in translation have investigated the use of translation techniques in a variety of domains, such as audio-visual subtitling of films [2] and product label translation [3] using the taxonomy proposed by [4]. For instance, Molina and Hurtado Albir define translation techniques as “an instrument of textual analysis to study how translation equivalence works in relation to the original text.” However, while many studies apply these techniques to general translation contexts (e.g., films, idioms, tourism leaflets), fewer investigations have focused specifically on scientific medical terminology translation in digital health discourse and even fewer within the context of neurology on social media.

This gap in the literature motivates the present study: namely, an analysis of how neurology terms, as classified by [1] are translated in the Instagram captions of @the_brain_doctor, and which translation by [4] are applied. By doing so, this research aims to contribute both to the field of translation studies (by applying specialist-terminology analysis) and to health communication research (by exploring translation practice in a digital social media context). Specifically, this research examines the intersection of three domains: specialised neurology lexicon, translation theory, and Instagram-based digital health discourse. By so doing, this research addresses two connected research gaps: (1) the under-explored domain of neuro-terminology translation in social media settings, and (2) the lack of studies combining terminological classification (as per [1]) with translation-technique analysis (as per [4]).

The significance of this study lies in its contribution to both translation studies and digital health communication by addressing the underexplored area of neurology terminology translation on social media platforms. By integrating Donkelaar *et al.*’s neurological terminological classification with Molina and Hurtado Albir’s translation technique framework, this research provides a systematic approach to analyzing how specialized medical terms are transferred from English into Indonesian in a public-facing digital context. The findings highlight the balance between maintaining scientific accuracy and ensuring communicative clarity, demonstrating how translation techniques such as borrowing, calque, adaptation, and amplification function to make complex neurological concepts accessible to general audiences. Consequently, this study offers practical insights for translators, health communicators, and content creators involved in popular science communication, while also enriching theoretical discussions on specialist terminology translation in digital media environments.

2 Research Method

This study employed a descriptive qualitative method to analyze the translation of neurological terminology found in the Instagram captions of the account @the_brain_doctor. According to [5], qualitative research is designed to investigate complex issues by collecting rich, descriptive data and interpreting these data within their natural contexts. Similarly, [6] emphasize that qualitative inquiry seeks to understand how individuals construct meaning, interact socially, and use language within specific cultural or situational settings. Thus, qualitative research is concerned not with quantification, but with depth, detail, and contextual understanding. This study applies a qualitative approach because the object of analysis, the neurological terms and their translations in Instagram captions, requires interpretation of linguistic, semantic, and contextual features rather than measurement. Translation studies, particularly those involving terminology, often demand an examination of how meaning is constructed and transformed across languages [7]. Furthermore, qualitative analysis is appropriate because the data consist of textual materials (Instagram captions) embedded in digital health discourse. As [8] notes, qualitative research is particularly suited for analyzing naturally occurring discourse, including digital communication, where meaning is shaped by context, audience, and social interaction.

The data source was taken from the verified official Instagram account of Dr. Faye Begeti, M.B., Ph.D, a neurologist and neuroscientist who actively shares educational content about neurology and neuroscience. The account was selected because it consistently provides scientific information containing neurological terms, making it a relevant and credible source for linguistic and translation analysis. Furthermore, the account has a blue verification badge and is followed by more than 143.000 users, indicating its authenticity and wide reach in the digital health community. The data in this study consisted of Instagram captions posted by @the_brain_doctor within the period of June 2024 to November 2025, which has more than 500 viewers. This time frame was chosen to ensure that the data represented recent linguistic usage and translation patterns in neurology-related digital discourse. The captions were written originally in English, and their machine-translated Indonesian versions automatically provided by Instagram's translation feature, were analyzed for comparison.

Data collection was conducted using the direct observation method, following several systematic steps:

1. Reading and observing all Instagram captions posted from June 2024 to November 2025.
2. Checking both the original English captions and their machine-translated Indonesian versions.
3. Transcribing the captions for textual analysis.
4. Highlighting the neurological terms and their corresponding translations in both language versions.

The data analysis process applied a descriptive qualitative approach, focusing on understanding patterns and contextual meanings rather than numerical measurement. The analysis was carried out in two main stages:

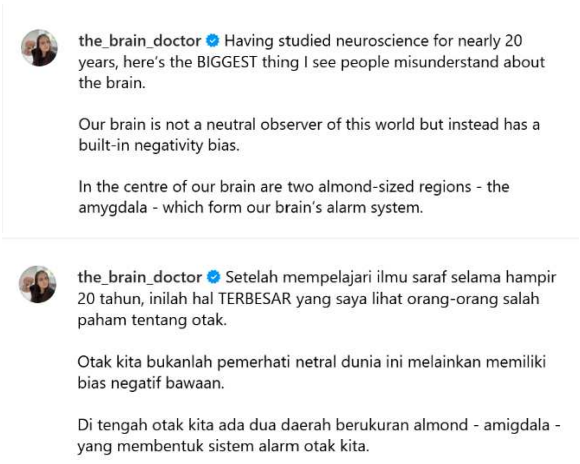
1. Classification of neurological terms using the framework proposed by Donkelaar et al. (2018) in *An Illustrated Terminologia Neuroanatomica*, which categorizes neurological terminology based on neuroanatomical structures, neurological function, and neurological disorders.
2. Analysis of translation techniques based on the taxonomy developed by Molina and Albir (2002), which identifies and explains the various strategies used to translate linguistic elements between languages.

The results were interpreted to reveal the dominant types of neurological terms used in digital health discourse and to evaluate the translation strategies applied to render these specialized terms accurately in Indonesian.

3 Finding and Discussion

This section presents the findings of the study based on the neurological terms identified in the selected captions from the @the_brain_doctor Instagram account and their corresponding Indonesian translations generated through Instagram's machine translation feature. This research found that all the types of neurological terms (neuroanatomical structures, neurological function, and neurological disorders) are found in this study. Also the translation strategy most likely used in the translating neurological terms are pure borrowing and naturalized borrowing. There were 30 datum found in the caption of the @the_brain_doctor Instagram account (period of June 2024-November 2025). However in this research, there were only four datum chosen as representative data. The detail discussion of those datum will be presented as follows.

Datum 1



SL : In the centre of our brain are two almond-sized regions-the **amygdala**-which form our brain's alarm system.

TL : *Di Tengah otak kita ada dua daerah berukuran almond-**amigdala**-yang membeentuk sistem alarm otak kita.*

(@the_brain_doctor, 21 July 2025)

The term *amygdala* refers to a paired, almond-shaped neuroanatomical structure located in the medial temporal lobe and is centrally involved in emotional processing, memory, and affective behavior. According to An Illustrated Terminologia Neuroanatomica by Donkelaar *et al.*, the amygdala is classified within the Telencephalon and more specifically under the Basal Foreb rain / Limbic System Structures. In the framework of *Terminologia Neuroanatomica* (TNA), the amygdala is explicitly identified as a neuroanatomical structure that plays a major role in emotion-related neural processes [1]. Consequently, based on this classification, the term *amygdala* falls into the category of **Neuroanatomical Structure – Limbic System (Telencephalon)**, indicating that it is a structural anatomical term referring to a distinct and standardized brain region.

In the Target Language (TL), Indonesian, the term *amygdala* is translated as *amigdala*. This translation involves only a minimal orthographic adjustment—from *y* to *i*—in accordance with Indonesian spelling conventions, while preserving the original lexical form. From the perspective of translation studies, this strategy corresponds to **naturalized borrowing** as defined by Translation Techniques Revisited [4]. Borrowing occurs when a term from the Source Language (SL) is directly transferred into the TL, and it is considered *naturalized* when minor phonological or orthographic adaptations are made to align with TL norms. The transformation *amygdala* → *amigdala* thus exemplifies naturalized borrowing, as the term is largely retained while being linguistically assimilated into Indonesian.

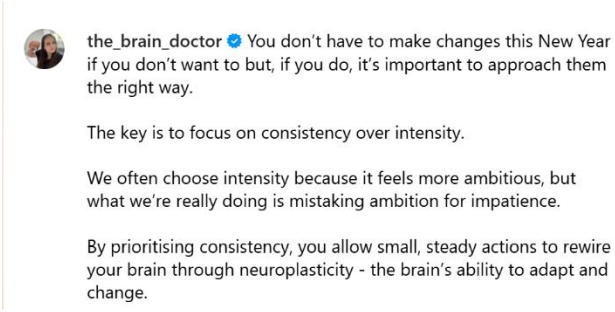
Previous studies consistently show that borrowing, particularly naturalized borrowing, is the dominant strategy in the translation of medical and scientific terminology. Newmark [9] argues that borrowing is often unavoidable in specialized fields because technical terms are designed to be internationally stable and semantically precise. Similarly, Montalt and González Davies [10] emphasize that medical translation prioritizes terminological consistency over stylistic variation, especially for anatomical terms that are grounded in Latin or Greek roots. In the Indonesian context, Nababan *et al.* [11] also observe that borrowing is frequently used in medical translations to maintain accuracy and avoid semantic distortion, particularly when no exact indigenous equivalent exists.

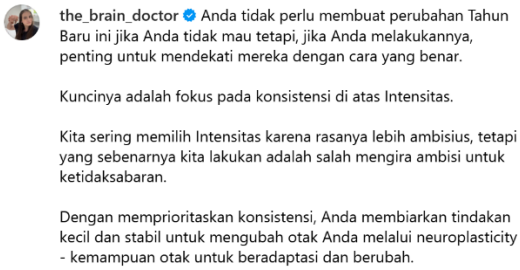
The preference for naturalized borrowing in translating *amygdala* further reflects the standardized nature of neuroanatomical terminology in global neuroscience. As noted by Temmerman [12], standardized scientific terms function as "labels for fixed concepts," and replacing them with descriptive or adaptive equivalents may risk ambiguity or conceptual loss.

In digital health discourse—such as Instagram-based educational content—this strategy allows translators to balance scientific authority with audience accessibility. By slightly adapting the spelling to Indonesian norms, the term becomes more readable for local audiences while still signaling its status as a technical, internationally recognized concept.

Therefore, the use of naturalized borrowing in translating *amygdala* demonstrates a conscious effort to preserve scientific precision while ensuring linguistic acceptability in the TL. This finding aligns with prior research in medical and scientific translation, which consistently reports borrowing as a preferred technique for highly specialized terminology [9], [10], [11]. In the context of social media–based health communication, such as the Instagram account *@the_brain_doctor*, this strategy supports effective knowledge dissemination by maintaining terminological accuracy without alienating non-specialist readers. Ultimately, this reinforces the view that accurate neurology translation in digital platforms requires adherence to established terminological conventions alongside sensitivity to the linguistic norms of the target audience.

Datum 2





SL : By prioritising consistency, you allow small, steady actions to rewire your brain through **neuroplasticity**-the brain's ability to adapt and change.

TL : *Dengan memprioritaskan konsistensi, Anda membiarkan Tindakan kecil dan stabil untuk mengubah otak Anda melalui* ***neuroplasticity****-kemampuan otak untuk beradaptasi dan berubah.*

(@the_brain_doctor, 1 January 2025)

The term *neuroplasticity* refers to the brain's capacity to reorganize neural pathways and modify both structural and functional connections in response to learning, experience, injury, or environmental change. Within the framework of *Terminologia Neuroanatomica* proposed by An Illustrated Terminologia Neuroanatomica, neuroplasticity is classified not as a physical brain structure but as a **Neurological Function – Physiological Process**. This categorization reflects the conceptual distinction between static anatomical entities and dynamic neurological mechanisms. Neuroplasticity encompasses processes such as synaptic strengthening and weakening, neuronal sprouting, cortical remapping, and functional reorganization, which collectively enable adaptive changes in brain function [1]. This functional classification clearly differentiates neuroplasticity from neuroanatomical terms such as *amygdala*, which denote identifiable brain regions rather than ongoing biological processes.

In the Target Language (TL), Indonesian, the term *neuroplasticity* appears unchanged and is retained in its original English form. Although an Indonesian equivalent (*neuroplastisitas*) exists and follows Indonesian morphological conventions, Instagram's machine translation system does not apply this adaptation. From the perspective of translation theory, this strategy corresponds to **pure borrowing**, as defined by Translation Techniques Revisited [4]. Pure borrowing occurs when a Source Language (SL) term is transferred verbatim into the TL without phonological, morphological, or orthographic modification. In this case, the indicators of pure borrowing are clear: the spelling remains identical, no localization occurs, and the English term is preserved intact in the Indonesian translation.

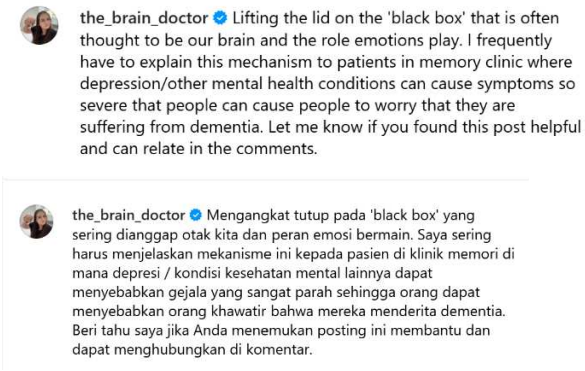
Previous studies in scientific and medical translation indicate that pure borrowing is frequently employed for abstract, process-oriented concepts, especially when they are globally standardized and predominantly circulated in English. Newmark [9] notes that for scientific innovations and theoretical constructs, translators often retain the original term to avoid conceptual ambiguity or misinterpretation. This is particularly relevant for terms like *neuroplasticity*, which function as umbrella concepts encompassing multiple sub-processes and theoretical frameworks within neuroscience. Similarly, Cabré [13] argues that borrowing is a preferred strategy when a term has achieved international currency and when its translated equivalent is not yet fully conventionalized in the target language.

In the Indonesian context, research by Nababan *et al.* [11] suggests that borrowing—especially pure borrowing—is commonly found in translations of advanced medical and scientific texts, particularly when the intended audience includes semi-specialist or educated readers. In digital health discourse, such as Instagram-based science communication, retaining the English term *neuroplasticity* may enhance recognition among readers who are already exposed to neuroscience content through global media and educational platforms. This aligns with findings by Olohan [14], who observes that popular science translation often blends specialist accuracy with internationalized terminology to maintain credibility and authority.

However, the use of pure borrowing in this case may also indicate a limitation of machine translation systems. While human translators may consciously choose between *neuroplasticity* and *neuroplastisitas* depending on audience and register, machine translation tends to default to source-language retention when term equivalence is uncertain or insufficiently represented in its training data. As noted by Kenny [15], machine translation systems frequently overuse borrowing for technical terms, prioritizing formal accuracy over linguistic naturalness. Consequently, while the retention of *neuroplasticity* ensures terminological precision, it may reduce accessibility for Indonesian readers without prior exposure to English scientific terminology.

Overall, the use of pure borrowing for *neuroplasticity* reflects both the globalized nature of neuroscience discourse and the operational tendencies of machine translation in digital platforms. The finding supports previous research indicating that functional neurological concepts are more likely to be borrowed intact than translated or adapted, particularly in popular science and social media contexts [9], [13], [14]. This underscores the need for careful consideration of audience competence in digital health translation, as effective communication requires balancing scientific exactness with linguistic inclusivity.

Datum 3



SL : I frequently have to explain this mechanism to patients in memory clinic where depression/other mental health conditions can cause symptoms so severe that people can cause people to worry that they are suffering from **dementia**.

TL : *Saya sering harus menjelaskan mekanisme ini kepada pasien di klinik memori dimana depresi/kondisi kesehatan mental lainnya dapat menyebabkan gejala yang sangat parah sehingga orang dapat menyebabkan orang khawatir bahwa mereka menderita* ***dementia***.

(@the_brain_doctor, 10 September 2024)

The term *dementia* refers to a group of clinical syndromes characterized by a progressive decline in cognitive functions, including memory, executive functioning, language, reasoning, and social cognition, severe enough to interfere with daily activities. Within the classification framework proposed by An Illustrated Terminologia Neuroanatomica, neurological terms are

broadly divided into neuroanatomical structures, neurological functions, and neurological disorders. Dementia does not denote a physical brain structure nor a normal physiological process; instead, it represents a **pathological condition** affecting the nervous system. Accordingly, *dementia* is classified under the category **Neurological Disorder**. This classification reflects its status as a disease entity associated with underlying neuropathological processes, such as neurodegeneration (e.g., Alzheimer's disease), cerebrovascular damage, or other central nervous system abnormalities [1]. As such, *dementia* functions as a diagnostic and clinical term rather than a descriptive anatomical or functional label.

In the Target Language (TL), Indonesian, the term *dementia* is not translated into its established Indonesian equivalent *demensia*, despite the latter being officially used in Indonesian medical literature and clinical practice. Instead, Instagram's machine translation retains the English form *dementia* without modification. From a translation-theoretical perspective, this strategy corresponds to **pure borrowing**, as defined by Translation Techniques Revisited [4]. Pure borrowing involves transferring a Source Language (SL) term directly into the Target Language without orthographic, phonological, or morphological adaptation. In this case, the English form *dementia* is preserved exactly, with no adjustment to Indonesian spelling conventions (*demensia*), resulting in a non-naturalized borrowed term.
Previous studies in medical and scientific translation suggest that borrowing is frequently employed for disease names due to their international standardization and clinical precision. Newmark [9] notes that disease terms often circulate globally in a relatively fixed form, especially in English-dominated medical discourse, making borrowing a common and sometimes unavoidable strategy. Similarly, Montalt and González Davies [10] argue that medical translation prioritizes terminological consistency and diagnostic accuracy, particularly for disease labels, which function as precise clinical identifiers rather than descriptive expressions. However, they also emphasize that when a standardized TL equivalent exists—as is the case with *demensia* in Indonesian—failure to use it may reduce linguistic naturalness and accessibility.

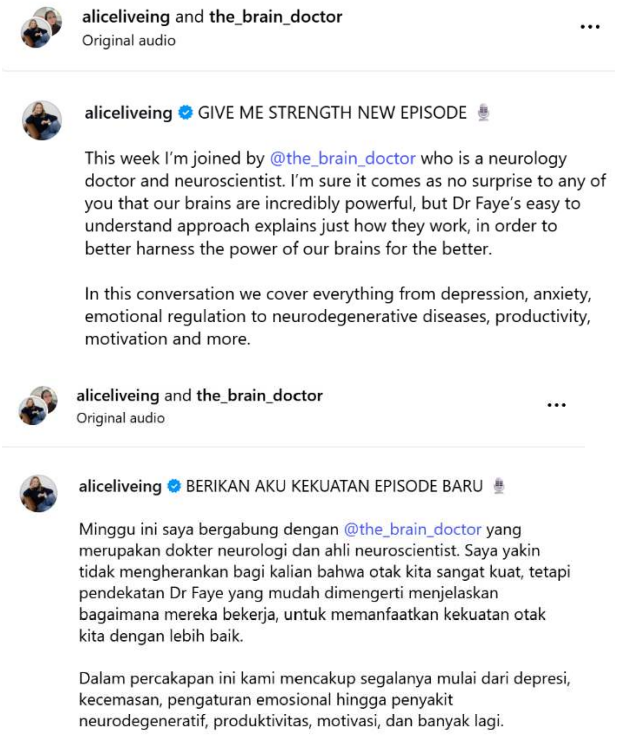
In the Indonesian context, research by Nababan *et al.* [11] demonstrates that while borrowing is widely used in medical translations, naturalized borrowing or established Indonesian equivalents are generally preferred in human translation to ensure clarity for non-specialist audiences. The use of pure borrowing in this case appears to reflect the operational tendencies of machine translation systems rather than a deliberate communicative choice. As Kenny [15] observes, machine translation often defaults to source-language retention for technical terms, particularly when multiple equivalents exist or when the system lacks sufficient contextual data to select the most appropriate TL form.

The retention of *dementia* may still be intelligible for Indonesian readers familiar with international medical discourse, as the English term frequently appears in academic articles, health campaigns, and media reports. However, for general audiences—the primary target of Instagram-based health education—this choice may reduce clarity compared to the more

familiar Indonesian term *demensia*. This finding contrasts with the translation of *amygdala* (*amigdala*), where naturalized borrowing was successfully applied, and highlights inconsistency in how Instagram's machine translation handles neurological terminology across different semantic categories (anatomical structure vs. disorder).

Overall, the use of pure borrowing for *dementia* illustrates both the globalized nature of neurological disease terminology and the limitations of automated translation in digital health discourse. While borrowing preserves scientific accuracy, it does not always guarantee communicative effectiveness for lay audiences. This supports previous findings that translation of medical disorders in public-facing platforms must carefully balance terminological precision with audience comprehension [10], [11]. The variation observed across different neurological terms underscores the need for greater awareness of terminological conventions and audience needs in machine-assisted health communication.

Datum 4



SL : In this conversation we cover everything from depression, anxiety, emotional regulation to **neurodegenerative disease**, productivity, motivation and more.

TL : *Dalam percakapan ini kami mencakup segalanya mulai dari depresi, kecemasan, pengaturan emosional hingga **penyakit neurodegeneratif,** produktivitas, motivasi, dan banyak lagi.*

(@the_brain_doctor, 13 June 2024)

The term *neurodegenerative disease* refers to a group of medical conditions characterized by the progressive degeneration and loss of structure or function of neurons in the brain or nervous system. Prominent examples include Alzheimer's disease, Parkinson's disease, Huntington's disease, and amyotrophic lateral sclerosis (ALS). Within the terminological framework proposed by An Illustrated Terminologia Neuroanatomica, such conditions are classified under **Neurological Disorder**, as they represent pathological states that impair normal nervous system function rather than anatomical structures or physiological processes. The term *neurodegenerative disease* thus functions as a higher-order disease category encompassing multiple specific disorders that share common pathological mechanisms, such as neuronal death, protein misfolding, and synaptic dysfunction [1]. This classification clearly distinguishes it from neuroanatomical terms (e.g., *amygdala*) and neurological function terms (e.g., *neuroplasticity*), which denote structural entities and adaptive processes, respectively.
In the Target Language (TL), Indonesian, the Source Language (SL) adjective *neurodegenerative* is translated as *neurodegeneratif*. This translation involves an orthographic and morphological adaptation consistent with Indonesian medical terminology conventions, in which English adjectives ending in *-ive* are commonly rendered as *-if* or *-atif*. From the perspective of translation theory, this strategy corresponds to **naturalized borrowing**, as defined by Translation Techniques Revisited [4]. Naturalized borrowing occurs when a term is borrowed from the SL but modified to conform to the phonological or orthographic norms of the TL. The transformation *neurodegenerative → neurodegeneratif* exemplifies this process, as the lexical root is preserved while the suffix is adapted to Indonesian spelling conventions.

Previous studies in medical translation consistently report that naturalized borrowing is a preferred strategy for translating disease-related terminology when a standardized TL equivalent exists. Newmark [9] argues that borrowing with adaptation allows translators to preserve terminological precision while ensuring linguistic acceptability in the target language. Similarly, Cabré [13] emphasizes that medical terminology often relies on international Latin- and Greek-based forms, which can be effectively integrated into national languages through controlled adaptation. In the Indonesian context, Nababan *et al.* [11] note that naturalized borrowing is commonly used in health and medical translations to balance accuracy with readability, particularly for terms that are already institutionalized in medical dictionaries and professional usage.

The use of *neurodegeneratif* is also consistent with standardized Indonesian medical terminology, as the term is attested in authoritative sources such as *Kamus Besar Bahasa Indonesia* (KBBI) and Indonesian medical dictionaries. This indicates that the translation choice reflects not only theoretical appropriateness but also terminological normalization within the TL. Compared to instances of pure borrowing observed in other data (e.g., *dementia* retained in English form), the translation of *neurodegenerative* as *neurodegeneratif* demonstrates a higher degree of localization and linguistic sensitivity. As Montalt and González Davies [10] argue, adapting disease-related terms into established TL forms enhances clarity and accessibility, especially in public-oriented health communication.

In the context of digital health discourse on social media platforms such as Instagram, the use of naturalized borrowing for *neurodegenerative disease* contributes to effective science communication by maintaining scientific credibility while accommodating the linguistic expectations of Indonesian readers. This finding aligns with Olohan's [14] observation that popular science translation often favors semi-domesticated terminology to bridge expert knowledge and lay understanding. Overall, the translation of *neurodegenerative* into *neurodegeneratif* illustrates an optimal balance between terminological accuracy and communicative clarity, reinforcing the importance of controlled adaptation in the translation of neurological disorder terminology.

The novelty of this study lies in its integrative and context-specific approach to analyzing the translation of neurology terminology in digital health discourse. Unlike previous studies that primarily examine translation techniques in general texts or conventional medical documents, this research uniquely combines Donkelaar *et al.*'s neuro-terminological classification with Molina and Hurtado Albir's translation technique framework to systematically analyze how neurological terms of different categories—neuroanatomical structures, neurological functions, and neurological disorders—are translated from English into Indonesian. Furthermore, by focusing on Instagram captions from a popular neuroscience account, this study introduces social media as a novel site of investigation for specialist medical translation, highlighting the role of machine translation in shaping public health communication. The findings reveal patterned variations in the use of borrowing strategies (pure vs. naturalized) across terminological categories, offering new empirical insights into how scientific precision, linguistic adaptation, and accessibility are negotiated in popular science communication. As such, this study extends existing translation research by bridging specialist terminology analysis, translation theory, and digital health communication within a real-world social media environment.

4 Conclusion

The findings of this study reveal that all three categories of neurological terms (neuroanatomical structures, neurological functions, and neurological disorders) appear in the captions of the @the_brain_doctor Instagram account. This indicates the rich and varied neurological content presented in digital health communication and highlights the relevance of specialized terminology in public science education. In terms of translation strategies, most neurological terms were rendered using pure borrowing, with the English terms transferred directly into Indonesian without orthographic or phonological adaptation. This tendency likely occurs because Instagram's machine translation system prioritizes terminological consistency and recognizes that many scientific terms are globally standardized in English. However, this reliance on pure borrowing may also reflect machine limitations in identifying or generating established Indonesian medical equivalents. Overall, the prevalence of borrowing strategies

shows the growing influence of English-based terminology in digital health discourse while also underscoring the need for more context-sensitive translation handling.

It is recommended that Instagram's machine translation system and application developers enhance the platform's sensitivity to domain-specific terminology, particularly in scientific and medical contexts. Integrating a specialized biomedical lexicon or collaborating with medical linguists could help the system better recognize established Indonesian equivalents for neurological terms (e.g., *demensia* instead of *dementia*). Additionally, improving adaptive translation algorithms would allow Instagram to distinguish between general and technical vocabulary, enabling more natural, comprehensible, and accurate translations for Indonesian users who rely on the platform for health information. Strengthening these features would not only improve translation quality but also promote clearer public understanding in digital health communication. Future studies are recommended to examine a broader range of medical specializations and social media platforms to determine whether the patterns of translation techniques identified in neurology-related Instagram content are consistent across different fields and digital contexts. Further research could also compare machine-generated translations with human translations to assess differences in accuracy, naturalness, and communicative effectiveness in digital health discourse. In addition, longitudinal or reception-based studies involving target readers are suggested to explore how different translation strategies affect public understanding and trust in health-related information.

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The Functions Of Emoticons As Markers Of Bullying In Social Media Comments

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Abstract. Cyberbullying on social media has become increasingly complex alongside the evolution of digital modes of expression, including the use of emoticons as markers of a speaker's stance. This study aims to analyze the functions of emoticons as indicators of bullying in users' comments and to explain how emoticons operate pragmatically and semiotically within online bullying practices. Employing a descriptive qualitative method, the research collected data through the documentation of screenshots of comments that contained signs of bullying. Data were analyzed using a multimodal approach by integrating Peirce's semiotic framework (icon–index–symbol) to interpret the meanings, intentions, and nonverbal communicative force conveyed through emoticons.
The findings show that emoticons function as nonverbal signals that reinforce, obscure, or replace verbal insults in comments; that the selection of emoticons is strongly influenced by the utterance context and the relational dynamics between commenter and target; and that particular emoticon variations produce different psychological effects on victims, ranging from subtle humiliation to overt intimidation. These results affirm that emoticons are not merely light or playful expressions but significant pragmatic elements in the construction of digital bullying. Future studies are recommended to develop multimodal automatic-detection models that integrate text, emoticons, and interaction patterns to enhance the effectiveness of content-moderation systems on social media platforms in Indonesia.

Keywords: emoticons; cyberbullying; Peircean semiotics; user comments; multimodal analysis.

1 Introduction

Cyberbullying on social media has emerged as a global phenomenon that affects mental health, academic performance among adolescents, and victims' social engagement. Systematic studies and literature reviews indicate that incidents of online bullying have increased during periods of intensive social media use (including during and after the COVID-19 pandemic), with prevalence varying across countries, measurement methods, and age groups. Recent international systematic reviews also emphasize that social media platforms provide channels for anonymity, broad reach, and accelerated content circulation, all of which heighten the risks of cyberbullying and extend the duration of victims' exposure

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[1]. Emoticons (along with emojis and stickers) have become an integral part of written communication on social media; they function as a form of digital *paralanguage* that helps signal emotions, attitudes, irony, or the sender's intentions when text alone is susceptible to misinterpretation. Numerous empirical studies and literature reviews have found that emoticons and emojis play a role in clarifying the sender's affective intentions, enhancing "social presence," and reducing ambiguity in short online messages. Their use is also associated with social motivations—such as expressing familiarity, humor, or a sarcastic tone—which are highly relevant for analyzing comment-based bullying practices [2].

Preliminary findings from several studies and forensic linguistic analyses indicate that emoticons can function as amplifiers of bullying meanings (e.g., reinforcing mockery or adding a taunting nuance), as mitigators (e.g., inserting a smiling emoticon to downplay responsibility), or even as symbols of implicit threats (e.g., weapon emojis or other aggressive symbols). Moreover, the combination of harmful textual content with specific emoticons often alters how readers interpret communicative intent—positioning emoticons as pragmatic markers that may serve as important indicators in identifying bullying. However, these patterns are highly dependent on linguistic, cultural, and platform-specific contexts, underscoring the need for systematic empirical research to formalize these relationships and develop analytical guidelines [3].

Within Charles Sanders Peirce's semiotic theory, a sign is understood as something that represents something else in the mind of an interpreter through a triadic process consisting of the representamen, the object, and the interpretant [4]. The representamen refers to the perceptible form of the sign, the object is the entity to which the sign refers, and the interpretant is the meaning or understanding that emerges in the mind of the receiver. Peirce classifies signs into three main categories: icons, indices, and symbols. Icons are signs that bear a resemblance to the objects they represent; indices have a causal or existential connection to their objects; and symbols are based on social conventions or cultural consensus. [5] In the context of emoticons as markers of bullying within social media comments, emoticons may function as symbols, as shared conventions of digital communication shape their meanings; however, they may also operate as indices, as they often directly reflect the sender's emotional stance or harmful intentions toward a target [6]. Thus, the analysis of emoticons in bullying practices can be examined through Peirce's triadic framework to reveal how the representamen of emoticons shape negative interpretations and produce bullying meanings for recipients.

Several previous studies provide foundational support for this research; [7]) examined the social motives underlying emoticon use and its impact on message interpretation; [8] offered a systematic review of emoji research demonstrating their emotional and semantic functions; [9] reviewed theoretical perspectives and empirical findings on emoticons/emoji/stickers in computer-mediated communication (CMC); and [10], along with other studies, showed that emoticons enhance perceived richness and enjoyment in online interactions. More recent research has explored the effects of emojis on social attribution and emotion interpretation. Nonetheless, there remains limited scholarship that explicitly investigates the role of emoticons as elements that mark or intensify bullying within public comment sections [11].

Although the literature on emojis/emoticons and on cyberbullying is relatively wealthy, several critical gaps remain to be explored: (a) most emoticon studies focus on affective or emotional functions, yet few systematically investigate the role of emoticons as markers or intensifiers of bullying (e.g., their use to mock, heighten sarcasm, or label targeted individuals); (b) cyberbullying research often centers on lexical text (words/phrases) and insufficiently integrates multimodal analysis (text + emoticons/emojis + other media) within user comments; and (c) there is a need for contextualized studies on specific platforms and sociocultural environments (e.g., variations in emoticon use in Indonesian-language contexts or within particular online communities). Therefore, research that focuses on the functions of emoticons as markers of bullying in user comments addresses these methodological and conceptual gaps [12].

Based on the research gaps outlined above, this study aims to describe patterns of emoticon use in user comments containing derogatory or hostile expressions. These objectives align with existing literature that emphasizes the importance of multimodal analysis and a deeper understanding of the role of digital nonverbal signals in the dynamics of online interaction [13].

The urgency of this research arises from both practical and scholarly considerations. Practically, content moderation and automated cyberbullying detection systems on social media platforms require a more nuanced understanding of multimodal elements, including emoticons, to enhance user protection. Scholarly significance emerges from the need to understand how emoticons function as markers of bullying, which can enrich Peircean semiotics and contribute methodological insights, such as the development of multimodal indicators for bullying detection. Furthermore, within the local Indonesian linguistic and cultural context, such analysis is essential given the variations in emoticon use and the dynamics of online communities that may differ from cross-cultural findings. Consequently, this study holds relevance for academics, platform practitioners, and policymakers concerned with child and youth protection in digital environments [14].

2 Research Method

This study employs a descriptive qualitative approach combined with multimodal analysis to examine the role of emoticons as markers of bullying in users' comments on social media. The qualitative approach was selected because it enables the researcher to explore the meanings, pragmatic functions, and contextual uses of emoticons in bullying practices in depth. This aligns with Creswell's view that qualitative methods are effective for uncovering social phenomena through the interpretation of message meaning [15]. The data sources in this study consist of two types: primary data in the form of user comments on social media platforms (such as Instagram or Facebook) that contain elements of bullying and emoticons, and secondary data in the form of journal articles discussing emoticons and cyberbullying.

The sampling technique employed in this study was purposive sampling, which involved selecting comments based on specific criteria: (1) the comment contains emoticons or emojis, (2) the comment displays indications of bullying (such as insults, sarcasm, or

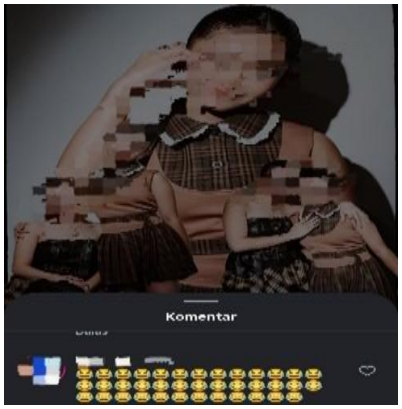
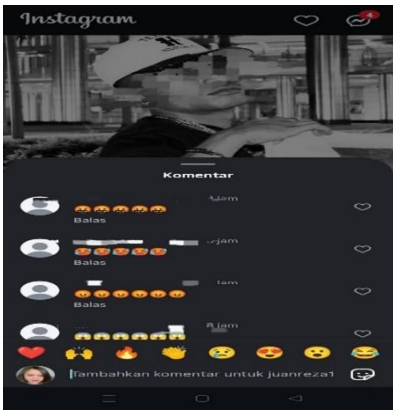
mockery), and (3) the comment is publicly accessible and ethically appropriate for analysis. This technique aligns with the explanation provided by [16], which states that purposive sampling is used when researchers require data that are genuinely relevant to the study's focus. Data collection was carried out in three stages: (1) observing and downloading comments on selected posts that contained a high density of bullying indicators; (2) documenting the emoticons used within those comments; and (3) recording the social context surrounding each comment. This data collection technique follows the qualitative content analysis approach, as recommended by [17], who emphasizes the importance of systematically coding meaning units in qualitative data. Data were analyzed using content analysis and multimodal analysis. In the initial stage, comments were categorized based on the forms of bullying they contained (e.g., mocking, degrading, or cornering the target). The emoticons were then examined for their functions using a pragmatic functional framework (e.g., emoticons as intensifiers of insults, markers of sarcasm, or triggers of conflict). The next stage involved multimodal analysis, integrating interpretations of verbal text and emoticons as a unified meaning structure, as developed in studies by [18]. These studies emphasize that emoticons can strengthen, alter, or soften the meaning of an utterance, including in negative contexts such as bullying. The validity of the study was maintained through theoretical triangulation and peer checking [19]. Through this analysis, the study produced a description of emoticon usage patterns, their pragmatic functions as markers of bullying, and a multimodal framework that can be applied in future research as well as in digital content moderation efforts in Indonesia.

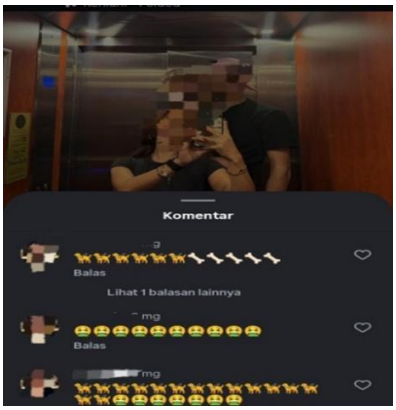
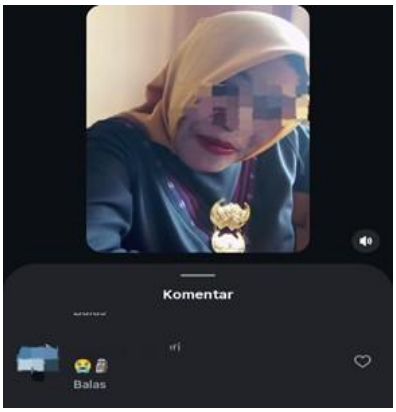
3 Research Findings

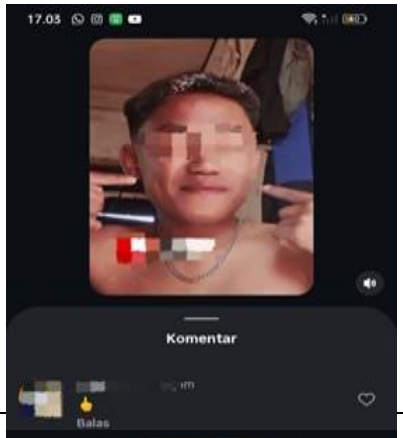
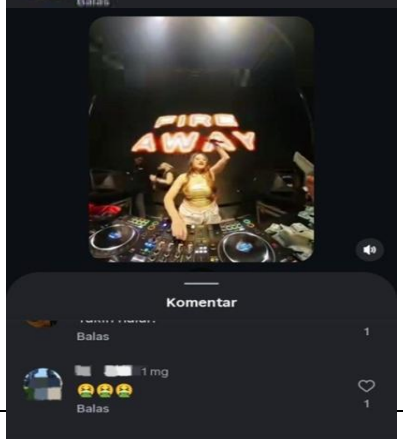
Based on the data collection and identification process, it was found that the use of emoticons is consistently bound to their contextual deployment. The following table presents several samples of bullying-related emoticons accompanied by descriptions of their usage contexts, as derived from the data sources.

Table 1. Data and Contexts of Emoticon Use in Bullying within Social Media Comments

No	Data	Context

1		Ola Ramlan's decision to remove her hijab sparked disapproval from some of her followers. One of them responded with a thumbs-down emoticon.
2		A well-known Indonesian dangdut singer, actress, and comedian posted a photo with her child, and one follower commented by using a large number of laughing emoticons.
3		A singer from Eastern Indonesia uploaded a photo taken abroad, and an anonymous account responded with a sequence of angry emoticons, indicating strong dislike toward the photo or the person featured in the post.

4		An Indonesian actress posted a photo with her child and her new partner, who is a professional Indonesian football player. Several accounts commented using vomiting emoticons, dog emoticons, and short-leg emoticons.
5		An Instagram user uploaded a reel conveying a positive message about a life partner. Another user commented using a crying emoticon and a Moai statue head emoticon, the intended meaning of which was ambiguous and lacked clear contextual justification.
6		An Instagram user posted a reel video, which received comments containing a vomiting emoticon, a pile-of-feces emoticon, and a face-with-rolling-eyes emoticon, without any clear or explicit justification.

7		An Indonesian actress, who is also a DJ, previously married to a well-known comedian and a mother, uploaded a reel showing her performing as a DJ at a nightclub. The post received comments containing a vomiting emoticon and a thumbs-down emoticon; some users also posted explicitly negative remarks, such as references to HIV, without any apparent or justifiable reason for such comments.
8		An Indonesian actress, who is also a DJ, previously married to a well-known comedian and a mother, uploaded a reel showing her performing as a DJ at a nightclub. The post received comments containing a vomiting emoticon and a thumbs-down emoticon; some users also posted explicitly negative remarks, such as references to HIV, without any apparent or justifiable reason for such comments.

Based on the sample data above, the researcher classified the types of emoticons according to Charles Sanders Peirce's semiotic theory, as presented in the table below.

Table 2. Classification of Emoticons as Markers of Bullying
Based on Peircean Semiotic Perspective

No	Type of Emoticon	Icon (Visual Resemblance)	Index (Causal / Contextual Relation)	Symbol (Social Cultural Convention)	Interpretant (Meaning in the Reader's Mind)	Function in the Context of Bullying
1	😌	A face with a smirking expression	Subtle insinuation or ironic stance	A symbol of condescension	A belittling attitude	Conveying implicit mockery

2		A tense, smiling facial expression	Indicator of discomfort or sarcasm	A symbol of awkward mockery	A harsh insinuation toward the target; awkward yet derisive	Covert sarcasm and public embarrassment
3		An inverted facial expression	Signals a reversal of the literal meaning	A symbol of irony/sarcasm	The opposite of what is stated	Passive-aggressive mockery
4		Image of a pig	Refers to greediness or filth	A symbol of insult and dehumanization	“You are disgusting/greedy.”	Dehumanization and physical/character-based insult
5		Hand-to-forehead gesture	Spontaneous reaction to perceived stupidity or error	A symbol of disappointment	“You are embarrassing/ stupid.”	Intellectual harassment
6		Face laughing with tears	Immediate reaction of laughing at something/someone	A symbol of ridicule	“This is very funny” (laughing at the target)	Collective ridicule and public shaming
7		Devil-like face	Indicator of mischievous or malicious intent	A symbol of evil or taunting	“I intentionally want to hurt you.”	Provocation and symbolic intimidation
8		Red face with an angry expression	Marker of emotional outburst	A symbol of verbal aggression	“You are annoying!”	Emotional pressure and intimidation
9		Image of a bone	Refers to something leftover or worthless	A symbol of degradation	“You are useless/empty.”	Dehumanization, identity degradation
10		Green vomiting face	Immediate reaction of disgust	A symbol of extreme rejection	“I am disgusted by you.”	Social exclusion and severe insult

11	🐶	Image of a dog	Refers to behavior perceived as low or contemptible	A symbol of insult in certain cultures	"You are like an animal."	Direct dehumanization and humiliation
12	🔞	Crossed-out number 18	Visual marker of prohibition	A symbol of social/moral norms	"You are immoral/obscene."	Moral stigmatization and sexual shaming
13	🗿	Moai statue-like face	Marker of stiffness or emotional flatness	A symbol of "insensitivity."	Emotionless/awkward/strange	Character degradation and stigmatization
14	🙄	Eyes rolling upward	Reaction of annoyance or dismissal	A symbol of condescension	"This is ridiculous/you are foolish."	Dismissive and belittling attitude
15	💩	Image of feces	Reaction of disgust and degradation	A symbol of extreme insult	"You are disgusting/worthless."	Extreme insult and dehumanization
16	🖕	Raised middle finger gesture	Direct sign of aggression or rejection	A universal symbol of insult	"Go away / **** you."	Explicit symbolic verbal intimidation
17	🤡	Clown-painted face	Indicates behavior seen as ridiculous or abnormal	A symbol of labeling someone as an object of ridicule	"You are a joke."	Labeling and degradation of dignity
18	👎	Hand gesture with thumb pointing downward	Marker of rejection or disapproval	A symbol of negative evaluation	"You are bad," "I disagree," "You are unworthy/failing."	Public disapproval, humiliation, and reinforcement of social pressure

4 Discussion

Multimodal analysis is used because the data analyzed is not only in the form of verbal text, but also includes emoticons/emoji as digital nonverbal elements, in line with the argument [20] that contemporary digital communication is multimodal and needs to be analyzed as a combination of text, symbols, and visual signs.

The emoticon 😏 represents an expression imbued with sarcasm and irony, functioning as a pragmatic device in digital interactions. From a Peircean semiotic perspective, this emoji

operates as an icon by visually resembling a human facial expression, while simultaneously functioning as a symbol whose meaning is shaped by social convention. In the context of bullying, 😏 serves as an indicator of implicit mockery that undermines the victim's social position. Its inherent ambiguity allows perpetrators to maintain emotional distance while simultaneously leaving room to deny aggressive intent. [21]; [22] categorizes this usage pattern as a form of *visual sarcasm*, whereas Derks et al. (2008) emphasize its role in intensifying the affective force of messages. Thus, 😏 can be understood as an instrument of symbolic legitimation in digital bullying practices [23]; [24].

The emoticon 😬 represents an expression of tension that, in digital communication, frequently functions as a marker of implicit sarcasm. Within Peirce's semiotic framework, this emoji functions as an icon due to its visual resemblance to a human facial expression, and as an index by pointing to a social situation characterized by discomfort. In bullying practices, 😬 is employed as a passive-aggressive device to highlight perceived mistakes or weaknesses of the target. [25][26] emphasizes that emojis possess pragmatic functions as emotion indicators that are highly context-dependent. Its use reinforces the production of shame while simultaneously constructing a symbolic hierarchy between perpetrator and victim. The collectively constructed interpretant renders 😬 a layered sign that reproduces relations of dominance in digital interactions [27]; [28].

The emoticon 🙃 represents a mechanism of meaning reversal commonly employed to convey irony and sarcasm in digital interactions. From a Peircean semiotic perspective, this emoji functions as a symbol through social conventions that govern its interpretation, while simultaneously operating as an icon due to its visual resemblance to a human facial expression [29] In the context of bullying, 🙃 serves as a medium of implicit mockery packaged as humor, thereby producing ambiguity that complicates the victim's ability to respond demonstrate that the use of sarcastic emojis can increase the potential for online conflict [30]. Socially, this emoji contributes to the normalization of symbolic aggression and signals a shift in the function of visual signs as substitutes for intonation in face-to-face communication. The resulting interpretant is shaped by users' social and cultural contexts, rendering 🙃 a strategic element in the dynamics of digital bullying [31].

The emoticon 🐷 represents the figure of a pig, which in many cultural contexts carries pejorative connotations. Within Peirce's semiotic framework, this emoji functions as an icon through its visual resemblance to the referenced object, and as a symbol through social constructions that shape its associated values and meanings. In bullying practices, 🐷 is used as an instrument of dehumanization by equating an individual with an animal. [32] notes that dehumanization leads to the degradation of dignity and the erosion of moral status. This emoji accelerates the process of negative labeling and shifts the victim's social positioning within digital interactions. Semiotic analysis reveals that the resulting interpretant frames the target as undeserving of equal treatment. Thus, 🐷 functions as an effective form of symbolic violence in the dynamics of online bullying.

The emoticon 🤦 represents a gesture that signals frustration while simultaneously conveying negative evaluation of another individual's actions. From a Peircean semiotic

perspective, this emoji functions as an icon due to its visual resemblance to human bodily movement, and as an index that points to an evaluative response to a particular situation. In the context of bullying, 🤦 is employed to construct meanings of intellectual disparagement by implying incompetence or inferiority on the part of the target. [33] demonstrates that emojis possess significant pragmatic force in digital communication. Its use reinforces the evaluative function of the message and establishes mechanisms of social control grounded in shame [34]. Semiotic interpretation shows that the interpretant associated with this sign is formed through the collective experience of bodily expression, allowing 🤦 to operate as an instrument of symbolic violence in digital bullying practices.

The emoticon 😂 represents an expression of laughter that is generally associated with entertainment; however, within the context of bullying, it functions as a device of humiliation. From a Peircean semiotic perspective, this emoji functions as an icon through its visual resemblance to human facial expressions, and as an index by evoking a strong emotional response. [35] demonstrate that emoticons have the capacity to amplify the emotional intensity of messages in online communication. The use of 😂 in aggressive comments produces collective legitimation of derogatory behavior while simultaneously reinforcing the perpetrator's power structure. The resulting interpretant frames the target as deserving of ridicule, thereby blurring the boundary between humor and aggression. Consequently, 😂 contributes to the reproduction of a culture of mockery within digital environments.

The emoticon 😈 represents a devil-like figure that is culturally associated with cunning and malicious intent. Within Peirce's semiotic framework, this emoji functions as an icon by visually resembling the represented creature and as a symbol through cultural conventions that shape its social meaning [36]. In bullying contexts, 😈 is employed as a form of symbolic intimidation that asserts the perpetrator's superiority. [37] argues that emojis possess the capacity to mediate implicit attitudes in digital communication. The interpretant that emerges is a perception of veiled threat, which in turn heightens anxiety for the targeted individual. Thus, 😈 operates as an effective instrument of intimidation in the dynamics of cyberbullying.

The emoticon 👺 represents an explicit and high-intensity expression of anger. From a Peircean semiotic perspective, this emoji functions as an icon through its visual resemblance to human facial expressions and as an index that signals a strong emotional response [38]. [39] Note that emoticons have a significant affective capacity in reinforcing perceptions of negative emotions. In the context of bullying, 👺 intensifies aggressive tone, consolidates the perpetrator's antagonistic stance, and constructs an interpretant characterized by a clear perception of hostility. Consequently, this emoji reduces message ambiguity and accentuates the intimidating character of online bullying communication.

The emoticon 🦴 represents a bone, which in many cultural contexts is frequently associated with death and a sense of valuelessness. From a Peircean semiotic perspective, this emoji functions as an icon through its visual resemblance to the referenced object, and as a symbol through the cultural construction of meaning attached to it. In the context of

bullying, 🦴 is used as a means of social devaluation, reducing the victim to an entity perceived as “worthless.” [40] emphasize that visual signs play a crucial role in shaping ideological meaning in communication processes. The resulting interpretant is the perception that the targeted individual is undeserving of respect, rendering this emoji a subtle instrument of symbolic violence that operates within digital spaces. The emoticon 🤮 represents an intense expression of disgust. Within Peirce’s semiotic framework, this emoji functions as an icon through its visual resemblance to a human physical reaction, and as an index that signals a negative affective response. In bullying contexts, 🤮 is employed as a mechanism of stigmatization that frames the target as repulsive [41]. The interpretant that emerges is a directed sense of disgust toward a specific individual, thereby reinforcing social exclusion and deepening psychological harm. Consequently, 🤮 operates as an effective form of visual aggression in cyberbullying practices.

The emoticon 🐶 represents the figure of a dog, which in specific cultural contexts carries pejorative connotations. Within Peirce's semiotic framework, this emoji functions as an icon due to its visual resemblance and as a symbol through socially constructed meanings attached to it. In bullying practices, 🐶 is used as a strategy of dehumanization that degrades the dignity and social status of the target [42]. The resulting interpretant is the perception of the victim’s inferiority, thereby accelerating stigmatization processes and reinforcing negative representations in digital environments.

The emoticon 🔞 represents a prohibition symbol associated with adult or restricted content. From a Peircean semiotic perspective, this emoji functions as a symbol, as its meaning is shaped by social conventions governing moral categorization. In the context of bullying, 🔞 is utilized as a tool of moral labeling that stigmatizes individuals[43]. The resulting interpretant is a perception of norm violation, which reinforces mechanisms of social control and potentially exacerbates the psychological impact on the victim. Thus, 🔞 operates as an instrument of bullying grounded in moral judgment within digital interaction.

The emoticon 🗿 represents a statue-like facial figure that is culturally associated with rigidity and emotional dullness. Within Peirce's semiotic framework, this emoji functions as an icon due to its visual resemblance to the represented object, and as a symbol through the cultural meanings associated with it. In bullying contexts, 🗿 is used as a strategy of stereotyping that labels the target as emotionally insensitive or cognitively deficient[44]. The resulting interpretant is the perception of emotional emptiness attributed to the victim, allowing this emoji to function as an instrument of symbolic stigmatization in digital communication.

The 🙄 emoticon encodes impatience, condescension, and implicit rejection. In Peircean semiotics, it functions as an icon through its resemblance to eye-rolling and as an index of a negative affective stance toward prior discourse. In bullying contexts, it operates as a delegitimization strategy that undermines the target’s voice and weakens their discursive position[45]. The resulting interpretant is the assumption that the victim is unworthy of attention or consideration, thereby reinforcing marginalization and operating as a form of symbolic harassment in digital communication [46].

The emoticon 💩 represents fecal matter, which is culturally associated with impurity, inappropriateness, and lack of value. Within Peirce's semiotic framework, this emoji functions as an icon due to its visual resemblance to the represented object, and as a symbol through social conventions that construct its pejorative meaning [47]. In bullying practices, 💩 is used as an instrument of dignity degradation that produces social stigma [33]. The resulting interpretant is a response of disgust directed at a specific individual, thereby reinforcing social exclusion and functioning as a form of visual aggression in cyberbullying.
The emoticon 🖕 represents an insulting gesture that is widely recognized across cultures due to its established social meaning. From a Peircean semiotic perspective, this emoji functions as an icon through its resemblance to an actual hand gesture, and as a symbol through cultural conventions that fix its offensive meaning. In bullying contexts, 🖕 is used as a form of direct aggression that asserts dominance and power relations between perpetrator and victim. [48] Classify this gesture as a taboo expression that typically produces an explicit insult. The resulting interpretant is a direct sense of humiliation, making this emoji an overt instrument of bullying in digital communication.
The emoticon 🤡 represents the figure of a clown, which in social media practices functions as a vehicle of mockery. Within Peirce's semiotic framework, this emoji operates as an icon through its visual resemblance to a clown character, and as a symbol through socially constructed meanings that associate it with foolishness or unseriousness. In bullying contexts, 🤡 is used to label the target as an object of public ridicule, thereby reducing the individual's identity to mere entertainment. [49] emphasizes that emojis possess strong evaluative functions in digital culture. The resulting interpretant is the perception that the victim is undeserving of respect, rendering 🤡 a marker of symbolic violence in online interaction.
The emoticon 👎 represents a digitally mediated gesture of rejection. From a Peircean semiotic perspective, this emoji functions as an icon due to its resemblance to an actual hand gesture, and as a symbol through cultural conventions that standardize its meaning of disapproval. In bullying contexts, 👎 is used as a tool of social evaluation that marks individuals as unacceptable or unapproved [50]. The resulting interpretant is a negative perception of the victim's social value, thereby reinforcing processes of exclusion and marginalization. Thus, 👎 operates as an effective instrument of social control in the dynamics of online bullying.

5 Conclusion

The findings of this discussion demonstrate that emoticons can transform into instruments of digital bullying when used in unequal relational contexts. Emoticons such as 😏, 😬, 😳, 😂, and 🙄 operate through mechanisms of ambiguity and implicit innuendo, allowing perpetrators to engage in symbolic aggression while maintaining the possibility of deniability. Meanwhile, emoticons such as 🐷, 🐶, 💩, 🤡, and 🦴 operate as devices of dehumanization and negative labeling that reduce the victim's identity, transform gestures

into objects of intimidation, and accelerate the process of social stigmatization. Furthermore, explicit emoticons such as 👺, 🤮, 😈, 🖕, and 👎 display a more direct aggressive function by amplifying the intensity of negative emotions, expressing power relations, and forming interpretants in the form of perceptions of hostility, rejection, or threat. In this context, emoticons function as a social control mechanism that normalizes the exclusion, shame, and subordination of victims through seemingly lighthearted yet ideologically charged communication practices. Thus, this study confirms that emoticons are active semiotic agents in the dynamics of bullying, contributing to the symbolic reproduction of violence, the formation of social hierarchies, and the legitimization of aggression in digital culture.

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Beyond Rationality: Reimagining Habermasian Public Sphere As A Pedagogical Foundation For Communicative Competence

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Abstract. This study aims to examine and integrate Jürgen Habermas's theory of communicative action within contemporary pedagogical frameworks to address the crisis of the modern public sphere. It seeks to provide a theoretical basis for cultivating leaders who possess not only spiritual integrity but also robust critical reasoning and an inclusive disposition towards social reality. The research employs a qualitative-philosophical literature review, specifically analyzing Habermas's concept of communicative rationality. This framework is further enriched by integrating the existential ethics of Emmanuel Levinas and Martin Buber to broaden the understanding of human interaction within discursive spaces. The results indicate that reimagining the public sphere as an egalitarian arena, modeled after the historical "Coffee House", allows for the flourishing of theological, philosophical, and socio-political discourse free from the constraints of hierarchy or dogma. The study finds that authentic communication must transcend mere rational argumentation, evolving into a profound site for the recognition of human dignity and the "Face" of the Other. This research recommends a fundamental transformation of educational institutions by implementing a "Habermasian Philosophical Coffee House" as a socio-educational laboratory. Such an initiative is instrumental in fortifying critical thinking, fostering ethical empathy, and equipping the younger generation with the communicative competence necessary to navigate social plurality and serve as transformative voices in a globalized, digital era.

Keywords: Coffee House; Communicative Action; Public Sphere; Transformative Education; Communicative Competence

1 Introduction

Have you ever imagined a place, perhaps like a bustling coffee shop, an online forum, or even just a casual chat in a crowded public hall, where everyone can sit together? They come not to flaunt power or status, but to discuss openly and rationally about the issues that affect our lives. It is there that an significant shift in intellectual paradigms is taking place. Various crucial issues that shape life are dissected and discussed in depth: ranging from the dynamics of community life, the struggle for human rights, democratic freedom, and the impact of media digitalization, to innovative concepts such as *deep learning* or *independent learning education*. The public

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sphere is a place where ideas are contested, arguments are constructed, and public opinion is formed through the power of reason, rather than coercion or manipulation.

Habermas, born in 1929 and a critical philosopher as well as a sociologist behind the profound tradition of "critical theory" and pragmatism, argues that it is in these places that individuals from various backgrounds gather, especially from the rising middle class (bourgeoisie). They come not to be entertained, but to elaborate rational thoughts on issues that were highly sensitive at the time: matters regarding the government, hidden conspiracies between the bourgeoisie and the Church that controlled society, the rights of marginalized groups, and the importance of freedom of speech and democracy. It is this place that the prominent German philosopher, Jürgen Habermas, refers to as the "public sphere." One of his most influential works, *The Structural Transformation of the Public Sphere*, truly opens our eyes to how crucial this space is[1].

The primary strength of this idea lies in its ability to encourage active participation in the act of generating innovative alternative ideas and constantly opening up new constructive spaces. Within the public sphere, individuals exercise their rational consciousness. This means they do not merely voice opinions based on emotion or prejudice, but on logical and accountable arguments. It is through this rational discussion and communication that various views and perspectives can be accommodated, tested, and even criticized. The result? Individuals have the potential to significantly influence various public actions and policies. In public debates, they may affirm or negate the diverse thoughts of other individuals. This is the foundation of a healthy democracy, where policies are not imposed from above but instead grow from dialogue and mutual understanding among citizens.

Historically, Habermas notes how public power was previously often associated with the 'representation of authority'—kings, nobility, or the Church, who displayed their power directly before the people (for instance, through grand ceremonies, trials, or dogmas). They were the 'rule-makers' whose positions were unshakeable. However, with the emergence of the bourgeois public sphere, the meaning of 'the public' itself began to shift. 'The public' no longer referred to the imposition or presentation of authority by a select few. Instead, it began to refer to the legitimacy of state policymakers that must be obtained through public consent and discussion. This means that power is no longer legitimate simply because it is inherited or divinely ordained, but because it is justified by reason and the consent of the people discussed within the public sphere.

According to Habermas, the public sphere is a place where common sense meets the aspirations of society. When citizens are actively involved, weighing arguments, and voicing their views on solid ground, they become not only spectators but also decisive actors in forming fairer and more relevant policies. This is the core of a healthy and participatory democracy, where true public power stems from free and informed discourse. Habermas himself is highly critical of the modern condition, which he views as having 'refeudalized' the public sphere, where mass media often becomes a tool of manipulation rather than a catalyst for rational discourse.

Therefore, he advocates for deliberative democracy, “a form of democracy in which political decisions are made through a process of public discussion that is rational, argumentative, and inclusive."

2 Method

This study employs a qualitative-philosophical research method utilizing a literature review approach. Moving beyond a mere description of phenomena, this philosophical inquiry seeks to synthesize Jürgen Habermas’s theory of communicative action with contemporary pedagogical challenges. The data collection process involves an extensive analysis of primary and secondary sources, including seminal books, peer-reviewed journal articles, and philosophical lexicons relevant to the discourse on the public sphere and communicative competence. The analytical framework is grounded in philosophical hermeneutics to critically examine Habermas’s communicative rationality.[2] [3]This approach enables the author to bridge the gap between secular social theory and the ethical-philosophical landscape of Indonesia, ultimately formulating a transformative socio-educational theory designed to address both current and future societal complexities.

3 Finding and Discussion

3.1 Coffee Houses: Spaces For Critical Discourse

Eighteenth-century coffee houses serve as an inspiration for discussion spaces where ideas are exchanged without fear; they are the heart of any society that wishes to maintain its democratic essence and resist all forms of domination. Habermas's concept of the public sphere consistently focuses on the relationship between norms and facts concerning the public and democracy, relying on the power of reason to mediate between the two. This is an enduring lesson on the importance of honest and open conversation in shaping a collective future. In the vortex of contemporary discussion, there is one fundamental correlation we cannot ignore: the close link between civil society and public life. Amidst the torrent of information and polarization, we must consider how to ensure the public voice is truly heard and influences the direction of specific policies. Furthermore, Habermas observed that during the same period (the 18th century), amidst the emergence of the bourgeoisie (the prosperous middle class), a concerning phenomenon arose: a lack of responsibility toward the "victims" or the common people. Those who now possessed economic and intellectual power often felt superior and lacked the social impetus to provide aid to marginalized populations.

We often hear the term "critical thinking," but what does it mean in practice? According to the philosopher Jürgen Habermas, critical consciousness always drives us to look beyond the surface, to question the phenomena around us, be it a decision or policy, a media narrative, or deeply rooted social norms. Interestingly, this critical consciousness is closely linked to how we

communicate. Habermas emphasizes the importance of what he calls "communicative action without domination." Imagine an ideal conversation: no one imposes their will, no one exerts pressure, and every participant aims to understand one another. Its essence is rational argumentation, the ability to convey opinions with logical reasoning, listen to counter-arguments, and be willing to change one's view if presented with a stronger argument. Habermas disagrees with the "anthropological pessimism" of his predecessors in the Frankfurt School, such as Adorno and Horkheimer. He rejects the notion that the only path to emancipation is through "definite negation" and believes that the emancipatory potential of modern reason can still be realized[4].

In the public sphere, where individuals are free to discuss and debate, every participant is 'required' to employ rational thinking. The objective is simple: to find the best outcome for all, achieving consensus and harmony in socio-political life. However, what happens if a consensus is not reached? This is where criticism plays a vital role.

Criticism is not merely complaining or denouncing. On the contrary, it is a significant segment in developing communicative action. Criticism arises when there is a discrepancy or injustice that needs to be uncovered. Moreover, this criticism possesses an emancipatory character, it is liberating. It seeks to dismantle and deconstruct specific ideologies or worldviews that may have unconsciously hindered individuals from participating fully, voicing their rights, or developing their potential within society. These ideologies may take the form of prejudices, stereotypes, or belief systems that justify injustice.

According to Habermas, the power of rational argument and the spirit of criticism lie in their validity. This means that every claim, every argument, and every critique must be accountable, based on solid reasoning, and open to being tested. Through this process, we can continue to engage in dialogue, learn, and move forward toward a more just and rational society. The validity of a claim is no longer based on how sacred or ancient its source is, but on how logical, coherent, and open it is to be tested and debated rationally within an equal dialogue. Consequently, a person's existence is no longer measured solely by adherence to dogma, but by their ability to participate in public reason and contribute to the formation of a rational consensus.

3.2 Coffee Houses: Beyond Discourse From and For The 'Other'

In the modern era, coffee houses possess multifaceted meanings. They do not merely represent a "locus", a place where groups of people are required to meet face-to-face over a warm cup of coffee, but also serve as public encounter spaces in the virtual world (online) through digital media platforms. As a Habermasian public sphere, the coffee house is a vital arena for rational discussion and opinion formation. However, there is another hidden strength that can enrich this space: our ability to learn from the experiences, orientations, and motivations of others. In both the physical and virtual worlds, we encounter diverse human characters every day. Every

meeting is an opportunity. We meet not only "ideas" but also individuals with unique capacities; their wealth of knowledge, life experiences, and their existential essence as part of society. How can we maximize these encounters? The key is to approach others with a high sense of responsibility, rather than merely as interlocutors or sources of information. We can link Habermas's concept of discourse with the profound thoughts of philosophers such as Emmanuel Levinas and Martin Buber.

Levinas positions 'the other' not as an object to be classified, but as a force that disrupts the sovereignty of our ego. In discursive spaces, we often find ourselves trapped in an attempt to 'master' our interlocutor through logic, an act that Levinas regards as a form of intellectual violence. As emphasized by Lee, the encounter between individuals is essentially a convergence that transcends categories of subjective similarity or difference[5]. When we truly confront 'the other,' our entire system of argumentative defense collapses before a 'Face' that cannot be reduced to mere words. This 'Face' is not merely visual; it is an appeal that compels us to suspend our desire for victory and, instead, open ourselves to something entirely foreign and unpredictable. In this context, public discussion is no longer about the synchronization of ideas, but about the willingness to be disturbed by the presence of another whom we can never fully comprehend.

This relationship transcends mere social interaction; it embodies Martin Buber’s 'I-Thou' framework, which has become increasingly vital as a counter-narrative to modern digital logic. Buber warns us against the 'I-It' relation, where 'the other' is reduced to data, an object, or a mere statistical category. The novelty of this perspective lies in our courage to deconstruct the interlocutor's identity: they are no longer a representation of gender, a political label, or a screen profile, but a complete and profound 'presence.' In such authentic dialogue, we are not merely extracting information; rather, we are entering an existential space where wisdom and constructive criticism are no longer perceived as threats, but as 'dialogical gifts.' Herein lies the transcendental dimension: when we cease treating humans as tools for our own ends, we encounter an inspiration and divine goodness that can only emerge in an equal, unmasked encounter.[6]

The other' identifies their existence through their own unique situation. By encountering and learning from 'the other,' we do not only expand our intellectual horizons but also build a stronger community, based on the socio-educational power generated from discussion and, more importantly, ethical experience. Every individual has the right to manifest positive consciousness and the values of goodness, including within the realms of education or self-development. A truly strong, inclusive, and transformative public sphere can only be realized when we are willing to learn from the existence of 'the other' with an open heart and ethical responsibility. This is a call to view every dialogue not merely as an exchange of ideas, but as an existential encounter that has the potential to refine our mission and build genuine harmony.

3.3 The Power and Challenges of Publicity in the Public Sphere

Habermas originally described the public sphere as centered on physical encounters in coffee houses or salons, where individuals freely discussed social issues. However, the landscape has now shifted drastically due to digital media. Applications such as WhatsApp, Twitter (X), Instagram, Line, YouTube, and TikTok have created massive new public spheres, often without the need for face-to-face meetings.

The presence of digital media also influences the primary strength of the public sphere: publicity. This means that the results of debates, discussions, or opinions formed within this space must be accessible and known to the wider public. Publicity enables a group to share their arguments, thoughts, and perspectives with others, allowing for the dissemination of ideas and the formation of a broader public opinion. It is the core mechanism that allows rational and critical thinking, formed in limited discussions, to influence specific actions and policies on a larger scale[7][8]

However, in the modern era, the concept of publicity also carries negative impacts that cannot be ignored. Digital media, particularly social media, has drastically altered the landscape of publicity. While on one hand it expands access and participation, on the other, it is vulnerable to becoming a battlefield for the spread of destructive information, such as hoaxes, fake news, hate speech, and echo chambers. Digital publication media are no longer just communication tools; they have transformed into a kind of “constant technological presence" that faithfully accompanies us wherever we go. Globalization has brought this technology into every corner of life, even to the remotest villages. So penetrative is this modern technology that it has seemingly become a new idol of this century. It is "worshipped" for providing extraordinary convenience and satisfying an infinite thirst for information. Computers, with all their applications, offer immense ease in completing tasks and work. Similarly, the internet eliminates the boundaries of distance and time in communication, while presenting an expansive and unmanaged volume of information. It is no wonder that many people rely so heavily on, and even "worship", this technology.

Online public spheres are often politicized by various groups. With sophisticated algorithms and the ability to target specific audiences, certain groups can easily influence their readers or followers, even to the point of adhering to dangerous radical concepts. Most online public spaces, which should serve as arenas for dialogue, often transform into "echo chambers" where biased information circulates without filters, and healthy criticism is replaced by personal attacks.

Nevertheless, these challenges do not negate the urgency of the public sphere. On the contrary, they emphasize the need for a higher level of critical consciousness from every individual in filtering information and participating in discussions. We must consciously recreate and maintain spaces where rational arguments are still valued, where 'the other' is viewed as a dignified subject who can enrich our insights, and where freedom of expression is balanced with ethical responsibility.

Another weakness that emerges is the temptation of superiority or inferiority claims within the orientation of the public sphere itself. Ironically, amidst efforts to voice equality, some individuals or groups may view themselves as possessing higher rationality or influence. They tend to attempt to control the thoughts of others, transforming the public sphere, which should be free, into a politicized arena for the exclusive interests of a few. This constitutes an intellectual betrayal of the fundamental principle of discursive equality envisioned by Habermas.

Furthermore, amidst the idealism of public discussion, Habermas also recognizes the reality that modern humans care not only about public life but also their private lives. The quality of public life often presupposes the quality of individual life. That is, if individuals are not personally healthy (for instance, due to life pressures or insecurity), how can they contribute maximally to the public sphere? Sometimes, overly strict standards of rationality can also backfire, leading to discrimination against individuals perceived to have lower-quality rational arguments, even though they may hold important perspectives derived from life experiences.

Contemporary phenomena further complicate Habermas's views. In this modern era, we witness countless conflicts, such as war, terrorism, suicide bombings, persecution, and violence. Tragically, many of these are even supported by seemingly rational arguments from conflicting groups, or at least justified through systematic narratives. This situation, where rationality can lead to destruction rather than consensus, has made Habermas himself skeptical of glorifying rational argument as the sole primary recommendation for public life. If pure rationality alone can trigger conflict, then something is missing. Consequently, in the modern era, Habermas indirectly acknowledges that modern humans require the influence of religion and culture to create a better life and a more harmonious future. Rationality alone is insufficient. Spiritual, ethical, and communal dimensions sourced from religion and cultural wisdom may serve as the glue capable of overcoming the limitations of instrumental rationality. Habermas has refined his concept of the public sphere over time. The 1962 version, which focused on the bourgeois public sphere, was criticized for excluding the proletariat and women. In response, Habermas's revisions in the 1990s aimed to include those previously marginalized. His latest version between 2005–2008, in his book *Between Naturalism and Religion*, is designed to integrate religious citizens, demonstrating its potential for greater inclusivity[9].

3.4 Communicative Rationality and the Spirit of Openness

The coffee house as a public sphere represents a fertile ground for intellectuals, and indeed every individual, to work together in a spirit of love, harmony, and peace. It is here that suspicion and hostility should dissolve, replaced by a collective effort to create peace within our diverse identities. Within this space, every individual is encouraged to explore successful communication and share their experiences from various roles in everyday life. This is not merely about exchanging facts, but also about sharing stories, perspectives, and even their educational, socio-cultural, and political experiences with complete openness. Communicative

action can even overcome social pathologies.[10] Thus, Habermas essentially focuses on communicative rationality and rational discourse within the public sphere.[11]

Openness in this context does not mean accepting all policies blindly without criticism. More deeply, openness also encompasses a willingness to acknowledge our own vulnerability and "brokenness." It is an admission that we, as humans, never feel completely "at home" or perfect within ourselves. We are always in a process of becoming, always possessing room to learn and grow. It is precisely within this awareness of imperfection that an individual's deepest freedom lies, our ability to be creative and to accept responsibility for our existence in the world. Creativity becomes the way out of limitations, and responsibility is the compass that guides us to use that freedom for the common good. Genuine harmony and peace can be realized through the pluralism of identities.

To possess freedom means to have the right to express one's opinions or perspectives without coercion or fear. It is the right to have 'sincerity' of autonomy [12]; the ability to speak, think, criticize, and ultimately, determine one's own stance. Only when the freedom and autonomy of every individual are recognized can honest and productive dialogue take place. This creates an environment where ideas can contend on equal footing, rather than being dictated by authority or dominance.

For Habermas, our critical consciousness is always projected toward external phenomena. This means we are constantly driven to question and analyze what occurs outside of ourselves. The correlation between this critical consciousness and communication is explicit. Habermas emphasizes the significance of communication that aims not only to convey information but is also capable of renovating situations or mindsets for the better. His idealism suggests that through communicative action, we can achieve consensus and harmony in our collective life in the digital age[13] .

Communication, in this view, is a highly substantial praxis. It opens the horizons of human critical consciousness to engage in dialogue and appreciate oneself without the 'chains of domination.' This means everyone has an equal right and opportunity to speak and be heard, overcoming the silence and fear that may still overshadow parts of society. Habermas develops a social pragmatics where the communicative use of language is a fundamental prerequisite for meaningful interaction.[14] In this type of communication, there are only active and responsive actions: speaking and listening. Every format of communication inherently possesses the intention to reach a consensus without coercion. The effort to achieve this consensus can only be realized if there is a paradigm of mutual respect within social life. For Habermas, the idea of rational consensus logically and chronologically takes precedence over violence. Violence is understood as a political failure, not as a means to achieve it. [15]

In the light of Habermas's ideas, our society or community will endure and flourish if it is built upon reciprocal communication that respects the freedom and equal status of every member. This respect opens the horizons of each individual's thinking, encouraging them to remain open to other perspectives and optimizing negotiation efforts to reach a common consensus. In this

context, it is essential to have the courage to relinquish something of value for the sake of something else that is rationally proven to be of greater value. This means we must be willing to correct our views or interests if rational dialogue demonstrates a stronger argument or a better solution. There is no practice of hegemony or coercion in this ideal communication; what appears is a relationship of partnership, where every voice carries equal weight.

The activity of expressing one's perspective must also be accompanied by an attitude of accepting external perspectives that are not one's own. However, what happens if perspectives clash and no consensus is reached? That is where criticism emerges. Habermas asserts that criticism is a natural response when consensus is not achieved. Criticism is a highly significant segment in building communicative interaction. It possesses social value and embodies an emancipatory spirit because it seeks to dismantle certain ideologies that may covertly negate the existence or rights of individuals within society. It is criticism that can uncover injustice, bias, or hidden assumptions. According to him, the potential for critique is not located outside of society (for instance, in individual consciousness) but is already 'inscribed' within everyday communicative practices that require discursive justification. Criticism is a practical competence possessed by all social actors.[16]

Habermas asserts that the framework of argumentative criticism must lead toward validity claims. These are four universal demands that we implicitly make every time we communicate: the claim of *truth*, the claim of *rightness*, the claim of *sincerity* (or authenticity), and the claim of *comprehensibility*. In the context of the truth claim, Habermas identifies three moments of truth: the 'Platonic' moment (unquestioned everyday beliefs), the 'Hybrid' moment (fallible truth reached through discourse), and the 'Kantian' moment (unconditional truth that transcends justification). [17] An individual who successfully fulfills these claims in their communication is said to possess communicative competence. This is the key to creating productive dialogue capable of generating consensus and, ultimately, building a more just and harmonious society. In relation to local contexts, Habermas introduces the concept of 'Janus-faced' validity claims. These claims are 'context-bound' because they are uttered in the here and now, yet at the same time, they are 'context-transcending' because, as claims, they refer to an unconditional moment embedded within the process of mutual understanding. [18]

3.5 Education: The Foundation of Habermasian Communicative Competence

In the midst of rapid globalization and increasingly massive digital dominance, one fundamental skill has become increasingly crucial for every individual: communicative competence. The ability to interact, engage in dialogue, and convey ideas effectively is no longer merely an added value but a basic necessity. How, then, can this skill be intensively formed? The answer lies within the educational process.

Jürgen Habermas's inspiration regarding coffee houses, the public sphere, and communicative rationality, namely the ability to argue rationally and reach consensus through dialogue without

domination and violence[19], would be difficult to comprehend and realize comprehensively without proper channels. This is where education plays a key role. Education is not merely a transfer of knowledge, but one of the most significant elements in the life of a global society. A society will not flourish without a solid educational foundation. In fact, the benchmark of a country's civilization often lies in its consistency and commitment to the advancement of its educational system.[7]

Therefore, every nation in the world is constantly encouraged to refine its educational system to align with the developments of the era. Adaptive education allows for alignment with the rapid progress occurring in various fields of life, ranging from technology and economics to socio-political dynamics.

In essence, education always requires reform and transformation. Reform ignites the existence of education to constantly renew itself, striving for perfection in the delivery and relevance of its materials. One significant aspect is how to create a public sphere that enables critical discussion, the exchange of ideas, and mutual learning of characters while accepting differences. Education is not a closed space that must remain untouched by global secular issues.[20] On the contrary, education is an open space that allows all issues to be articulated straightforwardly, discussed, and analyzed for their significant essence in personal and social life. Meanwhile, transformation enables education to fundamentally change its learning methods. It is no longer about rote memorization, but about shaping the character of students to possess 21st-century skills, the 4Cs: Critical Thinking, Creative, Collaborative, and, of course, effective Communication. Education is expected to evolve through curriculum changes that seek the right format to produce human resources based on these 4C competencies.[21] [22]

Through these processes of reform and transformation, the educational system can actively shape individuals who are not only academically intelligent but also possess the communicative competence required to participate actively in the Public Sphere. They will become citizens capable of articulating rational arguments, listening to other perspectives, identifying biases (including personal prejudices), and contributing to constructive dialogue, the very foundation for the consensus and harmony envisioned by Habermas. Thus, investing in quality education that continuously adapts and transforms is a tangible investment in building a public sphere for a society that is smarter, more critical, and better equipped to engage in productive dialogue amidst the complexities of a global and digital-driven era.

4 Conclusion

Ultimately, the grand vision of the public sphere championed by Jürgen Habermas is not merely a utopian theory. It is a practical blueprint for a more just and rational society. However, this blueprint will never be realized without two essential bridges: education and our willingness to integrate it into every facet of life.

Furthermore, this idea offers a transformative call for educational institutions. By manifesting a "Habermasian Coffee House" within educational environments, we do more than just integrate theological discussion with contemporary issues; we shape a generation of future leaders who possess balanced intellectual and spiritual integrity. Students trained in open dialogue, constructive criticism, and the recognition of "the other" will become more relevant servants of society, capable of navigating the complexities of a pluralistic community.

Thus, from the 18th-century coffee houses to today's online spaces, the public sphere remains a mirror of our civilization's quality. Education is the key to ensuring that this mirror reflects a society that is not only intelligent but also wise, critical, and courageous enough to achieve harmony through dialogue.

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The Role of Spatial Ability and Metacognitive Skills in Reducing Cognitive Load in Developmental Psychology Courses

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Abstract. This study investigates the degree to which students' spatial abilities and metacognitive skills forecast their cognitive load in a Developmental Psychology course. Data were gathered utilizing a quantitative associative design through self-administered questionnaires assessing spatial aptitude (Santa Barbara Sense of Direction Scale/SBSOD), metacognitive skills (Metacognition Self-Assessment Scale/MSAS), and cognitive load (Paas Cognitive Load Scale). Data were analyzed via PLS-SEM in SmartPLS 3. The findings demonstrate that spatial ability and metacognitive skills significantly and negatively predict cognitive load ($p < .05$), indicating that students with enhanced visuospatial processing and self-regulation perceive reduced mental effort when engaging with complex, diagram-intensive material. The findings underscore the necessity of including visuospatial aids (such as organized visual representations and augmented reality/visual media) and metacognitive supports (including prompts, reflection, and self-monitoring practices) to enhance learning efficacy in cognitively challenging courses.

Keywords: Spatial Ability; Metacognitive Skills; Cognitive Load; Developmental Psychology.

1 Introduction

Understanding humans throughout their lifespan is the core of Developmental Psychology. Its scope is very broad, encompassing physical, cognitive, social, emotional, and moral development from birth to the end of life. This complexity demands that students process large amounts of information at a high level of abstraction [1]. As a result, this material often presents a cognitive challenge because it demands an understanding that connects various concepts and theories, as well as the ability to integrate complex information from different stages of life.

Traditional instruction in Developmental Psychology is still primarily based on lectures and lengthy reading materials. In real classrooms, this technique frequently does not correspond to how kids learn. When asked to read graphs, follow

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developmental stage charts, or comprehend abstract concepts, many people become confused rather than assisted. Explanations are frequently overly brief and give little room for reflection. As a result, pupils attempt to memorize terms rather than actually comprehend the concepts. This condition makes learning feel weighty and burdensome, and students struggle to connect psychological ideas to real-world human growth. Classroom instruction frequently remains unaltered, despite the increasing interest in developmental psychology. Students are left to navigate abstract theories and overlapping developmental stages with little support, as lectures and dense literature dominate. Presenting an excessive amount of information at a rapid pace results in a silent conflict for many individuals. When cognitive demands exceed the capacity of learners to manage them, comprehension begins to deteriorate. Rather than fostering engagement, these methods may inadvertently alienate students from the subject matter. It is both urgent and indispensable to reconsider the manner in which we instruct this subject.

Cognitive Load Theory [2] explains that teaching materials that are too dense and poorly organized risk overloading working memory, thus triggering cognitive overload. As a result, the process of understanding the material is hindered, concentration is easily diverted, and information fails to be integrated into meaningful knowledge. The findings of [3] support this. They proved that presentation methods that ignore the basic principles of human information processing actually decrease learning effectiveness and long-term retention. These two studies together confirm one thing: that information organization strategies are not trivial, but rather a crucial element that determines the quality of a learning process.

Recent research further confirms the key role of spatial ability in learning. [4] found that the capacity to manipulate these mental representations of visual objects is very helpful for students in integrating verbal and visual information. As a result, their cognitive load becomes lighter when facing complex tasks. This finding aligns with the report by [5], which indicates that students with superior spatial abilities do not easily experience cognitive overload when solving visual analysis problems. Beyond technical ability, [6] reminds us that a person's self-confidence in dealing with visual material (spatial self-confidence) is also a determining factor in successful information processing in the academic world.

Recent findings reveal an interesting paradox in the world of digital education. Amidst the rise of immersive technologies like augmented reality, spatial ability is becoming increasingly crucial. Studies have shown that although technology can present more engaging visualizations, a deep understanding of complex material still depends on an individual's capacity to manipulate mental representations. This aligns with the research by [4], which shows that technology is merely a tool, while the key to understanding remains with the learner's visuospatial abilities. This finding confirms that investing in the development of basic skills remains relevant in the digital age.

Metacognitive skills are the ability to independently regulate the learning process. Similar to a guide, this skill allows students to plan, monitor, and evaluate the learning methods they use. Research by [7] revealed that students with good metacognitive skills are better able to stay focused and reduce distractions while studying. This ability allows individuals to recognize when their attention begins to wane and make immediate adjustments. As a result, the learning process becomes more effective and cognitive load can be reduced because everyone can find the most suitable learning method for themselves.

Metacognitive skills act like a personal coach in learning, helping us organize our thinking strategies and improve cognitive self-control. Ajayi's research proves that this approach not only reduces excessive mental effort but also improves the quality of understanding, while [8] study shows how metacognition creates a more directed and effective learning process. Ultimately, it is this ability that enables us to become independent learners capable of optimizing information processing while better managing cognitive load.

Various studies strengthen the evidence that metacognitive skills play a direct role in reducing mental load during learning. Research by [9] and [10] shows that metacognitive interventions successfully improve self-monitoring abilities and the selection of appropriate learning strategies, thereby effectively reducing unnecessary cognitive load. The findings from [11] also revealed that using metacognitive prompts, which are cues to reflect on the learning process, helps learners focus on relevant information and ultimately significantly improves their learning outcomes.

Research on instructional strategies to reduce cognitive load has been extensive, but studies on the role of individual cognitive characteristics are still limited. Specifically, the contribution of spatial abilities and metacognitive skills in understanding complex Developmental Psychology material has not been extensively researched. However, these two factors have been proven to help students process information more efficiently when dealing with abstract and multidimensional material like that found in Developmental Psychology.

Although many studies have examined instructional strategies for reducing cognitive load, limited attention has been given to learner characteristics that may help reduce cognitive overload in conceptually demanding courses such as Developmental Psychology. In particular, there aren't many actual studies that look at how spatial ability and metacognitive skills work together to lower cognitive load. Metacognitive skills help learners plan, monitor, and control their mental activities, while spatial skills help them handle visual representations efficiently. This study aims to examine how spatial ability and metacognitive skills predict students' cognitive load in a Developmental Psychology course. By doing this, it will add to the body of research on learner-centered approaches in higher education.

Students are still expected to learn developmental psychology through lengthy textbook readings and lectures in many schools. Despite its extensive history, this approach does not always aid pupils in comprehending the subject matter completely. The topic spans several developmental phases and contains a lot of intricate concepts. Presenting all of this at once may make it too much to handle. Pupils may become disinterested or confused. Some people could have trouble recalling what they have learnt. This does not imply that the subject is uninteresting; rather, it indicates that the curriculum needs to be taught more effectively. Learning is more effective when the material is simpler to understand and has a stronger real-world connection. Simple resources like group discussions, real-world examples, or brief movies can be used by educators. These adjustments can help students stay focused and involved in the classroom while also giving learning greater significance.

2 Research Methods

First-year college students who had taken the Developmental Psychology course at STIKES Mataram took part in this study. A total of 135 students consented to participate. The Santa Barbara Sense of Direction Scale (SBSOD) was used to test spatial ability. It has 15 items that are rated on a seven-point Likert scale that goes from strongly disagree to strongly agree. The Metacognition Self-Assessment Scale (MSAS) was used to assess metacognitive skills. It has 18 items that are rated on a five-point range from "never" to almost always. A single-item measure of mental work created by Paas and rated on a nine-point scale was used to measure cognitive load.

The SmartPLS 3 program was used for data analysis, which included Partial Least Squares-Structural Equation Modeling (PLS-SEM). First, the measurement model was evaluated to ensure that each indicator accurately represented its construct. To confirm convergent validity, we examined outer loadings and Average Variance Extracted (AVE). Discriminant validity was then determined using the Fornell-Larcker criterion and the Heterotrait-Monotrait (HTMT) ratio. After confirming the measurement model, we evaluated the structural model by analyzing path coefficients, significance levels ($p < .05$), effect sizes (f^2), and proportion of variance explained (R^2).

The Paas mental effort scale, which is made up of a single question, was used to measure cognitive load in this study. This single-item scale was used because previous research has shown that learners' direct and subjective ratings of mental effort provide a valid and reliable measure of cognitive load. Many studies on cognitive load use the Paas scale because it can quickly measure perceived mental effort without imposing additional cognitive load during learning. This is a one-item scale, but it is thought to be good for the study goal, which is to look at how people feel about cognitive load in general rather than specific aspects of cognitive load.

3 Results and Discussion

Results

3.1 Respondent Characteristics

This study involved 135 third-semester students from STIKES Mataram who had completed the Developmental Psychology course. The majority of participants were aged 19-22 years, placing them in the early adulthood phase where abstract thinking and cognitive flexibility are already mature [1], [14]. The participant composition is dominated by women, reflecting the general characteristics of healthcare institutions. The findings of [15] and [6] indicate that gender variation can influence spatial abilities and learning strategy preferences, which should be considered in data analysis.

The participants in this study have a uniform educational background as graduates of high school/Islamic senior high school science programs or health schools. This homogeneity minimizes the influence of external factors, making it more likely that variations in academic performance are due to differences in internal cognitive abilities. Spatial ability, self-confidence in processing visual information, and metacognitive skills in organizing learning strategies are key determining factors. The findings of [6], [8], [14] support this by showing that an individual's capacity to monitor their thinking processes and select appropriate learning strategies is crucial for the effectiveness of complex information processing.

The selection of third-semester students as respondents is very appropriate because they are actively studying Developmental Psychology with various abstract concepts and developmental diagrams. Spatial abilities help them understand visual representations like developmental stage charts, while metacognitive skills enable effective learning strategy regulation. Based on research by [4], [11], [15], the combination of these two abilities can reduce cognitive load when processing complex material. Such characteristics of the respondents are very suitable for researching the contribution of spatial and metacognitive abilities to managing cognitive load in Developmental Psychology learning.

3.2 Measurement Model (Outer Model)

Table 1. Measurement Model Assessment Results (Validity and Reliability)

Latent Variable	Item	Outer Loading	AVE	Cronbach's Alpha	Composite Reliability
Spatial Ability	KS1	0.763	0.576	0.947	0.953
	KS2	0.774			
	KS3	0.775			
	KS4	0.722			
	KS5	0.752			
	KS6	0.769			
	KS7	0.742			
	KS8	0.751			

Latent Variable	Item	Outer Loading	AVE	Cronbach's Alpha	Composite Reliability
	KS9	0.759			
	KS10	0.757			
	KS11	0.760			
	KS12	0.738			
	KS13	0.768			
	KS14	0.794			
	KS15	0.762			
Metacognitive Skills	KM1	0.767	0.634	0.966	0.969
	KM2	0.801			
	KM3	0.766			
	KM4	0.856			
	KM5	0.775			
	KM6	0.819			
	KM7	0.797			
	KM8	0.733			
	KM9	0.835			
	KM10	0.793			
	KM11	0.813			
	KM12	0.767			
	KM13	0.792			
	KM14	0.791			
	KM15	0.841			
	KM16	0.802			
	KM17	0.782			
	KM18	0.793			
Cognitive Load	CL1	0.892	0.796	0.957	0.965
	CL2	0.902			
	CL3	0.896			
	CL4	0.897			
	CL5	0.899			
	CL6	0.869			

Latent Variable	Item	Outer Loading	AVE	Cronbach's Alpha	Composite Reliability
	CL7	0.889			

The results of the convergent validity and reliability tests indicate that both the latent variables of spatial ability, metacognitive skills, and cognitive load meet good criteria. Convergent validity is assessed through outer loading values and Average Variance Extracted (AVE). All indicators of all variables have outer loading values greater than 0.7 indicating that each item is able to reflect the latent variable well. The AVE values also exceeded the minimum threshold of 0.5 (Spatial Ability = 0.576; Metacognitive Skills = 0.634; Cognitive Load = 0.796), indicating that each construct has sufficient ability to explain the variance of its indicators.

Table 2. Fornell-Larcker Criterion Values

	Cognitive Load	Spatial Ability	Metacognitive Skills
Cognitive Load	0.892*	-	-
Spatial Ability	-0.608	0.759*	-
Metacognitive Skills	-0.612	0.340	0.796*

Based on the Fornell-Larcker analysis, it can be confirmed that each construct in this study meets discriminant validity. The AVE root values for each variable, namely Cognitive Load (0.892), Spatial Ability (0.759), and Metacognitive Skills (0.796), were proven to be higher than any inter-latent variable correlation. This finding is further supported by the HTMT test results, which show all values are below the 0.85 threshold. Thus, it can be concluded that the three constructs indeed measure different and non-overlapping aspects, so this research instrument is declared valid for accurately measuring each variable.

Table 3. Cross-Loading

Item	Latent Variable		
	Cognitive Load	Spatial Ability	Metacognitive Skills
CL1	**0.892**	-0.557	-0.563
CL2	**0.902**	-0.550	-0.560
CL3	**0.896**	-0.571	-0.499
CL4	**0.897**	-0.543	-0.596
CL5	**0.899**	-0.533	-0.537
CL6	**0.869**	-0.526	-0.542
CL7	**0.889**	-0.514	-0.516

Item	Latent Variable		
	Cognitive Load	**Spatial Ability**	**Metacognitive Skills**
KM1	-0.467	0.302	**0.767**
KM10	-0.470	0.228	**0.793**
KM11	-0.556	0.358	**0.813**
KM12	-0.433	0.181	**0.767**
KM13	-0.449	0.266	**0.792**
KM14	-0.498	0.226	**0.791**
KM15	-0.553	0.369	**0.841**
KM16	-0.516	0.261	**0.802**
KM17	-0.523	0.333	**0.782**
KM18	-0.540	0.253	**0.793**
KM2	-0.418	0.249	**0.801**
KM3	-0.470	0.215	**0.766**
KM4	-0.518	0.212	**0.856**
KM5	-0.475	0.262	**0.775**
KM6	-0.481	0.273	**0.819**
KM7	-0.482	0.290	**0.797**
KM8	-0.351	0.260	**0.733**
KM9	-0.491	0.303	**0.835**
KS1	-0.474	**0.763**	0.277
KS10	-0.469	**0.757**	0.350
KS11	-0.515	**0.760**	0.284
KS12	-0.433	**0.738**	0.193
KS13	-0.494	**0.768**	0.288
KS14	-0.445	**0.794**	0.220
KS15	-0.477	**0.762**	0.246
KS2	-0.488	**0.774**	0.261
KS3	-0.446	**0.775**	0.273
KS4	-0.398	**0.722**	0.135
KS5	-0.410	**0.752**	0.243
KS6	-0.423	**0.769**	0.262
KS7	-0.489	**0.742**	0.315

Item	Latent Variable		
	Cognitive Load	Spatial Ability	Metacognitive Skills
KS8	-0.422	**0.751**	0.193
KS9	-0.501	**0.759**	0.294

The results of the cross-loading analysis indicate the accuracy of measuring each variable. Indicators CL1 to CL7 load most strongly on cognitive load with values of 0.869-0.902, while the correlation with other variables is negative. Indicators KM1-KM18 consistently load high on metacognitive ability (0.733-0.856), and KS1-KS15 are most closely related to spatial ability (0.722-0.794). This finding proves that there is no overlap in measurement between constructs. Each indicator specifically measures the target variable, so this research instrument has adequate discriminant validity to test the relationships between variables.

3.3 Results of Structural Model Assessment

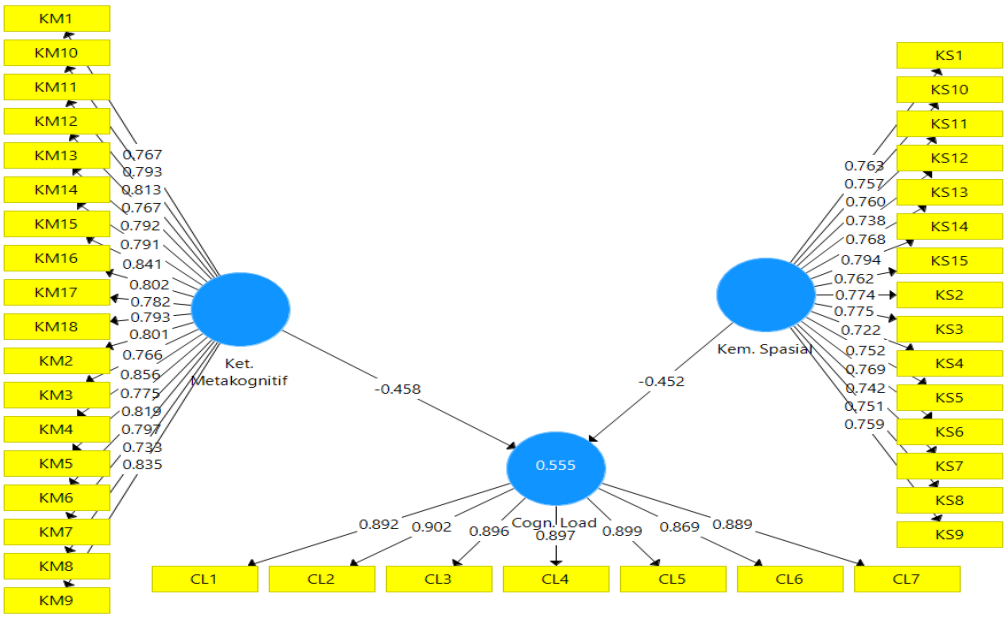

Figure 1. Output of Inner Model Testing Results (Resampling Algorithm Method)

From the PLS analysis, spatial ability and metacognitive skills together are able to explain 55.5% of the variation in cognitive load. This R-squared value of 0.555 becomes 0.548 after adjustment. This value indicates a moderately strong level of explanatory power. This means that more than half of the factors influencing students' cognitive load can be explained by the combination of these two variables. This finding

proves the important role of spatial and metacognitive abilities in determining the severity of cognitive load during learning.

Table 4. Structural Model Assessment Results (Inner Model)

Exogenous Latent Variable	R2	Adjusted R2	Effect Size (F2)
Spatial Ability	0.555	0.548	0.406
Metacognitive Skills			0.416

The effect size f^2 indicates that the two variables have a strong influence. The spatial ability has an f^2 value of 0.406, while the metacognitive ability is slightly higher at 0.416. According to the benchmark by Hair Jr. et al., a value above 0.35 is considered a large effect. So, it can be said that both of these abilities have a significant impact on cognitive load. Both spatial and metacognitive factors equally determine the perceived mental workload of students while learning.

Discussion

The results indicate that spatial ability significantly facilitates students' capacity to manage the cognitive challenges of Developmental Psychology, particularly when the content relies on diagrams, stage models, and visual arrangements. Students with superior spatial reasoning abilities tend to integrate images and explanations more effortlessly, thereby avoiding unnecessary effort in interpreting the visuals. This creates additional mental capacity for comprehending the concepts themselves. Simultaneously, metacognitive abilities enable students to maintain control over their learning process. Through careful planning of their tasks, verifying their comprehension, and adjusting strategies as necessary, they can prevent distractions and maintain focus. When these two capabilities operate in conjunction, students utilize their cognitive resources more efficiently and encounter reduced cognitive load during demanding learning activities. This finding is consistent with [16], which suggests that students with strong visualization skills are better able to focus on core concepts, while [15] also showed that the ability to visualize concepts improves efficiency in learning diagram-rich material. In short, spatial ability is like a key that unlocks the door, making it easier for complex information to enter the brain.

The material on Developmental Psychology contains a number of diagrams about developmental phases, interaction graphs, and complex conceptual models. This visualization is supposed to help with understanding, but it often hinders students with low spatial skills. The process of combining text, illustrations, and oral explanations actually adds to the mental burden and creates confusion. This situation is very different from students who have good visualization skills. Diagrams and graphs are very effective learning aids. The ability to transform images into more abstract concepts

makes it easier to understand the material. Research [5] indicates that students with this ability can effectively connect verbal and visual explanations. As a result, students not only avoid cognitive overload but are also able to process complex information into a more complete and in-depth understanding.

Developing metacognitive skills serves as a control mechanism that allows students to optimize their cognitive resources. When students are able to plan learning strategies, monitor their understanding, and evaluate the effectiveness of their learning methods, they will develop significant cognitive efficiency. [9] findings confirm that metacognitive interventions enhance monitoring abilities, which in turn reduces cognitive effort. Meanwhile, [10] adds that self-regulation practices such as goal setting and self-evaluation effectively reduce extraneous cognitive load. Furthermore, [11] found that metacognitive prompts serve as cues that direct attention to essential information, thereby minimizing cognitive overload. Thus, developing metacognitive skills not only improves academic outcomes but also creates fundamental efficiency in the learning process.

These two variables work complementarily in managing cognitive load. Spatial ability helps students navigate visual complexity, while metacognition helps them organize their thinking, choose strategies, and suppress irrelevant stimuli. This aligns with the integrative framework described by [14], [17], which combines Cognitive Load Theory with Self-Regulated Learning. According to de Bruin, the effectiveness of information processing depends not only on working memory capacity but also on an individual's ability to consciously control and monitor their mental effort.

Developmental Psychology material requires students to understand various theories, stages of development, and the interaction of genetic, environmental, and social factors. Students with high spatial abilities can efficiently organize charts, diagrams, and development flows, while students with strong metacognitive skills can develop learning strategies, identify core information, and break down complex concepts into smaller units. The combination of these two abilities results in optimal working memory allocation and reduces overall cognitive load. Thus, the results of this study are completely in line with the literature reviewed in this study and are supported by strong empirical evidence.

The synthesis of these two factors aligns with [17] integrative model, which asserts that learning effectiveness is determined by the dynamic interaction between cognitive capacity and regulatory abilities. Thus, students with adequate spatial abilities and supported by good metacognitive skills will be more capable of understanding visual-abstract material, managing the complexity of developmental concepts, and maintaining cognitive load at an optimal level. These findings confirm that both abilities are essential foundations for success in learning Developmental Psychology, and therefore require special attention in both instructional design and the development of learning strategies in higher education

4 Conclusion

This research concludes that spatial ability and metacognitive skills are significant predictors of students' cognitive burden in a Developmental Psychology course. Students possessing more advanced visuospatial processing skills and elevated levels of metacognitive regulation encounter reduced mental effort when engaging with complex and representation-intensive material. Practically, educators are advised to integrate structured visual aids and explicit metacognitive scaffolding, including planning prompts and reflective exercises, to mitigate extraneous cognitive load and improve learning outcomes in higher education settings.

The implications of these discoveries are evident in the manner in which we instruct Developmental Psychology. Abstract concepts and developmental stages are often difficult for students to comprehend simultaneously. Instructors can utilize straightforward and well-organized visual aids, such as diagrams that delineate processes in detail or charts that illustrate each stage, to facilitate their students' learning. It is also beneficial to instruct students in anticipating their learning, verifying their comprehension as they progress, and engaging in post-learning reflection. In college classrooms, these minor modifications, when implemented progressively, can contribute to improved student learning and reduce confusion.

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Gateway to Disparity: The Tourism-Education-Culture Trilemma and Structural Inequality in West Manggarai Regency

(A Political Economy and Sociological Analysis of Regional Development)

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Abstract. This study examines the developmental trilemma in West Manggarai, where tourism acceleration undermines educational progress and cultural authenticity. Using qualitative-descriptive analysis of the West Manggarai Educational Development Transformation Roadmap 2025–2045, supported by tourism data and cultural policy documents, the research identifies a pattern of "growth without inclusion." Despite rapid development in Labuan Bajo as a Super Priority Tourism Destination, 80% of strategic positions are occupied by external workers, while local communities face educational limitations, reflected in an average of 8.12 years of schooling and less than 50% achieving minimum competency. Drawing on the Matthew Effect and alienation theory, the study reveals economic displacement, exclusion from decision-making, and cultural commodification, where traditions lose their philosophical meaning. It concludes that culture-based educational transformation is essential to foster inclusive tourism, strengthen local identity, and ensure sustainable, community-centered development.

Keywords: Tourism, Education, Culture, educational transformation, cultural capital, hybrid identity, Matthew Effect.

1 Introduction

Over the past two decades, global tourism has experienced rapid growth and played a central role in the economic development of various countries. According to the World Tourism Organization (UNWTO) report, before the COVID-19 pandemic, the tourism sector contributed more than 10% of the world's Gross Domestic Product (GDP) and became one of the largest employment sectors [1]. This trend shows that tourism is not just a service sector but also a strategic instrument for accelerating development in developing countries. In Southeast Asia, tourism has become a main pillar of sustainable development, driving investment, creating job opportunities, and strengthening cultural diplomacy [2]. However, various studies show that tourism growth not balanced with human resource development can create a paradox: regions gain macroeconomic benefits, but local communities do not always become the main beneficiaries [3].

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This phenomenon is clearly visible in Indonesia, particularly in areas designated as Super Priority Tourism Destinations (DPSP). One of these is Labuan Bajo, the capital of West Manggarai Regency, East Nusa Tenggara. Its strategic geographical position at the entrance to Komodo National Park has made Labuan Bajo widely known as one of Indonesia's international tourism icons [4]. In recent years, massive investment flows for tourism infrastructure development, such as airports, ports, starred hotels, and convention centers, have transformed this small town into a world-class tourism gateway. The central government has positioned Labuan Bajo as "The New Bali" with the vision of making it a driver of national economic growth, particularly from the tourism sector [5].

This study's analysis of the *West Manggarai Educational Development Transformation Roadmap 2025-2045* provides a unique analytical lens absent from previous tourism studies in Labuan Bajo. While existing research examines tourism's socio-economic impacts (Sianipar et al. 2022) or environmental pressures on Komodo National Park (Hadiningrat et al. 2025), few investigate how educational planning documents themselves reveal systemic exclusion mechanisms. The Roadmap's data on the 8.12-year average schooling-equivalent to junior high completion-directly explains why locals cannot access strategic tourism positions requiring hospitality diplomas, international certifications, or foreign language fluency. This educational deficit perpetuates what Merton (1968) termed the Matthew Effect: external workers with pre-existing advantages (university degrees, English proficiency, networks) accumulate further benefits through high-wage tourism jobs, while locals without quality education remain trapped in low-skill positions. The "Komodo Gate" metaphor thus operates as a Matthew Effect mechanism, a gateway that paradoxically opens opportunities for outsiders while closing them for locals. Each tourism investment widens this gate for external capital and labor while educational stagnation keeps it shut for indigenous communities. By analyzing educational policy documents alongside tourism and cultural data, this research exposes how state planning inadvertently institutionalizes disparity through misaligned sectoral development, where tourism infrastructure races ahead while human capital development lags generationally behind.

The cultural dimension of this trilemma is equally critical yet often overlooked in tourism development discourse. West Manggarai possesses rich cultural capital; *caci* (ritual whip-fighting dance), *songke* (traditional ikat weaving), *compang* (sacred ancestral sites), and the *Wuat Wa'i* solidarity system; that have sustained community identity for centuries. However, tourism acceleration creates a paradoxical pressure: culture becomes simultaneously a marketable asset and an endangered heritage. When sacred rituals are staged as tourist performances, their philosophical meanings risk erosion. The *caci*, originally a ceremonial test of manhood tied to harvest celebrations and conflict resolution, increasingly becomes a 15-minute spectacle scheduled between hotel check-ins. Similarly, *songke* motifs carrying cosmological narratives are mass-produced as souvenirs, severed from their ritual contexts. This cultural commodification operates alongside educational deficits and tourism exclusion to form a genuine trilemma: advancing tourism without educational transformation accelerates cultural erosion; preserving culture without economic integration perpetuates poverty; improving education without cultural grounding produces culturally alienated youth. Unlike simple multi-sectoral challenges, this trilemma represents structural contradictions where progress in one dimension actively undermines the others, creating what Bhabha (1994) terms a "third space" requiring hybrid solutions that transcend binary choices between tradition and modernity, preservation and development.

However, behind the rapid tourism growth lies a paradoxical reality that cannot be ignored. First, there is a skill gap between the needs of the premium tourism industry and the quality of local workforce. Data shows that approximately 80% of strategic positions in Labuan Bajo's formal tourism sector are still dominated by external workers who possess international certification, foreign language skills, and professional expertise (Roadmap for the Transformation of West Manggarai Education Development 2025–2045). Meanwhile, most local workers can only fill basic positions with low wages, such as lower-level hotel workers, construction laborers, or non-technical staff. This condition reflects a situation often called "internal economic colonialism," where local communities become spectators in their own land [6].

Second, although school participation rates in West Manggarai are relatively high, educational quality still faces a serious crisis. The Average Years of Schooling (AYS) of the population is only 8.12 years, far below the Expected Years of Schooling (EYS) of 12.59 years. More than 50% of students do not achieve minimum literacy and numeracy competency, with scores far below the national average (Manggarai Regency Education Report Card and East Nusa Tenggara Education Report Card, 2024). The teacher paradox also worsens the situation: although nearly all teachers have bachelor's degrees, only a small portion pass professional certification competency tests. Thus, schools function as spaces of formality but fail to become arenas of meaningful learning. The phenomenon of "schooling without learning" becomes a fundamental problem threatening the competitiveness of West Manggarai's younger generation in the global era.

Third, local culture, which has long been the identity strength of West Manggarai society, also faces serious challenges. On one hand, cultural elements such as *caci dance*, *songke weaving*, and the *Wuat Wa'i* tradition have great potential to be developed into tourist attractions and creative economy bases. Regent Regulation No. 40 of 2024 has even provided legal framework for incorporating local content into the school curriculum. However, on the other hand, tourism industrialization risks turning culture into mere commodities displayed for tourists' interests, no longer a living identity of the community. The threat of cultural homogenization due to globalization pressures and market demands becomes an unavoidable problem [7].
Thus, it is clear that West Manggarai's development faces a "development trilogy" dilemma: tourism as the growth engine, lagging education, and culture at the crossroads between preservation and commodification. If not managed integratively, this condition can deepen social inequality, accelerate cultural identity erosion, and marginalize local communities from mainstream development.

This article aims to analyze the interconnection between tourism, education, and culture in the context of sustainable regional development in West Manggarai. Specifically, this study attempts to answer the questions: how can educational transformation strategies bridge workforce skill gaps while strengthening local cultural identity to remain relevant amid globalization currents? How can tourism development be directed to be inclusive and provide real benefits to local communities, not just bring macroeconomic profits? Through analysis based on regional planning documents, human development theory, and economic-cultural perspectives, this article is expected to provide comprehensive understanding of the development trilogy problems and offer practical recommendations for more just, inclusive, and sustainable policies.

2 Literature Review

2.1 Human Resource-Based Development Theory

The concept of HR-based development emphasizes that the progress of a nation or region is not solely measured by economic growth, but by the improvement of human quality as development actors. Amartya Sen (1999) through *Development as Freedom* emphasizes that development must be viewed as a process of expanding human capabilities to live lives they value[8]. Education within this framework is not merely a tool for social mobility, but a means to expand life choices, shape freedom, and strengthen people's bargaining power within economic structures.

From an economic perspective, Gary Becker (1993) introduced the concept of *human capital* as the accumulation of skills, knowledge, and competencies that increase labor productivity. Investment in education is considered a long-term investment capable of transforming individual and community productivity [9]. In the context of West Manggarai, tourism development will only bring sustainable benefits if supported by improved local HR quality. Otherwise, the resulting economic growth will actually widen the gap between local communities and more competitive migrants.

2.2 The Concept of Educational Transformation

In educational literature, Tyack & Cuban (1995) distinguish between reform and transformation. Reform usually focuses on incremental improvements within the old framework, such as curriculum revision, additional learning hours, or changes in evaluation methods [10]. Meanwhile, transformation demands paradigmatic change: redesigning the education system to suit the needs of the times. The World Innovation Summit for Education (WISE-Qatar, 2022) study affirms that when education faces systemic crisis, the reform approach is no longer adequate; what is needed is comprehensive transformation [11]. This transformation includes three aspects: paradigm shift (from teacher-centered to student-centered), structural change (from centralistic to autonomous-contextual systems), and cultural change (from resistance to continuous innovation).

In the West Manggarai context, educational transformation becomes highly relevant. Data shows that although school participation rates are relatively high, learning quality remains low; more than 50% of students do not achieve minimum literacy and numeracy competency. Thus, education can no longer be understood merely as schooling, but must shift to meaningful, contextual learning oriented toward both local needs and global standards.

2.3 Culture-Based Development

Culture is often viewed as static heritage, but cultural economists affirm that culture can also become development capital. Throsby (2001) introduced the concept of *cultural capital*, namely values, practices, and cultural expressions that have both economic and social functions [12]. Cultural capital not only functions as identity but can also become a competitive asset in the creative economy. Meanwhile, John Howkins (2001) in *The Creative Economy* emphasizes that culture-based innovation can create significant economic value [12]. Creativity rooted in local heritage can produce unique products and services, difficult to replicate, and relevant in global

markets. Richard Florida (2002) through *The Rise of the Creative Class* adds that cities or regions that successfully combine creativity, technology, and tolerance tend to become new economic growth centers [13].

For West Manggarai, cultural potential such as *caci* dance, *songke* weaving, or the *Wuat Wa'i* solidarity tradition can function dually: as a means of identity preservation and as an economic resource. However, cultural integration in development must be careful not to fall into excessive commodification that actually weakens the cultural meaning itself.

2.4 Sustainable Tourism and Its Relationship with Education

Sustainable tourism emphasizes three dimensions: economic, socio-cultural, and environmental. This concept demands that tourism not only bring short-term financial profits but also maintain ecological balance and strengthen social cohesion. Within this framework, education plays a role as the main connector [14]. First, education can equip local communities with skills relevant to the tourism industry, such as foreign language abilities, service management, or community-based destination management. Second, education can instill critical awareness about the importance of preserving culture and environment so tourism remains sustainable. Third, education can build flexible dual identity: West Manggarai's younger generation remains rooted in local culture but is also open and competitive in the global arena.

2.5 Case Studies and the Concept of Hybrid Identity

Bali's experience provides the most tangible example of tourism development paradox. On one hand, Bali's tourism has brought large foreign exchange and improved welfare. However, on the other hand, mass tourism creates environmental problems, cultural commodification, and economic dependence on the tourism sector. To address this, Bali began developing a community-based tourism approach emphasizing local culture-based tourism education [15].

Meanwhile, Yogyakarta presents a different model: combining higher education, culture, and creative tourism. As a student city, Yogyakarta integrates traditional arts and creative economy in curriculum and community development. This shows how education can function as a negotiation space between globalization and tradition [16].

In postcolonial theory context, Homi K. Bhabha introduced the concept of *Hybrid Identity* in his book ‘The Location of Culture’ (1994), which describes how local culture interacts with global culture. Identity is no longer seen as something static, but rather as the result of negotiation, encounter, and even resistance. Hybrid identity allows communities to maintain local cultural roots while adopting relevant global elements [17].

For West Manggarai, the hybrid identity concept is highly relevant. Education can become an arena for forming hybrid identity in the younger generation: they continue practicing Manggarai cultural values but also master global skills such as digital technology, foreign languages, and tourism management. Thus, the younger generation is not uprooted from its roots but is actually able to make culture a competitive advantage in the global world.

2.6 Matthew Effect and Alienation in Development Context

To understand the inequality mechanism occurring in West Manggarai, two sociological concepts become highly relevant: Matthew Effect from Robert K. Merton and Alienation from Karl Marx. The Matthew Effect, formulated by Merton (1968) based on Matthew 25:29 ("For to everyone who has, more will be given, and he will have abundance; but from him who does not have, even what he has will be taken away"), explains how initial advantages tend to accumulate cumulatively [18]. In the context of education and tourism in West Manggarai, this phenomenon is clear: external workers who already have skills, international certification, and networks continue to get strategic positions and high wages, while local communities without access to quality education become increasingly marginalized. This gap is self-reinforcing: children from families already integrated into the tourism economy have better access to education, while children from lagging farming families remain trapped in the cycle of educational poverty [19].

Marx's concept of Alienation (1844) describes the condition where workers are alienated from their work products, work processes, their essence, and fellow humans in the capitalist system [20]. In West Manggarai, contemporary forms of alienation manifest in several ways: First, alienation from product, where local communities working in the tourism sector do not feel ownership over the tourist experiences they create; the results are enjoyed by external investors. Second, alienation from process, where they only fill low-skilled positions without control over how tourism is managed. Third, cultural alienation, traditions like caci and songke that were originally communally meaningful become tourist commodities foreign to the younger generation. Fourth, social alienation, economic inequality creates distance between marginalized local communities and the "new class" integrated into the tourism economy.

The combination of Matthew Effect and alienation concept explains why "growth without inclusion" occurs: the existing system structurally benefits those who already have capital (education, skills, networks) while alienating those without access. Without transformative intervention in education, this cycle will continue to reproduce, deepening intergenerational inequality.

3. Methodology

This research employs a qualitative-descriptive approach to examine West Manggarai's educational development planning within the tourism-education-culture trilemma. The qualitative design was selected due to the multidimensional complexity requiring deep interpretation of policy texts, development narratives, and strategic visions, while the descriptive component maps existing conditions and policy directions holistically [21]

The primary data source is the West Manggarai Educational Development Transformation Roadmap 2025-2045, specifically Part I (Existing Educational Conditions 2025) containing quantitative indicators and qualitative analysis of development challenges, and Part II (Vision, Mission, and Strategic Direction). To strengthen triangulation and address the tourism-education-culture trilemma comprehensively, this study incorporates secondary sources including West Manggarai's Regional Tourism Development Master Plan (RIPPARDA), recent BPS statistical data on education participation and tourism workforce composition, and regional development policy documents. This multi-source approach enables cross-validation of

development priorities and identification of policy gaps between educational planning and tourism-cultural sector demands.

Analysis employs three complementary frameworks: (1) SWOT analysis identifying strengths, weaknesses, opportunities, and threats in educational development within tourism-cultural contexts; (2) CIPP evaluation model assessing policy design from Context (formulation background), Input (resource allocation), Process (implementation mechanisms), to Product (human resource quality outcomes); (3) Focus Group Discussion insights from roadmap preparation capturing stakeholder perspectives (government officials, educators, traditional leaders, tourism actors, community representatives).

The study utilizes critical discourse analysis as the primary qualitative technique, examining power relations, ideological assumptions, and marginalization patterns embedded in policy language. This involves three stages: (1) textual interpretation analyzing policy visions, missions, and strategic directions for implicit biases regarding local knowledge systems; (2) structured data analysis transforming quantitative indicators into relational findings revealing educational disparities; (3) diagram visualization clarifying inter-variable patterns comparing West Manggarai's achievements against national targets and tourism workforce requirements. While the current study focuses on document analysis, future research incorporating field observations and community interviews would significantly strengthen empirical understanding of experienced alienation and educational disparities.

4. Findings

4.1 Tourism as Growth Engine

Tourism has become the main locomotive of West Manggarai's economic development, especially since Labuan Bajo's designation as a Super Priority Tourism Destination (DPSP). Data shows that tourism's contribution to West Manggarai's GRDP continues to increase year by year, surpassing traditional sectors such as agriculture, fisheries, and livestock. Supporting infrastructure, such as airport expansion, port construction, starred hotels, and convention centers, drives the acceleration of transformation of this small town at the western tip of Flores into a world-class tourism destination.

However, behind this economic success lies a significant paradox. Approximately 80% of tourism sector workers are filled by external workers brought in from other regions. This indicates a serious gap between global tourism industry needs and local workforce qualifications. Most West Manggarai communities only occupy low-skilled positions such as lower-level hotel staff, construction laborers, or informal workers, while managerial, technical, and professional positions are filled by external workers who have foreign language skills, international certification, and industry experience.

This phenomenon creates a dualistic economy [22]. This tourism-driven displacement manifests in three intersecting ways: physically, as prime agricultural lands are acquired for resort development; economically, as traditional livelihoods become unviable; and culturally, as sacred sites like Wae Rebo transform into tourist attractions, creating tension between cultural preservation imperatives and tourism education demands that schools struggle to reconcile. On

one hand, premium tourism develops rapidly, driving modern consumption, investment, and new job creation. However, on the other hand, the agricultural sector that has been the backbone of the local economy stagnates or even declines. Many agricultural lands are converted for tourism facility construction, while the younger generation leaves agriculture because it is considered unpromising [23]. Consequently, polarization occurs between those integrated into the premium tourism economy and those left behind in traditional sectors.

4.2 Education in Systemic Crisis

The education crisis in West Manggarai is clearly depicted in macro and micro indicators. First, Average Years of Schooling (AYS) only reaches 8.12 years, far below the national target of 9.13 years. This means the majority of the population stops at junior high school level, with a small portion continuing to senior high school or college. Expected Years of Schooling (EYS) is actually higher, at 12.59 years, but the gap between AYS and EYS shows serious problems in educational participation sustainability. Second, student competency achievement remains low. Data shows that less than 50% of West Manggarai students achieve minimum literacy and numeracy competency. Literacy scores are only 52.7 and numeracy 49.8, both far behind the national average (64.9 and 62.3). This condition shows the phenomenon of schooling without learning, where children do attend school but do not acquire basic skills needed to participate in the modern economy [24]. Third, there is a teacher paradox. Nearly 95% of teachers have bachelor's or diploma four degrees, but only about 25% have professional certification. This shows a gap between formal qualifications and substantive competence. This certification gap critically undermines tourism-education linkages: uncertified teachers lack hospitality pedagogy, international service standards knowledge, and foreign language proficiency needed to prepare students for premium tourism careers. Consequently, the curriculum cannot bridge the chasm between traditional Manggarai cultural knowledge and global tourism industry competency requirements, perpetuating external worker dependence. Teachers may have met administrative standards but have not fully mastered innovative pedagogy, digital literacy, and active learning methodologies needed to drive educational transformation.

The combination of these factors shows that West Manggarai's education system is in systemic crisis: access is relatively open, but quality still lags far behind. Without serious intervention, this system will continue producing graduates who are not competitive in the global labor market, especially the premium tourism sector.

4.3 Culture as Strength and Threat

West Manggarai's culture has a strategic position in the development trilogy. Traditions such as *caci dance*, *songke weaving*, and the *Wuat Wa'i* social solidarity system are not only identity heritage but also potentially become economic capital through tourism and creative economy. Local government has provided legal framework through Regent Regulation No. 40 of 2024, which integrates local content into the education curriculum. This is an important step in maintaining cultural sustainability while equipping the younger generation with strong local identity.

However, tourism industrialization also brings serious threats. Culture risks experiencing homogenization and commodification [25]. The trilemma's intersection becomes most visible in the lived experiences of Manggarai youth: they master Caci rituals and Songke patterns in

cultural education programs yet lack Tourism English proficiency demanded by hotels; they complete senior high school (approaching the 12.59 EYS target) but achieve only 49.8 numeracy scores insufficient for revenue management positions; they witness their cultural heritage monetized through tourism yet remain economically marginalized as spectators rather than beneficiaries. This triple alienation, from traditional livelihoods, from modern employment, and from their own commodified culture, creates a lost generation scenario where neither cultural preservation nor tourism integration succeeds, because educational transformation capable of bridging these domains remains unrealized. The roadmap's ambitions thus confront harsh empirical realities. Originally sacred cultural practices can be reduced to mere performances for tourists, losing their philosophical meaning. In the long term, this can weaken community social bonds and make culture merely "merchandise." The biggest challenge is how to keep culture alive and meaningful for local communities while still being promoted as a sustainable tourism attraction.

4.4 Findings Visualization

The table highlights significant disparities between West Manggarai and national education targets, confirming a systemic learning crisis that reinforces inequality and limits local participation in tourism-driven development.

Table 1. Comparison of Educational Indicators: West Manggarai vs. National Targets

Educational Indicator	West Manggarai	National Target
Average Years of Schooling	8.12 years	9.13 years
Literacy Score	52.7	64.9
Numeracy Score	49.8	62.3
Students Achieving Minimum Competency	< 50%	> 75%
Certified Teachers	25%	> 80%

(Source: Roadmap for Educational Development Transformation, West Manggarai 2025-2045)

Figure 1 illustrates the development paradox in West Manggarai, where rapid tourism growth is not matched by educational quality, positioning the region in a high-tourism, low-education quadrant that reinforces structural inequality and exclusion of local communities.

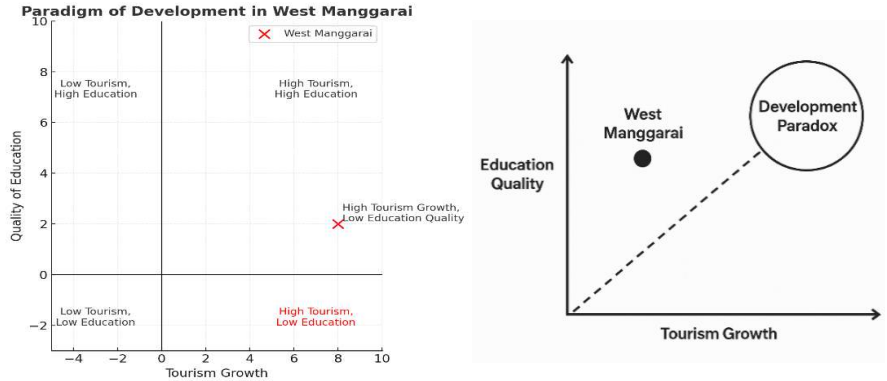
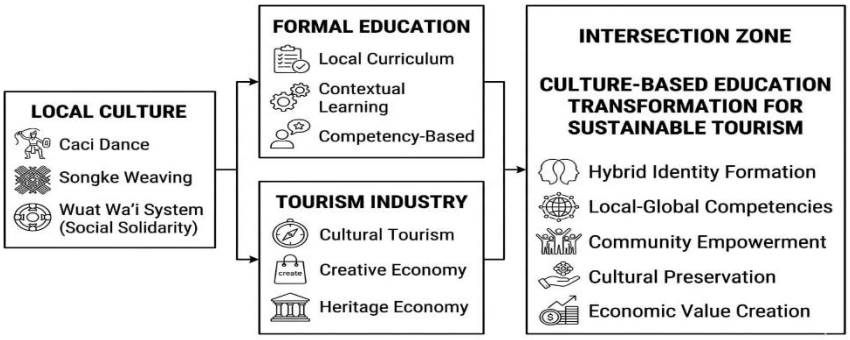


Fig. 1. Illustrates the development paradox in West Manggarai.

Figure 2 illustrates the strategic convergence of local culture, formal education, and the tourism industry as a transformative pathway to overcome structural inequality. It highlights culture-



based education as a bridge for fostering hybrid identity, community empowerment, and sustainable, inclusive tourism development.

Fig. 2. Integrated Culture, Education, Tourism Framework for Sustainable Development

Figure Legend

a. Box 1 (Left): Local Culture. Represents indigenous cultural assets, including traditional practices such as *Caci dance*, *Songke weaving*, and the *Wuat Wa'i* system of social solidarity, which form the foundational cultural capital.
b. Box 2 (Top Center): Formal Education. Refers to institutional learning systems that integrate local curriculum content, apply contextual learning approaches, and emphasize competency-based education.
c. Box 3 (Bottom Center): Tourism Industry. Encompasses sectors such as cultural tourism, the creative economy, and heritage-based economic activities that transform cultural resources into sustainable economic value.
d. Box 4 (Right): Intersection Zone. Represents the convergence of local culture, formal education, and the tourism industry. This integration generates a culture-based educational transformation that supports sustainable tourism through hybrid identity formation, local-global competencies, community empowerment, cultural preservation, and economic value creation.

(Source: Synthesized from West Manggarai Educational Development Transformation Roadmap 2025-204)

4.5 Critical Synthesis of Findings: West Manggarai's Development Crossroads

West Manggarai is currently at a crossroads that will determine the direction of its future development. This region's economic growth is driven by the tourism industry, especially after Labuan Bajo was designated as one of the national super priority destinations. Tourism has become the main economic engine, creating new jobs and attracting investment [26]. However, this dynamic contains a paradox: most local communities have not truly been integrated into the tourism value chain. Rather than becoming main actors, communities more often play roles as spectators or merely provide low-level services. Dependence on tourist flows also makes the economy vulnerable to external shocks, such as global crises or pandemics.

On the other hand, education as the main foundation of human development still faces serious challenges. Access and quality of educational services remain uneven, teacher capacity is still limited, and curricula are often not contextual to either local reality or global demands. This

condition has the potential to create a *lost generation*, namely a younger generation that fails to compete both locally and internationally [27]. Ironically, when tourism develops rapidly, local HR lags behind and many job opportunities are filled by workers from outside the region. If fundamental transformation is not immediately carried out in the education system, then West Manggarai's development sustainability will be fragile.

Meanwhile, local culture has extraordinary potential as a source of identity, tourist attraction, and social capital. Traditions such as *Caci dance*, *Songke weaving*, and the *Wuat Wa'i* solidarity system are invaluable wealth. However, this culture also faces serious threats: excessive commodification that reduces sacred values to mere commercial spectacle [28]. If culture is only viewed as a product for sale, then its essence as a source of meaning, solidarity, and life wisdom will erode.

The trilemma's intersection becomes most visible in the lived experiences of Manggarai youth: they master Caci rituals and Songke patterns in cultural education programs yet lack Tourism English proficiency demanded by hotels; they complete senior high school (approaching the 12.59 EYS target) but achieve only 49.8 numeracy scores insufficient for revenue management positions; they witness their cultural heritage monetized through tourism yet remain economically marginalized as spectators rather than beneficiaries. This triple alienation, from traditional livelihoods, from modern employment, and from their own commodified culture, creates a lost generation scenario where neither cultural preservation nor tourism integration succeeds, because educational transformation capable of bridging these domains remains unrealized. The roadmap's ambitions thus confront harsh empirical realities.

From these three dimensions, it is clear that West Manggarai's development requires an integrative strategy. First, education must transform to become more contextual, rooted in local culture, yet still prepare generations with global competencies. Second, tourism must be directed toward a sustainable model that not only pursues economic growth but also empowers local communities as main actors. Third, culture must be positioned not only as an attraction but also as a source of values that guides development direction. By connecting these three aspects synergistically, West Manggarai can escape the development paradox. The way forward is to make culture-based education a bridge that ensures tourism grows sustainably, communities are empowered, and cultural heritage remains preserved.

5. Discussion And Analysis

This research's findings reveal that West Manggarai faces a complex development trilemma: tourism develops rapidly, but education lags behind, and culture is at the crossroads between preservation and commodification. This discussion will analyze how these three dimensions are interconnected and why transformative intervention in education becomes key to breaking the structured inequality cycle.

5.1 Growth Without Inclusion Paradox: Matthew Effect in Tourism Context

The tourism boom's Matthew Effect cannot be understood in isolation from educational deficits and cultural commodification; these three forces create a trilemma where rapid tourism growth simultaneously demands skilled labor (which education fails to supply) while eroding cultural authenticity (which tourism simultaneously exploits and destroys).

Data shows that although tourism has become West Manggarai's economic growth engine, about 80% of strategic positions are still dominated by external workers. This phenomenon can be explained through Merton's (1968) *Matthew Effect* concept, where those who already have initial capital, in the form of skills, international certification, and networks, continue accumulating advantages, while local communities without access to quality education become increasingly marginalized. This gap is *self-reinforcing*: children from families already integrated into the tourism economy have better access to quality education, while children from farming or fishing families remain trapped in the educational poverty cycle [29]. This alienation manifests both physically through land acquisition for hotel construction displacing farming communities, and intellectually as school curricula fail to equip students with five-star hospitality skills, creating a double marginalization that reinforces the Matthew Effect across generations.

This condition contradicts Sen's (1999) HR-based development concept, which emphasizes that true development is the expansion of human capabilities to live lives they value. In West Manggarai's context, local communities actually experience narrowing life choices: they cannot compete in the premium tourism sector due to skill limitations, while traditional sectors like agriculture stagnate due to land conversion and youth migration. As a result, a dualistic economy emerges that deepens social inequality [22].

Furthermore, Marx's (1844) alienation concept becomes relevant for understanding local communities' experiences. They experience alienation from work products (tourism results enjoyed by external investors), alienation from work processes (no control over tourism management), and cultural alienation (traditions like caci and songke become commodities foreign to the younger generation) [20]. Without transformative intervention, this alienation cycle will continue reproducing across generations.

5.2 Educational Crisis as Root of Structural Inequality

West Manggarai's educational data reveals a systemic crisis threatening development sustainability. Average Years of Schooling is only 8.12 years, far below the national target of 9.13 years. More worryingly, competency achievement shows that less than 50% of students reach minimum literacy and numeracy standards, with scores of 52.7 and 49.8 respectively, far behind the national average of 64.9 and 62.3. This condition confirms the *schooling without learning* phenomenon identified by the World Bank (2018): children do attend school but do not acquire basic skills needed to participate in the modern economy [30].

The teacher paradox worsens the situation. Although 95% of teachers have bachelor's or diploma four degrees, only 25% have professional certification, far below the 80% national target. This shows a gap between formal qualifications and substantive competence. In Gary Becker's (1993) *human capital* perspective, investment in teacher education should increase learning productivity. However, without mastery of innovative pedagogy, digital literacy, and active learning methodologies, this investment does not produce expected quality transformation.This 70-percentage-point gap between degree holders and certified professionals directly impacts graduate quality: uncertified teachers cannot deliver competency-based tourism education, perpetuating the cycle where 80% of strategic tourism positions remain inaccessible to local youth, transforming the Komodo Gate into a Gate of Disparity [31].

Tyack & Cuban's (1995) study distinguishes between educational reform and transformation. In West Manggarai's context, incremental reform approaches, such as curriculum revision or additional learning hours, are no longer adequate [32]. What is needed is paradigmatic transformation: from *teacher-centered* to *student-centered*, from centralistic systems to autonomous-contextual, and from resistance toward continuous innovation [10]. Education must shift from merely *schooling* to meaningful, contextual *learning* oriented toward both local needs and global standards.

5.3 Culture as Development Capital or Market Commodity?

West Manggarai's culture, such as caci dance, songke weaving, and the Wuat Wa'i solidarity system, has dual potential: as identity that strengthens social cohesion and as economic capital in tourism and creative economy industries. Throsby's (2001) *cultural capital* concept emphasizes that culture not only functions as static heritage but also as a competitive asset that can create economic value [33]. Regent Regulation No. 40 of 2024 integrating local content in curriculum is a strategic step to ensure cultural sustainability across generations.

However, tourism industrialization brings serious risks: excessive commodification that reduces culture to mere commercial spectacle. When originally sacred cultural practices become performances for tourists, philosophical meaning and communal values can erode [25]. In the long term, this can cause cultural homogenization due to global market pressures, where local culture is forced to adapt to tourist tastes rather than maintain its authenticity. Yet commodification is not purely destructive; for many Caci performers and Songke weavers, tourism provides crucial livelihood survival amidst declining agriculture. The critical question is not whether to commodify but how to balance economic necessity with cultural authenticity, ensuring communities retain control over cultural representation and benefit distribution.

Homi K. Bhabha's (1994) *hybrid identity* concept offers a way out of this dilemma. Hybrid identity allows West Manggarai's younger generation to maintain local cultural roots while adopting relevant global elements. Education can become an arena for hybrid identity formation: students continue practicing Manggarai cultural values but also master global skills such as digital technology, foreign languages, and sustainable tourism management[17]. Thus, culture is not only passively maintained but transformed into a competitive advantage in the global economy.

5.4 Integration of Tourism, Education, and Culture: Toward Sustainable Development

Figure 2 on Cultural Integration Scheme in Education illustrates how the three domains, local culture, formal education, and tourism industry, can be strategically integrated. The convergence zone at the diagram's center represents culture-based educational transformation that serves sustainable tourism while preserving local identity and empowering communities.

Bali and Yogyakarta's experiences provide important lessons. Bali develops *community-based tourism* emphasizing local community empowerment as main actors, not merely low-level service providers. Meanwhile, Yogyakarta successfully integrates higher education, culture, and creative tourism, making the city a tradition-based innovation center [16]. These models show that sustainable tourism requires three pillars [34]: education that equips communities with

relevant skills, cultural preservation that is not merely symbolic, and inclusive tourism governance [35].

For West Manggarai, this integrative strategy demands paradigm change [36]. First, education must be directed to produce graduates who not only master global competencies but also have deep understanding of local culture and sustainability values. Second, tourism must be developed with a community-based approach, where local communities do not merely become objects but subjects of development. Third, culture must be positioned as a source of values guiding development direction, not merely commercial attractions. Hybrid Identity operationalization requires concrete curricular action: schools must simultaneously teach Tourism English for hotel industry competitiveness while preserving Manggarai oral literature transmission, integrating Songke geometric patterns into mathematics lessons, and using Caci philosophy to teach conflict resolution, thus making culture both heritage and competitive advantage. Without culture-based educational transformation oriented toward sustainable tourism, West Manggarai will remain trapped in paradox: economic growth without equity, modernization without roots, and development without sustainability. Therefore, education must become a bridge ensuring tourism grows inclusively, communities are empowered, and cultural heritage remains preserved.

While the 2025-2045 Roadmap ambitiously targets educational transformation, critical assessment reveals implementation gaps: without addressing the teacher certification crisis (25% vs 80% target) and establishing industry-education partnerships, the roadmap risks becoming aspirational rhetoric unable to dismantle the entrenched 80% external worker dominance within the 20-year timeframe.

6. Conclusion And Recommendations

This study reveals that West Manggarai is at a critical development crossroads, facing a complex trilemma between tourism acceleration, educational stagnation, and cultural preservation dilemmas. Labuan Bajo's designation as a Super Priority Tourism Destination has driven significant economic growth but created a “growth without inclusion” paradox where 80% of strategic positions are controlled by external workers, while local communities are marginalized in low-skilled roles. This phenomenon is reinforced by the Matthew Effect mechanism that deepens structural inequality across generations. The root problem lies in systemic educational crisis. With Average Years of Schooling of only 8.12 years and less than 50% of students achieving minimum literacy-numeracy competency, the education system fails to equip the younger generation with relevant skills to compete in the global tourism industry. The teacher paradox, 95% holding bachelor's degrees but only 25% professionally certified, shows a gap between formal credentials and substantive competence, producing the schooling without learning phenomenon.

Meanwhile, local culture faces a dual threat: on one hand potentially becoming economic capital through the cultural capital concept, but on the other hand risking excessive commodification that erodes philosophical meaning and communal values. Tourism industrialization can reduce sacred traditions like caci dance and songke weaving to mere commercial spectacles, creating cultural alienation for the younger generation. The way out of this trilemma requires paradigmatic transformation, not merely incremental reform. Education must become an integrative bridge that: (1) equips students with global competencies without uprooting them

from local cultural roots; (2) forms hybrid identity that enables the younger generation to make culture a competitive advantage; (3) promotes inclusive and sustainable community-based tourism. Without immediate transformative intervention, West Manggarai risks experiencing modernization without roots, growth without equity, and unsustainable development, making local communities spectators in their own land.

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The Impact of Social Media On Students In Khanh Hoa Province, Vietnam: Current Situation And Solutions

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Abstract. This paper addresses the dual impact of social media on students in Khanh Hoa, based on a survey of 453 students, 46 lecturers, and 04 student affairs staff. The results indicate that alongside positive benefits such as entertainment, social connection, and academic support, social media is causing serious adverse consequences, including loss of focus, academic procrastination, and negative effects on mental health. The study proposes a comprehensive system of solutions focusing on developing students' digital literacy skills, combined with the guiding role of educational institutions, the supportive companionship of families, and the management responsibilities of local authorities.

Keywords: Social media, Khanh Hoa students, consequences, solutions, digital skills

1 Introduction

The explosion of social media over the past decade has brought profound changes to social life, especially among the youth – the most active and responsive demographic to digital platforms [1], [2], [3]. In Khanh Hoa Province, Vietnam– a higher education hub in the South-Central region with institutions such as Nha Trang University, University of Khanh Hoa, Tourism College, and numerous other colleges and branch campuses – the student community is not only large but also highly diverse, hailing from various regions. Consequently, social media has become an essential tool for their connection, learning, and entertainment. However, alongside its undeniable benefits, uncontrolled use of social media also harbors unpredictable adverse consequences for students' mental health, academic performance, and social life [4], [5], [6]. Given this reality, this study was conducted to comprehensively analyze the current state of social media usage, delineate both positive and negative consequences, and thereby build a feasible system of solutions to help students in Khanh Hoa become smart digital citizens capable of effectively and safely harnessing the benefits of social media.

1.1 Social Media

In their foundational work on social media, scholars [3] describe social network sites as online platforms that enable users to create public or semi-public profiles within a defined system, connect with other users, and explore both their own networks and those of others. Furthermore,

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[4] conceptualize social media as a group of Internet-based applications built upon the principles of Web 2.0, which support the creation and dissemination of user-generated content. In this study, social media is understood as an online service platform, supported by Web 2.0 technologies and mobile applications, that allows individuals and organizations to establish a digital identity through personal profiles, develop and maintain social networks, and actively participate in the creation, sharing, and exchange of various forms of user-generated content (such as text, images, videos, and audio) within either open or restricted environments.

Within the context of this research on Khanh Hoa students' use of social media, digital skills are defined as a broad set of competencies that extend beyond basic technical abilities. These include self-regulation, social awareness, and critical thinking in digital environments [8], [9], and encompass technical, cognitive, managerial, as well as communication and social skills. Nevertheless, the use of social media may also lead to various consequences. In this study, the term “consequences” refers to the full range of outcomes—both intended and unintended, as well as positive and negative—that result from students’ social media usage and influence different aspects of their academic and personal lives. These consequences are categorized into positive and negative dimensions. Importantly, this research does not merely identify these effects but seeks to examine the causal relationships between patterns of social media use and their outcomes, thereby providing a foundation for the development of appropriate and effective solutions.

2 Research Method

The primary method employed in this study was quantitative research using a designed questionnaire [7]. The survey instrument included closed-ended questions and Likert scales to collect quantitative data. The research sample was selected using probability sampling to ensure representativeness of students in Khanh Hoa. The survey was conducted simultaneously through both online and offline channels to maximize reach. The data obtained from the questionnaire was highly quantitative, allowing for measurement and comparison of indicators. This quantitative data provided a solid basis for drawing scientific conclusions and making appropriate recommendations. Qualitative information collected from the open questions was also quantified for statistical analysis. The data were processed using descriptive and inferential statistical techniques. Differences in perceptions among surveyed groups were compared. Results from various data sources were synthesized to provide a comprehensive overview. The consistency and contradictions within research findings were assessed. Multifaceted opinions from students, lecturers, and student affairs staff were aggregated. Major trends from the analyzed data were generalized.

3 Results

A total of 453 students from Khanh Hoa province participated in the survey, from various colleges and universities within the province. 440 students answered the question "Which university are you from?": 47.7% (210 students) were from University of Khanh Hoa, 33.2% (146 students) from Nha Trang Tourism College, 9.8% (43 students) from Nha Trang University, 2.5% (11 students) from Pacific University, 2.3% (10 students) from Nha Trang College of Engineering and Technology, with the remaining students from the Naval Academy, Central Preschool College No. 2, and Khanh Hoa Medical College (see Figure 1). Students used a variety of social media platforms. A large majority, 86.3%, used Facebook, 74.6% used TikTok, 68.7% used Zalo, and 42.6% used Instagram (see Figure 1).

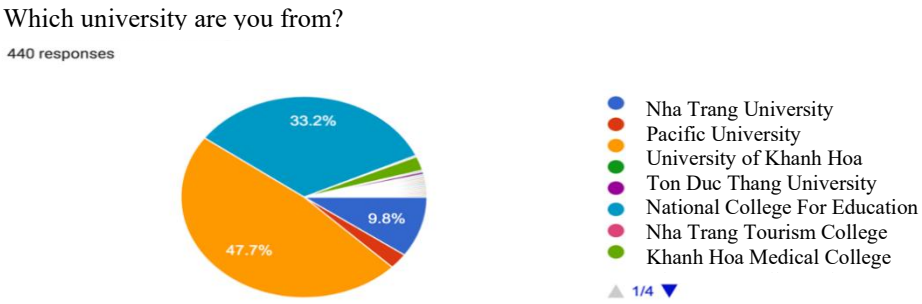

Figure 1. Students Studying in Khanh Hoa Province

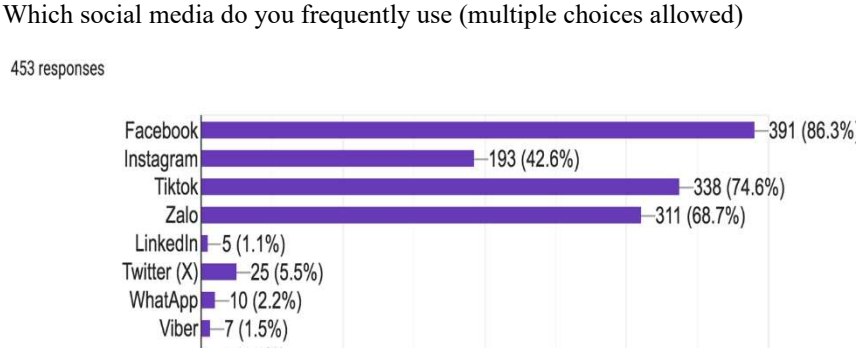

Figure 2. The Use of Social Media

Table 1. Students' responses of the positive impact of social media

No	Statement on the positive impacts of social media	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
		Numbers of responses	Percentage %	Numbers of responses	Percentage %	Numbers of responses	Percentage %	Numbers of responses	Percentage %	Numbers of responses	Percentage %
1	Social media helps me easily connect with friends and family.	5	1.1%	9	2.0%	25	5.5%	218	48.1 %	196	43.3 %
2	Social media helps me easily exchange coursework and form online study groups.	10	2.2%	25	5.5%	85	18.8 %	210	46.4 %	123	27.2 %
3	Social media supports my studies (through study groups, forums).	8	1.8%	22	4.9%	80	17.7 %	215	47.5 %	128	28.3 %
4	I learn many new skills through tutorial videos.	7	1.5%	20	4.4%	75	16.6 %	220	48.6 %	131	28.9 %

5	Social media helps me expand my network and connect professionally.	15	3.3%	30	6.6%	100	22.1%	195	43.0%	113	24.9%
6	Social media provides me with inspiration and ideas for projects.	12	2.6%	28	6.2%	95	21.0%	200	44.2%	118	26.0%
7	Social media is a channel for fast information and news updates.	4	0.9%	10	2.2%	35	7.7%	230	50.8%	174	38.4%
8	I can follow experts to update my professional knowledge.	9	2.0%	21	4.6%	89	19.6%	205	45.3%	129	28.5%
9	Social media helps me relax and entertain effectively after studying.	3	0.7%	5	1.1%	20	4.4%	190	41.9%	235	51.9%

10	Social media helps me discover new cultures and trends.	6	1.3%	15	3.3%	50	11.0 %	225	49.7 %	157	34.7 %

Across all aspects, the percentage of students responding "Disagree" and "Strongly Disagree" was very low (below 7%). This confirms a broad consensus on the positive aspects brought by social media. Students clearly recognize and highly value the diverse contributions of social media, from basic needs like entertainment and connection to higher goals such as learning, skill development, and knowledge expansion. This positive perspective underscores the position of social media as an integral part of the life and studies of the younger generation.

Table 2. Students' responses of the negative impact of social media

No	Statement on the negative impacts of social media	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
		Numbers of responses	Percentage %	Numbers of responses	Percentage %	Numbers of responses	Percentage %	Numbers of responses	Percentage %	Numbers of responses	Percentage %
1	Social media makes me easily lose focus while studying/ working.	18	4.0%	40	8.8%	92	20.3 %	188	41.5 %	115	25.4 %
2	I often procrastinate on studying/ completing assignments to use social media.	15	3.3%	42	9.3%	85	18.8 %	195	43.0 %	116	25.6 %
3	I feel anxious and restless when unable to	25	5.5%	61	13.5 %	145	32.0 %	155	34.2 %	67	14.8 %

	use social media.										
4	Heavy social media use negatively affects my sleep quality.	22	4.9%	55	12.1 %	120	26.5 %	175	38.6 %	81	17.9 %
5	I often compare myself to the "perfect" lives of others on social media.	28	6.2%	50	11.0 %	110	24.3 %	165	36.4 %	100	22.1 %
6	I feel pressured to create a beautiful image on social media.	30	6.6%	65	14.3 %	125	27.6 %	150	33.1 %	83	18.3 %
7	I have encountered negative information, fake news, or been bullied on social media.	20	4.4%	45	9.9%	98	21.6 %	185	40.8 %	105	23.2 %
8	I find it difficult to verify the reliability of information on social media.	35	7.7%	70	15.5 %	140	30.9 %	135	29.8 %	73	16.1 %
9	Using social media reduces time for outdoor	28	6.2%	52	11.5 %	105	23.2 %	170	37.5 %	98	21.6 %

	activities and face-to-face communication.										
10	I notice a decline in my/my friends' face-to-face communication skills.	32	7.1%	60	13.2 %	130	28.7 %	160	35.3 %	71	15.7 %
11	I am easily influenced by trends and fads on social media without much selectivity.	38	8.4%	75	16.6 %	145	32.0 %	130	28.7 %	65	14.3 %
12	I find it hard to express differing personal opinions on social media.	40	8.8%	80	17.7 %	150	33.1 %	120	26.5 %	63	13.9 %
13	Social media use makes me sit for too long, with little physical activity.	25	5.5%	50	11.0 %	100	22.1 %	180	39.7 %	98	21.6 %
14	I experience eye problems (eyestrain, eye pain, dry eyes) from prolonged screen time.	20	4.4%	45	9.9%	90	19.9 %	190	41.9 %	108	23.8 %

15	I tend to spe`nd more on products advertised on social media.	45	9.9%	85	18.8 %	155	34.2 %	110	24.3 %	58	12.8 %

From Table 2, several important observations can be drawn regarding students' perspectives on the negative impacts of social media. The most evident impact is on academic performance and time management**,** followed by profound effects on mental health and self-image**,** then on declining physical health and real-world activities**,** and finally, challenges in information and behavior control. Data from the Table 2 shows that students demonstrate very clear and comprehensive awareness of most downsides of social media, from its effects on studies, mental and physical health, to social skills and information literacy. However, this awareness does not seem sufficient to change behavior, as issues of distraction and procrastination remain at very high levels. Forty six (46) lecturers from colleges and universities in Khanh Hoa province participated in the survey: 37% (17 lecturers) from Khanh Hoa University, 28.3% (13) from Nha Trang Tourism College, 15.2% (7) from Nha Trang University, 8.7% (4) from Pacific University, 6.5% (3) from Nha Trang College of Engineering and Technology, with the remainder from Central Preschool College No. 2. Regarding teaching experience: 58.7% (27 lecturers) had over 10 years, 19.6% (9) had 5-10 years, and 21.7% (10) had less than 5 years. Educational levels: 13% (6) held a Bachelor's degree, 69.6% (32) a Master's degree, 8.7% (4) a Ph.D., 2.2% (1) an Assoc. Prof., and 6.5% (3) a Professor.

Table 3. Lecturers' responses of issues related to social media

No.	Statement on negative social media impacts	Very rarely		Rarely		Occasionally		Frequently		Very frequently	
		Numbers of responses	Percentage %	Numbers of responses	Percentage %	Numbers of responses	Percentage %	Numbers of responses	Percentage %	Numbers of responses	Percentage %
1	Students lose focus in class due to using social media	2	4.3%	5	10.9 %	15	32.6 %	18	39.1 %	6	13.0 %
2	Conflicts and misunderstandings among students originate from social media.	12	26.1 %	16	34.8 %	14	30.4 %	3	6.5%	1	2.2%

3	Students share or believe in misleading/false information.	3	6.5%	8	17.4 %	20	43.5 %	13	28.3 %	2	4.3%
4	Students use social media to cheat in exams/assignments.	4	8.7%	10	21.7 %	19	41.3 %	11	23.9 %	2	4.3%
5	Students criticize/complain about lecturers on social media.	15	32.6 %	17	37.0 %	11	23.9 %	2	4.3%	1	2.2%

From Table 3, several key observations can be made about lecturers' perspectives on issues arising from social media. The most prominent issue noted by lecturers, at 52.1% (combined "Frequently" and "Very Frequently"), is loss of concentration during class. Issues related to ethics and information literacy were noted at an alarming level: "Students share or believe in misinformation/fake news" (71.8% combined "Occasionally" to "Very Frequently") and "Use social media to cheat in exams/assignments" (65.2% combined). Data from the Table 3 shows that lecturers focus their concerns on the direct consequences of social media on learning quality and academic integrity, as well as students' information literacy. Meanwhile, impacts on social aspects and relationships (conflicts, complaints) do not appear to be prominent concerns in their observations.

According to you, what is the biggest challenge in classroom management and teaching that has arisen from students' use of social media?

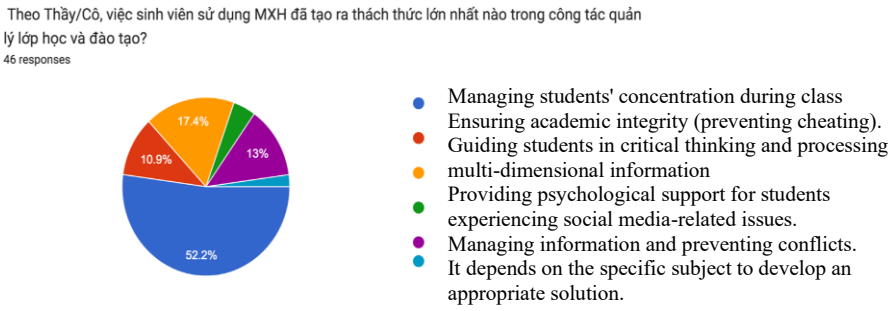

Figure 3. Challenges in using Social Media

The research (see Figure 3) also indicates significant challenges in classroom management and training resulting from students' social media use. The greatest challenge is managing student focus during class at 52.2% (24 lecturers); followed by guiding students in critical thinking and

processing multifaceted information at 17.4% (8 lecturers); managing information and preventing conflicts/communication crises originating from social media at 13% (6 lecturers); ensuring academic integrity (preventing cheating) at 10.9% (5 lecturers); and finally, supporting students with psychological issues related to social media at 4.3% (2 lecturers).

A questionnaire was also delivered to 04 direct student affairs staff; 25% (1 staff) had over 7 years of experience, 25% (1) had 3 to 7 years, and 50% (2) had under 3 years. According to their feedback, specific challenges faced in managing students under the influence of social media were prominent as follows: Challenges at an alarming level (High & Very High): Three issues were rated as relating to the most profound and difficult-to-control impacts of social media: Managing students' mental life and psychological health. Second, guiding students' ideology and lifestyle. Third, controlling information and preventing fake/harmful news. Challenges at a significant level relate directly to discipline and campus security: first, managing academic discipline and order (absences, lack of focus); second, managing students' online ethical behaviour; third, ensuring information security and safety. This can be seen that, social media not only impacts students but also poses severe and novel challenges for the management staff. The core difficulties lie in intangible and systemic issues such as mental health, ideological guidance, and information control.

4 Discussion

Survey results from the three target groups – students, lecturers, and student affairs staff – paint a comprehensive, nuanced picture of the consequences of social media use within the student community in Khanh Hoa. There is a high degree of consensus in recognizing both positive and negative aspects, while each perspective also offers distinct emphases. On the positive side, both students and lecturers acknowledge social media as a valuable supportive tool. Students most highly value its role in entertainment/relaxation (93.8% agree) and connecting with friends and family (91.4% agree), seen as the two most core and practical benefits. Furthermore, social media also affirms its value in learning and self-development, with a majority of students recognizing its ability to provide quick information (89.2%), support studies (75.8%), and develop new skills (77.5%). Lecturers, through observation, also acknowledge the usefulness of social media in exchanging coursework and forming study groups.

However, the negative consequences are of particular concern to all three groups, with consensus at an alarming level. Students, as direct users, are acutely aware of these downsides. They admit social media is a primary cause of distraction in studies (66.9% combined Agree/Strongly Agree) and procrastination habits (68.6%). This aligns perfectly with lecturers' observations, as 52.1% of them reported that students using social media causing distraction in class occurs frequently. The perspective from management staff reinforces this, with 75% rating the impact of social media on academic results as high to very high. Regarding mental health, although nearly half of the students admit to issues like self-comparison (58.5%), pressure to create an image (51.4%), and anxiety when not using social media (49.0%), the proportion choosing "Neutral" for psychological issues is quite high (32.0%). This suggests a segment of students may not fully recognize or are reluctant to acknowledge the link between social media and their mental health. In contrast, management staff have a very clear view, with 75% rating the impact on mental health as high to very high, indicating they observe negative manifestations from students that the students themselves may not deeply perceive.

Another point of consensus is concern over harmful and toxic information. 64% of students have encountered such information, and 71.8% of lecturers assessed this as occurring from "Occasionally" upwards. Management staff also ranked this as having a high to very high impact (75%). This reflects a common challenge in equipping students with defensive skills and information processing capabilities. Data from all three groups – students, lecturers, and student affairs staff – confirms that social media is seen as a double-edged sword. While leveraging its immense benefits for connection and learning, students in Khanh Hoa are facing profound consequences on academic performance, mental health, and awareness. The gap between students' self-awareness and the observations from lecturers and management (particularly regarding mental health) underscores the necessity for intervention programs that go beyond raising awareness, to providing concrete tools and skills enabling students to use social media proactively, healthily, and safely, thereby transforming challenges into development opportunities.

To mitigate the negative consequences of social media, each student needs to proactively enhance their awareness and digital skills [10], [11], [12], [13] – this is considered the foundational and most important solution. Specifically, students should cultivate purposeful social media habits by establishing personal rules, such as not using social media during study hours, turning off notifications when focus is needed, and using timer tools to control usage time – this directly addresses the prevalent issues of procrastination and distraction. Simultaneously, actively "cleaning" the online environment by filtering out negative accounts and actively following educational channels will help minimize exposure to harmful information. Equally important, students need to practice information critical thinking skills and proactively seek psychological support when needed, thereby equipping themselves to cope with difficulties in verifying information and mental health issues.

For educational institutions, guidance and support through education and counseling play a pivotal role in mitigating the negative impacts of social media. The key solution is to integrate "Digital Skills Education" as a formal or compulsory extracurricular module, with practical topics such as identifying fake news, information safety, and protecting mental health [2], [14], [15] – addressing the urgent need highlighted by 71.8% of lecturers noting students believe misinformation and management staff rating the impact on mental health as high. Concurrently, it is essential to enhance the capacity and widely promote campus psychological counseling services, helping to address the deep concerns about the increasingly prevalent mental health issues among students.

The role of families in accompanying and caring for students is crucial to help them balance virtual and real-life. Firstly, parents should establish open and understanding communication by listening and talking about their children's online experiences without judgment, while guiding them to use social media intelligently rather than imposing bans [8], [12]. This approach helps students relieve psychological pressure and reduce dependence on the virtual world. Additionally, families should encourage and facilitate student participation in extracurricular activities, sports, and volunteering, helping to improve physical health and enhance face-to-face communication skills.

For society and local authorities, the key responsibility is management and communication to establish a safe and healthy online environment for youth. Solutions should be implemented synchronously [9]. First, intensify communication campaigns to enhance online culture through

close coordination between press agencies, the Youth Union, and the Student Association. These campaigns should be deployed directly on social media platforms with specific hashtags, focusing on content combating fake news, preventing cyberbullying, and guiding effective usage skills, aiming to create a wave spreading positive values to counter harmful information. Simultaneously, regularly organize creative and practical activities such as entrepreneurship competitions, hackathons, job fairs, and skills festivals through collaboration between the province and universities. These activities not only attract young people but also help transform negative energy from social media into positive self-development motivation, while reducing unproductive online time and creating a healthy outlet for students.

5 Conclusion

The research "The impact of social media on students in Khanh Hoa Province, Vietnam: Current situation and solutions" has provided a comprehensive and multifaceted view of the state of social media use by analyzing data from students, lecturers, and student affairs staff themselves. It can be confirmed that social media has become an inseparable part of students' lives, offering great opportunities but also posing significant challenges.

From the above analyses, it is evident that addressing negative issues does not lie in prohibition or restricting access, but rather in transforming awareness into concrete action through a synchronized system of solutions. The key solution must start with equipping students with skills – including time management, information evaluation, mental health protection, and using social media for academic purposes. The proactive role of educational institutions in integrating digital skills education into training programs, the understanding companionship of families, and a healthy online environment from the community will be the solid pillars to realize this goal. Social media in itself is neither inherently good nor bad; its value is determined by how each individual uses it. For students in Khanh Hoa, shifting from a passive to an active stance, transforming social media into a tool serving academic and personal development, is the key to harnessing its opportunities and overcoming its challenges in the digital era.

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Geography Perspective: Spatial, Social, and Ecological Dimensions of the Manggarai Ritual

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Abstract. This article examines the Penti rites of the Manggarai people through a cultural geography perspective, emphasizing spatial, social, and ecological dimensions as a system of knowledge. Penti, celebrated as a thanksgiving ritual, reflects a cultural philosophy that guides land use, settlement patterns, and sacred spaces such as mbaru gendang, compang, lodok, and wae teku. The rite demonstrates a relationship between humans, the Creator, and nature through symbols, actions, and spatial arrangements transmitted across generations to sustain social cohesion and environmental balance. Using a literature-based approach, this study shows that Penti is not merely a ceremony but also an expression of geographical concepts. Spatial aspects appear in village layouts and ritual sites, social aspects in collective participation and kinship, and environmental aspects in respect for forests, water sources, and ecological sustainability. These findings confirm Penti as a framework of wisdom integrating cosmology, ethics, and environmental management.

Keywords: Culture; geography; penti; relations

1 Introduction

Local culture is a culture owned by a certain region that is distinctive and different from foreign culture and inherited from generation to generation. This culture is formed because humans face problems that need to be solved, especially in maintaining and overcoming economic, social, political, and cultural problems. In order to survive and overcome the problems that arise, the community needs organizations to build a consensus on some cultural values and norms, in the local community that will become a tradition and will live and survive in their group [1], [2].

Local culture contains local wisdom (local wisdom). It is born from human interaction with the environment that results in a deep understanding and interdependence. As such, [3] highlights that local wisdom is a form of geographical phenomenon that is manifested by the interaction between humans and the environment. Moreover Local wisdom is a system of knowledge, truth and identity of the community related to its existence in the natural environment. This local knowledge is collected by the local community and has been tested and applies in the local context as well. This is in line with the opinion of [4], [5] saying that local wisdom is known as

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local knowledge (indigenious or local knowledge), or local intelligence (local genious), which is the basis of cultural identity (cultural identity).

Many studies on the local wisdom of Manggarai have been carried out. The research that has been conducted examines local culture in relation to the social life of the Manggarai people and their cosmic view of nature and the creator from a sociological and communication perspective [6], [7], [8], [9], [10] and economics and ethnobotany [11], [12]. A study of Manggarai's local wisdom related to the management and utilization of nature in the perspective of Geography has never been carried out by researchers. In addition, efforts and concepts of instilling traditional values carried out in the educational process for the younger generation have not been studied by previous researchers. This is very important to be done to form a noble, conduct, manner and dignified character in the process of interaction with nature and others. Since the sustainability of the traditional values of the Manggarai people and efforts to sustain and preserve local cultural values for generations is essential, a new perspective in examining local culture must be carried out. Based on the two reason in question, the author wants to explain the local culture, especially in the rite of penti of the Manggarai people from the perspective of Geography.

2 Geography and Culture

The Geography and culture are two interrelated terms and are the science of human beings that study about landscape, cultural products and norms as well as the relationship between space and place. In this case, culture in geography studies the earth and its life, which influences the outlook on life and human activities in determining the fulfillment of the needs of life such as the food needed, the clothes we use, the houses we live in and the places of recreation we observe [13]. In line with this, [14], [15], humans create landscape when they take advantage of ecological settings- they then become traces of a particular culture. Culture landscape is not only about the material cultural artifacts, but also the spiritual and religious values inherent, especially in areas that are still inhabited by indigenous peoples [16].

Cultural geography is the main agent of natural transformation, since humans do not build their environment only in a purely productive perspective but also on the basis of their values and representations. This can be interpreted that landscape is a reflection of past and present life. In this regard, such aspects be seen from the number, the location of the building, the design and plan used, the way the surrounding area is organized, the plants in the field, the commercial buildings and their forms of service, as well as other details that tell the overall economic and cultural history of a place. As such, the geography and history of the area are guides to reading this landscape. This is in line with the results of the research [17] that found that culture landscape has values that apply to all scales such as the aesthetic value of conservation culture, which can be used for lessons in environmental management, and can also be used in agricultural management practices as well as other resource management that have relevance to the improvement and sustainability of natural resources. Based on this opinion, cultural geography is important to be studied because of the existence of cultural problems, especially the relationship between population growth, resource consumption, and the increase in the intensity of problems due to overexploitation of resources. In other words that the relationship between geography and culture can provide a strong combination of conceptual tools to understand complex cultural problems of the people.

The relationship between geography and culture is characterized by the way humans interact with nature and their works. This is in line with the opinion of [2] highlighting that the cultural stream of geography prioritizes the study of various forms of human work on the surface of the earth as a region. The study of cultural geography is human space, namely population (population geography), human activities such as economic activities, social activities (social geography) and cultural activities. Cultural geography places humans at the center of human geographical knowledge, with the various beliefs they have, their motivations and life experiences [16], [4], Geography and culture are meant to be human sciences with a special approach to people's lives. This reveals how the relevance of cultures around the world today relates to the manner human has, facts, and emotions. Geography affects culture when the environment influences cultural change. The cultural environment forms a cultural ecosystem; the cultural ecosystem creates a dynamic cultural ecology.

Furthermore, Geography not only studies nature (earth) and its physical symptoms, but also studies non-physical human beings and all the cultures that they produce from their interactions. Regarding space, [18], [19] emphasized that there is a need to combine the two things mentioned above into four main parts, namely: 1) natural physical phenomena (physico natural-phenomena) which are symptoms that show the physical expression and the process of formation is caused by nature itself, 2) physical/artificial (physico-artificial phenomenon) which is a phenomenon that shows that physical bearings with human process of formation, 3) non-physical cultural phenomena (nonphsyco- cultural phenomena) are a non-physical phenomenon (untangible) and its existence is due to the power of taste, creation and human karsa, 4) non-physical phenomena (nonphysico -natural phenomena); symptoms that are not physical (untangible) but occur due to natural forces. Thus, geography recognizes the influence of humans on nature and nature on humans.

Addressing environmental problems and disasters, it is assumed to be the result of an imbalance in interaction between the environment and human activities [20], [21]. Human environmental interaction is part of the study of geography that uses an environmental approach. Environmental problems are complex, multi-dimensional, interrelated, so their solutions require an integrated approach. In this context, geography places a phenomenon to be solved holistically so that development continues- while still paying attention to environmental sustainability. Many cases of environmental exploitation have brought disaster to the local area, such as gold mining, manganese mining and others that do not pay attention to the impact on the local community both now and in the future. The environment is the interface between the natural and cultural environment, land and life, people and their biophysical environment [22].

3 Method

This article belongs to a qualitative approach with a literature study method to examine geographical aspects in the local culture of Penti of the Manggarai community. Data collection was carried out through the search of various written sources such as academic journals, ethnographic books, research reports, and local documents relevant to Penti's practice and the context of the Manggarai space. The analysis was carried out in a descriptive-interpretive manner by linking the concepts of cultural geography, including space, place, environment, and cultural landscape, with the meaning of the Penti rite in people's lives. Through this conceptual approach, the article aims to build a comprehensive theoretical framework of understanding of how geographical elements form, influence, and are represented in the Penti tradition.

4 Discussion

Penti culture is one of the many local cultural celebrations of the Manggarai people. Lexically, penti is rejuvenation, conservation, peace (repentance/forgiveness). In the Manggarai dictionary, [23], penti is interpreted as a Manggarai New Year's party. Penti is a New Year's party of the Manggarai people and is interpreted as a thanksgiving party for the harvest as well as a sign of the start of a new work season, celebrated together by all villagers/villagers every year at the beginning of the planting season or after the harvest season. Penti has norms that regulate the relationship between the Creator (Mori Jari agu Dedek) and his creation (the earth and its contents), so that in penti culture there are vertical dimensions, horizontal dimensions, and socio-cultural dimensions

Penti has a core philosophy that describes the existence of land use. The philosophy is lingko peang, gendang one, wae teku compang, natas labar [24]. From this philosophy, penti ritual describes the existence of land use as well as cultural spatial planning. This is in line with [11] who found that the spatial pattern of traditional settlements in Manggarai is in direct contact with the Penti cultural ceremony. In addition, penti is a geosphere and a cultural phenomenon, based on land spatial planning, which is an interesting geographical fact and cultural spatial planning to learn. Cultural spatial planning in local culture is closely related to the spatial approach. The spatial approach discusses diversity, distribution, use, organization, provision, and use of space [25]. Spatial planning in the penti culture is part of the ritual stages consisting of traditional houses (mbaru gendang), offering altars (compang), village courtyards (natas labar), spring water sources (wae teku) in sacred sacred forests (wae teku/wae barong), communal garden centers (lodok), and ancestral graves (boa). Each stages has its own function in the context of Manggarai spatial planning [12].

Penti is a medium of communicating with the creator, the natural environment and fellow humans. This is relevant to the results of the research [26], [14] who concluded that the penti ritual has a role as a traffic sign that provides a cue in actions, moral power, and is useful for all behaviors of the Manggarai people. This can be seen from the behavior of the Manggarai people in interacting and applying traditional values, norms and rituals- vertical and horizontal communication, people and Mori Keraeng (the Creator) and people and their neighbors and natural environment. These three things are an inseparable unit. This opinion is supported by [8] saying that communication is necessary in order to repair the less harmonious dialogical

relationship between humans and the creator through metanonia (repentance and cleansing). Metanonia is one part of the penti culture that conducts repentance communication.

Moving further ahead, Penti that is a cultural ceremony aiming to give thanks for the harvest, and nature and all life during the past year, has several stages. The stages are the preparation stages (Pre- penti), core (whilst), and the final stage (Post-penti). In each of these stages, the spatial aspect in Geography is fully appeared. Spatial aspects is more on the selection of places or locations that are used as the ritual. This is closely related to the philosophical views of the Manggarai indigenous people, who interpret nature is a unity of the cosmos and integrated with human life as living beings and as social creatures [27, 28]. This is inseparable from the belief of the local community, that these locations have meanings and values that also influence the lives of the surrounding community, both in terms of the physical natural environment, the social environment and also the meaning of religiosity contained.

In addition to location, interpersonal relationships and social resilience are also found in the penti. Stages reflects a complete and harmonious social relationship that regulates its relationship with fellow members of society as a social group [24]. This indicates that in addition to regulating the relationship with nature, philosophically penti has a deep social meaning in arranging their lives with others; human interaction with nature is a geographical concern. The attitude of brotherhood and sense of belonging as a member of an indigenous people is built with a strong customary relationship and formed with a familiar collegial spirit as well as a harmonious vision and mission that is in line with the essence of their lives as part of nature. This awareness makes them grateful for what they get from nature and highly committed to a cultural social forum and interaction to maintain its sustainability and sustainability [25].

To date, the context of Geography in penti refers to social life, spatial context and its orientation. The ceremony is embodied in the philosophical and cosmos concepts inherent in the Manggarai indigenous people. People's recognition of the environment is actually an expression of dignified and responsible awareness in arranging a harmonious life, harmony between humans and nature. This is manifested in cultural behavior at each location and the sacred symbols used. These efforts are carried out to organize the existence and sustainability of the natural and social environment which are covered in the context of spatial geography, social geography and environmental geography.

Geography of space in Penti reflected in the arrangement of the traditional spatial arrangement of the Manggarai community which is very structured and full of meaning. Sacred locations such as mbaru gendang (traditional house), compang (sacrificial altar), lodok (communal garden), natas labar (circular village yard), and wae teku/ulu wae (spring) show that the Penti rite always considers the function of space and its connection to the cosmos. This spatial pattern does not change from generation to generation because it is believed to be an ancestral heritage that maintains a balance of life. Thus, spatial geography in the Penti examines how space is used, arranged, and interpreted as part of a customary system that unites humans with nature and the spiritual world.

Social geography in penti is seen in the relationships and interactions between community members that are strongly established through all stages of the ceremony. Penti unites all elements of society, both through mutual cooperation, division of roles, and symbols of traditional communication; so as to form harmonious and collective social relations. This ritual also emphasizes the social structure, kinship system, and the value of togetherness that is the

basis of the life of the Manggarai people. Social geography in this context explains how Penti culture shapes patterns of social interaction, group identity, and community dynamics that are bound by customary norms and values [21].

Environmental geography in Penti can be seen from the deep respect of the Manggarai people for nature, especially forests, soils, and springs which are considered as the source of life. Forests are understood as sacred entities that give birth to and sustain life, so they must be preserved. Through symbols such as sacred forests, ulu wae, and lodok, the community customarily sets rules for environmental use to remain balanced and sustainable [13]. Therefore, environmental geography in Penti examines the mutual relationship between humans and the environment, as well as how cultural practices play a role in maintaining ecosystem sustainability and community quality of life.

5 Conclusion

Penti culture is a traditional ceremony of the Manggarai people that serves as an expression of gratitude for the harvest as well as a marker of the start of a new work season, and contains spiritual, social, and ecological values that are reflected in cultural spatial planning such as mbaru gendang (traditional house), compang (sacrificial altar), lodok (communal garden), natas labar (circular village yard), and wae teku/ulu wae (spring). Penti not only regulates the harmonious relationship between humans and the Creator, but also human interaction with others and with the environment, so that it becomes a form of local wisdom that preserves nature and strengthens community social relations. All values, symbols, rites, and spatial arrangements in Penti are covered in the study of geography, both social geography, spatial geography, and environmental geography which describe the deep relationship between humans, their living space, and the sustainability of nature.

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Evaluation of Pig Slaughtering at Tuke Slaughterhouse (RPH) on Carcass and Physical Meat Quality

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Abstract. This study aims to evaluate the effect of pig slaughtering processes at the Tuke Slaughterhouse on carcass yield and meat quality. The main focus of the study is to understand how pre- and during-slaughter treatments affect meat quality, taking into account the variables of pig age and sex. The parameters observed include slaughter weight, carcass weight, carcass percentage, carcass length, fat thickness and physical meat quality such as moisture content and pH. The methods used include direct observation and laboratory measurements. The research process involved quarantine, ante-mortem and post-mortem examinations, slaughter and collection of muscle samples for laboratory analysis, namely the back muscle (*Longissimus dorsi*), thigh muscle (*Biceps femoris*) and abdominal muscle (*M. rectus abdominis*). The instruments used included pH meter, analytical scales, drying oven and thermometer. The data were analyzed using simple linear regression. The results showed that male pigs had higher slaughter weight (113,50 kg) and carcass weight (96,25 kg) than females (99,56 kg and 81,67 kg). The carcass percentage of males was 85%, while that of females was 80%. The length of the female carcass (105,17 cm) was greater than that of the male (84,5 cm) with a relatively similar backfat thickness of around 6 cm. The pH value of male meat (5,75) was higher than that of female meat (5,17) while the moisture content ranged from 7,5 to 7,67%. Statistical analysis showed a positive relationship between slaughter weight and carcass weight, carcass percentage, carcass length and meat pH. These findings provide important insights into the factors that affect carcass quality and the physical quality of pork at slaughterhouses.

Keywords: Pig, Slaughterhouse, Slaughtering, Carcass, physical meat quality

1 Introduction

Pigs are one of the main commodities in the livestock sector and play an important role as a source of animal protein. This species is known to have a number of advantages, such as high birth rates in a single reproductive period (*prolific)*, the ability to efficiently convert feed into meat, and the production of carcasses with a large proportion, namely around 65%

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to 80% (Wibawa et al., 2019). In addition to its role in food supply, pig farming also contributes significantly to meeting domestic meat demand. According to data from the Central Statistics Agency (BPS) of the Ministry of Agriculture in 2024, the six regions with the highest pork production in Indonesia are Bali, North Sumatra, East Nusa Tenggara, East Java, South Sulawesi, and Central Papua. Based on records from the Central Statistics Agency (BPS) of East Nusa Tenggara Province, the pig population in Manggarai Regency was recorded at 56,779 in 2020, 43,427 in 2021, 44,847 in 2022, 61,276 in 2023, and 63,190 in 2024. Pigs also have a strong symbolic function in various cultural traditions. To support the sustainability and safety of livestock meat consumption, especially pork, the existence of slaughterhouses that meet health and slaughtering standards is a very important requirement.

Slaughterhouses (RPH) are public service facilities that play a vital role in providing safe, healthy, intact, and halal meat. As a center for livestock slaughtering activities, RPH ensures that all processes are carried out in accordance with veterinary public health standards, animal welfare principles, and Islamic sharia provisions. Within the facility, ante-mortem (checking the health of livestock before slaughter) and post-mortem (examination of carcasses and offal) inspections are carried out to prevent the transmission of zoonotic diseases to humans. The main product of pig slaughtering at slaughterhouses is meat. Meat is a highly nutritious food source that can meet human nutritional needs. Therefore, it is important to ensure the availability of meat that is safe, healthy, and of high quality so that it can be something that is very important for every consumer in the market. Meat quality can be assessed based on physical and chemical aspects. Physical quality assessment of meat includes parameters such as pH and moisture content (Sangkek et al., 2021)

The quality and quantity of meat are greatly influenced by the treatment pigs receive prior to slaughter. Stress in these animals can reduce the quality of the meat produced. One cause of this is the process of transporting them from the farm to the slaughterhouse. During the journey, pigs can face various stresses, such as unfavorable microenvironmental conditions during transport, including the use of unsuitable vehicles, high ambient temperatures, lack of drinking water, and cramped or uncomfortable living quarters. In addition to causing stress, these conditions can also lead to fatigue, which ultimately has a negative impact on meat quality (Sosiawan et al., 2021). Carcass is the part of livestock that does not contain blood, including the head, legs, hair, and all contents of the abdominal cavity, except for the liver and heart. The carcass inspection process in slaughtered livestock, especially pigs, is carried out to evaluate carcass quality. This includes measuring carcass weight, carcass length, and carcass percentage (Gerungan et al., 2017) Carcass quality can be assessed using several parameters, including live weight, carcass weight, carcass percentage, carcass length, fat cover, muscle tone, grading results, and muscle percentage. High-quality carcasses generally have a higher proportion of meat than bone and fat. Carcass is a key indicator of broiler productivity because it is the main product produced. Its composition

includes bones, muscles, fat, and other tissues that grow as body weight increases. Carcass percentage is directly proportional to body weight and is greatly influenced by feed quality and quantity. Its growth is determined by internal factors, such as genetics, age, and sex, as well as external factors, such as temperature, humidity, and feed availability (Mukhlas et al., 2016) Based on the background description explained above, the researcher considers it important to further examine pig slaughtering at the Mena Slaughterhouse, particularly in relation to the carcasses and physical quality of the meat produced.

2 Research Method

Research Location And Time

This study was conducted over a period of two months in the form of field and laboratory experiments at two locations, namely the Mena Slaughterhouse located in Langke Rembong District, Manggarai, East Nusa Tenggara, and the Agricultural Study Program Laboratory, Faculty of Agriculture (FPP). These locations were chosen because RPH Mena is one of the main slaughterhouses in the region and routinely processes pigs, while the laboratory was used to analyze samples related to carcass quality and the physical quality of pork.

Population And Sample

The population in this study included all pigs slaughtered at the Tuke slaughterhouse during the study period. Samples were taken using purposive sampling techniques, with selection criteria based on age, weight, and health condition of the pigs prior to slaughter. The number of samples 10 pigs, the sample used consisted of 4 males and 6 females. which was considered representative for describing carcass quality and physical meat quality.

Data Collection Metodh

In this study, data was obtained through several methods, one of which was through direct observation in the field, physical measurements of carcasses and meat, and documentation. Direct observations were conducted in the morning, between 05:00 and 08:00 WITA, to observe all stages of the pig slaughtering process, including quarantine, ante-mortem inspection, slaughtering, post-mortem inspection, stamping, and cleaning of the slaughterhouse (RPH). Before measuring the carcass, ensure that all necessary tools are properly prepared. The tools needed include scales to measure the weight of the carcass and a measuring tape to measure the length and width of the carcass. Before slaughter, the pigs will be rested in an adaptation pen and fasted for 12 hours. Physical measurements of carcasses and meat were carried out using laboratory equipment such as pH meters, analytical balances, drying ovens, and thermometers to analyze the physical quality of the meat. The samples analyzed included back muscle (*Longissimus dorsi*), thigh muscle

(Semimembranosus or Biceps femoris), and meat muscle (M. Rectus abdominis or M. Trapezius), with each sample weighing 50-100 grams. In addition, documentation was used to collect secondary data in the form of slaughterhouse activity reports and slaughtering processes.

Reserach Variabel

Carcass Quality

The samples were then analyzed by measuring several parameters, including carcass weight, carcass length, and carcass percentage.

Slaughter Weight

Slaughter weight is measured after livestock have fasted for approximately 12 hours, but are still given access to drinking water to prevent dehydration. The weighing process uses digital scales with the appropriate capacity, so that the results obtained are accurate.

Carcass Weight

Carcass weight measurement is carried out immediately after the cutting and cleaning process is complete. This weight includes all parts of the carcass, consisting of meat, bones and fat, but does not include the head, feet, offal, or skin, if the skin is not counted as part of the carcass. Weight measurement is carried out before the carcass undergoes the cooling process, so that the results obtained reflect the actual condition after cutting.

Carcass Percentage

The carcass percentage is obtained by comparing the carcass weight to the slaughter weight, then multiplying the result by 100%.

% Carcass = (Carcass weight) / (Slaughter weight) × 100%

Carcass Leght

The measurement process is carried out using a measuring tape, starting from the base of the atlas bone (base of the skull) to the tip of the ischium bone (base of the tailbone).

Fat Thickness

Back fat thickness is measured at three points: above the first rib, above the last rib, and above the last hip bone (lumbar vertebra).

pH Test

A 10-gram sample of meat was ground, then mixed with 10 ml of distilled water until homogeneous. The mixture was measured using a pH meter, with the electrode cleaned using distilled water and dried with tissue before measurement. Each sample was measured three times, then the results were averaged to obtain the pH value.

Moisture Content Test

moisture content is calculated using a specific formula to determine the percentage. Each sample is tested twice to ensure the accuracy of the moisture content measurement. Moisture content is calculated using the formula:

Moisture Content (%): (W2-W3)/(W2-W1) ×100 (%)

Data Analysis Techniques

The collected data were analyzed using simple linear regression with the equation Y = a + bX. In this equation, X represents the cut weight, while Y includes the carcass weight, carcass percentage, and backfat thickness (Sangkek et al., 2021).

3 Result And Discussion

Table 1. Average slaughter weight, carcass weight, carcass percentage, carcass length, and fat thickness based on age and sex differences.

Gender	Age (month)	Slaughter Weight (kg)	Carcass Weight (kg)	Carcass Percentage (%)	Carcass Leght (cm)	Fat Thickness (cm)
Male	11	95	75	79%	96	6
		136	114	84%	106	5
	14	116	96	90%	70	6
	17	107	100	86%	66	8
Total		**454**	**385**	**339%**	**338**	**25**
Average		**113,50±17,29**	**96,25±16,13**	**85±5**	**84,50±19,55**	**6±1,26**
Female	9	73	50	90%	104	7
	10	89	70	83%	93	7
		84	64	81%	97	7
		122	108	89%	116	5
	11	130	82	89%	116	5
	13	100	116	82%	105	6
Total		**598**	**490**	**514%**	**631**	**37**

Average	**99,66±3,38**	**81,67±25,78**	**80±8**	**105,17±9,50**	**6,17±0,98**

Slaughter Weight

The results showed that the average weight of male pigs at slaughter was 113.50 kg, which exceeded the ideal slaughter weight standard. The ideal slaughter weight for local pigs (Bali/Timor) ranges from 60 to 80 kg, which is generally achieved at 6 to 7 months of age (Sangkek et al., 2021) However, in this study, the weight of the pigs obtained exceeded the ideal range because slaughtering was carried out at an older age. This finding is in line with the study by (Aritonang et al, 2011) which reported that the carcass weight of Duroc male pigs tends to increase with age. At the age range of 331–360 days, the highest carcass weight was recorded, with an average of 112.18 kg. The increase in carcass weight at this stage is related to increased metabolic activity and organ development as the livestock ages. This condition opens up opportunities to improve production efficiency by adjusting the slaughter time so that the livestock weight meets the standard. Slaughtering at the ideal weight has the potential to produce carcasses with better quality, optimal meat proportions, and higher selling value.

The results of the study show that the average slaughter weight of female livestock is 99.56 kg, while the average slaughter weight of male livestock is 113.50 kg. Thus, the slaughter weight of female livestock is slightly lower than that of male livestock. This difference is in line with what has been explained by (Sangkek et al., 2021) that sex steroid hormones, especially androgens, play an important role in regulating growth and influencing differences in body composition between male and female livestock. At the same age, male livestock usually have a larger body weight than females due to the influence of these hormones. Additionally, according to (Bee, 2004), steroid hormones work by increasing protein synthesis in muscles, thereby accelerating muscle growth in pigs. These hormones also reduce protein breakdown, resulting in an increase in lean body mass. Furthermore, steroid hormones can stimulate appetite, causing pigs to consume more feed.

Carcass Weight And Percentage

The results of the study show that the average weight and percentage of carcasses of each animal slaughtered at the Tuke Slaughterhouse is 96.26 kg for male animals and 81.67 kg for female animals (Table 1). The carcass weight of both male and female pigs generally increases with age. However, at 9-17 months of age, which is the finishing or adult phase, carcass weight may decrease, possibly due to a decline in the livestock's endurance and productivity. For example, at the Tuke Slaughterhouse, the carcass weight of male pigs at 14 months of age was slightly higher than at 17 months of age, with the highest average carcass weight reaching 96.25 kg. A similar phenomenon occurs in female pigs, where carcass weight at 11 months of age is higher than at 13 months of age, with the highest average carcass weight of 81.67 kg, reflecting that early age increases weight, but at a more

advanced age, decreased productivity can cause weight to decline. This is in line with the opinion (Goniwala et al., 2016) that carcass weight tends to increase with the age of livestock during a certain period. This increase occurs due to the growth and development of the livestock's organs.

Carcass percentage is the ratio of carcass weight to slaughter weight and is an indicator of carcass production efficiency. The carcass percentage in male pigs has an average value of 85 ± 5%, while in females it is 80 ± 8%. This value shows that male pigs are more efficient at producing carcasses than females. This efficiency may be due to the lower proportion of fat and internal organs in males compared to females, which allows more parts of the body to be included in the carcass. According to Sinaga 2012 in Andika et al, (2015), pig carcasses generally reach 60–75% of their live weight. This percentage is relatively high and greater than the carcass percentage of other livestock, such as sheep and cattle. In pigs, stress is one of the factors that can affect carcass percentage. One cause of stress is an environmental temperature that exceeds the thermoneutral zone, which is above 27°C, especially in pigs and sows that are about to be slaughtered. This condition can cause a significant decline in growth performance and reproductive efficiency. These losses can occur even without changes in feed intake, as heat stress causes direct metabolic disturbances, including changes in nutrient distribution and a decrease in lean tissue formation.

Carcass Length

The average carcass length of female and male livestock is 105.17 cm and 84.50 cm, respectively, as shown in Table 1. The data shows that female pigs have a greater average carcass length than male pigs, namely 105.17 cm, compared to male pigs, which have an average of 84.50 cm. The standard deviation (SD) value for female pigs is smaller, namely 9.50 cm, compared to male pigs at 19.55 cm, which shows that the variation in carcass length in female pigs is smaller. This difference is likely due to female pigs generally being younger, ranging from 9 to 13 months old, while male pigs are older, ranging from 11 to 17 months old, with only 4 males in the sample, resulting in greater variation affecting the SD value for male pigs. As explained by (Wibawa et al., 2019) carcass size is one of the important parameters in evaluating the quality of pig carcasses. Carcass size has a strong relationship with slaughter weight; pigs with higher slaughter weights usually have longer carcasses, and vice versa. The findings of (Sangkek et al., 2021) show that, in general, female pig carcasses are larger than male pigs. Research on slaughter age also indicates that female pigs are usually slaughtered at a younger age, around 9 to 17 months, while male pigs tend to be slaughtered at an older age, namely under 11-14 months. According to Reiland (2020), the growth and development of domestic pigs (native Swedish and Yorkshire breeds) were reported, and weight curves for male pigs from birth to adulthood were included. Other parameters are tooth development and the growth of certain bones. It is concluded that daily weight gain increases rapidly until around 5 months of age. Sexual maturity is reached by male and female pigs at around 5-6 months of age. At this point,

there is a turning point in the weight curve. The period from 5-6 months to around 18 months of age. Conclusion Skeletal growth in pigs occurs rapidly until around 5 months of age, with a significant increase in daily weight gain. After reaching sexual maturity at 5–6 months of age, growth enters an adolescent phase that lasts until around 18 months. During this phase, growth still occurs, but at a slower rate compared to the previous phase.

Fat Thickness

Pigs that are raised for longer periods tend to show a significant increase in backfat thickness. Equally important, physical activity levels and housing systems (intensive and semi-intensive) can affect fat distribution; pigs that are confined with limited space are more prone to subcutaneous fat accumulation. Thus, the thickness of backfat in pigs is influenced by a complex interaction between genetic, physiological, nutritional, and management factors (Kim et al. 2017) The average backfat thickness in male and female pigs is 6 cm and 6.17 cm, respectively, as shown in Table 1. Based on the data in the table, there is a difference in backfat thickness between male and female pigs, both in terms of average values and data distribution. In male pigs, the average backfat thickness was recorded at 6 cm with a standard deviation (SD) of 1.26 cm. This shows that there is quite a noticeable variation between individuals, with the lowest backfat thickness being 5 cm and the maximum being 8 cm. Meanwhile, female pigs had an average backfat thickness of 6.17 cm, slightly higher than males. The standard deviation in the female group was smaller, at 0.98 cm, indicating that backfat thickness in female pigs tended to be more uniform and stable. These findings are in line with the statements by (Mukhlas et al., 2016.) that thin backfat can increase meat percentage, while excessively thick fat has the potential to reduce meat yield.

Table 2. The relationship between factors affecting slaughter weight and carcass weight, carcass percentage, carcass length, and backfat thickness.

Variable	TH	Equation	coefficient	Std. Error	Pro
Carcass Weight	+	BK=-26,382+1,082 BP	1,082 -26,382	0,059	0,003*
			98% 97%		
Carcass Percentage	+	%K=52,994+0,277 BP	0,277 52,994	0,066	0,003*
			69% 65%		
Carcass Leght	+	PK=74,674+0,357 BP	0,357	0,035	0,087ts

			74,674		
			11%		
			0%		
Fat Thickness	-	TLP=8,672+-0,02 BP	-0,02	0,015	0,001*
			8,672		
			22%		
			12%		

*Desription: * = Significant, ts=not significant, TH=no hope*

Relationship Between Slaughter Weight And Carcass Weight

Based on the regression analysis results presented in the table, there is a very strong and significant relationship between Slaughter Weight (SW) and Carcass Weight (CW). The regression equation obtained is CW = -26.382 + 1.082 SW, which indicates that every 1 kilogram increase in slaughter weight will increase carcass weight by 1.082 kilograms. This positive regression coefficient indicates a positive linear relationship between the two variables. The R-squared value of 98% indicates that 98% of the variation in carcass weight can be explained by the variation in slaughter weight, while the Adjusted R-squared value of 97% reinforces that this regression model is very good at explaining the relationship between variables. In addition, the probability value (P<0.05) of 0.003, which is much smaller than the significance threshold of 0.05, indicates that this relationship is statistically significant. According to (Rizki et al., 2025), the positive regression coefficient value between cut weight and carcass weight also means that an increase in both variables will be followed by an increase in muscle area. One of the most important factors affecting muscle area is the type and quality of feed given. In addition, muscle size is also influenced by carcass weight and meat yield.

Relationship Between Carcass Weight and Carcass Percentage

The regression analysis results show that there is a positive relationship between Carcass Weight (CW) and Carcass Percentage (%CP). The regression equation obtained is %CP = 52.994 + 0.277 CW. This means that every 1 kilogram increase in carcass weight will increase the carcass percentage by 0.277%. This relationship is positively linear, which means that the greater the carcass weight, the higher the carcass percentage tends to be. The R-squared value of 69% indicates that approximately 69% of the variation in carcass percentage can be explained by the variation in slaughter weight. Meanwhile, the Adjusted R-squared value of 65% indicates that the model is quite good at explaining this relationship, although it is not as strong as the direct relationship between BP and carcass weight. The coefficient value of 0.277 has a standard error of 0.066, and a P<0.05 value of 7.128, which indicates that this relationship is also statistically significant because P<0.05 is still within an acceptable range when interpreted from the t value, not p directly—the probability of P is very small considering the large t value. Thus, it can be concluded that Slaughter Weight has a positive effect on Carcass Percentage, although its effect is not as strong as its effect on Carcass Weight directly.

The relationship between carcass weight and carcass percentage can occur because both describe the composition of livestock, especially how much of the body can be used as meat after slaughter. Carcass percentage itself is calculated from the ratio between carcass weight and slaughter weight, so any change in slaughter weight will affect this percentage. When slaughter weight increases, it is usually because the livestock has experienced muscle growth and fat accumulation, especially during the fattening period. This increase will add to the parts of the body that are included in the carcass, such as muscle and subcutaneous fat, so that the carcass weight also increases. If the weight gain occurs more in the parts of the body that are components of the carcass (not the parts that are discarded, such as the entrails or head), then the carcass percentage will also increase.

Relationship Between Carcass Weight and Carcass Length

Based on the regression analysis results, the relationship between Carcass Weight (CW) and Carcass Length (CL) is formulated in the regression equation CL = 74.674 + 0.357 CW. This indicates that every 1 kilogram increase in carcass weight will contribute to a 0.357 cm increase in carcass length. This relationship is positively linear, indicating that the greater the slaughter weight, the greater the carcass length tends to be. However, the coefficient of determination (R-squared) value only reaches 11%, while the Adjusted R-squared is even 0%, which means that only a small portion of the variation in carcass length can be explained by slaughter weight. This shows that slaughter weight is not a strong predictor of carcass length, suggesting that other factors may play a more significant role in influencing carcass length. In addition, the P-value of 0.087 indicates that this relationship is not statistically significant at the 5% significance level (because it is greater than 0.05). Thus, it can be concluded that although mathematically there is a positive relationship between slaughter weight and carcass length, this relationship is relatively weak and not statistically significant. (Sari., 2021.) stated that an increase in body weight is generally followed by an increase in the size of other body parts. Meanwhile, grouping based on age shows a highly significant relationship between slaughter weight and carcass length. One of the main factors is genetics or livestock breed, as each breed has different body growth characteristics. Certain breeds, such as Landrace pigs, are known to have longer bodies than other breeds of the same weight. In addition, the age of the livestock also plays an important role because body length growth tends to occur in the early stages of growth, while in the later stages, weight gain comes more from fat. Another influential factor is linear body size, such as body length, shoulder height, and chest circumference, which directly reflects body dimensions and is usually more strongly correlated with carcass length than total weight.

Relationship Between Carcass Weight and Backfat Thickness

The regression analysis results show that the relationship between Carcass Weight (CW) and Backfat Thickness (BFT) is expressed through the regression equation BFT = 8.672 + (-0.02) CW. This means that every 1 kilogram increase in carcass weight causes a 0.02 mm decrease in backfat thickness. This negative regression coefficient indicates a negative linear relationship between the two variables. However, the R-squared value is only 22%, and the Adjusted R-squared is 12%, indicating that only a small portion of the variation in backfat thickness can be

explained by carcass weight. Nevertheless, the P-value of 0.001 indicates that this relationship is statistically significant. This is interesting because even though the contribution of carcass weight to the variation in fat thickness is relatively small, the relationship is statistically significant. In other words, there is a significant negative relationship between carcass weight and backfat thickness, but its predictive power is weak, as seen from the low R^2 value. This indicates that there are other more dominant factors that affect fat thickness, such as genetic factors, feed type, or livestock activity levels. This contrasts with the results of the study by (Aritonang, 2011), which described a very strong relationship between age and carcass weight, carcass percentage, and backfat thickness, with correlation values of 0.989, 0.891, and 0.957, respectively. The process of fat accumulation occurs at various stages of life when energy intake exceeds the basic requirements for maintenance and growth. As age and body weight increase, fat tends to accumulate more in the back, causing a significant increase in back fat thickness. According to (Bee, 2004) the main parts of the body that undergo development include bones, muscles, and fatty tissue. In the early stages, the fastest growth rate generally occurs in the skeletal bones, followed by muscle development, while fat accumulation occurs in the final stage of growth.

Table 3. The Effect of Age and Gender on Average pH and Water Content

Gender	Age (month)	pH	Moisture Content (%)
Male	11	5	48,55
		6	47,37
	14	6	46,64
	17	6	46,67
Total		**23**	**189,03**
Average		**5,75±0,5**	**47,26±0,95**
Female	9	5	46,70
	10	6	48,28
		5	47,38
		5	45,86
	11	5	46,69
	13	5	48,35
Total		**31**	**283,26**
Average		**5,17±0,41**	**47,21±0,98**

pH

Based on the results of observations, male pork has a pH value ranging from 5.00 to 6.00, with an average of 5.75 ± 0.50. This value indicates that the pH of male pork tends to be close to neutral, with a fairly high level of variation between individuals. In contrast, female pork has an average pH of 5.17 ± 0.41, which indicates that female pork tends to be more acidic and has a

more stable pH variation than male pork. This difference indicates that gender has an effect on the pH value of meat. Factors that may cause lower pH values in female pigs are higher muscle glycogen levels. After slaughter, this glycogen is converted into lactic acid, which ultimately lowers muscle pH. Therefore, female meat shows lower pH due to greater lactic acid accumulation, as a result of more active postmortem metabolism. Overall, it can be concluded that sex is one of the physiological factors that affect meat pH values. Female pork tends to have a lower and more consistent pH, while male pork shows a tendency for higher and more variable pH. Understanding these differences is important in controlling meat quality and determining the appropriate post-harvest handling to maintain the quality of pork products. In this study, pH measurements were taken one hour after slaughter and continued at several-hour intervals thereafter. These findings are consistent with the opinion of (Sangkek et al., 2021) which states that in some livestock, the pH decreases very rapidly in the first hour after slaughter, then stabilizes at a high range of around 6.5–6.8. Conversely, there are also livestock that experience a sharp decrease in pH to 5.4–5.5 in the first hour, then remain in the range of 5.3–5.6.

Moisture Content Test

The moisture content in meat is an important indicator in determining freshness, texture, and shelf life. From the measurement results, the moisture content of male pork varied between 46% and 48% and an average of 47,26 ± 0,95. The relatively high standard deviation indicates that there are significant differences in water content between individual males. This condition may be caused by variations in muscle structure, fat content, and different metabolic activities between male livestock. Meanwhile, female pork showed more stable moisture content, with values ranging from 45% to 48%, and an average of 47,21 ± 0,98. Although the average moisture content in females was slightly higher than in males, the lower standard deviation indicates that the moisture content in this group was more uniform. This may reflect the more homogeneous characteristics of muscle tissue in females, as well as the possible influence of hormones on water retention in muscle tissue. Pork generally contains a significant amount of water, ranging from 68–75%. In addition, this meat is also rich in nitrogen compounds with varying levels of complexity, as well as minerals and various other important nutrients (Sosiawan et al., 2021) The water content in pork that has undergone the resting process tends to be maintained. This is in line with the results of research by (Hernando et al., 2015), which shows that resting, cutting, and proper carcass handling can help maintain the water content of meat within the normal range.

Table 4. The relationship between the factors causing cutting weight and each of the factors affecting pH and moisture content

Variable	TH	Equation	Coefficient	Std Error	Pro
pH		pH=5,777+(-0,003)	-0,003 5,777 14% 2%	0,935	0,000*

Moisture content	KA=0,040+0,000 BP	0,000 0,040 41% 17%	0,028	0,191ts

*Desription: * = Significant, ts=not significant, TH=no hope*

Relationship Between Cut Weight and pH

The regression equation obtained in this study for the relationship between cut weight and pork pH is pH = 5.777 + (-0.003 × CW). The regression coefficient of -0.003 indicates that every 1 kilogram increase in cut weight will decrease the pH value of the meat by 0.003 units. The p-value (Pro) of 0.001 indicates that this relationship is statistically significant (because it is less than 0.05). This means that there is a real effect of cut weight on the pH of pork. The initial pH value of 5.777 indicates the normal pH range for meat, and this small decrease is still within the safe range for meat quality. The high average pH in pork that has not been given time to rest is generally triggered by stress and fatigue experienced by livestock during the shipping or transportation process (Sosiawan et al., 2021) This condition causes a reduction in glycogen reserves in the muscles, which then affects the metabolic process after slaughter and causes the pH of the meat to rise above normal limits (Gerungan et al., 2017).(Rambu et al., 2016) also stated that in pigs experiencing stress and fatigue, the reduction in muscle glycogen stores makes lactic acid formation suboptimal for lowering the pH to the normal range. As a result, the meat tends to be darker in color, harder in texture, and dry in taste, a condition known as DFD (Dark, Firm, Dry).

Relationship Between Cutting Weight and Moisture Content

The regression equation obtained in this study for the relationship between cut weight and pork moisture content is KA = 0.040 + 0.001 × BP. The regression coefficient is 0.001, which means that mathematically, cut weight has no effect on pork moisture content. This is supported by a p-value (Pro) of 0.191, which is much greater than 0.05, so the relationship is not statistically significant. Thus, it can be concluded that in this study, the moisture content of pork is not affected by cut weight. The relative humidity of the air surrounding meat can affect the moisture content on the surface of the meat. If the moisture content of the meat is low while the humidity of the air is high, the meat will absorb water vapor from the air, making its surface more moist and increasing its moisture content. In addition, if the temperature of the meat is lower than the ambient temperature, water vapor in the air can condense on the surface of the meat. This condensation creates conditions that are more conducive to bacterial growth. In general, the moisture content in meat ranges from 68% to 80% (Sitompul et al., 2015) According to (Agustina et al., 2017) the water content in meat plays an important role in determining the level of damage during storage, especially due to microbial activity. High humidity and water content generally support the growth of microorganisms. Both bacteria and fungi generally require humidity above 85% to reproduce well.

3 Conclusion

In terms of carcass percentage, male pigs showed higher results with an average of 85 ± 5%, while females only 80 ± 8%. This shows that males are more efficient in producing carcass meat, which is related to their body composition—where males have more muscle tissue and less fat and non-carcass organs than females. Interestingly, the average carcass length of females (105.17 cm) is actually greater than that of males (84.50 cm), but statistically, slaughter weight has no significant relationship with carcass length. This indicates that factors such as age, genetics, and bone growth are more decisive in determining carcass length than slaughter weight itself.

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Application of Various Doses of Chicken Manure on the Growth and Production of Japanese Cucumber (*Cucumis sativus* L. var. Japonese)

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Abstract. Japanese cucumber is a horticultural plant from the Cucurbitaceae family. This plant is quite popular among Indonesians because of its taste and nutritional benefits. This study was conducted to determine the effect and optimal dosage of chicken manure fertilizer on the growth and yield of Japanese cucumbers. This research was conducted over two months from June to July 2025 in Lasang, Benteng Suru Village, Kuwus District, West Manggarai Regency, East Nusa Tenggara. This study used a non-factorial randomized block design consisting of 6 treatments and 4 replicates, resulting in 24 experimental units. Each treatment had 5 sample plants, resulting in 120 sample plants. The treatment levels in this study were P0 (no fertilizer), P1 (20 tons per hectare), P2 (30 tons per hectare), P3 (40 tons per hectare), P4 (50 tons per hectare), and P5 (60 tons per hectare). The results showed that the application of chicken manure fertilizer affects the number of leaves, flowering age, number of fruits per plant, fruit length, and fruit weight per plant. The P3 treatment with a chicken manure fertilizer dose of 40 tons per hectare in the P3 treatment is the optimal dose for increasing the growth and yield of Japanese cucumber plants.

Keywords: Chicken manure fertilizer, Japanese cucumber, production

1 Introduction

Japanese cucumber is a vegetable variety from the Cucurbitaceae family, also commonly known as squash [6]. Cucumbers are generally very popular in Indonesia. The delicious taste and benefits of this vegetable make Indonesians interested in consuming it. The rapid growth of Japanese culture and the public's interest in Japanese cuisine have created opportunities for the development of Japanese cucumbers [3]. Japanese cucumbers are a type of cucumber that is very popular among the Japanese. However, research on this topic is still minimal in Indonesia. This is due to the lack of understanding among Indonesians about this topic, even though there

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is great potential for development and unique characteristics compared to local cucumbers, in terms of color, shape, taste, and texture [2].
[4] shows a decline in cucumber production in West Manggarai in 2022 and 2023, from 22,29 quintals in 2022 to 18,99 quintals in 2023. This decline is thought to be caused by excessive use of inorganic fertilizers and poor cultivation methods, which have reduced soil fertility and adversely affected cucumber production. Results of interviews with farmers in Benteng Suru Village, West Manggarai. Residents tend to choose chemical fertilizers and inefficient cultivation methods. Excessive use of synthetic fertilizers can have negative effects on the environment, such as a reduction in organic matter in the soil, an increased risk of soil erosion, and a reduction in the soil's ability to absorb water [10]. One method that can be applied to increase agricultural yields in cucumber crops is to use organic fertilizer derived from chicken manure. [8] Chicken manure contains three times more N than other manure, namely 1.70%, five times more P_2O_5 than other manure, namely 1.90%, and four times more K_2O than other manure, namely 1.50%. The nutrient content of chicken manure fertilizer is 1.7% N, 1.9% P, and 1.5% K [17]. Chicken manure fertilizer was chosen because it has a higher P content and provides better results as it decomposes easily and has better nutrient content [9].

2 Method

This study was conducted from June 2025 to July 2025 in Lasang, Beteng Suru Village, Kuwus Subdistrict, West Manggarai Regency. The equipment used in this experiment included shovels, buckets, dippers, watering cans, ropes, rulers, scissors, labels, bamboo, cameras, measuring tapes, and writing instruments. The materials used in this study were chicken manure and Roberto 92 Japanese cucumber seeds. The method used in this experiment was a non-factorial randomized block design consisting of 6 treatments and 4 replicates, resulting in 24 experimental units. The treatment levels in this study were P0 (no fertilizer), P1 (20 tons per hectare), P2 (30 tons FaHP3 (40 tons per hectare), P4 (50 tons per hectare), and P5 (60 tons per hectare). The number of plants in each experimental plot was 10, resulting in a total of 240 plants. Each treatment had 5 sample plants, resulting in a total of 120 sample plants. The observation results were analyzed using variance or ANOVA (Analysis of variance). If there were significant differences between the treatment means and the apparent effects, the DMRT test at the 5% level was then performed to determine the best treatment for each parameter observed. This process was carried out using SPSS software version 25.0.

3 Results and Discussion

3. 1 Number of Leaves

Table 1. Average number of leaves on Japanese cucumber plants

Treatment	Number of leaves			
	7 DAP	14 DAP	21 DAP	28 DAP
P0	2,65[a]	4,40[d]	5,65[a]	8,60[a]
P1	2,80[a]	4,90[bc]	6,40[b]	8,80[ab]
P2	2,75[a]	5,70[d]	6,90[bc]	9,20[ab]
P3	**2,80[a]**	**6,50[d]**	**8,20[d]**	**11,45[c]**
P4	2,75[a]	5,20[c]	7,55[cd]	9,95[b]
P5	2,75[a]	4,70[ab]	7,60[cd]	9,35[ab]

Note: Numbers followed by the same letter indicate no significant difference, while numbers not followed by the same letter indicate a significant difference based on Duncan's 5% level post hoc test.

Leaves are the part of the plant that performs photosynthesis, a process that produces assimilates, which are used by plants in the vegetative and generative phases [2]. Table 1 shows that 7 days after planting (DAP), there was no significant difference in the number of leaves in all treatments. However, the number of leaves began to show significant differences at 14 DAP and continued to increase until 28 DAP. As the plants aged, the number of leaves increased, thereby increasing nutritional requirements. The application of manure increased the number of leaves. This is supported by the research of [16], who found that the application of bokashi chicken manure increased the number of cucumber plants. Treatment P3 with 40 tons per hectare of chicken manure produced the highest number of leaves compared to other treatments, namely 11.45 leaves at 28 days after planting. This shows that the dose in P3 provides adequate nutrients to optimize the formation of Japanese cucumber leaves. When the fertilizer applied was less than 40 tons per hectare, fewer leaves were produced (Table 1).

[5] growth can reach its maximum without a decrease in yield if supporting factors such as balanced elements, appropriate dosage, and nutrients are fulfilled. [13] stated that high fertilizer doses cause the soil solution to become concentrated, making it difficult for plants to absorb nutrients. An increase in the dose of manure applied is inversely proportional to the growth results obtained because the dose is not in accordance with the needs of the plants.

3.2 Flowering Age

Table 2. Average flowering age of Japanese cucumber plants

Treatment	Flowering age (days)
P0	32,25^{c}
P1	31,50^{bc}
P2	30,50^{bc}
P3	**28,25^{a}**
P4	30,25^{b}
P5	31,25^{bc}

Note: Numbers followed by the same letter indicate no significant difference, while numbers not followed by the same letter indicate a significant difference based on Duncan's 5% level post hoc test.

Generally, cucumber plants begin to flower around 28.50-31.33 days after planting (DAP) [20]. P3 at a dose of 40 tons per hectare resulted in a faster flowering time compared to other treatments, namely 28.25 days after planting. This dose is effective in accelerating flowering. Table 2 shows that when manure was applied at less than or more than 40 tons per hectare on P3, flowering was slower. The table shows that nutrients affect plant growth and development, including flowering. Efficient nutrient use is closely related to flowering time and crop yield [23].

3.3 Average Number, Length, and Weight of Fruits per Plant

Table 3. Average number of fruits, fruit length, and weight of Japanese cucumbers

Treatment	Harvest		
	Number of fruit	fruit length (cm)	Weight of Fruit (g)
P0	2,30^{a}	19,80^{a}	705,00^{a}
P1	2,30^{a}	25,50^{b}	720,00^{a}
P2	2,45^{a}	25,95^{bc}	895,65^{b}
P3	**3,20^{b}**	**29,80^{d}**	**1305,15^{c}**
P4	2,90^{b}	27,20^{c}	1209,35^{c}
P5	2,55^{a}	26,65^{bc}	1172,20^{c}

Note: Numbers followed by the same letter indicate no significant difference, while numbers not followed by the same letter indicate a significant difference based on Duncan's 5% level post hoc test.

Treatment P3 with 40 tons of chicken manure per hectare produced the highest number of fruits per plant with an average of 3.20 fruits, the longest fruits with an average of 29.80 cm, and the heaviest fruits with an average of 1,305 g. The dosage in treatment P3 was sufficient to optimize the number, length, and weight of the fruit, as shown in Table 4. When the dosage was increased in P4 (50 tons per hectare) and P5 (60 tons per hectare), the results were actually lower. This is supported by the results of a study by [7], which showed that high fertilizer doses did not increase the growth or yield of cucumber plants. Similar findings were reported in a study by [15], which showed that increasing the dose of a combination of chicken manure and NPP fertilizer did not result in significant differences in fruit weight and length between treatments. Based on this, P3 is thought to be the appropriate dose for optimizing cucumber yields. The

right dose can increase fertilization efficiency and optimize the utilization of nutrients provided [18]. [12] [11] that integrated nutrient management increases fertilization efficiency by ensuring that nutrients are provided in the right amounts and at the right time to meet plant needs.
The number, length, and weight of cucumber fruits produced in Table 3 were influenced by the type, variety, fertilizer dose, and environment. This indicates that the results obtained differed from those in the study by [22], despite the use of the same treatments. The results of the [21] study show that different doses of chicken manure fertilizer produce variations in the number of cucumber fruits per plant. In addition, this component is influenced by the photosynthesis process. [19] found that photosynthesis in cucumber fruits contributes significantly to fruit growth through direct fixation of atmospheric CO_2 and reabsorption of released CO_2, as verified through $14CO_2$ absorption and gas exchange, providing an important contribution to fruit growth.
This study differs from previous studies in several ways. First, research on the dosage used is still limited. In general, previous studies or other studies have used a maximum chicken manure fertilizer dosage of 35 tons per hectare. There is one study with the same treatment dose as this study, but not on the Japanese cucumber variety Roberto 92. Second, this study is the first to test chicken manure fertilizer doses above 40 tons per hectare, namely up to a dose of 60 tons per hectare, on Japanese cucumber varieties. Third, this study discusses the relationship between organic fertilizer doses, particularly chicken manure, and the flowering age of cucumber plants. Fourth, this study found that the optimal chicken manure fertilizer dose for the Japanese cucumber variety Roberto 92 is 40 tons per hectare. When the dose was lower or higher than 40 tons per hectare, growth and yield were lower. This shows that the increase in dose is inversely proportional to the results obtained, which is different from other studies, which generally show that growth and yield are directly proportional to the increase in organic fertilizer doses, especially chicken manure on cucumber plants.

4. Conclusions and Suggestions

4.1 Conclusions

Chicken manure has a significant impact on the growth and yield of Japanese cucumbers, including increased leaf number, accelerated flowering, higher fruit number per plant, longer fruit length, and increased fruit weight per plant. Organic nutrients, such as nitrogen, phosphorus, and potassium, in this fertilizer support photosynthesis and the gradual development of flowers and fruits, resulting in more productive and higher-quality plants. The optimal dose was found in the P3 treatment of 40 tons per hectare, which balances the benefits of nutrients without the risk of over-fertilization, resulting in optimal vegetative and generative growth for yields. The 40 tons per hectare treatment in this study increased yields by 85% in Japanese cucumbers. Overall, this approach supports sustainable agriculture by reducing reliance on synthetic chemicals.

4.2 Suggestions

A dose of 40 tons of chicken manure per hectare can be used as a recommendation for organic fertilization of Japanese cucumbers. Further research is needed to apply the fertilizer dosage in

this study to other varieties of Japanese cucumbers, testing them in multiple locations, and increasing the harvest frequency to two or three times to determine the maximum yield achieved in a single growing season.

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The Effect of Chicken Manure Application on the Growth and Yield of Celery (*Apium graveolens* L.)

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Abstract. Celery (*Apium graveolens* L.) is a vegetable plant used as a food ingredient, especially in soups. Celery is also used as a medicinal plant because it can treat various ailments such as digestive disorders, prevent lymphatic disease, and treat fever and flu. Celery export volume decreased from 2015 to 2016 due to inappropriate cultivation techniques, particularly in fertilization. The purpose of this research was to determine the effect of chicken manure application on celery growth and yield, as well as to determine the appropriate dosage of chicken manure to increase celery growth and yield. This research was conducted from March to June 2025 in Leda, Bangka Leda Village, Langke Rembong District, Manggarai Regency, Nusa Tenggara Timur. A randomized block design (RBD) was used with four treatment levels, each containing chicken manure: 0 kg/plot, 1 kg/plot, 2 kg/plot, and 3 kg/plot. Data were analyzed using a scaled Analysis of Variance (ANOVA) and Duncan's test at the 5% level. The results showed that chicken manure application significantly affected plant height, number of leaf stalks, fresh weight per plant, and leaf chlorophyll content. A dose of 3 kg/plot of chicken manure yielded the best results in terms of plant height (13.90 cm), number of leaf stalks (5.36 stalks), fresh weight per plant (31.40 g), and chlorophyll content (23.77 mg/g).

Keywords: Celery; chicken manure; dosage; organic.

1 Introduction

Celery (*Apium graveolens* L.) is a vegetable used as a food ingredient, especially in soups. It is also used as a medicinal plant because it can treat various ailments such as digestive disorders, prevent lymphatic disease, treat fever, and flu [1].This is because celery has beneficial content for the body, according to the opinion of [2] that in 100 grams of raw celery contains 130 IU of vitamin A, 0.03 mg of vitamin B, 0.9 grams of protein, 0.1 g of fat, 4 g of carbohydrates, 0.9 g of fiber, 50 mg of calcium, 1 mg of iron, 0.005 mg of riboflavin, 0.003 mg of thiamine, 0.4 mg of nicotinamide, 15 mg of ascorbic acid, and 95 ml of water, and supported by the opinion of [3] that celery contains chemical compounds in the form of flavonoids, saponins, choline, tannins, essential oils, and apigenin for the basic ingredients of making herbal medicines. Based on this, it shows that celery has great potential to be developed in Indonesia.

Celery has high prospects for cultivation and marketing, particularly as an export commodity. Celery export volume in 2015 was 6,797 kg, while celery export volume decreased to 4,037 kg in 2016 [4]. Celery cultivation in Indonesia is not yet widely managed commercially, so it has

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not yet become a major vegetable commodity in Indonesia. This refers to data from [5], which states that there is no data on horticultural crop production in Indonesia, especially vegetables such as celery, which does not yet contain data on harvested area and celery production in Indonesia. According to [6], one of the most important cultivation factors that influences plant growth and development is the growing medium.

People still use chemical fertilizers for fertilization. Continuous use over several cultivation periods can deplete the soil's organic matter, disrupting the balance of organic matter for soil microbes, and thus reducing land productivity and crop production [7]. Furthermore, chemical fertilizers are very expensive on the market, increasing cultivation costs. One way to reduce chemical fertilizer use is by applying organic fertilizer from chicken manure.

Chicken manure has a higher nutrient and organic content than other manures [8]. These nutrients are macronutrients that are needed by plants to increase growth and development. The N nutrient element functions to increase the number of leaves and chlorophyll [9], the P element functions to accelerate fruiting and flowering, while the K element functions to strengthen cell walls to strengthen plant stems [10]. Based on the results of research by [11] that the application of chicken manure with a dose of 10 tons/ha can increase plant height (22.28 cm), number of leaves (16.50 strands), production per plant (27.13 g), production per plot of (113.78), and soil pH 6.60.

In this regard, it is necessary to study the potential of chicken manure to support the growth and yield of celery plants to be more optimal. The objectives of this study are as follows: (1) To determine the effect of providing chicken manure on the growth and yield of celery plants, (2) To determine the appropriate dose of chicken manure to increase the growth and yield of celery plants. In line with this, the hypothesis is proposed that the application of chicken manure fertilizer not only improves the availability of nutrients in the soil, but also significantly increases the stem diameter and economic weight of celery, with the assumption that higher doses will provide better results until reaching a certain nutrient saturation point.

2 Method and Materials

This research was conducted from March to June 2025 in Leda, Bangka Leda Village, Langke Rembong District, Manggarai Regency, Nusa Tenggara Timur. The materials used in this were hole punch, shovel, tape measure, tofa, machete, scale, ruler, chlorophyll meter, Amigo celery seeds, and chicken manure. This study used a non-factorial Randomized Block Design (RBD) with 4 treatment levels and 6 replications, resulting in 24 experimental units. The treatments were various doses of chicken manure, namely P0 (0 kg/plot), P1 (1 kg/plot), P2 (2 kg/plot), P3 (3 kg/plot).

The dosage justification used refers to [12] research results, which showed that a dose of 1 kg of chicken manure per plot with a planting distance of 30 cm x 20 cm had a positive effect on the number of leaves, tuber length, tuber diameter, and tuber weight per plot in carrots, a plant in the same family as celery. However, its effectiveness on celery has not been tested in plot form, only tested in hectares, so it often varies depending on local agro-ecosystem conditions. Testing various dosage levels in this study was conducted to evaluate whether there was a linear increase in yield or actually experienced a decline (the law of diminishing returns) at a certain level. This is important to provide precise fertilization recommendations that can balance the productivity of celery plant biomass with the efficiency of organic fertilizer use from chicken manure.

The research began with seeding, which lasted until the seeds were four weeks old. Seeding was carried out in seed trays using a mixture of chicken manure and soil in a 1:1 ratio. The mixture was placed in the seed trays, followed by soaking the seeds in water for one hour. According to [1] the purpose of soaking the seeds was to ensure full seeds. When soaked in water, the seeds would sink. Therefore, celery seeds that did not sink (float) were discarded and not used for sowing. After soaking and selecting full seeds, the seeds were dried for approximately 10 minutes on a tissue. After planting, the seeds were made into holes in the soil 2-3 cm deep in the seed trays. Land preparation and basic fertilizer application included chicken manure at the same dose of 2.5 kg per plot. Seedlings were planted in the research area at a spacing of 25 cm x 30 cm, with one seedling per hole, with a total of 18 plants per plot. Meanwhile, fertilizer application was carried out according to research [21], namely when the plants were 2 weeks after planting (WAP), 4 weeks after planting (WAP), and 6 weeks after planting (WAP). The dosage given was in accordance with the treatment in this study and was given by making a furrow next to the plant, so that there were 2 furrows in the bed, then the fertilizer was put into the furrow, then the furrow was covered again with soil.

Celery is harvested after 90 days after planting (DAP), when the leaves are lush, broad, and dark green. They have produced numerous leaf sheaths, reached a suitable height, and have produced shoots. Before harvesting, the plants are watered to facilitate uprooting. The plants are then carefully removed along with their roots and observed on each sample plant.

This study focused on observing the growth and productivity of celery plants in response to various doses of chicken manure fertilizer. Given resource limitations and the study's focus on practical agronomic aspects, this study did not include an in-depth analysis of soil chemical properties before and after treatment, nor did it conduct laboratory tests on the specific nutrient composition (macro and micronutrients) of the chicken manure fertilizer used. Success parameters were measured solely through vegetative growth indicators and crop yields in the field. Therefore, the mechanisms of nutrient changes in the soil and the efficiency of chemical nutrient uptake are beyond the scope of this study.

Observation parameters consisted of plant height, number of leaf stalks, fresh weight per plant, and chlorophyll content. Data were analyzed using Analysis of Variance (ANOVA) and Duncan's Multiple Range Test (DMRT) at the 5% level.

3 Results and Discussion

3.1 Plant Height

The results of the analysis of variance showed that various doses of chicken manure had a significant effect on the height of celery plants at the ages of 3 WAP, 5 WAP, and 7 WAP as shown in **Table 1**.

Table 1. Celery plant height at various doses of chicken manure fertilizer

Chicken Manure Fertilizer Dosage	Plant Height (cm)		
	3 WAP	5 WAP	7 WAP
P0 (0 kg/plot)	4.66 a	7.93 a	11.99 a
P1 (1 kg/plot)	4.77 ab	8.29 b	12.52 b
P2 (2 kg/plot)	5.06 bc	8.74 c	13.50 c
P3 (3 kg/plot)	5.27 c	8.92 c	13.90 c

Note: Numbers followed by the same letter and same column indicate an insignificant difference based on the DMRT test for Difference at 5%.

Chicken manure with a dose of 3 kg/plot (P3) produced the highest plant height of 5.27 cm at 3 WAP, 8.92 cm at 5 WAP, and 13.90 cm at 7 WAP (**Table 1**). The dose of 3 kg/plot of chicken manure is the optimal dose to increase plant vegetative growth. Based on research by [13], the application of 3 kg/plot of chicken manure can increase plant growth, especially plant height, because it has several nutrients in the form of N, P, and K.

According to [14] during the vegetative phase, plants require high levels of nutrients to increase productivity. High nutrient levels are found in higher fertilizer doses [15]. Chicken manure contains 2-3.17% N, 1.8-3.10% P, and 1.38-2.2% K [16]. The provision of organic fertilizer in the form of chicken manure into the soil is thought to be able to improve the biological, physical and chemical properties of the soil and can increase the nutrients in the soil. These three elements, namely N, P, and K, are macronutrients that are really needed by plants for vegetative growth, especially the nutrient N which influences stem elongation.

According to [17], nitrogen is a nutrient that plays a crucial role in plant growth and development and is most needed for the formation or growth of vegetative plant parts, such as plant height growth due to cell development, such as elongation and cell division. Supported by a statement from [18] that optimal nitrogen is essential for plant height growth, as N is a key component of protein, which is the building block of plant cells and tissues. The nitrogen absorbed by plants is converted into amino acids, which are then assembled into structural

proteins [7]. These proteins are the main components of protoplasm (cell contents) and cell membranes. The more protein produced, the faster cell division occurs in the apical meristem (the growing point at the tip of the stem). This directly increases plant height. Applying high-nitrogen chicken manure, which increases protein sources, can also increase soil microbial populations, which support nutrient uptake by roots. This can enhance plant physiological and metabolic processes, leading to increased plant height.

3.2 Number of Leaf Stalks

The results of the analysis of variance showed that various doses of chicken manure significantly affected the number of celery leaf stalks at 3 WAP, 5 WAP, and 7 WAP, as shown in **Table 2**.

Table 2. Number of celery leaf stalks in various doses of chicken manure

Chicken Manure Fertilizer Dosage	Number of Leaf Stalks		
	3 WAP	5 WAP	7 WAP
P0 (0 kg/plot)	3.28 a	3.92 a	4.69 a
P1 (1 kg/plot)	3.52 b	4.11 b	4.97 b
P2 (2 kg/plot)	3.72 c	4.36 c	5.22 c
P3 (3 kg/plot)	3.78 c	4.50 c	5.36 c

Note: Numbers followed by the same letter and same column indicate an insignificant difference based on the DMRT test for Difference at 5%.

A dose of 3 kg of chicken manure/plot produced the highest number of leaf stalks, namely 3.78 stalks at 3 WAP, 4.50 stalks at 5 WAP, and 5.36 stalks at 7 WAP (**Table 2**). It is suspected that the dose of chicken manure of 3 kg/plot is the optimal dose to increase the vegetative growth of plants and the nutrient content in chicken manure can be utilized optimally by plants to help growth.Referring to [19] statement explained that plants will grow well and well if the nutrients needed by plants are available in a balanced and sufficient manner so that new leaf formation will be better. The nutrient content in chicken manure with a high dose causes more availability of nutrients that can be utilized in plant growth [20]. Quoting a statement from [21], chicken manure can stimulate plant growth, especially leafy vegetables, because chicken manure contains higher N nutrients compared to other manures.

The element N functions in the formation of chlorophyll, a green pigment that functions to capture sunlight energy to break down water and carbon dioxide into sugar, where sugar is used for the formation of plant organs such as leaves [22]. Plants that lack N can cause chlorosis (leaves turning yellow) which can inhibit the process of photosynthesis and the development of plant organs [23]. In addition, chicken manure contains 1.44% Mg [24]. The element Mg (magnesium) is an important element of the chlorophyll molecule to support increased photosynthate production which will be translocated to plant parts during the vegetative and generative phases, one of which is for leaf formation [25].

Mg also acts as an enzyme activator involved in plant metabolic processes such as protein and carbohydrate synthesis, where protein and carbohydrates are used as energy in the formation of

meristem plant parts such as stems, leaves, and roots [24]. According to [17] the high and balanced availability of N and Mg nutrients in chicken manure can accelerate leaf formation, thereby facilitating photosynthesis and enabling smooth photosynthate translocation. Mg deficiency will cause interveinal chlorosis (leaf veins remain green but the areas between them turn yellow), which causes the plant to lack the energy to increase the number of leaves.

3.3 Fresh Weight per Plant

The results of the analysis of variance showed that various doses of chicken manure had a significant effect on the fresh weight per celery plant as shown in **Table 3**.

Table 3. Fresh weight per celery plant at various doses of chicken manure fertilizer

Chicken Manure Fertilizer Dosage	Fresh Weight per Plant (g)
P0 (0 kg/plot)	29.23 a
P1 (1 kg/plot)	30.14 b
P2 (2 kg/plot)	31.04 c
P3 (3 kg/plot)	31.40 c

Note: Numbers followed by the same letter and same column indicate an insignificant difference based on the DMRT test for Difference at 5%.

Chicken manure of 3 kg/plot (P3) produced the highest fresh weight per plant, namely 31.40 g (**Table 3**). It is suspected that the P3 treatment has the highest dose of chicken manure among the other treatments, resulting in higher nutrient absorption by plant roots during the growth process, resulting in higher fresh weight of a plant. The low fresh weight of a plant is thought to be due to the lack of nutrient availability in the soil that can be utilized by the plant. This is in line with the opinion of [26], that the fresh weight of a plant can be influenced by the optimal availability of nutrients in the soil and can be absorbed by plant roots. The lower the nutrient content in the soil, the more inhibited plant growth will be, especially in increasing the fresh weight of the plant.

According to [8], fresh plant weight is a combination of plant tissue growth and growth, such as plant height, leaf number, and leaf area. This is influenced by nutrient content and water content within the plant tissue cells. This statement is supported by [24], who stated that the nutrients that contribute to plant weight increase are K and Mn, which are found in chicken manure at 2.18% for K and 250 ppm for Mn.

The K nutrient element is a nutrient that plays a role in opening and closing stomata, where this process is useful in absorbing sunlight and minerals, so that if the plant lacks the K nutrient, the plant cannot open and close the stomata optimally, thus inhibiting the photosynthesis process which results in lower photosynthate results [27], this causes a decrease in weight in a plant.

Potassium or K is often referred to as a "quality regulator" because of its role in regulating cellular metabolism, which directly impacts plant weight. According to [26] K activates more

than 60 types of enzymes involved in protein synthesis and starch formation. This directly increases biomass accumulation (plant weight). K is thought to function as a transporter of photosynthetic products (sugar/photosynthates) from leaves to storage organs (such as stems and roots). If this transport is smooth, the weight of plant organs will increase significantly.

Meanwhile, Manganese (Mn) is a micro nutrient that plants need in small amounts but can also be used to support the photosynthesis process. Manganese (Mn) can facilitate assimilation and provide electrons for the light reaction process of photosynthesis which will ultimately be used to produce sugar as an energy source in plant development such as increasing stem length, increasing leaf area and plant weight [16]. [8] also stated that another function of Mn is that it can activate various types of enzymes to help form proteins, where proteins are the building blocks of plant structures such as leaves, stems, roots, flowers and increasingly larger fruits. Mn also helps plants assimilate nitrogen. The interaction between N and Mn ensures the smooth formation of amino acids and proteins, which are the main building blocks of plant structure. This can increase dry matter (biomass) accumulation and accelerate plant growth and development.

3.4 Chlorophyll Content

The results of the analysis of variance showed that various doses of chicken manure had a significant effect on the chlorophyll content of celery leaves, as shown in **Table 4**.

Table 4. Chlorophyll content of celery leaves at various doses of chicken manure fertilizer

Chicken Manure Fertilizer Dosage	Chlorophyll Content (mg/g)
P0 (0 kg/plot)	13.95 a
P1 (1 kg/plot)	17.49 b
P2 (2 kg/plot)	21.98 c
P3 (3 kg/plot)	23.77 d

Note: Numbers followed by the same letter and same column indicate an insignificant difference based on the DMRT test for Difference at 5%.

The leaf chlorophyll content results in **Table 4** show that 3 kg of manure/plot (P3) produced the highest leaf chlorophyll content, at 27.33 mg/g. This is thought to be because the nutrient content in chicken manure can meet plant nutrient needs to promote growth. As stated by [28], plant growth can increase if nutrients are available in the soil. The higher the chlorophyll content in leaves, the higher the photosynthesis results, thus enhancing plant growth and development.

Chlorophyll formation is strongly influenced by the nitrogen content in chicken manure, which is 3.21% [24]. N forms the pyrrole unit in the chlorophyll structure, which forms a porphyrin ring [29]. N is also involved in the formation of early chlorophyll precursors, such as ALA (Aminolevulinic Acid), which is used in chlorophyll biosynthesis [30]. In line with previous findings, [31] stated nitrogen is the main component of amino acids that make up proteins and

several enzymes such as reductase and synthase which are involved in the formation of aminolevulinic acid for the formation of chlorophyll.

Besides nitrogen, chicken manure contains other micro and macro elements, including magnesium [20]. Magnesium is the central atom in the chlorophyll molecule. If nitrogen is the "wall" of the molecule, then magnesium is the central atom. Chicken manure helps ensure a sufficient supply of magnesium for plants to maintain a stable chlorophyll structure. Chicken manure also contains micro elements such as manganese and iron, which act as catalysts [21]. Although not part of the chlorophyll molecule, manganese and iron are essential for chlorophyll biosynthesis. These two elements act as enzymes that accelerate the formation of chlorophyll units in the chloroplasts.

The organic matter in chicken manure is also thought to stimulate the activity of soil microorganisms, which can aid in the mineralization process, which converts nutrients bound in organic matter into inorganic forms that can be absorbed by roots (such as ammonium and nitrate) [1]. More efficient nutrient uptake is directly proportional to the rate at which plants produce chlorophyll. Based on this, it can be seen that the increase in chlorophyll content by chicken manure occurs through the mechanism of providing essential nutrients which are the main raw materials for forming green leaf substances.

4 Conclusion

Application of chicken manure to celery plants significantly affected celery growth and yield. A dose of 3 kg of chicken manure per plot resulted in the highest plant height (13.90 cm), the highest number of leaf stalks (5.36 stalks), the highest fresh weight per plant (31.40 g), and the highest chlorophyll content (23.77 mg/g). However, its effectiveness is greatly influenced by the variability of environmental factors such as light intensity, temperature fluctuations, and micro-humidity at the research site. Optimal environmental conditions act as a catalyst in accelerating the mineralization process of organic matter from chicken manure into plant-available nutrients.

From a broader application perspective, the use of chicken manure offers a sustainable fertilization solution that not only increases celery biomass productivity but also has the potential to be adapted to various types of marginal soil in other regions with appropriate dosage adjustments. These results provide a foundation for horticultural farmers to reduce their dependence on inorganic fertilizers, while supporting efforts to restore the physical and biological quality of soil in the long term within a broader organic farming system. However, further research is needed and combination with other organic fertilizers is needed to better understand the effectiveness of each organic fertilizer studied.

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Evaluation of the Success of Artificial Insemination in Bali Cattle in Borong, East Nusa Tenggara

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Abstract. Artificial insemination (AI) is a reproductive technology implemented to increase the population and genetic quality of beef cattle in Indonesia, including Bali cattle. This study aims to evaluate the success rate of AI in Bali cattle in Borong District, East Manggarai Regency, and analyze the factors influencing it. This study used a quantitative descriptive method with a survey technique of 173 productive female cattle that had received AI treatment. Parameters used in this evaluation included Service Per Conception (S/C) and Conception Rate (CR). The results showed that the S/C value obtained was 3.84, which means that on average a cow requires one insemination before pregnancy occurs. Meanwhile, the CR value reached 26.01%, which indicates that the success rate of AI is not good enough. The success of this AI program is influenced by several factors, including the skill of the inseminator, the quality of frozen semen, the health condition of the cows, and the correct detection of estrus. These findings indicate that the implementation of AI in Borong District has been running well and effectively in increasing the productivity of Bali cattle. This research is expected to serve as a reference for local governments and breeders in further developing AI programs. Extension to breeders on estrus detection techniques and cow husbandry management needs to be improved to maintain and improve AI success in the future.

Keywords: Artificial insemination, Bali cattle, Service Per Conception, Conception Rate

1 Introduction

One agricultural subsector with significant growth potential is livestock farming. Beef cattle are a livestock commodity with promising business prospects, and economic growth can impact food demand due to population growth, which in turn increases the demand for animal products [1]. Beef cattle is a livestock product with promising business prospects [2]. National demand for meat is increasing along with economic growth, population growth, increased education, and public awareness of the importance of consuming nutrients from livestock.

As a source of animal protein for the community, Bali cattle are one of the most profitable meat-producing livestock. Currently, the amount of animal protein consumed per person is 4.19 grams per day, equivalent to 5.25 kilograms of meat, 3.5 kilograms of eggs, and 4.94 kilograms of milk. The normal level of animal protein consumption is 62.33 grams per

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day. The government must import beef to meet Indonesia's beef needs. This import policy will make us dependent on beef-exporting countries, so we need to make efforts to increase domestic beef production.

Based on statistical data from East Manggarai Regency (2023), the beef cattle population in this region was recorded at 2,065 in 2021, increasing to 3,061 in 2022, but then dropping again to 2,976 in 2023. This decline was due to high cattle sales by livestock farmers. Livestock farmers in East Manggarai Regency, particularly in Borong District, face a major challenge: low cattle productivity and genetic quality. This is because livestock development methods are still traditional and have not adopted technology, impacting livestock production and genetic quality.

This situation will make smallholder livestock farming increasingly uncompetitive. The implementation of artificial insemination technology, which can accelerate cattle population growth, is one of the government's efforts to encourage an increase in the cattle population. One technology that has been optimized in livestock development is Artificial Insemination (AI), which has increased livestock productivity and improved farmer income and welfare. The use of AI is also considered beneficial for improving livestock performance and potential, facilitating progeny testing, and increasing the number of offspring from males proven to possess superior traits for specific production purposes [3].

East Manggarai Regency has implemented an AI program to increase the beef cattle population, with Borong District being one of the most intensively implemented districts. The goal of implementing the AI program in Borong District is to increase livestock productivity. The success of the artificial insemination program for cattle in East Manggarai Regency has resulted in improved cattle quality and improved livestock farmer incomes. According to data from the East Manggarai Livestock Service, the AI program in Borong District has been successful for the past two years, with a success rate of 60%. To ensure the program's smooth operation, the East Manggarai Regional Government employs staff trained at the Lembang Insemination Center in Bandung, West Java. With East Manggarai's status as a livestock district, this AI program is crucial for improving the economy and reducing extreme poverty in East Manggarai Regency.

2 Research Methods

This research is a quantitative descriptive study, which involves collecting data from the field and analyzing it to draw conclusions. The sample of this study was 173 productive female cattle from 64 respondents in Borong District, East Manggarai Regency, who had undergone Artificial Insemination (AI). This research was conducted in Borong District, East Manggarai Regency. This research used a direct survey technique to obtain data from breeders and inseminators. Primary data is data obtained from information from breeders' responses. Secondary data is data obtained from related agencies, such as breeders who received artificial insemination in Borong District.

The population in this study comprised the entire analysis unit of 173 productive Bali cattle in Borong District, mated using AI. The sample size represents a subset of the population and its characteristics; the sample taken must be truly representative. Because the Bali cattle population being studied is spread across these locations, descriptive analysis was conducted using the Slovin formula:

$$n = \frac{N}{1 + N(\ e\ )^2}$$

Where:
N = Population Size
n = Sample Size
e = Error Rate (0.5%)

The data collection and collection techniques used in this study were:
a) Observations were conducted through direct observation at the research site.
b) Interviews were conducted with each farmer at the research site, asking several questions to obtain the information or data needed for the study.
c) Documentation was conducted by taking photographs of the research objects to prove that the research was actually conducted.

The collected data will be processed and analyzed descriptively, namely by describing the research results to draw conclusions regarding the evaluation of the success rate of Bali cattle AI in Borong District, East Manggarai Regency.

3 Results

3.1 Characteristics of Respondents in Borong District

The characteristics of the farmers in this study include the farmer's age, education, length of farming, and gender as in Table 1.

Table 1. Characteristics of Respondents in Borong District, Nangalabang Village

	Category/Quantity	Percentage / %
Respondent Gender	Male / 63 people	98.44%
	Female / 1 person	1.56%
Respondents' Education	Elementary – Middle School / 62 people	96.88%
	High School – Bachelor's Degree / 2 people	3.13%
Respondent's age	40 - 49 years / 34 people	53.13%
	30 - 39 years / 13 people	20.31%
	50 - 70 years / 11 people	17.19%
	20 - 29 years / 6 people	9.38%

Length of Breeding	20 - 32 years / 28 people	43.75%
	3 - 20 years / 36 people	56.25%

Respondent characteristics were used to determine the identity of the farmers involved in this study, namely the farmers used as samples. A farmer used as a sample is not free from factors that influence the success of artificial insemination, including gender, age, highest level of education, and length of farming experience.

Based on Table 1, the highest age group among breeders is 40-49, representing 34 individuals, representing a percentage of 34%. This indicates that breeders are still within the productive age range. Overall, most breeders are between 46-49 years old. According to Asyraf [4], breeder age influences the success rate of AI in Bali cattle. Age can contribute to the success rate of AI. The relationship between age and experience and skills increases with age[5].

Table 1 also shows that the majority of breeders are elementary school graduates (SD-SMA), with 62 individuals (62%). Furthermore, the highest percentage of inseminators with a bachelor's degree (S1) was achieved by 2 individuals, representing 66.7%. Although the level of formal education of breeders is relatively low, this does not prevent them from possessing the knowledge and skills that play a significant role in the success of AI. According to Kastalani [6], education level influences the absorption of information and knowledge, as well as the way breeders think. However, these difficulties can be overcome through experience gained by breeders and through extension activities. The education level of inseminators is quite high, as stated by Ardhani [7], who stated that the average education of inseminators is high if they have completed 12 years of basic education.

The highest number of years of farming experience, based on Table 1, is 20-32 years, with a percentage of 36.4%. This indicates that farmers have considerable farming experience. Length of experience influences the success of AI, which is in line with Kastalani [6] who stated that farmer experience is positively correlated with productivity. The longer the farming experience, the higher the productivity. This is because longer experience allows farmers and inseminators to gain more practical knowledge and skills relevant to livestock management, including AI techniques. Success factors can be influenced by a person's age and their ability to work, which is manifested in the results they obtain.

The gender of the livestock farmers, as shown in Table 1, was predominantly male, with 63 representing 98.44% of the population, and 1 female representing 1.56%. This indicates a male predominance in this study. Success factors can be influenced by a person's gender, which affects their work ability, which is reflected in the results they achieve.

3.2 Characteristics of Livestock

The type of livestock selected for this study was Bali cattle, the most commonly raised in Borong District. Based on observations, the cattle sampled in this study were of medium size, with an average Body Condition Score (BCS) of 4. One of the parameters used for visual assessment is the *Body Condition Score* (BCS). The BCS of beef cattle is influenced by the level of feed consumption and the digestibility of the nutrients in the feed consumed [8]. In general, these livestock are broodstock or adult female cows that have previously gone through the birthing process.

Livestock farming in Borong District is still dominated by traditional systems with semi-intensive husbandry. Although livestock populations and productivity are relatively

stable, key challenges such as feed availability, livestock health, and the implementation of modern technology remain obstacles that need to be addressed to improve livestock yields. The lower the value of S/C (*Service per Conception*), then the value CR (*Conception Rate*) will be higher. In terms of S/C values, heifers showed higher values compared to mother cows. This is in line with the opinion of Huda [8], which states that as age increases, the reproductive ability of mother cows tends to decrease, thus potentially reducing the CR value.

The mother cow has *Body Condition Score* (BCS) of 4, indicating good body condition. There were 173 breeding cows, ranging in age from 21 to 22 months. The artificial insemination process in this group showed excellent results, with cows successfully becoming pregnant with just one AI. Meanwhile, the heifers also had a BCS of 4, indicating their body condition was also considered good. There were 17 heifers recorded, ranging in age from 16 to 19 months. However, the success rate of AI in heifers was slightly lower than in breeding cows, as two AIs were required to achieve pregnancy. Overall, both groups were in ideal body condition for reproduction, with breeding cows showing higher efficiency in the process of becoming pregnant through artificial insemination.

3.3 Service per Conception (S/C)

The ideal S/C value indicates good reproductive efficiency, namely when pregnancy can be achieved with the minimum number of services possible [9]. The lower the S/C value, the better the fertility of the livestock. The results of the descriptive analysis regarding the Service per Conception value in Bali cattle can be seen in the following table.

$$\frac{s}{c} = \frac{Number\ of\ IB\ until\ pregnant}{Number\ of\ expectorants\ until\ pregnancy}$$

$$\frac{173}{45} \times 100$$

$$= 3{,}84$$

The research results showed a S/C ratio of 3.84 for 173 acceptor animals. A high service per conception results in a longer calving interval compared to animals with a normal 12-month interval. According to Muslimiah [10] A good S/C ratio is 1.6 to 2.0 services. The average S/C ratio in Borong District, which is 45, indicates that only 1 to 2 inseminations will the animal become pregnant. This indicates that the S/C in the study area is not yet satisfactory, as it is higher than the established standard.

The S/C value itself is intended to indicate the fertility level of livestock. The higher the S/C value, the lower the fertility rate. High S/C values are caused by several factors, such as delays in detecting heat by breeders and inseminators and inappropriate timing of insemination, as delays in insemination can lead to pregnancy failure.

3.4 Conception Rate (CR)

Conception rate Good fertility reflects sound reproductive management, including timely AI, semen quality, and the physiological and health conditions of the cattle. The following table shows conception rate data as a measure of fertility in a population of female cattle that have undergone AI.

$$CR = \frac{\sum Number\ of\ female\ cows\ pregnant\ with\ the\ first\ IB}{\sum Number\ of\ exeptors} \text{X } 100\%$$

$$\frac{45}{173} \times 100\%$$

$$= 26,\ 0\ \%$$

The success rate of AI in Borong District was poor, with only 26.01% of the animals being pregnant, with 45 animals. Research results showed that the conception rate (CR) was below the established standard. Fanani [11] states that the ideal value for a cattle population ranges from 60% to 75%. A higher CR value indicates a better fertility rate for the cattle. Conversely, a low CR value indicates a less than optimal fertility rate in the cattle. According to Fanani, *et al.* (2013) states that the CR value is determined by male fertility, female fertility, and insemination technique. Male fertility is partly the responsibility of the Artificial Insemination Center (BIB), which produces frozen semen, in addition to storage management at the inseminator level.

Female fertility is the responsibility of the farmer, assisted by a veterinarian who monitors the health of the breeding cows. Meanwhile, AI implementation is the responsibility of the inseminator. The level of fertility is influenced by the condition of the herd, heat detection, and reproductive management, which in turn impacts the herd's fertility and conception rate. According to Dirgahayu [12] The conception rate value is influenced by several factors, including re-estrus after giving birth and re-mating after giving birth.

3.5 Factors Affecting the Success of Artificial Insemination

According to Ardhani [7], good characteristics of breeders and inseminators will guarantee the success of artificial insemination. The higher the level of knowledge and skills of breeders and inseminators, the higher the success of artificial insemination. Widiyaningsih [13] also stated that breeders and inseminators play a significant role in the success of artificial insemination. Characteristic factors, the level of knowledge of signs of estrus, the estrus cycle, and the right timing of artificial insemination by breeders play a significant role in the success of artificial insemination. The characteristics, experience, and skills of inseminators show significant results in the success of artificial insemination.

The skills of the inseminators sampled in this study in depositing semen at the research site demonstrated good quality and results, as they were experienced in performing Artificial Insemination. The inseminators' skills were categorized as high, with a percentage of 86.8%. The inseminators' skills in recognizing signs of estrus were high, as they were able to identify more than three signs of estrus. Common signs of heat include clear mucus discharge, restlessness, and the 3A signs of heat (abang, aboh & anget). Other signs of heat include mounting and remaining still when mounted by other livestock, and decreased appetite. This role is supported by the characteristics of high-quality inseminators and high levels of knowledge. According to Labetubun [14], good inseminator characteristics will guarantee successful AI. Inseminators have also undergone training in skills to become inseminators and already have SIMI (Insemination Permit) which supports their ability to perform AI.

Failure to detect estrus can lead to pregnancy failure. Accurate estrus detection is a crucial factor in a mating program to ensure timely fertilization. Research shows that breeders detect estrus through symptoms such as visible mucus discharge from the vulva, decreased appetite, restlessness, and frequent mounting of mates, a reddened vagina, and a swollen vulva. Breeders are already skilled at recognizing the signs of estrus. This demonstrates the significant role breeders play in the success of AI. This is in line with research by Widiyaningsih [13], which shows a correlation between the role of breeders and the success of AI.

Accurate and precise detection of estrus is one of the keys to successful artificial insemination in cattle. After ovulation, the lifespan of oocytes is very short, only surviving for 10-12 hours in the female reproductive tract, so this time must be carried out at the right time and utilized optimally [15]. The right time for AI is when the cow is in estrus in the morning,

and the cow should be inseminated in the afternoon. Conversely, if the cow is in estrus in the afternoon, the cow should be inseminated the following morning. Inaccurate insemination timing in Borong District often occurs due to a lack of observation of estrus detection by the farmers themselves, resulting in insemination officers experiencing problems in timely insemination. If signs of estrus in cattle are not detected, then the inseminator has no basis for performing artificial insemination. Research results show that farmers have a good understanding of the signs of estrus (heat) in their livestock. This understanding facilitates the implementation of artificial insemination (AI), so that the timing of AI can be carried out precisely according to the livestock's fertile period, which ultimately increases the chance of a successful pregnancy. Putri [15] stated that signs of perfect estrus include a swollen, red vulva, moaning sounds, mucus discharge, and restlessness of the animal. The timing of insemination depends on the detection of estrus, to determine the right time for insemination [16].

The quality of frozen semen can be a key determinant of successful artificial insemination (AI). Artificial insemination (AI) is a reproductive technology program implemented in the livestock sector with the aim of improving the genetic quality of livestock offspring, increasing livestock populations evenly, and preventing the transmission of sexually transmitted diseases [17]. The main indicator of frozen semen quality is post-thawing motility (PTM), which reflects the ability of sperm to remain active and move progressively after undergoing the freezing and thawing process. Quality frozen semen for use in artificial insemination (AI) must meet Indonesian National Standards (SNI). One of the main indicators of this quality is post-thawing sperm motility, which must be greater than 40%. Furthermore, frozen semen that meets SNI standards must also have a minimum concentration of 25 million sperm cells per straw. This parameter indicates that the semen has good fertilization potential and is suitable for use in reproductive programs. Frozen semen used in artificial insemination (AI) in Borong District is imported from Kupang. To ensure the quality and suitability of the semen, the East Manggarai Regency Animal Husbandry and Agriculture Office conducts regular evaluations of the frozen semen before field use. These evaluations include post-thawing motility testing, sperm cell concentration per straw, and membrane integrity and sperm morphology. These tests are crucial to ensure that the semen meets Indonesian National Standards (SNI) standards, thereby supporting the success of the AI program and increasing the productivity of Bali cattle in the region. There was a decrease in the quality of sexed sperm compared to unsexed sperm during the four-hour extension period after thawing. This indicates that sexed sperm experienced a decrease in motility below the 40% threshold.

Recipient or donor cows are females used as breeding stock, so selecting productive cows is crucial. Artificial insemination is often performed successfully with proper technique. However, using unproductive cows can result in infertility because the cows are unable to produce eggs. Herd genetics, BCS Body Condition Score (BCS)/oversized/undersized body condition, reproductive organ condition, hormonal levels, and the presence of certain diseases are all factors that need to be considered [15]. After successful artificial insemination, Bali cattle in Borong District showed a slight decrease in their Body Condition Score (BCS) from 4 on a scale after calving. This decrease in BCS is common due to increased energy requirements during pregnancy and lactation. To address this, farmers in Borong District implement nutritional interventions by providing high-quality supplemental feed, such as fresh, protein-rich forage, concentrates, and mineral and vitamin supplements tailored to the physiological needs of lactating cows. The aim of this strategy is to accelerate the recovery of the mother cow's body condition, increase milk production, and support the next reproductive cycle to remain optimal.

4 Conclusion

The evaluation results show the success of AI based on the Service Per Conception (S/C) value of 3.84, and the Conception Rate (CR) of 26.01, which is not yet included in the good category. The implementation of AI in Borong sub-district is influenced by several factors, namely the body condition of the livestock (Body Condition Score/BCS), the skills of the inseminator, detection of estrus, time of insemination, quality of frozen semen and the condition of the livestock itself.

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Global Trend Digital Teaching Material For Improving Critical Thinking Skill: A Bibliometric Analysis (2016-2026)

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Abstract. This study offers a comprehensive bibliometric analysis of global patterns in digital educational resources designed to foster critical thinking abilities over the period 2016–2026. Utilizing data from Scopus and Dimensions databases, the research analyzes publication trends, citation impacts, and thematic evolutions using VOSviewer and Biblioshiny. The results reveal an exponential surge in publication volume, particularly post-2020, with Dimensions recording significantly higher data density than Scopus. Geographically, Indonesia dominates productivity in Scopus, while the US and UK lead in collaborative network strength and citation impact. However, co-authorship analysis indicates significant fragmentation, particularly in Scopus-indexed research. The findings suggest that while the field is maturing, there is a critical need for cross-border collaboration and the integration of niche themes like "flipped learning" and "augmented reality" into mainstream pedagogy. This study provides a strategic roadmap for educators and policymakers to design technology-mediated materials that foster higher-order thinking in an AI-driven information ecosystem.

Keywords: bibliometric analysis; critical thinking; digital teaching materials; artificial intelligence; digital pedagogy.

1 Introduction

The ascendancy of critical thinking as a paramount educational objective is not merely an academic trend but a consolidated global policy priority. National educational frameworks worldwide are increasingly mandating the integration of such higher-order skills into curricula, recognizing them as essential for innovation and workforce adaptability [1]. This policy-driven imperative provides a significant catalyst for the research and development of innovative pedagogical tools, including digital teaching materials. Concurrently, the evolution of digital tools themselves—from basic repositories to interactive platforms incorporating artificial intelligence and adaptive learning pathways—has created unprecedented opportunities to translate policy into practice [2]. The confluence of these factors has generated a dynamic and expanding corpus of academic literature seeking to evaluate, validate, and refine digital interventions aimed at fostering critical thought. This burgeoning field, however, is

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characterized by diverse methodologies, contextual applications, and theoretical underpinnings, necessitating a systematic effort to map its intellectual contours and trajectories.

Despite the proliferation of digital tools and a rich body of pedagogical research on critical thinking, a significant analytical gap persists. Existing scholarship often remains siloed within specific disciplines, educational levels, or regional contexts. For instance, while studies explore digital storytelling in language arts or simulations in STEM, comprehensive analyses that transcend these boundaries are scarce [3] . Similarly, research output and influence show notable disparities between world regions . While systematic and qualitative reviews abound, there is a distinct lack of comprehensive, longitudinal mapping of the global intellectual structure, evolution, and collaborative networks driving research at the intersection of digital teaching materials and critical thinking skill development [4]. A bibliometric analysis, which quantitatively examines publication patterns, citations, keywords, and author affiliations, is uniquely positioned to illuminate these macro-trends [5]. Such an analysis can move beyond individual case studies to identify dominant research fronts, emerging themes, influential scholarly communities, and geographical centers of innovation, thereby revealing the field's underlying architecture and trajectory.

The domain of "digital teaching materials" itself has evolved dramatically within the 2016-2026 scope, expanding from static digital reproductions of textbooks to dynamic, interactive, and intelligent resources. Modern materials are increasingly designed around pedagogies proven to cultivate critical thinking, such as inquiry-based learning, where digital environments scaffold students through cycles of questioning, investigation, and reflection [6] . These resources leverage learning management systems (LMS) to host interactive modules that prompt analysis, employ simulations for problem-based learning, and integrate functionalities like adaptive feedback. The primary educational challenge revolves around how the design of these materials can effectively support the cultivation of specific critical thinking skills—such as analysis, evaluation, and inference—while simultaneously fostering foundational dispositions like open-mindedness. [7]. Current research trends highlight their application in hybrid and distance learning environments, where strategic digital use is crucial for fostering deep cognitive engagement outside traditional classrooms [8].

Preliminary bibliometric investigations in adjacent educational fields underscore the value of this approach. For example, a bibliometric analysis of research on critical thinking within English Language Teaching (ELT) revealed China as the most prolific contributing country and underscored a transition of thematic focus from collaborative learning toward the integration of language and thinking skill instruction over time [9]. Another study on quality assurance in higher education used bibliometric methods to delineate clear phases of research evolution and identify "motor themes" like technological pedagogy and sustainability. These examples demonstrate how bibliometrics can effectively chart the maturation of a scholarly domain. They provide a precedent for applying similar analytical rigor to the specific nexus of digital teaching materials and critical thinking, promising insights into the field's foundational works, current frontiers, and network of contributing scholars and institutions [10].

To bridge this research gap, the present study utilizes a bibliometric approach to map global research trends concerning digital instructional materials for critical thinking over the decade from 2016 to 2026. By analyzing a corpus of literature from major indices like Scopus and Web of Science, this research question are:

1. **RQ1:** What are the anual trends in Digital Teaching Material For Improving Critical Thinking Skill based on publication and citation per year 2015-2025?
2. **RQ2:** What characterizes the collaborative patterns among the most highly cited and influential authors currently working on digital teaching materials for enhancing critical thinking skills?
3. **RQ3:** What are the research gaps and novelty in Digital Teaching Material For Improving Critical Thinking Skill for upcoming research?

The findings will provide a synthesized, evidence-based overview of the field's development, offering scholars a clear roadmap of past achievements and future directions. For educators and policymakers, this analysis will highlight evidence-supported practices and tools, informing the design of professional development and the strategic integration of technology to cultivate the critical thinkers needed for a complex future.

2 Method

2.1 Research Design

This study seeks to investigate contemporary trends in science education that integrate local wisdom at the elementary school level. The research adopts a mixed-methods approach, drawing on diverse data sources and framed within a descriptive survey model. To accomplish this objective, the study utilizes two analytical techniques: bibliometric and descriptive analysis. These methods are applied to examine existing academic literature on science learning integrated with local wisdom at the elementary students level. Bibliometric analysis, which evaluates a subject's development, scholarly quality, influence, and relevant resources, has grown in popularity across various disciplines [11] [12]. While not a replacement for conventional literature reviews, it serves as a crucial complementary tool [13].

Meanwhile, the descriptive analytical approach involves gathering and interpreting data within established thematic categories. In general, bibliometric analysis serves two main purposes: performance analysis and the mapping of scientific knowledge. [14]. Performance analysis assesses the volume and influence of scholarly output from various contributors, including institutions, authors, and countries. In contrast, scientific mapping employs visualization techniques to elucidate the intellectual structure and evolving dynamics within a particular research domain.

2.2 Data Collection

The data for this investigation were drawn from the Scopus and Dimensions databases, chosen for their extensive coverage of peer-reviewed scholarly literature. The search was conducted on Nov 24, 2025, using the Boolean search string: "digital teaching" AND "critical thinking" AND ("elementary students" OR "primary students"). At the same time, the systematic review and meta-analysis adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, which encompass four key stages: identification, screening, eligibility assessment, and final inclusion. [15].

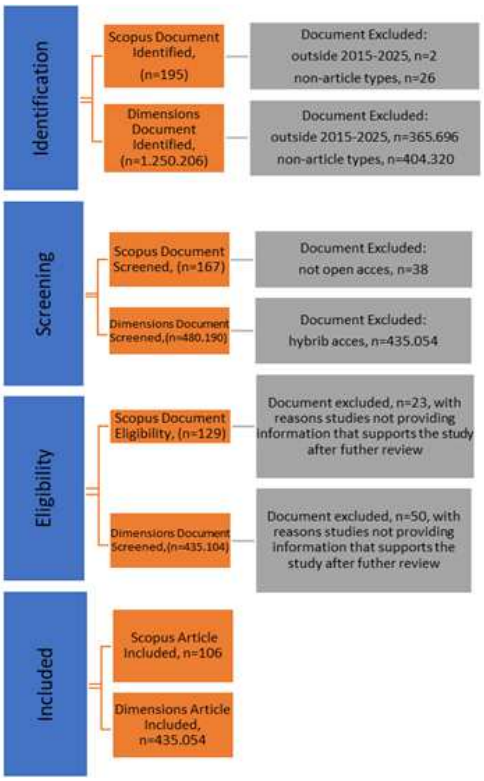

Figure 1. Prisma Flow Chart

Reffering to Figure 1. during the identification stage 2 documents were excluded for outside 2015-2025 and 26 documents were excluded non-article types (for Scopus databases); 365.696 documents were excluded for outside 2015-2025 and 404.320 documents were excluded non-article types (for Dimensions databases). During Screening stage, 38 documents were excluded for not open acces (for Scopus databases) and 435.054 documents were excluded hybrid acces (for Dimensions databases). In the eligibility phase, 23 documents (Scopus databases) and 50 documents (Dimensions databases) were excluded with reason studies not providing information for supports the study after future review. Ultimately, 106 Sopus documents and 435.054 Dimensions documents were included in the bibliometrics análisis-depth qualitative análisis and deep descriptive analysis.

2.3 Data Analysis

This study adopted a dual analytical approach, integrating both bibliometric and descriptive methods. The descriptive component was used to examine articles based on several criteria, including publication year, country of origin, and authorship patterns. Meanwhile, the bibliometric analysis employed various techniques such as citation analysis (at the author and

country levels), co-authorship analysis (involving both authors and their affiliated countries), author keyword co-occurrence analysis, and term co-occurrence analysis. To conduct these analyses and generate visualizations, the study utilized VOSviewer version 1.6.16—a software tool developed by Van Eck and Waltman—alongside R Studio [16] Written by JAVA and accessible at www.vosviewer.com, along with the Biblioshiny application, this free software enables the visualization and exploration of maps derived from network data. The network maps produced using VOSviewer and Biblioshiny in this study are accompanied by accessible links to facilitate a more detailed examination of the connection strength associated with each node.

3 Results

The findings of this study cover multiple dimensions of science education that integrate local wisdom for elementary students. The analysis addresses the central research questions by exploring key areas such as publication trends, citation patterns, the most influential authors, country-level contributions, co-authorship networks among researchers, and international collaboration patterns. Each of these aspects is examined in detail to provide a comprehensive understanding of the research landscape.

RQ1: What are the annual trends in Digital Teaching Material For Improving Critical Thinking Skill based on publication and citation per year 2015-2025?

3.1 Annual Trend of Publications and Citations

3.1.1 Publication Trend

The bibliometric examination of publication trends between 2015 and 2025 reveals a pronounced divergence in research indexing patterns between the Scopus and Dimensions databases concerning digital instructional materials for critical thinking. Scopus coverage appears minimal, showing a negligible increase from a single document in 2015 to only 32 documents in 2025, suggesting that this specific niche is either underrepresented in Scopus-indexed high-impact journals or is still in a nascent stage within that specific dataset. In contrast, the Dimensions database captures a massive proliferation of scholarship, surging exponentially from 512 documents in 2016 to 11,487 in 2026, indicating that the broader academic community is actively and aggressively prioritizing this field of inquiry.

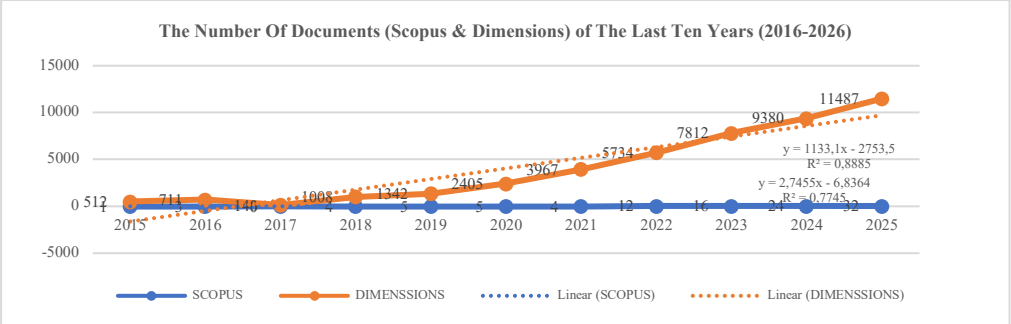

Figure 2. Global Trend Digital Teaching Material For Improving Critical Thinking Skill: A Bibliometric Analysis (2016-2026)

3.1.2 Citation Trend

The bibliometric analysis of research concerning Global Trend Digital Teaching Material For Improving Critical Thinking Skill: A Bibliometrıc Analysıs (2016-2026)' reveals a field characterized by a disparity between publication volume and citation impact over time. The citation analysis on Table 1. shows that indicates a distinct non-linear relationship between publication volume and scholarly impact over the observed decade.

Table 1. Average Citations Per Year (Scopus Databases)

Year	MeanTCperArt	N	MeanTCperYear	CitableYears
2015	7,00	1	0,64	11
2016	4,67	3	0,47	10
2018	6,25	4	0,78	8
2019	30,20	5	4,31	7
2020	8,00	5	1,33	6
2021	7,50	4	1,50	5
2022	8,50	12	2,12	4
2023	14,62	16	4,87	3
2024	3,46	24	1,73	2
2025	0,91	32	0,91	1

While the number of citable documents (N) shows a consistent upward trajectory, peaking at 32 publications in 2025, the highest impact per article was recorded significantly earlier. Specifically, 2019 emerges as a seminal year for this field; despite a modest output of only 5 documents, it achieved the highest Mean Total Citations per Article (30.20) and a high annual citation rate (4.31). This suggests that foundational research published during this period has driven the theoretical underpinnings of the field, continuing to garner significant academic attention despite the lower volume of papers produced at that time.

In contrast, the data for the most recent years reflects a surge in productivity accompanied by the natural latency of citation accumulation. The year 2023 represents a notable outlier in the recent trend, balancing a rising publication count (N=16) with a substantial impact factor of 14.62 citations per article and the highest recorded Mean Total Citations per Year (4.87). However, the sharp decline in mean citations for 2024 (3.46) and 2025 (0.91), despite 2025 having the highest publication volume (N=32), illustrates the "immediacy effect". The most recent literature has simply not yet had sufficient citable years to accumulate references, even though the sheer volume of new documents indicates that academic interest in digital teaching materials for critical thinking is currently at its peak.

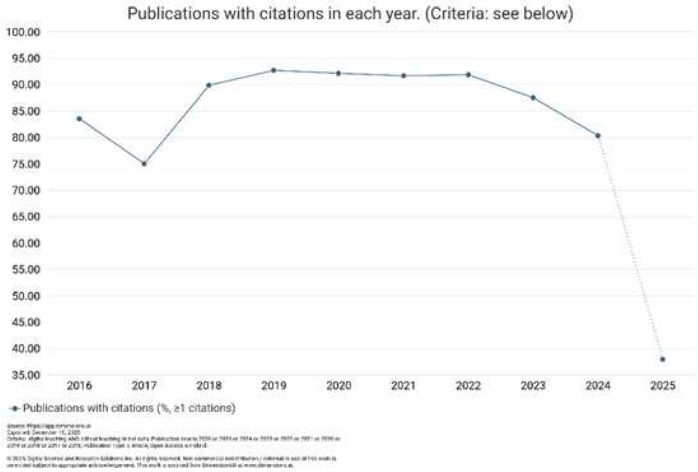

Figure 3. Publication with Citation from Dimensions Databases

According to Figure 3, it can be seen that the citation analysis reveals a significant inverse relationship between publication volume and individual article impact over the surveyed decade. While the number of citable documents (N) reached its zenith in 2025 with 32 publications, the highest scholarly impact was recorded in 2019, where a modest output of five documents achieved a peak Mean Total Citations per Article of 30.20. This suggests that the foundational research established during the field's earlier stages (2018–2021) continues to drive the theoretical discourse, as evidenced by consistent mean citation counts above 6.00 during this period. Conversely, the most recent years exhibit a "citation lag"; for instance, 2025 shows the highest productivity but the lowest mean impact (0.91 citations per article), indicating that while the field is expanding rapidly, the newest literature has not yet had sufficient time to accrue significant academic attention.

This temporal latency is further substantiated by the percentage of publications receiving citations, which remained remarkably robust and stable between 90% and 93% from 2018 through 2022. This stability indicates a highly active research community where the vast majority of published work was immediately relevant and referenced. However, a precipitous decline is observed starting in 2023, dropping to approximately 80% in 2024 and further to roughly 38% in 2025. This downward trajectory does not imply a reduction in research quality, but rather reflects the natural immediacy effect in bibliometrics, where the surge in volume (N=16 in 2023 to N=32 in 2025) currently outpaces the speed at which these new digital teaching material studies can be integrated and cited within subsequent global scholarship.

RQ2: What characterizes the collaborative patterns among the most highly cited and influential authors currently working on digital teaching materials for enhancing critical thinking skills?

3.2 Authors and Co-authorship Network

3.2.1 Co-authorship among Authors

The co-authorship relationships among researchers were examined to elucidate the dynamics of collaboration within this field of study. For this bibliometric analysis, 'Co-authorship' was designated as the type of analysis, with 'Authors' serving as the unit of analysis. According to Scopus Databases, the co-authorship analysis reveals a highly fragmented and decentralized research landscape, characterized by the presence of small, isolated "research silos" rather than a unified global community. The network visualization identifies several distinct colored clusters (e.g., green, red, and blue), each representing independent teams of authors who collaborate exclusively within their own groups. Notably, these clusters are physically separated on the map with no interconnecting lines, which indicates a complete absence of cross-collaboration between the different research factions working on digital teaching materials and critical thinking. While certain individuals like F. Chesire, M. Kaseje, and S. Lewin act as central nodes within their respective teams—demonstrating strong internal collaborative links—the overall network density is remarkably low. This structural isolation suggests that while specialized knowledge is being produced within specific pedagogical or geographical pockets, the field currently lacks the "knowledge brokers" or inter-institutional partnerships necessary to synthesize these disparate findings into a cohesive global framework.

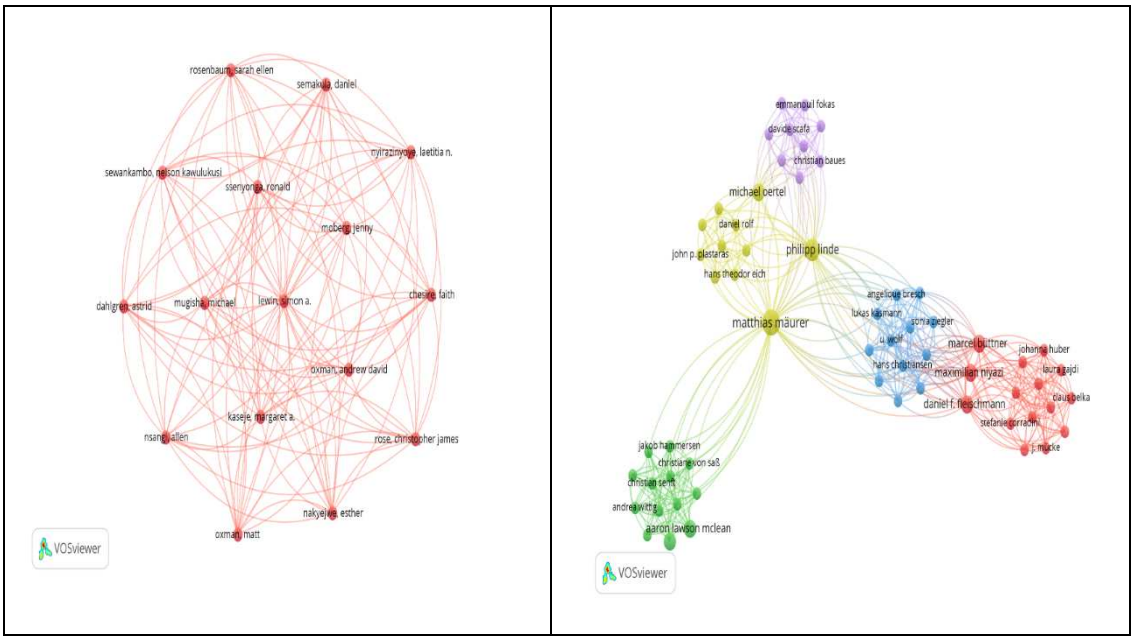

Figure 4. Co-Authorship Analysis of Authors (Scopus and Dimensions Databases)

According to Figure 4. the co-authorship network analysis from the Dimensions database reveals a highly collaborative and structured intellectual community, characterized by five distinct inter-connected clusters that signify a maturing field of research. Unlike the fragmented patterns often seen in emerging niches, this visualization demonstrates significant cross-cluster synergy, with Matthias Mäurer and Philipp Linde acting as pivotal "knowledge brokers" or

central nodes that bridge the yellow, green, blue, and purple research groups. The dense web of linkages within the red and blue clusters indicates intense localized collaboration, likely representing established institutional research laboratories or long-term international consortia dedicated to digital pedagogy. This structural integration suggests that the discourse on digital teaching materials for critical thinking has moved beyond isolated investigations into a more robust, networked phase where ideas are actively exchanged across different theoretical and geographical boundaries.

3.2.2 Co-Authorship among Countries

The analysis of country-level co-authorship within the Scopus database illustrates a global research network characterized by a high degree of international synergy, where Indonesia serves as the primary epicenter of scholarly collaboration. The visualization reveals a dense central cluster with Indonesia maintaining the most robust link strengths, indicating its pivotal role in bridging research between Eastern and Western academic spheres. This central hub is intricately connected to a diverse array of nations including the United States, the United Arab Emirates and South Africa, which form substantial nodes within the network, while countries like China, Norway, and Malaysia occupy more peripheral but stable positions. The emergence of multi-colored clusters linked through a network of lines indicates that the development of digital teaching materials for critical thinking has transcended isolated regional efforts, evolving instead into a globally integrated academic discourse. This transformation has been particularly propelled by Indonesia's substantial research output and its strategic role in fostering collaborative connections across diverse continents and varying levels of human development.

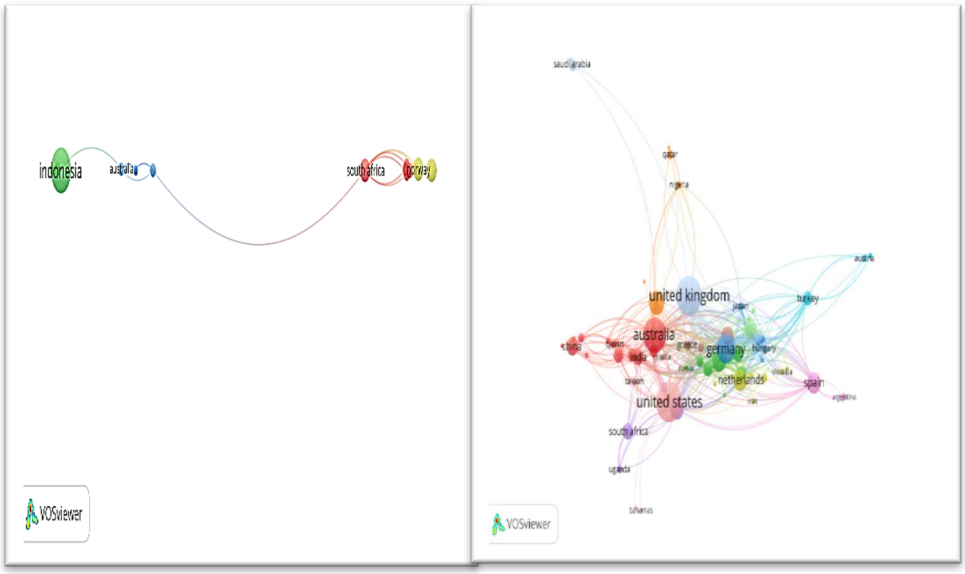

Figure 5. Co-Authorship Analysis of Countries (Scopus and Dimensions Databases)

Reffering Figure 4. shows that the country-level co-authorship analysis within the Dimensions database reveals a robust and highly integrated international research network, with the United Kingdom and the United States functioning as the primary global conduits for scholarly collaboration. The resulting network visualization depicts a complex configuration of interconnected nodes, in which the United Kingdom exhibits the highest Total Link Strength at 115, closely followed by the United States with a score of 112. This positions both countries as central mediators—or "knowledge brokers"—in the global discourse on digital instructional materials for critical thinking.

This network is characterized by three major collaborative clusters: a dominant Anglo-American and European cluster (red) including Australia, Germany, and Sweden; a focused Southern European group (green) led by Italy and Spain; and a distinct Asian-Pacific presence (blue and yellow) featuring Indonesia and Thailand. The high density of connecting lines across these clusters indicates that research in this field has transitioned from localized investigations into a mature, cross-border scientific discourse, where Western methodologies are increasingly being integrated with diverse global perspectives to address the challenges of 21st-century digital pedagogy.

RQ3: What are the research gaps and novelty in Digital Teaching Material For Improving Critical Thinking Skill for upcoming research?

3.3 The Research Gaps and Novelty by Neywork Approach-Thematic Map

The presence of "artificial intelligence" and "challenges" in this same quadrant indicates that the integration of smart technologies currently serves as a primary driver in the evolution of digital pedagogy aimed at sharpening critical reasoning. Meanwhile, topics such as "game-based learning," "collaborative learning," and "critical thinking skills" (plural) are situated in the emerging or declining themes quadrant, suggesting a need for research reorientation or the growth of new specializations outside conventional frameworks. Conversely, "augmented reality" is positioned as a basic theme, implying that while it constitutes an essential technical foundation for the field, it requires further exploration to achieve conceptual maturity as a primary instrument for future instructional strategies.

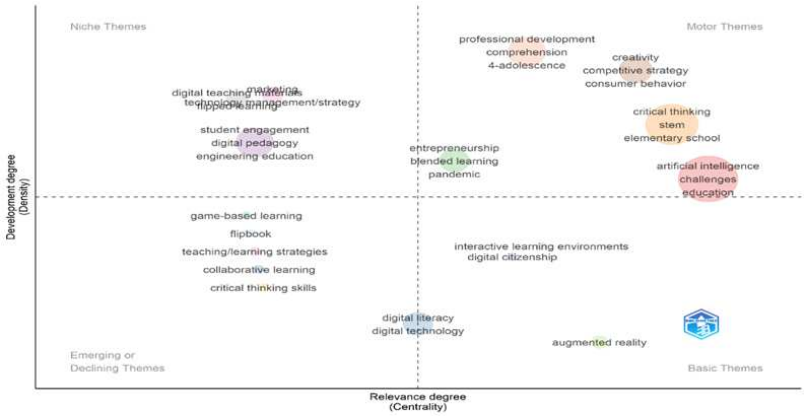

Figure 6. Thematic Map in Digital Teaching Material For Improving Critical Thinking Skill

The figure 7. shows that thematic map reveals a dynamic intellectual structure within the literature, where "critical thinking," "STEM," and "elementary school" emerge as established motor themes, signifying both high relevance and strong internal development within the context of primary education. Despite the maturation of "critical thinking" and "STEM" as central pedagogical drivers in "elementary school" settings, a significant gap remains where specialized "niche themes"—specifically "flipped learning" and "digital teaching materials"—operate in isolation from established "motor themes". While "artificial intelligence" is rapidly emerging as a transformative "challenge" within the global educational landscape, current scholarship has yet to fully integrate "game-based" and "collaborative learning" strategies with the technical foundations of "augmented reality" to create a cohesive instructional framework.

Furthermore, although "professional development" is a well-developed area of research, there is a lack of empirical evidence exploring how "digital pedagogy" can be transitioned from a specialized niche into a mainstream "instructional strategy" that effectively balances "21st-century skills" with student "comprehension". Consequently, there is an urgent need for research that bridges these disparate thematic clusters to provide a unified, technology-mediated approach for fostering critical reasoning in the next generation of learners.

4. Discussion

4.1 The Annual Trends In Digital Teaching Material For Improving Critical Thinking Skill Based On Publication And Citation Per Year 2015-2025

Publication trends between 2016 and 2025 reveal a significant paradigm shift in the digitalization of education, with the Dimensions database recording a document volume that far outstrips Scopus, peaking in 2025. This phenomenon reflects the democratization of digital teaching material research, which is no longer confined to elite journals but has expanded into open-access platforms. Consistent with the observations of Haleem et al. [17] in the context of smart learning environments, the incorporation of digital tools has transitioned from a supplementary option to an indispensable prerequisite for cultivating 21st-century competencies in the post-pandemic era.

This exponential growth confirms that digital teaching materials have become mainstream in global pedagogical discourse. By incorporating tools such as artificial intelligence, augmented and virtual reality (AR/VR), and adaptive learning platforms, digital technologies facilitate more interactive, individualized, and flexible approaches to education. [18] [19]. These digital tools promote independent learning and offer convenient access to information, thereby cultivating essential 21st-century competencies such as creativity, critical thinking, collaboration, and communication. [20] [21]

4.2 The Characterizes Collaborative Patterns among The Most Highly Cited and Influential Authors Currently Working on Digital Teaching Materials for Enhancing Critical Thinking Skills

The co-authorship structure reinforces this fragmentation, as Scopus visualizations show isolated small groups, while Dimensions displays a more integrated network through central figures like Matthias Mäurer. The existence of these "knowledge brokers" is vital for bridging disparate theoretical perspectives. As explained by Arcos-argudo et al., [22],

"small-world" networks in educational research accelerate the validation of new pedagogical models; thus, integration among global researchers is an absolute prerequisite for achieving scientific consensus on the effectiveness of digital media in sharpening student logic.

The integration of educational technology encompasses the deliberate application of digital tools to enhance learning, including the cultivation of critical thinking abilities. Influential authors collaborate on projects that focus on effective technology integration, creating digital teaching materials that enhance educational outcomes. This concept is directly relevant to understanding the collaborative efforts in digital teaching material development. The primary challenge for educators lies in determining the most effective methods for teaching with technology while simultaneously advancing their students' technological proficiency. In the United States, federal legislation currently mandates the integration of technology into school curricula, driven by the widespread belief that its use enhances learning outcomes. [23].

The incorporation of gamification strategies in educational settings involves leveraging game mechanics to foster more engaging learning environments and to promote the development of critical thinking abilities. Collaborations among authors often focus on the integration of gamification strategies into digital teaching materials, making learning more engaging and interactive. This concept is relevant to the query as it highlights innovative approaches to digital education. The objective of this research is to conduct a critical review of the shortcomings and scholarly criticisms of gamification in education, focusing specifically on the risks of excessive simplification, the role of game-induced pleasure, and the effects on learner motivation, in order to shed light on how current engagement frameworks might be refined. [24]. Despite its growing popularity in educational settings, this review reveals that: (i) there is a lack of robust evidence supporting the enduring educational benefits of gamification; (ii) the practical application of gamified learning has outpaced theoretical understanding of its operational mechanisms; and (iii) knowledge regarding the contextualization of gamification approaches according to specific pedagogical environments remains limited, underscoring a gap between theoretical potential and practical application. [25].

Open educational resources (OER) are freely accessible, adaptable, and shareable educational materials. Collaborative efforts between authors often emphasize the creation and distribution of OER for critical thinking development, contributing to greater educational equity and accessibility.The nature of these collaborations highlights the commitment to making high-quality educational resources available to all. Subsequently, we outline a set of principles for developing thinking skills, underscoring the significance of mapping techniques in organizing knowledge. In the concluding section, we address critical considerations for cultivating critical and creative thinking through the integration of open educational resources and knowledge mapping strategies. [26].

4.3 The Research Gaps And Novelty In Digital Teaching Material For Improving Critical Thinking Skill For Upcoming Research

The presence of isolated niche themes such as "flipped learning" and "student engagement" points toward untapped future research opportunities. This gap suggests that although innovative learning strategies have been developed, their technical integration

with AI-based digital teaching materials has not yet been fully empirically tested in enhancing critical thinking skills. Future research must bridge basic themes like "augmented reality" with collaborative strategies to create a learning ecosystem that is not only interactive but also capable of systematically fostering critical capacities.

Augmented reality (AR) can be integrated into digital teaching materials to create immersive and interactive learning experiences. Augmented reality has the potential to foster critical thinking by offering students immersive, experiential learning opportunities that replicate authentic, real-world contexts. Investigating the effects of AR on critical thinking skills may reveal novel pedagogical approaches. A substantial body of research indicates that integrating AR into learning environments promotes critical thinking, deepens comprehension, and enhances learner motivation for continued study. [27]. When combined with pedagogical material, augmented reality technology produces innovative automated tools that significantly improve the efficacy and engagement of educational experiences within real-life settings. [28]. As an educational platform, augmented reality is progressively more attainable for young students, spanning both elementary and high school populations. Although existing studies suggest that AR technologies can positively influence learning, the field has yet to establish a clear understanding of their educational utility or to identify the particular circumstances under which this medium outperforms traditional or other digital learning tools. [29].

As digital teaching materials become more prevalent, ethical considerations regarding access, privacy, and bias must be addressed. Ensuring that digital materials are designed and implemented ethically is crucial for promoting fair and inclusive learning environments that support critical thinking development for all students. Virtual reality constitutes a valuable pedagogical resource for fostering critical thinking, as it enables immersive engagement with authentic, simulated contexts. By exploring how VR can be integrated with digital teaching materials, researchers can identify new avenues for creating engaging and effective learning experiences. Although the long-term educational implications of emerging technologies in this field are still uncertain, this is a question that demands the attention of those involved in educational research, teaching, and administration.[30].

5. Conclusion

The bibliometric analysis conducted from 2016 to 2026 demonstrates an exponential surge in global interest regarding digital teaching materials designed to enhance critical thinking, particularly following the pedagogical shifts of 2020. While the Dimensions database reveals a massive proliferation of scholarship—reaching its peak productivity in 2025—the citation impact remains anchored in seminal works from 2019, highlighting a temporal lag between the current volume of publication and the maturation of scholarly influence. Geographically, the field exhibits a unique dual-center dynamic: Indonesia emerges as a primary epicenter for productivity and collaborative bridging in Scopus, whereas the United States and the United Kingdom continue to serve as the dominant knowledge brokers in terms of citation impact and network strength.

Thematic mapping identifies a shift from traditional pedagogical frameworks toward an AI-driven information ecosystem, with "artificial intelligence" and "STEM" establishing themselves as transformative drivers for adaptive learning in elementary education. However, the research landscape remains notably fragmented, characterized by isolated "research silos" that lack the inter-institutional synergy required to synthesize disparate findings into a cohesive global framework. While "critical thinking" is now a consolidated global policy priority, the integration of niche technologies such as augmented reality and flipped learning into mainstream instructional strategies is still in its nascent stages, requiring more robust empirical validation.

This study thus furnishes a practical roadmap for educational stakeholders seeking to effectively manage the evolving demands of digital-era pedagogy. The findings underscore an urgent need for cross-border collaboration and a thematic reorientation that bridges the gap between technical foundations and higher-order thinking dispositions. To ensure the effectiveness of technology-mediated materials, future research must move beyond localized investigations toward a unified approach that balances digital innovation with the fundamental goal of fostering inquisitive, analytical, and open-minded learners in an increasingly automated world.

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The Effect of Metacognitive Guidance Assisted by Rich Mathematical Tasks on Mathematical Representation Ability in Terms of Students' Initial Ability

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Abstract. The low mathematical representation ability (MRA) of students necessitated innovative solutions. This study aimed to: 1) compare MRA of students receiving metacognitive guidance (MG) assisted by rich mathematical tasks (RMT) with students receiving conventional instruction; and 2) examine the interaction between MG and students' prior knowledge on their MRA. A quasi-experimental design with a 2 × 2 factorial arrangement was employed. Sample consisted of 56 fifth-grade students at SDK Ruteng VI that selected through simple random sampling technique. Data were collected using test and analyzed by using two-way ANOVA. The findings revealed that the MRA of students utilizing MG was significantly higher than those without MG ($p = 0.00$). Furthermore, no significant interaction was found between the implementation of the MG model and students' prior knowledge ($p = 0.305$). Thus, MG effectively enhanced students' MRA regardless of their prior knowledge, providing equitable benefits for both high- and low-ability students.

Keywords: mathematics representation, metacognitive guidance, rich mathematical task

1 Introduction

Mathematical representation abilities are increasingly recognized as critical in students' overall understanding of mathematics; however, the capabilities of Indonesian students in this area remain a concern in both national and international assessments. Reports from PISA and TIMSS have highlighted significant difficulties among students in constructing meaningful mathematical representations, whether symbolic, graphical, or verbal in nature[1]. Specifically in Manggarai Regency (including Langke Rembong District), East Nusa Tenggara Province, the 2025 Education Report indicates that elementary students' numeracy skills remain at a moderate level[2]. At SDI Ruteng VI in particular, more than 50% of students have not yet reached the minimum competency threshold for numeracy. This indicates that students' basic mathematical skills are generally limited to fundamental computational abilities and the ability to solve simple, routine mathematical problems. They have not yet demonstrated the capacity to apply mathematical knowledge in more varied contexts, nor to reason in solving complex and non-routine problems based on the mathematical concepts they possess.

These limitations suggest that current mathematics instruction strategies may be insufficient in promoting reflective thinking and the flexible transformation of mathematical ideas. Numerous studies point to the need for instructional practices that foster critical engagement and flexibility in students' reasoning and conceptual understanding[3], [4]. These persistent difficulties indicate structural weaknesses in prevailing instructional practices, which remain largely teacher-centered and focused on procedural accuracy[5]. Research has illustrated that when

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mathematical representations are presented in isolation, it hinders the establishment of conceptual connections among symbolic, graphical, and verbal forms of mathematics[6]. Therefore, enhancing students' metacognitive skills through targeted strategies, such as metacognitive guidance, offers a promising approach to support deeper understanding of mathematics, especially through richer tasks that encourage various representations.

The concept of mathematical representation is crucial in the context of elementary education, as it allows students to develop a diverse toolbox for understanding and solving mathematical problems. According to Sormin & Ratuanik[7], mathematical representation involves translating real-world scenarios into mathematical models, generating graphical illustrations, and articulating mathematical concepts through various modes of communication, such as verbal and written expressions. These representations play an integral role in engaging students with mathematical content, as they foster a deeper understanding and facilitate the application of mathematics in everyday situations. For elementary students, effective mathematical representation is linked to the ability to identify relevant mathematical concepts, comprehend the connections between different representations, and apply these skills in problem-solving contexts. Indicators of mathematical representation ability among elementary students can include their proficiency in creating visual models and translating calculations into graphical formats.

Mathematical representation is a central construct in elementary mathematics learning because it mediates how students perceive, process, and apply mathematical ideas. However, from a cognitive perspective, constructing and transforming representations imposes substantial cognitive load on elementary students, particularly in the domain of plane geometry. Learners are required to simultaneously process visual-spatial information, symbolic notation, and verbal explanations, which can strain working memory when instructional support is limited[8]. In plane geometry, these demands are intensified by the need to coordinate abstract properties of shapes, spatial relationships, and visual transformations. Many students struggle not because of a lack of procedural knowledge, but due to difficulties in managing intrinsic and extraneous cognitive load when linking diagrams, symbols, and verbal reasoning[9]. This challenge underscores the importance of instructional approaches that deliberately support representational processing, as unstructured tasks may overwhelm students’ cognitive resources and hinder meaningful geometric understanding.

Among many innovative strategies, metacognitive guidance, is one that offers a promising approach to support deeper understanding of mathematics, especially through richer tasks that encourage various representations. As Mckevett et al.[10] point out, students' difficulties in utilizing mathematical representation can be mitigated through targeted instructional frameworks that embed metacognitive prompts. These prompts foster self-regulation and reflective practices, enabling students to become more aware of their cognitive processes during problem-solving tasks. For instance, present studies demonstrate that students who are guided to reflect on their mathematical reasoning exhibit improved performance in representation tasks at the elementary level. Additionally, students' engagement with multiple forms of representation—including symbolic, graphical, and verbal—has been shown to enhance their overall mathematical proficiency. This finding aligns with the work of Mainali[11], who highlighted the critical role of various forms of representation in teaching and learning mathematics, asserting that utilizing multiple modes significantly benefits students' learning processes. Furthermore, Jamaludin[12] provided evidence that contextual teaching materials

developed using a systematic approach improve students' mathematical representation abilities, indicating the positive impact of structured educational environments. Therefore, fostering an educational environment that emphasizes mathematical representation along with the necessary metacognitive skills can significantly improve the mathematical outcomes of elementary students, providing them with the foundational tools needed for future academic success.

Given these empirical insights on the benefits of metacognitive support for strengthening students' use of mathematical representations, a more structured instructional approach—such as metacognitive guidance—becomes essential to systematically cultivate the cognitive awareness needed for effective mathematical learning. Metacognitive guidance is a vital pedagogical approach that emphasizes the enhancement of students' self-awareness and regulation regarding their cognitive processes. It involves guiding students through systematic steps aimed at improving their planning, monitoring, and evaluation strategies when approaching learning tasks, particularly in mathematics[13], [14].

In the planning phase, students identify relevant information and select representations that align with problem demands. Monitoring involves checking coherence among diagrams, symbols, and verbal explanations and revising them when inconsistencies appear. Evaluation requires judging whether representations meaningfully support problem solving rather than merely yielding correct results. These processes are especially important in elementary geometry, where frequent shifts between visual, symbolic, and verbal forms occur. Without explicit prompts, students may engage mechanically. Research indicates that embedded metacognitive prompts can enhance representational coherence and support adaptive reasoning across different initial ability levels [15].

Furthermore, this approach entails several critical components: first, explicit instruction on metacognitive strategies, such as self-questioning and reflection, should be integrated into the curriculum. Second, educators must model these strategies in real-world problem-solving contexts, enabling students to observe and understand how to apply them effectively. Third, promoting active student engagement through group discussions and collaborative tasks facilitates peer learning and the sharing of metacognitive strategies. Lastly, comprehensive feedback and self-reflection opportunities allow students to assess their cognitive approaches and adjust their strategies accordingly[16]. This structured use of metacognitive guidance not only boosts students' mathematical problem-solving capabilities but also fosters a culture of autonomous learning, where students take ownership of their educational journeys and develop critical thinking skills crucial for their academic success.

The effectiveness of metacognitive guidance in enhancing students' mathematical representation abilities can be significantly amplified when coupled with rich mathematical tasks. Rich mathematical tasks are characterized by their complexity, requiring students to engage in deeper levels of thinking, thereby promoting exploration and application of various mathematical concepts. These tasks push students beyond rote memorization and encourage them to deploy metacognitive strategies such as planning, monitoring, and evaluating their approaches in real-time. A study by Cahyani et al. [17] found that when students are faced with tasks that necessitate strategic problem-solving and critical thinking, their engagement with metacognitive strategies improves, resulting in better mathematical reflective thinking. Moreover, integrating rich tasks into the educational framework compels students to articulate their reasoning and processes, fostering a deeper understanding of mathematical representations and enhancing their ability to

connect theory with practical applications. This merging of metacognitive guidance with rich tasks creates an environment conducive to developing critical problem-solving skills necessary for success in mathematics.

The concept of a mathematical rich task involves engaging students in high-level cognitive processes, encouraging them to explore concepts through inquiry and problem-solving rather than mere procedural application. As indicated by Sasson & Tifferet[18], such tasks should be designed to stimulate critical thinking, allowing students to analyze, synthesize, and evaluate mathematical information in ways that are both meaningful and relevant. Key characteristics of rich mathematical tasks include their open-ended nature, allowing for multiple solution strategies, and their connection to real-world contexts that enhance students' motivation and interest. Furthermore, these tasks are often designed to be collaborative, fostering discussion and reflection among peers, which inherently supports the metacognitive process by allowing learners to articulate their thought processes while learning from each other. The integration of rich mathematical tasks within a metacognitive framework not only empowers students to take ownership of their learning but also equips them with essential skills for critical thinking, ultimately resulting in improved mathematical representation and problem-solving capabilities.

Moreover, students' initial ability plays a critical role in shaping the effectiveness of metacognitive guidance within rich mathematical tasks and warrants careful theoretical examination. From the perspective of differentiated instruction, students' initial ability is theorized to moderate the effectiveness of instructional approaches, as learners with different readiness levels are expected to respond differently to the same learning design[19], [20]. Differentiation theory assumes that instructional supports, task complexity, and scaffolding should be adjusted to students' prior knowledge to optimize learning outcomes[21], [22]. Consequently, when metacognitive guidance is implemented uniformly, differentiated instruction would predict a significant interaction effect, particularly in representation-intensive mathematical tasks where cognitive demands vary substantially across learners [14].

However, the absence of a significant interaction between instructional model and students' initial ability in this study stands in contrast to the assumptions of differentiated instruction, which theoretically predict differential learning effects based on learners' readiness levels[23]. The relatively uniform effects observed in this study suggest an alternative explanatory mechanism that metacognitive guidance embedded within rich mathematical tasks may function as an inclusive design approach rather than an ability-based adaptation. The open-ended and multi-representational nature of rich tasks provides flexible entry points that allow students with diverse initial abilities to engage in meaningful sense-making, while metacognitive prompts scaffold regulation processes without requiring explicit differentiation [24], [25]. This finding positions the present study as a theoretical counterpoint to strict differentiation assumptions and highlights a need for further empirical investigation into whether adaptive task design combined with metacognitive support can systematically mitigate ability-based learning disparities in elementary mathematical representation[26], [27].

Against this theoretical background, the primary focus of this research is to examine how metacognitive guidance embedded in rich mathematical tasks influences students' mathematical representation ability when viewed in relation to their initial ability levels. Although prior studies have documented the separate contributions of metacognitive support and task richness to mathematical learning, empirical investigations analyzing their interaction with students'

initial ability, particularly within elementary geometry, remain limited. Existing research in this area tends to emphasize general achievement outcomes or focus on higher-grade mathematics, while neglecting how students with differing entry-level competencies construct and transform geometric representations[28]. Consequently, there is insufficient evidence explaining whether metacognitive guidance benefits students uniformly or differentially across ability levels. Addressing this gap is essential, as elementary geometry relies heavily on representational reasoning, and understanding this interaction can inform more equitable and responsive instructional designs in mathematics education contexts such as Indonesia[29]. This research contributes to the existing body of literature by offering an innovative perspective on the intersection of metacognition and mathematics education, particularly in contexts characterized by diverse student demographics. The novelty of this investigation lies in its emphasis on integrating metacognitive guidance with rich mathematical tasks, which is currently underexplored within existing research. By shedding light on this interdisciplinary approach, the study aims to establish a new pedagogical framework that can serve as a model for improving mathematics instruction and learning outcomes across various educational settings[7].

The expected outcomes of this research include improved mathematical representation abilities among students and heightened awareness and application of metacognitive strategies in their problem-solving processes. It is anticipated that through targeted interventions, students will be better equipped to approach complex mathematical tasks with confidence and competence, potentially leading to an overall enhancement in their academic and cognitive development. Additionally, findings from Rajagukguk et al.[30] demonstrate how metacognitive strategies may play a crucial role in mathematics learning, suggesting that students who engage in these strategies are likely to achieve better academic outcomes. Moreover, this research aims to stimulate further discussion and investigation into the critical role of metacognition in mathematics education, especially in light of increasingly demanding educational standards worldwide, as evidenced by Cahyani et al.[17]. The exploration of the relationship between metacognitive guidance, rich mathematical tasks, and mathematical representation abilities presents a vital avenue for enhancing educational practices. This research seeks to fill existing gaps in the literature by providing empirical evidence and theoretical insights that can inform innovative approaches to mathematics teaching and learning[31]. By situating this investigation within the broader context of global educational trends and challenges, it underscores the significance of adaptive pedagogical strategies that cater to the diverse needs of learners in mathematics, ultimately advocating for a future where all students can achieve their full potential in this critical area of study.

2 Method

This study is a quantitative research employing a quasi-experimental design with a 2x2 factorial structure in the form of a pretest-posttest control group design. The research population comprised fifth-grade students at SDK Ruteng VI, from which two classes were purposively selected to minimize selection bias. In addition to equivalence in mathematics report card scores, the selection considered similarities in curriculum implementation, instructional time, teacher qualifications, and classroom learning conditions. Preliminary discussions with teachers and a review of prior assessment records indicated comparable learning experiences across the two classes. These criteria were applied to ensure that differences in outcomes could be more

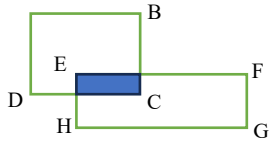
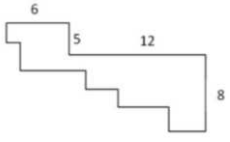
confidently attributed to the instructional intervention rather than pre-existing contextual or instructional disparities.

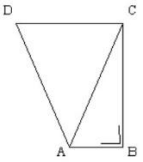
The sample comprised 56 fifth-grade students of SDK Ruteng VI, with class VA (29 students) serving as the experimental group and class VB (27 students) as the control group. The experimental group was taught using metacognitive guidance supported by rich mathematical tasks, whereas the control group received conventional instruction aligned with the teacher's regular practices. To ensure instructional fidelity, the control group lessons were monitored through classroom observations and lesson plan reviews, confirming the absence of explicit metacognitive prompts or rich task structures. This monitoring helped ensure that observed differences were attributable to the intervention rather than unintended instructional overlap. The instructional intervention was carried out over ten sessions, during which the experimental group was provided explicit metacognitive guidance across three phases (planning, monitoring, and reflection) concurrently with exploration of open-ended mathematical tasks.

Prior to the intervention, students' initial mathematical ability was determined from their first semester mathematics grades in the 2024/2025 academic year, which were used to categorize students into high and low initial ability groups based on the median score. The independent variable in this study was the instructional model (metacognitive guidance with rich mathematical tasks vs. conventional instruction), the moderating variable was initial ability (high vs. low), and the dependent variable was students' mathematical representation ability. Instruction in the experimental class began with activation of prior knowledge and strategic planning, followed by exploration of mathematical tasks and concluded with reflective discussions to evaluate the representation processes used. In contrast, the control class engaged in expository learning consisting of concept explanations, worked examples, and direct practice problems.

Data collection was conducted through a written test comprising five essay questions developed by the research team to assess students' mathematical representation abilities (MRA) in the topic of plane geometry, covering verbal-visual, visual-symbolic, and visual-verbal-symbolic aspects.

Table 1. Test Items of MRA

Item No	Aspect of RMA	Test Items
1	Verbal - visual	A father intends to construct a rectangular frame by bending a wire with a total length of 18 decimeters. Determine the dimensions of the length and width of the frame so that the enclosed area is maximized, with no wire remaining unused.
2	Visual - simbolik	Shown alongside are a square ABCD and a rectangle EFGH. If the area of the unshaded region is 68 cm², determine the area of the shaded region. 
3		Observe the following plane figure. The lengths of its sides are given in centimeters. Determine the perimeter of the figure. 

4	Verbal - visual - simbolik	In the following figure, triangle ABC is a right triangle with the right angle at B. Triangle ACD is an isosceles triangle (AC = AD) with an area of 20 square units. Determine the area of trapezoid ABCD in square units.	
5		A rectangular garden has a length of 15 meters and a width of 12 meters. A path with a width of 2 meters is constructed around the garden and will be paved with tiles. What is the area of the tiled path?	

After the intervention, all students completed a posttest to measure learning outcomes. Data were analyzed using descriptive and inferential statistics (two-way ANOVA) with SPSS 22 to evaluate the main effects and interactions between instructional model and initial ability on mathematical representation ability. All research procedures adhered to ethical principles, including obtaining approval from the school and ensuring the confidentiality of participants' identities.

3 Results and Discussion

Prior to conducting the study, the researchers established students' initial mathematical ability (IMA) as a fundamental basis in designing the experiment to ensure internal validity and the equitable distribution of treatments. IMA is defined as the students' level of mastery over mathematical material before the intervention, which in the context of this research was determined through scores from the even semester's daily mathematics assessments in the 2024/2025 academic year. These scores were selected because they authentically and contextually reflect students' academic achievement and originate from regular classroom learning activities.

Based on these scores, students were classified into two ability categories (high and low) in order to ensure that both the experimental and control groups had a balanced distribution of initial ability. This grouping aimed to control variables that might affect the treatment outcomes, as well as to facilitate the researchers in interpreting the effectiveness of the intervention implemented.

Table 2. Classification of Initial Mathematical Ability (IMA)

Groups	Mean	Range	Category	
			High (≥ mean score)	Low (< mean score)
Experiment	74,12	28	12	17
Control	75,29	25	15	12

The results of descriptive statistical analysis in this study provide an overview of the distribution of students' mathematical representation abilities in both the experimental and control groups. The analyzed statistics include the mean, standard deviation, maximum, and minimum values. The higher mean score achieved by the experimental group indicates that the instructional intervention contributed positively to students' mathematical representation ability. More importantly, the smaller standard deviation reflects a narrower spread of achievement, suggesting that the treatment supported more balanced learning outcomes among students. This

pattern implies that lower-achieving students benefited substantially from the structured metacognitive guidance, reducing performance disparities without diminishing gains among higher-achieving peers. Qualitatively, the intervention appears to have promoted more equitable engagement with representational tasks, leading to a more uniform distribution of learning gains across the group. These data serve as the preliminary basis for subsequent inferential analysis.

Table 3. Results of Descriptive Statistical Analysis

Groups	Mean		Total	Std. Deviation		Total
	High IMA	Low IMA		High IMA	Low IMA	
Experiment	76.9792	70.4412	73.1466	7.14020	7.14020	8.07070
Control	58.9500	48.6292	54.3630	7.16340	3.45513	7.74559

The results of the normality and homogeneity tests in this study indicate that the analyzed data meet the basic assumptions required for parametric statistical testing. The normality test, conducted using the Kolmogorov-Smirnov test, showed that the data in both the experimental and control groups were normally distributed, as evidenced by significance values ($p > 0.05$). Furthermore, the homogeneity of variance test using Levene's Test produced significance values greater than 0.05, indicating that the variances of the two groups were homogeneous. These findings suggest that both groups had comparable data distributions and consistent variance, thereby allowing for valid subsequent analyses such as t-tests or ANOVA to examine differences between the groups.

Table 4. Results of Normality and Homogeneity Tests

Tests of Normality				Levene's Test of Equality of Error Variances[a]			
	Statistic	df	Sig.	F	df1	df2	Sig.
Standardized Residual for RMA	.107	56	.167	1.969	3	52	.130
				Design: Intercept + Kelas + IMA + Kelas * IMA			

The results of hypothesis testing using two-way ANOVA in this study revealed a significant partial effect of the treatment on students' mathematical representation abilities. The two-way ANOVA analysis yielded a significance value (p-value) of less than 0.05 for the treatment factor, indicating a significant difference between the experimental and control groups. In addition, the significance value for the initial mathematical ability factor was also below 0.05, demonstrating that differences in initial ability levels influenced students' learning outcomes. However, the interaction test between the instructional model and students' initial ability resulted in a significance value greater than 0.05, indicating that there was no significant interaction between the two variables with respect to students' mathematical representation abilities. Thus, the effectiveness of the instructional model applied was not affected by differences in students' initial abilities. This suggests that the model had a relatively uniform impact across all categories of initial ability—high, moderate, and low—making it applicable to all students without the need for differentiated treatment based on initial ability.

Table 5. Results of Hypothesis Testing

Source	Type III Sum of	df	Mean Square	F	Sig.

	Squares				
Intercept	222567.936	1	222567.936	4877.501	.000
Groups	5433.106	1	5433.106	119.065	.000
IMA	972.833	1	972.833	21.319	.000
Groups * IMA	48.980	1	48.980	1.073	.305

The findings from this study offer essential insights into the effects of the implemented instructional model on enhancing students' mathematical representation capabilities. The two-way ANOVA analysis revealed that the treatment factor had a statistically significant effect on students' mathematical representation skills, with a p-value less than 0.05. This indicates that the metacognitive guidance adopted in the experimental group outperformed traditional teaching methods found in the control group. Moreover, the significant p-value associated with initial mathematical ability underscores the critical role of a student's starting level of competence in their learning process. This is consistent with existing literature indicating that prior knowledge significantly influences current learning outcomes, particularly in mathematics[1].

However, an intriguing aspect of the results is the non-significant interaction effect between the treatment and students' initial ability levels with a p-value greater than 0.05. The absence of a significant interaction between the instructional treatment and students' initial ability levels suggests that metacognitive guidance assisted by rich mathematical tasks functioned consistently across diverse learner profiles. One plausible explanation is the open-ended structure of rich mathematical tasks, which allows for multiple solution pathways and varying depths of engagement. Such tasks may provide natural entry points for students with lower initial ability while simultaneously challenging higher-ability students to extend their reasoning[32]. As a result, differences in prior competence may have been moderated by the flexibility inherent in the task design.

Furthermore, the metacognitive guidance embedded within the instruction likely supported all students in regulating their learning processes, reducing reliance on prior knowledge. Rather than tailoring content explicitly by ability level, the guidance emphasized planning, monitoring, and evaluation strategies that are broadly applicable. This approach may have minimized performance gaps by helping students engage meaningfully with representations at their own level[28]. Consequently, the non-significant interaction does not negate differentiation theory but suggests that task openness and cognitive regulation can implicitly address learner diversity within a unified instructional framework.

In relation to existing literature, the results align well with studies advocating for enriched instructional methods over traditional practices. Research has demonstrated that strategies such as problem-based learning, inquiry-based learning, and integrative approaches yield positive outcomes in students' mathematical understanding and skills[33], [34]. Students exposed to richer contextual tasks showed greater engagement and comprehension in mathematics than their peers receiving conventional instruction[35]. This finding is also supported by empirical studies indicating that instructional models integrating reflective prompts and open-ended tasks can enhance representational understanding compared to conventional, procedure-oriented instruction[36]. Contemporary research in elementary mathematics has shown that students exposed to metacognitive scaffolding demonstrate improved abilities to construct, interpret, and connect multiple representations, suggesting consistency with current instructional trends[37].

Further reinforcement arises when comparing this study with investigations contrasting enriched learning environments with traditional teaching approaches. Studies in similar elementary settings have indicated that rich tasks promote active engagement and deeper cognitive processing, leading to improved performance in representation-based assessments[38]. For example, Arianto[39] highlights the positive effects of metacognitive strategies on problem-solving abilities in elementary students, reinforcing how enriched instructional methods bolster cognitive engagement. Furthermore, research by Jumanto & Mustofa[38] emphasizes that metacognitive-based teaching materials significantly affect learning outcomes, corroborating the notion that rich, contextual tasks enhance student performance in mathematics. The alignment of these outcomes implies that the effectiveness noted in this study is not merely context-specific but reflects a broader trend identified in recent literature, thereby strengthening the external validity of the findings.

Nonetheless, discrepancies in research advocating personalized and differentiated strategies based on students' initial aptitude present a contrasting perspective. These differences may arise from variations in sample demographics, instructional contexts, or research methodologies. Several contemporary studies emphasize that personalized and differentiated instruction, particularly for students with lower initial ability, leads to stronger learning gains when task difficulty and scaffolding are explicitly adjusted[40]. In contrast, the present study did not implement formal differentiation based on initial aptitude; instead, the use of rich mathematical tasks combined with metacognitive guidance provided flexible entry points and multiple solution pathways, potentially reducing the need for explicit personalization. This distinction suggests that discrepancies across studies may be explained by differing approaches to addressing learner variability, either through structured differentiation or adaptable task design[41].

Moreover, recent comparative research indicates that instructional context plays a critical role in determining the effectiveness of differentiation. Studies conducted in classrooms with limited instructional time or large student–teacher ratios often report stronger effects for explicit differentiation. In contrast, settings that emphasize reflective learning and open-ended tasks show more uniform benefits across ability levels. The current findings reinforce this latter perspective, indicating that well-designed instructional models can implicitly accommodate learner diversity while maintaining consistent learning outcomes[42].

The theoretical implications of the study's outcomes can be understood through relevant educational theories such as constructivism and metacognitive learning theory. Constructivist theories suggest that learners construct knowledge through active engagement and reflection, with the integration of metacognitive strategies enhancing this process[43]. The combination of metacognitive guidance and rich mathematical tasks promotes students' reflection on their learning processes, facilitating deeper understanding and retention of mathematical concepts. Furthermore, the absence of a significant interaction with initial ability levels suggests that the model possesses universal applicability across diverse student populations, reinforcing the potential for broad implementation to provide equitable access to quality mathematics education[1].

From a practical standpoint, the results have significant implications for mathematics educators and institutions. Given the instructional model's effectiveness across differing ability levels, educators should adopt this approach broadly within their teaching strategies, recognizing that

all students can benefit from a rich learning environment[44]. This finding aligns with the trend towards inclusive teaching practices, moving away from tracking or differentiating instruction solely based on initial competencies. Instead, the focus should be on creating opportunities for all students to engage analytically with mathematical concepts, fostering a collaborative classroom atmosphere where diverse learners thrive[45].

Moreover, the successful implementation of metacognitive guidance underlines the importance of teacher training in adopting innovative pedagogical practices. Educators require support and ongoing professional development to effectively employ strategies that promote metacognitive engagement and task-rich learning environments. Collaborative initiatives between education authorities and institutions can enhance teaching quality, ensuring educators are equipped for modern classrooms filled with diverse learners, as evidenced by the ongoing necessity for adaptive teaching methods[46].

In terms of future research directions, several avenues emerge from this investigation. Future studies should replicate these findings in different educational settings with larger and more diverse samples to verify the stability of results across various contexts. Investigating additional factors, such as motivational variables and students' emotional responses in learning, can provide valuable insights into their interactions with instructional models and inform effective teaching practices[47]. Furthermore, exploring how technological advancements and digital learning tools can complement metacognitive strategies and rich tasks presents a significant opportunity for future educational research.

The research findings underscore the effectiveness of a metacognitive guidance and rich mathematical task model in enhancing students' mathematical representation skills. The inclusive nature of this instructional model, which accommodates students at varying competency levels, suggests significant implications for mathematics education, advocating for shifts towards inclusive practices and continuous professional growth among educators. The potential for further advancement in this research area encourages ongoing inquiry into the multifaceted nature of mathematics learning, ultimately aiming to foster a more equitable and effective educational landscape for all students.

4 Conclusion

The findings indicate that metacognitive guidance integrated with rich mathematical tasks contributes meaningfully to the development of students' mathematical representation ability in heterogeneous elementary classrooms. For broader implementation, teacher professional development should move beyond general training and be organized into focused modules that address the design of multi-representational tasks, the practical use of metacognitive prompts during instruction, and the interpretation of formative assessment evidence to support students' regulation processes. Embedding these modules within lesson study and instructional coaching frameworks may support systematic reflection, peer-based feedback, and closer monitoring of instructional fidelity, thereby increasing the sustainability of classroom implementation.

This study also recognizes the relatively small sample size as a primary methodological limitation, as it may reduce statistical power and necessitate caution when interpreting the non-significant interaction between instructional model and students' initial ability. Moreover, the focus on a single school context restricts broader generalization. Future research should

therefore replicate this model with larger and more diverse samples. Longitudinal designs are particularly needed to examine whether improvements in representation ability persist over time and extend to other mathematical domains. Additional studies may also investigate how different configurations of task complexity and metacognitive scaffolding shape learning outcomes across varied instructional settings.

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Catechesis as a Pastoral Strategy for Faith Formation in a Rural Catholic Community in Indonesia

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Abstract. This study examines catechesis as a pastoral strategy for faith formation in a rural Catholic community in Indonesia, focusing on its concrete effectiveness amid real pastoral challenges. Using a qualitative-descriptive approach, data were collected through semi-structured interviews, participant observation, and document analysis involving parishioners, catechists, and pastoral leaders. The findings indicate that catechesis generates deep personal and relational transformation among actively engaged participants, strengthening doctrinal understanding, moral discernment, and communal responsibility. However, its impact remains uneven, operating more intensively at a qualitative level than expansively at a communal scale due to structural constraints, limited catechist resources, economic demands, and low participation rates. The study further shows that catechesis in this context is not merely universal but deeply contextual, integrating local cultural practices, kinship values, and communal storytelling into its pedagogical process. In response to digital challenges, catechesis emphasizes embodied encounters and dialogical learning rather than technological sophistication. Rather than confirming normative catechetical ideals, this research offers an empirically grounded portrait of catechesis as a fragile yet meaningful pastoral practice whose transformative potential depends on specific relational, cultural, and structural conditions.

Keywords: Catechesis; Faith Formation; Pastoral Strategy; Rural Catholic Community; Contextual Theology; Digital Challenges

1 Introduction

Faith formation lies at the heart of the Catholic Church's evangelizing mission, rooted in Christ's command to "make disciples of all nations" (Mt 28:19). Within this mission, catechesis has long been recognized as a fundamental pastoral practice that nurtures believers' intellectual, spiritual, and moral development. According to *Catechesi Tradendae*, catechesis is not merely the transmission of doctrinal content but a holistic process aimed at forming mature Christian disciples [1]. Similarly, the *General Directory for Catechesis* emphasizes that catechesis constitutes an integral dimension of the Church's evangelizing activity, enabling believers to live out their faith with personal conviction and social responsibility [2].

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In the Indonesian Catholic context, particularly in rural areas, catechesis plays a decisive role in sustaining faith life amid limited pastoral resources. Rural Catholic communities often function as small, semi-autonomous ecclesial units under the supervision of a central parish, commonly referred to as *stations*. These communities are typically characterized by strong interpersonal bonds, shared religious practices, and collective responsibility for spiritual growth. However, catechesis in such contexts is frequently perceived as mere religious instruction rather than a transformative encounter with Christ and the Christian community [3]. This instrumental understanding risks reducing catechesis to cognitive learning alone, neglecting its formative, relational, and existential dimensions. As noted by Hardawiryana and Wignyanta, effective catechesis must engage the whole person—mind, heart, and action—if it is to produce authentic Christian witness [4,5].

Contemporary pastoral realities further complicate faith formation processes. Global secularization, media saturation, and shifting sociocultural patterns increasingly shape how individuals internalize and express their religious beliefs. Pope Francis highlights that evangelization today must address these complex dynamics by fostering personal encounter, dialogue, and missionary engagement rather than mere doctrinal transmission [6]. Recent studies on religious education confirm that younger generations, in particular, engage more meaningfully through experiential, dialogical, and visually mediated learning processes than through traditional lecture-based instruction [7,8]. Consequently, pastoral strategies must evolve by integrating interactive pedagogies, community-based reflection, and contextual relevance. The *Directory for Catechesis* further calls for innovative catechetical models that are kerygmatic, participatory, and inculturated, ensuring that faith formation responds to concrete local realities while remaining faithful to the Gospel message [9].

Within this broader framework, this study focuses on a rural Catholic community in Indonesia specially in Labe Stasion community of Santa Teresa of Calcutta Parish, as a microcosm of these pastoral challenges and opportunities. Despite its strong communal identity, catechetical participation remains inconsistent due to time constraints, a shortage of trained catechists, and limited pedagogical creativity. Nevertheless, pastoral theology suggests that even small, lay-led communities can become powerful agents of spiritual transformation when doctrinal depth is integrated with lived experience [10,11]. This setting therefore provides fertile ground for exploring how contextualized catechesis can deepen faith, strengthen communal solidarity, and promote ethical transformation.

Empirical and theological scholarship increasingly affirms that catechesis is most effective when embedded within relational, participatory, and socially engaged frameworks. Studies indicate that integrative models—such as family catechesis, digital learning platforms, and service-based formation—significantly enhance spiritual maturity and social commitment [12,13]. These approaches embody what Pope Francis describes as a “missionary dynamism” that transforms catechesis from passive instruction into an active process of encounter, dialogue, and conversion [6].

Accordingly, this study investigates catechesis as a pastoral strategy for faith formation in a rural Catholic community in Indonesia. It seeks to analyze how catechesis contributes to doctrinal understanding, spiritual deepening, and communal participation, while also identifying structural and cultural obstacles that hinder its effectiveness. By situating this

research within its specific socio-religious context, the study contributes to the growing body of scholarship on contextual catechesis and practical theology. Ultimately, it argues that catechesis, when reimagined as a participatory and transformative process, becomes not merely a means of religious instruction but a lived journey of faith in communion and mission [14,15].

2 Methodology

This study employs a qualitative-descriptive design to examine catechesis as a pastoral strategy for faith formation within a rural Catholic community such as in Labe Station community of Santa Teresa of Calcutta Parish, Indonesia. A qualitative approach is particularly appropriate for this inquiry because it allows for an in-depth exploration of lived religious experiences, meanings, and social practices as they are interpreted by community members themselves [16]. Rather than aiming for statistical generalization, this research seeks to produce contextually grounded insights into how catechesis is understood, experienced, and enacted in everyday ecclesial life. Such an approach is especially relevant in pastoral and theological research, where faith practices are deeply embedded in relational, cultural, and symbolic dimensions of human experience.

Given the normative and faith-based nature of the research setting, particular attention was given to maintaining analytical objectivity and avoiding a merely appreciative or pastoral-reporting tone. To this end, the study adopted a reflexive qualitative stance, which emphasizes critical awareness of the researcher's positionality, assumptions, and potential interpretive biases [17]. Reflexive field notes were maintained throughout the research process to document methodological decisions, emotional responses, and emerging presuppositions. This practice enabled a continuous differentiation between empirical description and theological or pastoral evaluation. Furthermore, the analysis was guided by systematic coding procedures rather than intuitive interpretation, following the reflexive thematic analysis model proposed by Braun and Clarke [18]. This ensured that findings emerged inductively from participants' narratives rather than being imposed by predefined theological categories.

To strengthen analytical rigor and credibility, methodological triangulation was applied by integrating data from semi-structured interviews, participant observation, and parish document analysis [19]. This multi-source strategy enabled cross-validation of emerging themes and minimized the risk of idealized or one-dimensional interpretations. In addition, member checking was conducted by sharing preliminary findings with selected participants, allowing them to verify the accuracy of interpretations and to clarify possible misunderstandings [20]. This process enhanced the trustworthiness of the data and reinforced the study's interpretive transparency.

Participants were selected through purposive sampling, which is commonly used in qualitative research to identify information-rich cases relevant to the research objectives [21]. The inclusion criteria were designed to ensure diversity of perspectives, roles, and levels of involvement in catechetical activities. Parishioners were included if they had actively participated in catechetical or parish activities for at least two years, catechists were selected based on their direct involvement in organizing and facilitating catechetical programs, and pastoral leaders were chosen due to their formal leadership roles within the parish structure. A total of twenty informants participated in the study, consisting of ten parishioners, six catechists, and four

pastoral leaders. Although qualitative research does not seek statistical representativeness, this distribution enabled a sufficiently broad range of experiences and viewpoints, thereby strengthening the analytical depth and internal coherence of the findings [21].

Data were collected over a three-month period using semi-structured interviews, participant observation, and document analysis. The semi-structured interviews allowed participants to articulate their experiences, motivations, challenges, and perceived transformations related to catechesis in their own words, while maintaining thematic consistency across interviews [16]. Participant observation was conducted during catechetical sessions, liturgical celebrations, and communal gatherings, enabling the researcher to examine not only verbal narratives but also embodied practices, social interactions, and communal dynamics that shape faith formation [22]. Relevant parish documents, including catechetical schedules, pastoral reports, and program outlines, were also analyzed to provide institutional and contextual background.

Data analysis followed the stages of reflexive thematic analysis, involving familiarization with the data, initial coding, theme construction, review, refinement, and final interpretation [18]. Coding was conducted inductively, allowing patterns to emerge from the data rather than from predetermined theoretical frameworks. An audit trail was maintained throughout the analytical process, documenting coding decisions, theme revisions, and interpretive shifts. This procedure enhanced the dependability and transparency of the findings and enabled readers to trace the logic of the analytical process [20]. The interpretation of themes was informed by the framework of practical theology, which integrates empirical description with theological reflection while preserving methodological accountability [23].

Ethical considerations were carefully observed throughout the study. All participants provided informed consent and were assured of confidentiality and anonymity. Pseudonyms were used to protect participants' identities, and all data were stored securely. Given the sensitivity of religious beliefs and personal faith narratives, interviews were conducted with particular attention to emotional safety, cultural respect, and pastoral sensitivity. The study adhered to internationally recognized ethical principles for qualitative research [24].

3 Results and Discussion

The findings of this study indicate that catechesis in the Labe station, rural Catholic community, contributes meaningfully to the personal faith development of participants, particularly in terms of doctrinal understanding, spiritual awareness, and moral reflection. However, rather than presenting these outcomes as universal or abstract, the data reveal that these effects occur in specific, localized, and uneven ways. Participants who attended catechetical sessions regularly reported a deeper understanding of biblical narratives, a clearer sense of Christian moral responsibility, and increased confidence in articulating their faith within family and community settings. This supports the Church's vision of catechesis as a formative rather than merely instructional process [1,6]. Yet, the impact of catechesis in Labe station must be understood as *qualitatively intensive but quantitatively limited*.

Several informants emphasized that catechesis helped them interpret everyday struggles—such as poverty, family conflict, and social tensions—through a faith-based lens. For example, one middle-aged participant described how scriptural reflections on forgiveness influenced her

decision to reconcile with a sibling after years of estrangement. Another informant explained that catechetical discussions on Christian stewardship encouraged him to reduce alcohol consumption and redirect household spending toward children's education. These narratives demonstrate that faith formation in Labe is not abstract but embedded in concrete ethical decisions and relational practices. Such transformations resonate with empirical findings that effective catechesis functions as a process of moral and relational reorientation rather than mere cognitive acquisition [12,13].

Nevertheless, the findings also reveal a structural paradox: although catechesis appears transformative for those who actively participate, overall participation remains low. The data suggest that catechesis in Labe is effective primarily on an individual and small-group level but has not yet succeeded as a broadly internalized communal habitus. Several factors contribute to this limitation, including agricultural work schedules, seasonal migration, and competing economic demands. This aligns with research showing that rural religious communities often experience strong spiritual intensity among core members while struggling with wider participation due to structural constraints [21].

This distinction between *qualitative depth* and *quantitative reach* is crucial. Catechesis in Labe cannot yet be described as a community-wide formation system but rather as a formative space for a committed minority. Such a pattern corresponds to Osmer's observation that pastoral initiatives often generate deep transformation among a limited group before expanding structurally [23]. Thus, the apparent contradiction does not invalidate catechesis as a pastoral strategy but reveals its current developmental stage. The challenge lies not in its formative power but in its limited accessibility and institutional support.

While Labe is a rural community with limited internet infrastructure, digital technologies—especially smartphones and social media—have increasingly shaped daily life, particularly among younger members. Several young participants reported that their religious imagination was more influenced by TikTok, YouTube, and Facebook than by parish activities. Catechists acknowledged that catechesis often struggles to compete with the immediacy, entertainment value, and emotional appeal of digital content.

However, the findings also show that catechesis in Labe has begun to adapt—albeit modestly—to these challenges. For instance, some catechists created WhatsApp groups to distribute short biblical reflections, prayer reminders, and voice-note catecheses for members unable to attend sessions physically. Others reported using short video clips during sessions to stimulate discussion. These practices represent early forms of what Kaggwa terms "digitally mediated faith communities," in which technology becomes a pastoral tool rather than a competing force [13]. While these initiatives remain informal and unsystematic, they illustrate that catechesis in Labe is not merely resisting modernity but negotiating with it.

Importantly, the digital challenge is not merely technological but anthropological. Participants reported shortened attention spans, declining interest in collective rituals, and increasing individualism—patterns consistent with global trends identified by Valencia-Serrano et al. [8]. Catechesis in Labe attempts to counteract these tendencies by emphasizing face-to-face dialogue, storytelling, and communal prayer. Thus, its resistance to digital fragmentation lies not in technological sophistication but in relational intensity. This finding reframes catechesis

as a counter-cultural practice that resists the atomizing tendencies of digital life through embodied, communal interaction.

The claim of ethical transformation in family and social contexts is supported by concrete empirical narratives. Parents reported changes in disciplinary styles, moving from punitive approaches to more dialogical ones inspired by biblical reflections on compassion and patience. Several participants described renewed commitment to marital fidelity, family prayer, and mutual care for elderly relatives. On a communal level, informants noted increased willingness to participate in mutual aid, such as collective farming assistance and support for bereaved families. These practices reflect what de Mesa describes as "embedded ethics," where faith becomes visible through everyday social habits rather than formal moral discourse [12].

Nevertheless, these ethical transformations remain localized and uneven. They are more evident among those deeply involved in catechetical activities, reinforcing the conclusion that catechesis currently produces *pockets of transformation* rather than a generalized communal shift. This again highlights the need to distinguish between normative theological expectations and empirically observable outcomes. Without such differentiation, catechesis risks being described according to what it *should* accomplish rather than what it *actually* accomplishes.

Catechesis in Labe integrates local cultural practices such as communal storytelling, collective decision-making, and traditional forms of mutual labor (gotong royong). Catechists often employ local metaphors drawn from farming cycles, kinship obligations, and ancestral respect to explain biblical themes. For example, one catechist compared the Parable of the Sower to traditional planting rituals familiar to the community, enabling participants to grasp theological concepts through culturally embedded experiences. This practice reflects Bevans' model of contextual theology, where local culture becomes a theological resource rather than a passive background [10].

Moreover, catechetical sessions are frequently held in family homes rather than formal parish buildings, reinforcing the domestic and relational character of faith formation. This spatial flexibility distinguishes Labe's catechesis from institutionalized models typical of urban parishes. Such practices reveal that catechesis here is not merely localized in geography but inculturated in social form. This confirms that contextualization is not a decorative feature but a structural principle shaping how faith is communicated and embodied.

In sum, the findings demonstrate that catechesis in Labe is neither a universal solution nor a symbolic ritual. It functions as a fragile yet meaningful formative practice that negotiates between tradition and modernity, depth and reach, intimacy and scalability. Its strength lies in its capacity to generate deep transformation among committed participants, while its limitation lies in its restricted social penetration. Recognizing this duality allows for a more honest and analytically robust evaluation of catechesis as a pastoral strategy.

This study therefore reframes catechesis not as a completed solution but as an evolving pastoral experiment. Its future effectiveness depends on structural support, catechist formation, strategic use of digital tools, and deeper integration with family life. Without such developments, catechesis risks remaining spiritually powerful but socially marginal. With them, it holds potential to become a genuinely transformative force within the rural Catholic community.

4 Conclusion

This study set out to examine catechesis not as an abstract theological ideal but as a concrete pastoral strategy operating within the lived realities of a rural Catholic community in Indonesia. The findings demonstrate that catechesis in the Labe community functions as a meaningful formative practice for those who actively engage in it, fostering deeper doctrinal understanding, moral discernment, and relational transformation. However, its effectiveness is uneven: while it produces significant qualitative depth among a limited group of committed participants, it has not yet achieved broad quantitative reach at the communal level. This distinction is crucial, as it prevents the results from merely confirming normative catechetical theories and instead offers a grounded portrait of what catechesis actually accomplishes under real pastoral conditions.

The pastoral challenges identified at the beginning of this study—low participation rates, limited catechist resources, economic pressures, and digital distractions—are not marginal but central to understanding the strategy's present limitations. Rather than invalidating catechesis as a formative practice, these constraints reveal its structural fragility. Catechesis in Labe currently operates as a relationally intense but socially narrow process that transforms a committed minority rather than the community as a whole. This finding reframes catechesis not as a finished solution but as an evolving pastoral experiment whose outcomes depend heavily on institutional support, accessibility, continuity, and strategic adaptation.

This research also demonstrates that catechesis in Labe is not a mere replication of universal models of religious education but is deeply shaped by local culture. It integrates communal storytelling, kinship values, agricultural metaphors, and practices of mutual aid into its pedagogical process, making contextualization a constitutive rather than decorative element of faith formation. In this sense, catechesis becomes a cultural practice through which theology is interpreted, embodied, and negotiated in everyday life, confirming the importance of contextual theological approaches that view local culture as a genuine theological resource rather than a passive background [25].

In response to digital challenges, this study shows that catechesis in Labe does not primarily compete with digital culture through technological sophistication but through relational depth, embodied encounters, and dialogical learning. While modest digital adaptations have emerged, they remain largely informal and unsystematic. This highlights the need for intentional pastoral planning, catechist formation, and the integration of family-based and digitally mediated models of faith formation. Ultimately, catechesis in Labe should be understood as a fragile yet meaningful pastoral practice—one that holds genuine transformative potential but remains structurally constrained. Its future effectiveness depends on whether it can evolve from a spiritually intensive practice for a few into a socially embedded habitus for the many, requiring not only theological fidelity but also empirical attentiveness, strategic creativity, and long-term pastoral commitment [26].

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Theological Analysis of Manggarai Traditional Marriage Rituals: An Ethnographic Study In Wae Rii Village, Manggarai Regency

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Abstract. This study explores the theological meanings embedded in Manggarai traditional marriage rituals through a qualitative ethnographic study conducted in Wae Rii Village, Manggarai Regency. The research addresses the tension between the ritual's theological ideals—unity, fidelity, and indissolubility—and the contemporary reality of marital conflict and domestic violence among younger couples. Data were collected through participant observation and in-depth interviews with traditional elders, Catholic religious leaders, married couples, and young adults, and analyzed using thematic analysis within a contextual theological framework. The findings reveal that while Manggarai marriage rituals function as mediations of Christian covenantal values through indigenous symbols and communal practices, their moral formative power is weakened by ritual formalism and intergenerational gaps. The study underscores the need for liturgical inculturation and pastoral strategies to revitalize these rituals as living theological resources for marital integrity and social resilience.

Keywords: Manggarai marriage ritual, contextual theology, sacrament of marriage, liturgical inculturation

1 Introduction

Indonesia is endowed with a rich diversity of cultural traditions that continue to shape social and religious life. Among these traditions, indigenous marriage rituals occupy a central role, not only as cultural heritage but also as moral and spiritual frameworks that guide family life. In many indigenous societies, marriage is governed by customary law (*adat*), which functions as both a social norm and a moral authority regulating communal life [1].

In Manggarai, East Nusa Tenggara, traditional marriage rituals are deeply embedded within a Catholic worldview, reflecting a long-standing encounter between faith and local culture [5,6]. Previous studies have highlighted how Manggarai society integrates Christian teachings with ancestral wisdom, particularly in marriage practices [2–4]. However, most existing studies focus on the sociological, anthropological, or legal dimensions of marriage, leaving a gap in the exploration of its theological meaning as lived and interpreted within local ritual practices.

This study addresses a specific theological tension: the discrepancy between the enduring theological ideals embedded in Manggarai marriage rituals—such as unity, fidelity, and

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indissolubility—and the contemporary reality of increasing domestic violence and divorce among young couples. While the ritual strongly affirms marriage as a lifelong and sacred covenant, these values are increasingly undermined by modernization, secularization, and generational shifts in moral understanding [6].

Wae Rii Village was deliberately selected as the research site because it is known for its strong adherence to ancestral marriage rituals, yet it simultaneously experiences the social challenges of marital conflict and domestic violence. This paradox makes Wae Rii a significant locus for theological reflection: it represents a community where ritual continuity coexists with moral fragmentation [5].

From a theological perspective, this study adopts a contextual theological framework, emphasizing inculturation and moral theology. It seeks to understand how traditional rituals function as a hermeneutic space where Christian faith, ancestral beliefs, and communal ethics intersect [6,7]. By examining prayers, symbols, and oral expressions within the marriage ritual, this research aims to uncover how theological meanings are transmitted—or fail to be internalized—by the younger generation.

Ultimately, this study contributes to the discourse on liturgical inculturation and contextual theology, demonstrating that traditional rituals are not merely cultural artifacts but theological resources capable of strengthening marital integrity and social resilience when their meanings are properly understood and lived [6,7].

2 Methodology

This study adopted a qualitative ethnographic approach to examine the theological meanings embedded in Manggarai traditional marriage rituals in Wae Rii Village, Manggarai Regency. A qualitative ethnographic design was chosen to enable an in-depth understanding of ritual practices, symbols, and lived religious meanings within their natural social and cultural context [5,6]. Informants were selected through purposive sampling to ensure intergenerational data triangulation, involving six key participants: two traditional elders (*tu'a adat*), one representative of Catholic religious leadership, one Catholic married couple, and one representative of young adults. This sampling strategy allowed the study to capture diverse perspectives on the transmission and interpretation of ritual meanings across generations [5].

Fieldwork included direct observation of key stages of marriage rituals, such as pre-marital negotiations, ritual prayers, and communal affirmations of marital unity. The researcher assumed a moderate participant-observer role, allowing engagement with ritual practices while maintaining analytical reflexivity, which is essential in ethnographic theological research [6]. Data were collected through participant observation, in-depth semi-structured interviews, and

systematic field notes, while the data collection process was conducted for three months (Januari-March, 2025). The collected data were analyzed using a thematic analysis approach to identify recurring symbols, ritual expressions, and moral narratives emerging from the field data [8].

The thematic analysis followed the phases outlined by Braun and Clarke, including familiarization with the data, initial coding, theme development, and interpretation [8]. The resulting themes were subsequently interpreted through a contextual theological framework, synthesizing ethnographic findings with Catholic doctrines of marriage, covenant, and sacramentality [6,7]. Ethical considerations included obtaining informed consent from all participants, respecting the sacred nature of marriage rituals, and ensuring confidentiality and privacy throughout the research process.

3 Results and Discussion

This section presents and discusses the main findings of the study, focusing on the theological meaning of Manggarai traditional marriage rituals in Wae Rii Village, their socio-cultural implications, and the contemporary challenges that threaten their transformative moral power. Rather than merely asserting a parallelism between customary practices and Catholic doctrine, this discussion engages in a theological dialogue that critically examines how local rituals both enrich and challenge Christian understandings of marriage [1,2].

3.1 Theological Meaning of Manggarai Traditional Marriage Rituals

The findings demonstrate that Manggarai traditional marriage rituals embody core theological principles that resonate deeply with the Catholic sacrament of marriage, particularly unity (*unitas*) and indissolubility (*indissolubilitas*), which stand at the heart of Catholic matrimonial theology. Informants consistently emphasized that marriage in Manggarai culture is not understood as a mere social contract or private agreement, but as a sacred covenant that binds the couple for life before God, ancestors, and the community [6]. One informant articulated this conviction clearly: *"The traditional marriage ritual strengthens church marriage because it emphasizes that marriage cannot be separated. What is united in custom must remain united forever."*

This testimony reflects a covenantal understanding of marriage that carries moral, spiritual, and communal consequences. Marriage is perceived as a lifelong commitment sustained not only by personal affection but also by shared responsibility within a network of kinship and tradition. Such an understanding corresponds closely with Catholic theology, which views marriage as a sacramental participation in God's faithful and enduring covenantal love [6].

This covenantal vision is articulated most explicitly through ritual prayers, symbolic expressions, and communal participation that function as theological language within the local cultural framework [6,7]. Rather than serving as cultural embellishments, these ritual elements communicate theological meanings that shape moral imagination and marital responsibility. In this sense, Manggarai marriage rituals exemplify what inculturation theology describes as the embodiment of Christian faith within culturally specific forms, enabling doctrine to be experienced as lived reality rather than abstract teaching [5].

Contemporary theological scholarship increasingly recognizes that inculturation is not a peripheral concern but a constitutive dimension of the Church's mission. Widyawati et al. emphasize that the preservation of local language and culture within the Indonesian Church is essential for sustaining evangelization, particularly in sacramental and liturgical contexts [9]. From this perspective, Manggarai marriage rituals can be understood as a concrete expression of the Church's inculturative mission, where faith is articulated through indigenous symbols without diminishing its sacramental depth.

a. Renge Ela Nempung and the Dual Spiritual Dimension

A central theological element of the Manggarai marriage ritual is the prayer *renge ela nempung*. This prayer invokes blessings not only from God but also from the ancestors, reflecting a dual spiritual orientation: (1) a vertical relationship with God as the ultimate source of life and blessing, and (2) a horizontal relationship with ancestors and the community as moral witnesses and guardians of marital fidelity.

From a contextual theological perspective, this dual orientation does not contradict Christian faith but resonates with the doctrine of the Communion of Saints, where the living and the dead remain united within a sacred spiritual fellowship [7,5]. Ancestors are not worshipped as divine beings but revered as moral mediators whose lives exemplify fidelity, responsibility, and continuity of tradition. This understanding aligns with broader African and Asian theological reflections that interpret ancestral consciousness as a culturally mediated expression of communal memory and ethical accountability rather than idolatry.

Comparative insights from African Catholic theology further illuminate this dynamic. The synodal reimagining of Nigerian Catholic marriage rites demonstrates how ancestral symbols and communal memory can enrich sacramental theology when critically integrated within ecclesial discernment [11]. Similarly, *renge ela nempung* functions as an inculturated theological expression that affirms Christian covenant theology while grounding it in local cosmology and social ethics.

In this sense, *renge ela nempung* represents a form of liturgical inculturation, where theological meanings are communicated through culturally intelligible symbols and prayers [10]. The prayer does not replace Christian prayer but mediates it through indigenous

language, rhythm, and symbolic imagination. As theoretical discussions on inculturation for transformative evangelization emphasize, authentic inculturation occurs when local symbols are not merely tolerated but become vehicles of theological meaning capable of shaping moral life and communal responsibility [12].

Anthropological and empirical approaches to inculturation further stress that ritual practices must be understood as lived realities that influence moral behavior and social relationships [13]. In Manggarai society, the invocation of ancestors during marriage rituals reinforces the conviction that marriage is accountable not only before God but also before the moral memory of the community, thereby strengthening communal responsibility and ethical commitment.

b. Acer Nao Wase Wunut and the Theology of Indissolubility

Another powerful symbolic expression within the Manggarai marriage ritual is *acer nao wase wunut*, meaning "one in life and one in death." This expression affirms marital permanence and encapsulates the Manggarai understanding of marriage as an irrevocable covenant rather than a reversible personal choice. It conveys a vision of marriage that integrates emotional commitment, moral responsibility, and spiritual endurance.

Theologically, this aligns closely with Catholic moral and sacramental theology, which understands marriage as a sacramental sign of God's faithful and enduring love [6]. Within the Manggarai context, this belief is not articulated through doctrinal formulas but is concretized through ritual speech acts that publicly bind the couple before God, ancestors, and the community.

This public and communal dimension of marital commitment resonates with Afro-theological perspectives that view marriage rituals as communal acts of moral formation, where the community assumes responsibility for sustaining marital fidelity [11]. Similarly, in Manggarai society, *acer nao wase wunut* operates as a performative declaration that embeds ethical obligations—fidelity, mutual respect, and perseverance—within the ritual itself.

Thus, Manggarai traditional marriage rituals can be read as a form of contextual moral theology, where ethical norms are internalized through symbolic participation and communal accountability rather than imposed externally [6,7]. This challenges modern individualistic conceptions of marriage by affirming that marital commitment is sustained through relational networks, shared moral narratives, and collective responsibility.

3.2 Socio-Cultural Values and Communal Responsibility

Beyond its theological dimension, the Manggarai traditional marriage ritual functions as a vital social institution that reinforces communal responsibility and collective identity. In

Manggarai society, marriage is not understood as a private contract between two individuals but as a communal event that unites two extended families (*woe nelu*), thereby establishing long-term social, moral, and relational obligations. Informants consistently emphasized this communal understanding, as reflected in the statement: *"Marriage unites not only the couple but the two big families, and this bond should last forever."* This perspective situates marriage within a broader social framework where individual commitment is inseparable from communal accountability.

From a sociological perspective, the Manggarai marriage ritual operates as an integrative mechanism that strengthens social cohesion and sustains social order. Émile Durkheim's theory of ritual provides a useful analytical lens for understanding this function. Durkheim argues that rituals renew collective consciousness and reinforce social solidarity by reasserting shared values and moral norms through symbolic action [14]. In the Manggarai context, this function is clearly visible in communal meals, ritual negotiations, public exchanges of symbolic goods, and collective participation by kinship groups before, during, and after the marriage ceremony. These ritual practices transform marriage into a social fact that binds individuals into a moral community.

Ritual actions do not merely accompany marriage; they actively constitute marriage as a socially binding reality. Through ritual dialogue, symbolic gestures, and public acknowledgment, the community legitimizes the marital union and embeds it within collective moral expectations. In this sense, the marriage ritual becomes a performative act that renews not only marital bonds but also the moral fabric of the community itself.

Recent empirical studies on Indonesian ritual practices support this interpretation. Niman's study on the intersection of belief, culture, and social life demonstrates that rituals function as critical spaces where religious meaning, ethnic identity, and social norms converge, shaping patterns of behavior and communal expectations [15]. Manggarai marriage rituals exemplify this intersection, as they simultaneously articulate cultural identity, regulate social relationships, and reinforce shared moral values.

Anthropologically, Manggarai marriage rituals also generate social capital, understood as networks of trust, reciprocity, and mutual obligation embedded within social relationships [16]. By uniting two extended families, marriage expands kinship networks and redistributes social responsibilities across generations. Married couples are not left to navigate marital challenges in isolation but are embedded within dense kinship structures that provide moral guidance, mediation, and informal social control. Elders and relatives play an active role in advising, correcting, and intervening when marital tensions arise. Ideally, this communal involvement serves as a protective buffer against marital breakdown and social fragmentation.

Comparative studies on ritual and ethnic identity further illuminate this function. Research on liturgical rituals in Jewish synagogues shows that ritual practices play a crucial role in

constructing ethnic identity and reinforcing communal boundaries, especially in contexts of social and cultural change [17]. Similarly, Manggarai marriage rituals reinforce ethnic identity by embedding marriage within ancestral customs, ritual language, and communal memory. Through repeated participation in these rituals, individuals internalize a sense of belonging and moral responsibility toward both family and community.

Beyond social cohesion, Manggarai marriage rituals contribute significantly to the formation of moral life. Philosophical reflections on ritual emphasize that rituals are not merely symbolic representations of moral values but active processes that shape moral dispositions and ethical sensibilities [18]. Through embodied participation in ritual practices, individuals learn what is expected of them—not through abstract instruction, but through lived experience and communal affirmation. In the Manggarai context, marriage rituals communicate moral expectations such as fidelity, perseverance, mutual respect, and responsibility toward extended family networks.

However, the effectiveness of this social and moral mechanism depends not merely on ritual participation but on the internalization of its values. Several informants observed that while ritual performance remains relatively strong, its deeper meanings are increasingly at risk of erosion, particularly among younger generations. When rituals are performed primarily as social obligations or cultural formalities, their capacity to shape moral behavior diminishes. This condition reflects a broader pattern of ritual formalism, where symbols persist but lose their ethical and formative power [15].

From a contextual theological perspective, this challenge underscores the need to integrate ritual practice with moral and spiritual formation. Models of contextual theology emphasize that cultural rituals must be continuously interpreted and re-appropriated within changing social contexts to remain meaningful [6,7]. Inculturation, therefore, is not a static preservation of tradition but a dynamic process of dialogue between faith, culture, and lived experience. Without such reflective engagement, rituals risk becoming symbolic shells detached from moral life.

In this framework, Manggarai marriage rituals should be understood as pedagogical spaces for moral formation. Ritual participation must be accompanied by intentional catechesis, intergenerational dialogue, and communal reflection that help individuals grasp the ethical significance of the symbols they enact. As philosophical and sociological studies on ritual and morality suggest, rituals retain their social and ethical effectiveness only when communities actively engage in meaning-making processes that connect symbolic action with lived responsibility [18].

Overall, the socio-cultural values embedded in Manggarai marriage rituals offer a compelling alternative to increasingly individualistic conceptions of marriage. By affirming marriage as a communal and moral institution sustained by collective responsibility, these rituals contribute

to social cohesion, moral formation, and the resilience of communal life in the face of rapid social change.

3.3 The Paradox of Sacred Values and Social Reality

One of the most critical findings of this study is the paradox between the profound theological ideals embedded in Manggarai traditional marriage rituals and the contemporary social reality marked by increasing domestic violence and marital dissolution. While the rituals strongly emphasize unity, harmony, and indissolubility, these sacred values are not consistently embodied in everyday marital life. Informants repeatedly observed that many young couples participate in traditional marriage rituals primarily as cultural obligations rather than as deeply internalized moral and spiritual commitments. As one informant stated candidly, *"We follow the traditional rituals because it is required, but honestly, we do not really understand the meaning."*

This gap between ritual ideals and lived reality highlights a fundamental tension between tradition and modern social experience. Rituals that once functioned as powerful mechanisms of moral formation now risk becoming symbolic performances detached from ethical practice. This phenomenon reflects what may be described as ritual formalism, in which rituals are maintained outwardly while their transformative moral power is gradually eroded.

Sutam describes this process as ritual reduction, where ritual symbols lose their ethical and pedagogical force under the pressures of modernization, secularization, and shifting social values [19]. In such contexts, rituals continue to be performed due to social expectations, cultural identity, or fear of communal sanctions, rather than because they shape moral consciousness. Similar patterns are observed in broader Indonesian ritual contexts, where ritual continuity persists despite diminishing interpretive depth, particularly among younger generations [15].

From the perspective of ritual theory, this erosion of moral efficacy is deeply problematic. Scholars of ritual and moral life emphasize that rituals do not automatically form virtue; rather, they require sustained processes of interpretation, communal reflection, and moral reinforcement to remain ethically effective [18]. When these processes weaken, ritual action alone becomes insufficient to guide ethical behavior or sustain moral commitments.

The paradox between sacred values and social reality can also be examined through postmodern theories of intimacy and relational risk. Bulcroft and colleagues argue that contemporary romantic relationships are increasingly shaped by uncertainty, emotional vulnerability, and an emphasis on individual self-fulfillment [20]. In such contexts, marriage is no longer perceived primarily as an irrevocable moral covenant but as a negotiable

relationship subject to ongoing evaluation. This shift fundamentally challenges traditional understandings of marital indissolubility.

In the Manggarai context, ritual affirmations of lifelong unity coexist with social conditions that normalize separation as a response to conflict. While the ritual proclaims permanence, lived marital experience is shaped by economic pressures, changing gender roles, media narratives, and evolving expectations of emotional satisfaction. This tension weakens the capacity of ritual symbols to function as stable moral anchors in everyday life.

A particularly troubling dimension of this paradox is the persistence of domestic violence despite the ritual's strong emphasis on harmony, mutual responsibility, and communal accountability. Recent sociological research in Indonesia demonstrates that unresolved power imbalances, weak communication patterns, and limited relational resilience significantly contribute to family breakdown, even within culturally ritualized marriages [21]. These findings suggest that ritual participation alone cannot function as an effective safeguard against marital violence.

From a theological perspective, this situation raises a critical critique: ritual does not automatically form virtue. Stephen B. Bevans emphasizes that contextual rituals require continuous theological interpretation so that symbols remain ethically formative within changing social realities [6]. Without catechetical explanation and moral reflection, rituals risk becoming empty symbols detached from lived Christian discipleship.

Moreover, certain patriarchal interpretations embedded within customary practices may unintentionally legitimize power asymmetries within marriage. Without critical theological discernment, such interpretations can normalize domination rather than mutuality, contradicting the very theological ideals of unity and covenantal love that the ritual seeks to uphold [7]. Contextual theology therefore calls not only for preservation of ritual forms but also for critical engagement with their social implications.

This condition illustrates Ogburn's concept of cultural lag, in which symbolic and moral systems fail to adapt at the same pace as social change, resulting in a rupture between tradition and lived experience [22]. In Manggarai society, marriage rituals continue to articulate enduring theological ideals, while everyday marital life is increasingly shaped by rapid social transformation.

Philosophical reflections on ritual and moral life underscore that rituals sustain ethical traditions only when accompanied by narrative interpretation, communal accountability, and intentional moral formation [18]. Without these supporting structures, rituals risk becoming symbolic remnants rather than living practices capable of shaping moral behavior. The paradox observed in Manggarai marriage rituals thus reveals not the failure of tradition itself,

but the urgent need for renewed theological interpretation and pastoral engagement that reconnect ritual symbols with lived moral responsibility.

3.4 Intergenerational Gaps and Cultural Discontinuity

This study identifies a pronounced intergenerational gap in the interpretation and appropriation of Manggarai traditional marriage rituals. Older generations consistently understand these rituals as sacred expressions of faith, moral order, and communal identity, rooted in ancestral tradition and integrated with Catholic belief. For them, ritual participation carries ethical weight and spiritual responsibility, shaping lifelong marital commitment. In contrast, many younger participants increasingly perceive marriage rituals as costly and time-consuming formalities, performed primarily to meet social expectations rather than as meaningful theological practices. As one informant noted, “Tradition still exists, but its meaning is slowly disappearing among young people.”

This divergence reflects a deeper process of cultural discontinuity, in which ritual forms persist while their symbolic, moral, and theological meanings weaken across generations. Such discontinuity threatens the sustainability of Manggarai marriage rituals not only as cultural heritage but as living theological resources capable of shaping Christian marital life. When rituals are repeated without meaningful transmission of values, they risk becoming symbolic shells—externally performed yet internally emptied of ethical and spiritual substance.

From the perspective of contextual theology, this condition signals a failure of theological interiorization. Bevans emphasizes that contextual theology is not the passive inheritance of forms but an ongoing interpretive process in which faith is continually articulated within concrete cultural experience [6]. When ritual continuity is not accompanied by catechetical narration and theological reflection, especially for younger generations shaped by rapid social change, the mediating power of ritual diminishes. Martasudjita similarly argues that inculturation requires critical engagement with cultural symbols so that they remain vehicles of faith rather than static traditions [7].

This insight resonates with Omollo’s theoretical discussion of inculturation for transformative evangelization. Drawing on African Catholic theological heritage and grassroots experience, Omollo contends that inculturation fails when it remains at the level of external adaptation rather than fostering deep symbolic transformation within the believing community [12]. Rituals become transformative only when communities actively interpret their symbols in relation to lived realities. Applied to the Manggarai context, this suggests that the persistence of ritual performance alone is insufficient; what is required is an intentional pedagogical process that enables younger generations to appropriate ritual meanings as resources for moral discernment and marital commitment.

Broader socio-cultural transformations further intensify this generational gap. Niman's recent study on Indonesian ritual practices highlights how modernization, education, media exposure, and economic pressures reshape how younger generations relate to ritual obligations [15]. While elders associate rituals with collective identity and moral accountability, younger participants often approach them pragmatically, evaluating their relevance in terms of cost, efficiency, and personal benefit. This shift does not necessarily indicate rejection of tradition, but rather a reconfiguration of meaning-making within changing social contexts.

Traditionally, Manggarai marriage rituals functioned as mechanisms of moral socialization, embedding couples within dense networks of kinship responsibility and communal oversight. However, when younger couples participate without understanding the theological and ethical dimensions of these rituals, their formative function weakens. The result is a growing gap between ritual performance and moral practice, contributing to the broader paradox between sacred ritual values and contemporary marital realities.

Insights from mission and inculturation studies in the Indonesian Church further clarify this challenge. Widyawati, Lon, and Midun stress that effective inculturation involves preserving not only ritual forms but also local language, narrative, and symbolic imagination [9]. When rituals are detached from their linguistic and narrative foundations, their capacity to communicate faith erodes. In the Manggarai context, reduced familiarity with ritual language among younger generations limits their ability to grasp the theological depth embedded in customary marriage practices.

Comparative perspectives from African theology offer constructive pathways forward. Aina's synodal approach to reimagining Nigerian Catholic marriage rites emphasizes inclusive dialogue involving elders, clergy, theologians, and young couples [11]. Such a synodal process allows rituals to remain faithful to tradition while being reinterpreted in light of contemporary realities. Applied to Manggarai society, this approach suggests that bridging intergenerational gaps requires communal discernment rather than mere preservation of form.

Ultimately, the intergenerational gap identified in this study reflects a broader crisis of cultural and theological transmission under conditions of social change. While ritual forms endure, their moral and theological meanings risk erosion without intentional efforts to foster interpretation, dialogue, and catechesis. Integrating insights from contextual theology, inculturation theory, Indonesian ritual studies, and synodal pastoral models, this study argues that revitalizing Manggarai marriage rituals requires moving beyond ritual maintenance toward participatory reinterpretation. Only through such processes can these rituals continue to function as living theological resources that shape marital integrity, communal responsibility, and Christian discipleship in contemporary Manggarai society.

3.5 Pastoral and Theological Implications: Toward Liturgical Inculturation

In response to the theological and socio-cultural challenges identified in this study—namely ritual formalism, intergenerational gaps, and the weakening of moral internalization—there is an urgent need for pastoral and theological interventions that move beyond the mere preservation of ritual forms toward the revitalization of meaning. Within the framework of contextual theology, such interventions must enable Manggarai traditional marriage rituals to function as living theological resources that shape moral consciousness, communal responsibility, and Christian marital commitment.

Central to this effort is the principle of liturgical inculturation, understood not as the superficial insertion of cultural elements into Christian worship, but as a dynamic and dialogical process in which faith and culture mutually interpret and transform one another. Shorter emphasizes that inculturation is a continuous process whereby the Gospel becomes embedded in local cultures while simultaneously purifying and renewing them [10]. Similarly, Doyle underscores that inculturation in Roman Catholicism is fundamentally theological, aiming to express the Gospel authentically within particular cultural contexts without compromising ecclesial communion [23]. Applied to Manggarai society, this implies that traditional marriage rituals should not be treated merely as parallel customs accompanying the sacrament of marriage, but as culturally embodied theological expressions that can enrich the Church's understanding of covenant, fidelity, and communal responsibility.

A first pastoral implication concerns intergenerational education and theological interiorization. The findings show that many younger couples participate in customary rituals without adequate understanding of their symbolic and moral significance. This reflects what Omollo describes as a failure of inculturation at the level of interiorization, where rituals are transmitted externally but lack transformative depth [12]. To address this, marriage catechesis should intentionally integrate Manggarai ritual symbols, narratives, and language with Catholic moral teaching on marriage. For example, explaining the meaning of *acer nao wase wunut* ("one in life and one in death") alongside the Church's doctrine of marital indissolubility can help couples recognize the deep convergence between cultural wisdom and sacramental theology [6,7].

Language plays a crucial role in this process. Widyawati, Lon, and Midun argue that preserving local language and symbolic imagination is essential for effective mission and inculturation in the Indonesian Church [9]. When rituals are conducted in forms no longer understood by younger generations, their catechetical and ethical power diminishes. Pastoral formation therefore requires contextual translation—both linguistic and theological—so that ritual symbols remain intelligible and morally formative.

A second implication involves the integration of Manggarai symbols within marriage catechesis and liturgical celebration. Authentic liturgical inculturation does not alter the

essential structure of the sacrament but enriches its celebration through culturally resonant expressions. Doyle stresses that inculturation respects the integrity of the liturgy while allowing local cultures to shape its expression [23]. In this light, Manggarai ritual prayers, communal affirmations, and symbolic language can be incorporated into preparatory rites, homilies, or catechetical explanations surrounding the sacrament of marriage. Such integration allows couples to experience the sacrament not as a foreign imposition but as the fulfillment of values already embedded within their cultural tradition.

Comparative insights from African theology reinforce this approach. Aina's synodal reimagining of Nigerian Catholic marriage rites demonstrates how local symbols and communal participation can be meaningfully integrated into sacramental practice without undermining theological integrity [11]. Aina emphasizes the importance of synodal processes involving clergy, theologians, elders, and married couples in discerning how rituals can respond to contemporary pastoral challenges. This model offers a valuable paradigm for the Manggarai Church, suggesting that liturgical inculturation should emerge from communal discernment rather than unilateral decision-making.

A third implication concerns critical theological discernment and collaboration. While Manggarai marriage rituals embody profound theological values, this study also indicates that certain customary interpretations may unintentionally reinforce patriarchal power relations. Contextual theology insists that culture must neither be absolutized nor dismissed, but engaged critically through dialogue with the Gospel [6]. Bevans highlights that contextual theology requires ongoing interaction between faith and culture to affirm what is life-giving and transform what contradicts Christian anthropology [6].

Omollo further emphasizes that inculturation must remain open to prophetic critique if it is to contribute to transformative evangelization [12]. In the Manggarai context, collaboration between traditional leaders, clergy, and theologians is essential to distinguish core symbolic values—such as fidelity and communal responsibility—from culturally conditioned practices that may require reinterpretation.

In sum, revitalizing Manggarai traditional marriage rituals requires moving beyond ritual maintenance toward living contextual theology. Through intergenerational catechesis, liturgical inculturation, synodal collaboration, and critical theological reflection, these rituals can continue to mediate the Gospel meaningfully. As Martasudjita affirms, inculturation becomes authentic when faith is lived and experienced within concrete cultural realities [7]. In this way, Manggarai marriage rituals can remain vital theological resources that nurture marital integrity, communal accountability, and Christian discipleship within a changing social landscape.

4 Conclusion

This study has demonstrated that Manggarai traditional marriage rituals constitute more than cultural heritage or customary obligations; they function as contextual theological expressions that mediate Christian covenantal values through indigenous symbols, ritual language, and communal practices. Core theological principles such as unity (*unitas*), fidelity, and indissolubility (*indissolubilitas*) are deeply embedded in ritual elements like *renge ela nempung* and *acer nao wase wunut*, which articulate marriage as a sacred and lifelong covenant witnessed by God, ancestors, and the community.

However, the findings also reveal a critical paradox between the enduring theological ideals articulated in these rituals and the contemporary social reality marked by increasing marital conflict, domestic violence, and weakening commitment, particularly among younger couples. This paradox is not primarily the result of a doctrinal contradiction between custom and Catholic teaching, but rather reflects processes of ritual formalism, intergenerational discontinuity, and insufficient theological interiorization. Ritual continuity persists, yet its moral and formative power is increasingly eroded when symbols are performed without sustained catechetical interpretation and ethical formation.

By engaging Manggarai marriage rituals through the lens of contextual theology and inculturation, this study contributes to a deeper theological understanding of how local cultural practices can function as living loci of theological meaning. At the same time, it underscores that inculturation is not a static achievement but an ongoing process requiring critical dialogue between faith and culture. Without such dialogue, rituals risk either being absolutized as untouchable traditions or reduced to mere cultural performances detached from Gospel values.

The study further highlights the importance of intergenerational transmission and communal participation in sustaining the theological vitality of marriage rituals. Bridging generational gaps requires intentional pastoral strategies that integrate traditional symbols with Catholic moral teaching, preserve local ritual language, and foster shared theological reflection among elders, clergy, and young couples. In this regard, synodal and collaborative approaches offer promising pathways for reimagining marriage catechesis and liturgical practice without compromising theological integrity.

Ultimately, this research affirms that Manggarai traditional marriage rituals can continue to serve as transformative theological resources when they are critically interpreted, pastorally integrated, and ethically embodied. Through liturgical inculturation and contextual theological reflection, these rituals may not only preserve cultural identity but also strengthen marital integrity, communal responsibility, and the lived proclamation of Christ's covenantal love within contemporary Manggarai society.

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The Effect of Timorese Traditional Games Siki Doka and Gobak Sodor on the Physical Fitness of Elementary School Students

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Abstract. This research was motivated by the decline in physical activity and the decline of traditional games among elementary school students due to the prevalence of gadgets, highlighting the need for innovations in PJOK learning that are both fun and effective in improving physical fitness. The study used a quasi-experimental design for 8 weeks with two treatment groups: Siki doka (n=14) and Gobak Sodor (n=14). The learning intervention was conducted three times a week, lasting 60 minutes at each meeting. Fitness was measured using a 30-meter sprint test (TKJI subtest) in the pre-test and post-test. The results showed that both games improved physical fitness, but Gobak Sodor was more effective. The Gobak Sodor group's running time decreased from 16.14 seconds to 12.93 seconds (a 19.88% increase), while Siki doka decreased from 16.05 seconds to 14.66 seconds (an 8.65% increase). These findings confirm that traditional games can be meaningfully integrated into PJOK to improve students' fitness and active participation.

Keywords: traditional games, Timor, Siki Doka, Gobak Sodor, physical fitness

1 Introduction

Traditional sports games are the result of traditions that originate from a community's culture. To understand them, it's necessary to understand the concept of play [1], [2]. Therefore, games in an educational context can be used as a means of providing information on the importance of physical activity to improve health, physical fitness, social relationships, emotional control, and character [3], [4]. Today, traditional games are fading and sinking into the global tide of modernization. The current generation is increasingly losing the ability and creativity to understand the principles of local wisdom in the era of the 4.0 industrial revolution, especially in traditional sports games. So, physical activities and traditional games are being forgotten and replaced by gadgets [5]. Furthermore, physical fitness is also essential for children to achieve their education and support their health. Successfully achieving the learning objectives of Physical Education, Sports, and Health (PJOK) is not easy. This is due to the very low level of implementation of the physical fitness measurement instrument (TJKI), whose components are a combination of physical fitness related to skills and health [6]. Meanwhile, what students need is improved physical fitness. As educators in this field, we have a significant responsibility. Success in achieving learning objectives is determined by the teacher's ability to plan accordingly. Physical education (PJOK) learning is crucial because it is part of the overall educational process, the goal of which is to improve human performance through physical

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activities to develop and maintain the body. In the context of sports, physical fitness is the primary foundation that must be met before an athlete enters advanced training stages to achieve optimal training quality and maximum performance during competition. Physical fitness encompasses several basic components of motor skills: strength, agility, endurance, flexibility, and speed. All of these components are interconnected and play a role in determining an athlete's readiness to participate in an effective training program. Improving physical fitness also requires the application of systematic, planned, and continuous training principles so that each aspect can develop proportionally [7], [8]. As the era of industrial revolution 4.0 advances, the development of science is also increasing. In line with this, as an educator, one must be able to carry out 21st century learning indicators by: 1. Integrating Strengthening of Character Education, 2. Integrating Literacy Movements, 3. Stimulating the Growth of 6C (Critical Thinking, Collaborative, Creativity, Communicative, Character, and Citizenship), 4. Integrating HOTS (Higher Order Thinking Skill). These indicators aim to make students have character, be competent, and be literate. These objectives can be achieved through the PJOK learning process. According to Law Number 3 of 2005, it is explained that sport is a systematic activity to encourage, foster, and develop physical, spiritual, and social potential [9]. Based on observations and interviews with physical education teachers at elementary schools in Kupang Regency, researchers found that the lack of potential for physical activity and an active lifestyle is a growing problem in education. Physical activity and an active lifestyle are among the most important challenges, as physical fitness is included in the physical education curriculum, aiming to develop a healthy and active lifestyle [10]. So, PJOK learning should be an opportunity for students to achieve a healthy life [11]. Current developments, faced with technological advances such as television, online games, computers, the internet and the emergence of Android smartphones, many children today spend their time playing with gadgets, both the internet and social media, so children need to be able to increase their physical activity through exercise, so that they can reduce the impact of excess weight, individualism and lack of socialization with the surrounding environment [12]. The sophistication of technology and its free use by children without strict parental supervision can affect a child's character. The role of physical education teachers in monitoring the development of students' physical fitness and character is crucial. A common obstacle in elementary school learning is the lack of knowledge of physical education teachers in applying appropriate models in the teaching and learning process, which can seem monotonous and unattractive to students. This is due to a lack of knowledge due to limited references or reading sources on how physical education teachers teach appropriate traditional sports games to support the achievement of desired learning outcomes [13], [14]. In this context, researchers are increasingly confident in innovating by developing traditional Timorese games "Siki doka " and "Gobak Sodor" for the Physical Fitness of Elementary School Students to improve physical fitness with a sportsmanship character, and attract students' attention in learning and increase physical fitness activities [15]. The learning model developed believes that the success of physical education learning begins with students' enjoyment of physical activities [16]. The traditional sports games "Siki doka" and "Gobak Sodor" instill the values of character, sportsmanship, and cooperation in children from elementary school age and can also help increase children's focus [17]. Motor skills learning is one part of physical education learning in schools, developing attitudes, knowledge, and motor skills. Traditional sports games can foster good character values in elementary school-aged children, including the joy children experience when playing with their friends, a strong sense of friendship, democracy, leadership, responsibility, tolerance, self-confidence, honesty,

courage, cooperation, and high sportsmanship [18], [19]. Traditional games can be an activity that can prevent excessive dependence on gadgets, which can make children aggressive and individualistic. The implementation of the traditional games "Siki doka " and "Gobak Sodor" can improve students' physical fitness.

Siki doka is a traditional game of the Kupang Regency community that is structurally identical to engklek. The game begins with the creation of squares on the ground, then each player prepares a gacuk (a small piece of tile or ceramic tile). On each turn, a player throws a keweng (a type of wooden stick) into one of the available squares, with the stipulation that the throw must fall within the square's boundaries. If the throw goes beyond the boundary, the player is declared out, and the turn passes to the next player. Once the keweng lands on a square, that square becomes a forbidden square that cannot be occupied, so the player must jump over it and continue moving to the next square on one foot. Mechanically, Siki doka is dominated by a series of repeated single-leg jumps on a narrow surface, accompanied by a single support phase, controlled landings, and quick posture corrections to avoid touching the square lines. This movement pattern requires explosive contraction of the lower leg muscles during the push-off phase, stabilization of the ankles, knees, and hips during the support phase, and activation of the core muscles to maintain dynamic balance during landings and transitions between squares. In terms of intensity profile, Siki doka is intermittent with short, medium-length activities per turn, characterized by repeated explosive jumps separated by short pauses at turn changes. Therefore, Siki doka tends to place a dominant neuromuscular load on the lower limbs with a relatively prominent contribution from the anaerobic energy system, making it relevant as a stimulus for the development of explosive leg strength and postural control in elementary school-aged children. Gobak Sodor is a traditional team game played on a grid-patterned field and involves direct interaction between the attacking and defending teams. Operationally, the game proceeds through the attacking team's efforts to pass through the guard lines without being touched, while the defending team focuses on blocking and making touches within the boundaries of the lines of movement that apply in the game. The attacker's success is largely determined by the ability to read gaps, manage timing, and coordinate strategies with teammates, while the defender's success is determined by inter-player coordination, positional discipline, and quick response to changes in the attacker's direction.

Mechanically, Gobak Sodor is dominated by repeated short-distance sprints, sudden accelerations, decelerations, changes of direction, and reactions to opponent movements within a relatively limited playing space. This movement pattern demands a combination of agility, spatio-temporal coordination, and quick motor decision-making by both attacking and defending players. In terms of intensity profile, Gobak Sodor is intermittent, with episodes of moderate- and high-intensity work (short sprints, evasive maneuvers, and changes of direction) interspersed with short recovery periods as players wait for opportunities or reposition. Consequently, the game requires alternating aerobic and anaerobic contributions, with the anaerobic system playing a dominant role during sprints and changes of direction, while the aerobic system supports recovery during work periods. In addition to its fitness implications, the team-based nature of the game, with its touch or block rules and the need for strategic coordination, makes Gobak Sodor a potential platform for developing socio-emotional aspects

such as cooperation, communication, and sportsmanship through play situations that demand adherence to rules and collaboration.

The integration of these two games in PJOK learning not only functions as a fun variation of activities but also provides targeted physiological and neuromotor stimuli [20]. This aligns with recent research findings showing that traditional sports games can generate moderate to high levels of physical activity, increase motor engagement, and trigger positive emotional responses and social cooperation in students. In addressing this challenge, various studies have shown that traditional games can be an effective contextual solution. Traditional games are also effective in preventing children's dependence on gadgets, which can trigger individualistic and aggressive behavior. Therefore, the implementation of Siki doka and Gobak Sodor, typical games of East Nusa Tenggara Province, is believed to improve physical fitness while instilling important character values in the development of elementary school-aged students. In this study, a physical education (PJOK) learning model was developed based on local wisdom by integrating the traditional games of Siki doka and Gobak Sodor. These games were chosen not only for their high local cultural value but also for their potential to improve physical fitness, sportsmanship, and social character in elementary school students. This integration was carried out in a quasi-experimental design, which has not been widely used in previous research in eastern Indonesia.

2 Method

This study used a quasi-experimental design with two treatment groups. The research activities were carried out for 8 weeks, starting from the preparation stage to the final data collection. The learning intervention was carried out three times per week, with a duration of 60 minutes at each meeting. The research subjects were 28 elementary school students who were divided equally into two treatment groups, namely the Siki doka group (n = 14) and the Gobak Sodor group (n = 14). The balanced distribution of sample sizes between groups aimed to maintain the comparability of the results in the quasi-experimental design. The measurement instrument used was a 30-meter sprint test, which is one of the sub-tests in the Indonesian Physical Fitness Test (TKJI) for elementary school-age students. Measurements were carried out using a stopwatch, with the test results in the form of travel time (in seconds). Participants ran 30 meters from a standing start position, and the time was stopped when the participants reached the finish line. Data collection was carried out twice, namely in the pre-test before the treatment was given and the post-test after the entire series of interventions was completed. The data obtained were used to analyze changes in students' running speed after participating in traditional game-based learning of Siki doka and Gobak Sodor.

3 Results and Discussion

3.1. Results

This study aims to analyze the effect of traditional games Gobak Sodor and Siki doka on improving the physical fitness of fifth-grade students at Dendeng Public Elementary School, Kupang Regency. Physical fitness measurements were conducted using the Indonesian Physical Fitness Test (TKJI) through a pre-test and post-test design after eight weeks of intervention. The data obtained were analyzed statistically through normality and homogeneity tests as

prerequisites for analysis, then continued with paired t-tests and independent t-tests to identify differences in physical fitness improvement between treatment groups.

Table 1. Normality Test of Physical Fitness Data

Variabel	N	Average ± SB (Before)	P (Before)	Average ± SB (After)	P (After)	Information
Group 1 (Gobak Sodor)	14	16,140 ± 0,736	0,101	12,930 ± 0,716	0,110	Normal
Group 2 (Siki doka)	14	16,055 ± 0,461	0,123	14,666 ± 0,678	0,148	Normal

Table 2. Homogeneity Test of Physical Fitness Data

Measurement Stage	F	p	Information
Before Training	0,210	0,528	Homogen
After Training	0,129	0,722	Homogen

Table 3. Comparison Test of the Effects of Improving Physical Fitness

Stage	n	Group 1 (Gobak Sodor)	Group 2 (Siki Doka)	t	p	Information
Before Training	14	16,14 ± 0,73	16,05 ± 0,46	10,05	0,001	Not significantly different
After Training	14	12,93 ± 0,71	14,66 ± 0,67	12,46	0,001	Significantly different

Table 4. Percentage of Increase in Physical Fitness

Group	Before Training (second)	After Training (second)	Difference (second)	Percentage Increase (%)
Gobak sodor	16,140	12,930	3,210	19,88
Siki doka	16,055	14,666	1,389	8,65

3.2. Discussion

3.2.1. Effectiveness of traditional games on physical fitness

This study shows that the traditional games of Gobak Sodor and Siki doka both contribute to improving the physical fitness of fifth-grade students at Dendeng Public Elementary School, although the magnitude of the effects differs. Fitness measurements using a 30-meter sprint test indicate that the Gobak Sodor group experienced a decrease in time from 16.14 seconds to 12.93 seconds, representing a 19.88% increase in performance. In the Siki doka group, running time decreased from 16.05 seconds to 14.66 seconds, an increase of 8.65%. This difference in performance suggests that the physical activity characteristics of Gobak Sodor produce a stronger training stimulus than Siki doka in the context of improving sprint performance. Physiologically, Gobak Sodor contains dynamic and intermittent movement demands, characterized by repeated accelerations, rapid changes of direction, sudden stops, and responses to opponent movements. This pattern has the potential to increase neuromuscular and metabolic capacity relevant to sprint performance, particularly through strengthening the components of speed, agility, coordination, and explosive power of leg muscles. The complexity of these movements also encourages the involvement of more comprehensive muscle groups and increases the need for motor control in rapidly changing game situations, thereby increasing the opportunity for meaningful functional adaptations.

Siki doka emphasizes locomotor skills involving single-leg support, repetitive stepping patterns, and postural control. These movement characteristics tend to facilitate the development of stability, balance, and coordination through the activation of stabilizer muscles and strengthening of postural control. This relatively specific focus on movement demands makes Sikidoka effective in supporting basic motor skills related to balance and coordination. However, the lower intensity of acceleration and frequency of direction changes compared to Gobak Sodor results in a more limited stimulus for speed-based fitness development. Overall, these findings emphasize that the selection of traditional games in Physical Education (PJOK) learning needs to consider the suitability between the characteristics of the game's movement demands and the physical fitness components being targeted.

3.2.2. Social emotional aspects of cooperation and sportsmanship

The research findings show that the implementation of the traditional games Gobak Sodor and Siki doka not only has an impact on improving students' physical fitness, but also contributes to the development of socio-emotional aspects, especially cooperation and sportsmanship, through social and cooperative learning mechanisms that are developed during the playing process. This framework is in line with the tendency of physical education pedagogy that places games and student-centered learning models as a vehicle for developing dual physical and affective-social goals in authentic learning experiences [21]. From a social learning perspective, prosocial behaviors such as reminding each other of rules, providing support when a friend makes a mistake, and accepting group decisions develop through observation, imitation, and social reinforcement that emerge from peer interactions. This pattern is also consistent with the argument that cooperative strategies in physical education can shape students' emotional regulation and social interaction quality because activities are designed to require attention to others and self-control during movement tasks [22]. In line with the principles of cooperative

learning that emphasize positive interdependence, individual accountability, face-to-face interaction, and social skills, the meaning of cooperation during interventions appears different according to the structure of the game in Gobak Sodor, positive interdependence appears strong because the success of the team is influenced by the coordination of the guard-attack roles, short communication, and collective decision making to secure and seize the game area, this character is in line with the finding that the effectiveness of cooperative learning in physical education is largely determined by theory-based preparation (for example, the formation of heterogeneous groups) and adaptive implementation to the conditions of students [23].

Cooperation in Siki doka develops in the form of social support and turn-taking, which maintains the continuity of the activity. Although the task structure tends to be technically individual, interaction between students is still necessary to maintain the rhythm of the game, ensure adherence to rules, and maintain a conducive classroom climate. This pattern parallels the finding that cooperative learning can be used as a classroom strategy to strengthen social relationships and reduce friction as students learn to negotiate their roles and responsibilities [24]. The aspect of sportsmanship is observed through students' ability to manage minor conflicts, accept mistakes, and agree on solutions without escalation (e.g., repeating a round or accepting a joint decision), which indicates the development of an appreciation for procedural justice and self-control; in physical education literature, the strengthening of this dimension is generally more stable when learning does not stop at normative claims, but is supported by a learning model structure that provides space for practicing values through experience, reflection, and interaction [25].

3.2.3. Pedagogical implications and integration in the PJOK curriculum

Based on a synthesis of quantitative and observational findings, this study confirms that traditional games have comprehensive pedagogical potential in Physical Education (PJOK) learning. Games not only function as a means of improving physical fitness but also as a learning medium that supports integrated social and emotional development. This argument is in line with evidence that game-based approaches and student-centered models in physical education tend to produce multi-domain outcomes, including motivation, participation, and the quality of social interactions, when activities are designed to require decision-making, coordination, and teamwork. The pedagogical value of traditional games is also more likely to be achieved when they are placed as core activities, implemented in a structured manner (dynamic warm-up, core, cool-down), and their intensity is controlled through modifications of area, duration, repetition, and role rotation; within the framework of models-based practice, such arrangements are considered crucial so that learning objectives (physical, social, and personal) are aligned with the learning strategies and experiences experienced by students.

The differences in movement characteristics between Siki doka and Gobak Sodor show opportunities for specific utilization in accordance with the objectives of Physical Education and Health, while also opening up space for differentiation and inclusive participation in heterogeneous classes. Empirical evidence that systematically designed game or movement activities can influence certain motor skills is also shown in movement game-based research

that reports changes in balance components and student movement performance after programmed intervention. On the other hand, strengthening social competencies such as cooperation, communication, and leadership is often more apparent when traditional games are combined with experiential and reflection-based learning approaches. For example, a service-learning program in a traditional sports game course was reported to improve the soft skills (including collaboration) of prospective physical education teachers after eight weeks of implementation [26]. Thus, the integration of Gobak Sodor and Siki doka in PJOK can be positioned not merely as an enrichment activity but as a learning strategy that deliberately targets fitness components while building cooperation and sportsmanship through a game structure that demands social interaction.

4 Conclusion

This study provides empirical evidence that the traditional games Gobak Sodor and Siki doka can be effectively integrated into Physical Education, Sports, and Health (PJOK) learning in elementary schools as a pedagogical approach that is not only oriented towards improving physical fitness, but also supports the development of students' social-emotional aspects. Quantitative findings indicate that both games are able to improve sprint performance as an indicator of physical fitness, although with varying levels of effectiveness. Gobak Sodor produces greater performance improvements than Siki doka, indicating that the dynamic, cooperative movement patterns involving rapid changes of direction provide a stronger physiological stimulus to the speed-based fitness components and explosive power of leg muscles. These movement characteristics encourage more complex neuromuscular involvement and higher metabolic demands, thus potentially accelerating the physical adaptation process.

The Siki doka game demonstrates a more specific contribution to the development of balance, coordination, and motor control. The movement demands that emphasize single-leg support, repetitive step patterns, and postural stability make this game relevant for strengthening basic motor skills related to body control. These activity characteristics encourage the activation of stabilizer muscles and improved neuromuscular control, which play a crucial role in the development of fundamental motor skills in elementary school students. The differences in the movement demands of Gobak Sodor and Siki doka emphasize that traditional games are not homogeneous in their impact but rather possess distinct pedagogical potentials according to the physical fitness learning objectives to be achieved in the context of Physical Education and Health. In addition to the physical aspects, the observational findings of this study indicate that the implementation of Gobak Sodor and Siki doka also contributes to the development of students' social-emotional competencies, particularly cooperation and sportsmanship. In Gobak Sodor, cooperation develops through role coordination, communication between players, and collective decision-making in cooperative-competitive game situations. Group success is largely determined by the contribution of each individual, thus encouraging the emergence of positive interdependence and individual accountability. On the other hand, Siki doka excels in facilitating learning about sportsmanship and self-regulation, as reflected in students' ability to accept rules, manage mistakes, and accept game outcomes without escalating conflict. These

social values develop contextually through interactions during play, in line with the principles of social and cooperative learning in physical education.

This study has several limitations that should be considered when interpreting the results. The relatively limited sample size and short-term intervention duration limit the generalizability of the findings to a broader population and do not allow for analysis of the long-term sustainability of the impact of traditional games. Furthermore, the measurement of socio-emotional aspects relies on observational data during the learning process, thus not fully representing the dynamics of student behavior outside the classroom context or in more diverse social situations. Based on these limitations, further research is recommended involving a larger sample size, a longer intervention duration, and a longitudinal design to assess the stability and sustainability of the impact of traditional games on students' physical fitness and socio-emotional development. Future research could also combine various socio-emotional measurement instruments, such as standardized attitude scales, student and teacher reflections, or a mixed methods approach, to obtain a more comprehensive picture. Exploring the application of traditional games at different educational levels and school contexts is also important to broaden the relevance of the findings. This research strengthens the position of traditional games as an adaptive, contextual, and potentially sustainable approach to physical education (PJOK) learning. Integrating traditional games into PJOK learning is not only relevant to addressing the challenge of declining student physical activity but also offers a holistic pedagogical framework for simultaneously developing students' physical fitness and social character.

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