Enhancing German Language Learning: A Neuro-Linguistic Programming Approach to Online Platforms Within a Team-Based Framework

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Abstract. This study explores the potential of a web-based online learning portal that integrates Neuro-Linguistic Programming (NLP) within a Team-Based Learning (TBL) framework to enhance German language education at the A2 level. The portal customizes learning experiences based on individual cognitive processes, addressing diverse student needs. TBL promotes collaborative learning, critical thinking, and active participation, fostering deeper understanding. Using a Learning Management System (LMS) and algorithms for personalizing content and optimizing group dynamics, the study involves A2-level German students from Medan State University. Data analysis via pre-tests and post-tests shows significant improvements in learning outcomes, demonstrating the effectiveness of combining NLP and TBL in language education.

Keywords: Neuro-Linguistic Programming (NLP), Team-Based Learning (TBL), Online German Learning Web, German language learning level A2

1 Introduction

Indonesia is persistently working to enhance its education system, aiming to empower all citizens to evolve into outstanding individuals capable of addressing and adapting to the evolving challenges of the modern world, as outlined in Law No. 20 of 2003. The effectiveness of an education system is measured not only by the academic achievements it fosters but also by the holistic development it promotes. Elevating the quality of education goes beyond refining

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instructional methods and curricula—it involves nurturing moral and ethical values, which are integral to the formation of well-rounded individuals. This aligns with the national education objectives as defined by law, which emphasize the cultivation of both intellectual capacity and moral character. Therefore, a truly effective education system must aim to develop responsible, ethical citizens who contribute positively to society, in addition to fostering academic excellence. Several factors must be considered to enhance educational quality, with one critical aspect being the creation of effective learning environments. Our previous research has demonstrated that effective learning is achieved when students actively engage in the educational process [1]. To maximize student engagement and enhance educational outcomes, teachers, as facilitators of learning, must thoughtfully and creatively select and implement instructional approaches that are not only appropriate but also tailored to the diverse needs and abilities of their students. By doing so, they can foster a dynamic and inclusive learning environment where every student is actively involved in the learning process, ultimately leading to more meaningful and lasting educational achievements.

The Team-Based Learning (TBL) method is a highly effective pedagogical strategy designed to promote active student participation and foster deep, collaborative learning. By placing students in teams, TBL not only encourages cooperative problem-solving but also sharpens their ability to work cohesively in group settings. This approach goes beyond traditional learning methods, actively engaging students through real-world scenarios and discussions that require critical thinking and teamwork [1]. One of the core strengths of TBL is its integration of both general management processes and specialized topics, offering a comprehensive approach to learning that combines theoretical knowledge with practical applications. This holistic approach helps students develop not only technical or "hard" skills but also crucial "soft" skills such as effective communication, leadership, collaboration, initiative, and presentation abilities. Through structured group activities and team assessments, TBL nurtures a learning environment where students can thrive both individually and collectively, preparing them for dynamic workplace environments and real-world challenges [2]. By fostering a sense of shared responsibility and accountability within teams, TBL ensures that each student contributes meaningfully to the group’s success, thus promoting a higher level of engagement and mastery of the subject matter [3].

Before initiating face-to-face instruction, teachers play a crucial role in providing a variety of learning resources to support the independent study phase within the Team-Based Learning (TBL) framework. These resources typically include multimedia tools such as instructional videos, animated content, slide presentations, e-books, and scholarly articles, all designed to cater to the diverse needs of learners. To ensure seamless access to these materials, educators are encouraged to utilize a comprehensive Learning Management System (LMS) portal, making the content readily available to students. This aligns with Article 35, Paragraph 1 of Law No. 20 of 2003, which mandates the integration of information technology into educational systems to enhance accessibility and promote equitable learning opportunities. The success of the TBL independent

learning phase is closely tied to the availability of a diverse range of learning resources that accommodate individual learning preferences. Tailoring educational content to these preferences fosters a more engaging and effective learning experience. Therefore, the development of an accurate method for predicting each student's unique learning style is imperative. By employing data-driven approaches and predictive analytics, educators can identify these styles, allowing for the personalization of resources that enable students to better comprehend the material.

Furthermore, accurate identification of learning styles also facilitates the formation of dynamic and effective learning teams. In TBL, collaboration and group dynamics are key to deepening understanding and promoting peer-to-peer learning. Grouping students based on complementary learning styles not only optimizes group performance but also enriches the learning experience through diverse perspectives [4]. In addition, adopting varied teaching methods enhances student participation and engagement throughout the learning process. As stipulated in Law No. 14 of 2005, teachers are required to possess strong pedagogical skills, including the ability to identify student learning styles and adapt instructional strategies accordingly. The review of pedagogical practices suggests that creating an active and student-centered learning environment is crucial for improving educational outcomes. A personalized approach—where students' learning styles are recognized and the most suitable teaching techniques are employed—lays the foundation for a more interactive and meaningful learning process. This study aims to design and evaluate the impact of an AI-powered online learning platform within the TBL framework. By harnessing the capabilities of artificial intelligence and predictive analytics, this platform will facilitate personalized learning, foster student engagement, and maximize the potential of information technology in education. The integration of AI technologies into the TBL process not only enables the personalization of learning experiences but also allows for continuous feedback and improvement, ensuring that educational practices evolve to meet the needs of all learners.

This study aims to develop a cutting-edge AI-powered digital learning system to enhance German language acquisition at the A2 level, with a specific focus on addressing the challenges of independent learning within the Task-Based Learning (TBL) framework. By leveraging Artificial Intelligence (AI), the system will provide personalized learning experiences that cater to individual learning styles and performance metrics. Through an online learning portal, the system will dynamically recommend tailored learning resources that align with the principles of Personalized Learning, offering a more effective and individualized approach to language education. Additionally, the AI will facilitate collaborative learning by forming study groups based on students' preferences, skill levels, and achievements. This feature is designed to promote peer interaction and support, creating a more engaging and cooperative learning environment. By adapting to various learning styles and providing targeted resources, the system aims to boost student engagement, improve language learning outcomes, and assist teachers in recognizing and responding to the diverse needs of their students. The primary objective of this research is to enhance the overall

quality of language education by integrating AI-driven personalization into the TBL framework. This will empower educators to provide more responsive and adaptive teaching while fostering a collaborative, student-centered learning experience. The scope of this study includes both the development and rigorous evaluation of the AI-powered digital learning system, ensuring its effectiveness in improving learning outcomes and engagement within the TBL methodology.

2 Literature Review

1) Team-Based Learning

Team-Based Learning (TBL) is an educational strategy that focuses on organizing students into teams to enhance both their hard and soft skills. Unlike Project-Based Learning (PBL) and other small-group methods, TBL is characterized by its minimal spatial requirements, less need for extensive student preparation, and significant emphasis on team responsibility for productivity. In TBL, instructors are crucial for delivering the content effectively but are not necessarily required to have expertise in group dynamics or procedures. Students naturally develop collaborative skills through the TBL process itself, making explicit collaborative instruction unnecessary. TBL can serve as a replacement for or supplement to traditional lecture-based courses and curricula [5]. The core objective of TBL is to move beyond mere content delivery and to shift focus towards practical application and problem-solving, thereby providing students with the opportunity to engage deeply with course material [1]. The approach aims to foster both conceptual understanding and procedural skills [6]. While some class time is dedicated to ensuring comprehension of course content, the majority is spent on team-based projects that simulate real-world challenges, offering students practical problem-solving experiences that are integral to developmental assessment courses [1].

2) E-Learning And Learning Management System

E-learning aligns closely with the concept of Distance Education (PJJ) as defined by Indonesian Law Number 20 of 2005. According to Law Number 20 of 2013, Distance Education refers to a mode of education where students and teachers are separated, and learning occurs through various media such as communication technology, information systems, and other forms of media. In contemporary usage, e-learning is often synonymous with online learning or internet-based education. Within this framework, information technology plays a pivotal role as a bridge connecting teachers, students, and educational content. This digital medium facilitates the delivery of instructional materials, interaction, and engagement, thus transforming traditional learning methods into more flexible and accessible formats.

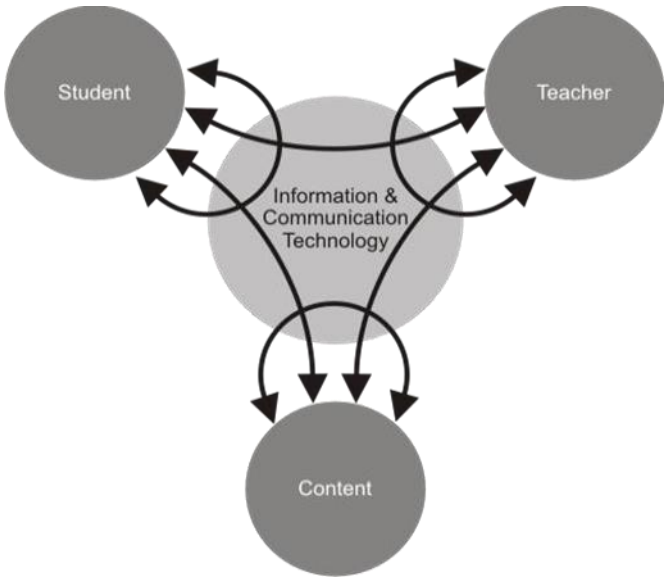

Fig. 1. Dynamics of Interaction between Students, Educators, and Learning Content in E-Learning Environments

In e-learning, students, teachers, and learning content interact dynamically, as illustrated in **Figure 1** [7]. This mode of education serves not only as a platform for interaction between these elements but also as a communication channel for all parties involved. Effective e-learning relies on the integration of a Learning Management System (LMS). A Learning Management System is defined as "a platform that records student progress and facilitates instructor-led online courses" [8]. Among the various LMS options available, MOODLE stands out as a widely used program. MOODLE, which stands for Modular Object-Oriented Dynamic Learning Environment, is an open-source Course Management System (CMS), often referred to as a Learning Management System (LMS) or Virtual Learning Environment (VLE) [9]. Developed using PHP and MySQL, MOODLE is a robust open-source application [8]. Initially built on a foundation of open-source software, including Linux as the operating system (www.linux.com), Zope as the server application (www.zope.org), and Python for programming (www.python.org), MOODLE also utilizes Apache as a web-based gateway server (www.apache.org). Additionally, Unix shell scripts were employed during its initial development phase to manage the system [10]. Today, MOODLE is also compatible with Windows.

2) Personalized Learning

Personalized Learning is defined as the comprehensive integration of tailored educational strategies throughout the entire school environment and across all subjects. With the advancement of technology, this approach has become increasingly feasible [11]. Personalized Learning allows students to receive instruction and support precisely when they need it, enhancing their learning experience [12]. Personalized Learning offers a promising approach to enhancing educational experiences by enabling deeper exploration of subjects and more adaptable paths to success. For instance, in courses such as calculus, statistics, or accounting, mastery-based systems allow students to focus on specific areas of each subject that align with their interests or career aspirations [11]. This tailored approach helps students engage more deeply with the material, improving their understanding and retention.

The growth of digitally personalized learning, facilitated by pre-packaged courses, assessments, and data collection, has become a significant trend in education [13]. Artificial Intelligence (AI) plays a crucial role in this development by enabling the creation of personalized learning experiences on digital platforms. AI can identify students' preferred learning styles, which can be described as their natural tendencies or methods for acquiring and processing information effectively. This includes their speech patterns, learning preferences, task completion strategies, social interactions, and preferred activities [14].

3 Research Method

This study employs a Research and Development (R&D) methodology following the framework established by Sugiyono [15]. Specifically, it focuses on the initial six phases of Sugiyono's comprehensive ten-step process. The research sample comprised 138 students enrolled in an A2 level German reading skills course at the State University of Medan, under the guidance of three experienced lecturers specializing in A2-level instruction. To evaluate the impact of personalized learning on student performance, the study conducted a rigorous t-test to compare pre-test and post-test scores. Central to the study was the integration of artificial intelligence (AI) to create a personalized learning model designed to cater to individual student learning styles. The AI-driven model not only facilitated adaptive learning but also played a key role in optimizing group formation. Through AI modeling, the effectiveness of learning style distribution was systematically evaluated, allowing for a data-driven approach to enhance collaboration and student engagement within groups. The results of this research aim to offer valuable insights into the efficacy of personalized learning models in higher education, particularly in language acquisition, and highlight the potential of AI in improving both individualized and collaborative learning experiences.

4 Research Results and Discussion

1. Data Collection Process

Data for this study, including information on TBL (Task-Based Learning), MOODLE, AI, student activities, and learning styles, were gathered through interviews with experts and literature reviews. The study identified three primary learning styles: Auditory, Visual, and Kinesthetic. Teacher observations were used to determine which learning styles were most applicable to the students. The chosen material for this study consisted of German reading texts at the A2 level, selected based on interviews with experts. This choice was driven by the observation that A2-level German reading skills are often challenging for students, who frequently struggle with this material and show limited interest.

2. Product Design

The online learning portal for this study was developed using the Moodle framework. The portal was hosted on a server equipped with an Intel Xeon E5-2620 processor, an NVIDIA Tesla K40 GPU, 32GB of RAM, and 4TB of storage in a RAID 5 configuration. Installation was performed using a cloud computing solution based on Docker virtualization technology. The process began with the creation of a container featuring the latest version of Moodle. Additional software modules were integrated into this container to build the online learning portal. A new AI-based software module was developed to predict students' learning styles, enabling an automated determination of these styles. This module employs a collaborative filtering system to predict learning styles by analyzing patterns of similarity among students. An evolutionary algorithm is utilized to form learning groups within the AI software module. Figure 3 shows the overall design of the online learning platform, which can be accessed at https://leseverstehena2.dorik.io/. An example of the portal’s interface is also illustrated in Figure 3.

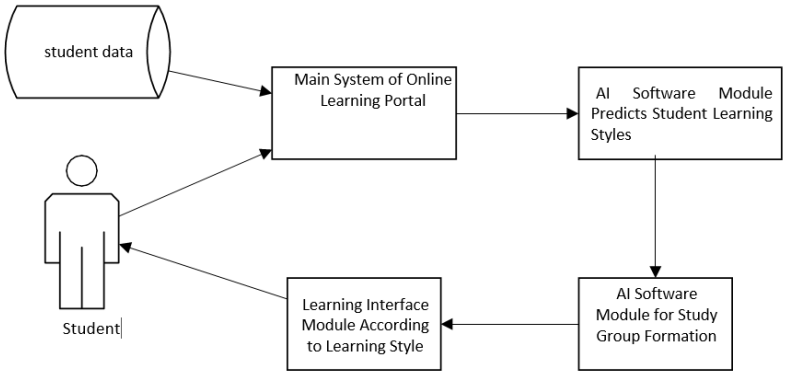

Fig. 2. Architecture of the Developed Online Learning Portal

Fig. 3. Example of the Display of the Developed Online Learning Portal

a. Expert Validation

During the expert validation phase, specialized evaluators assess the teaching materials and tools utilized in this study. The experts have confirmed that the materials satisfy the established content validation criteria. Additionally, they reviewed and evaluated 10 questions from both the pre-test and post-test instruments. It was determined that both assessment tools conform to the predefined requirements and measurement capability frameworks.

b. Product Trial

This study follows the standards for Task-Based Learning (TBL), incorporating modifications to substitute in-person discussions with teleconferences. This approach demonstrates that each student is encouraged to engage with the subject matter independently, tailoring their study methods to their individual learning styles. By employing this Task-Based Learning (TBL) model, it is anticipated that students will be more adept at contributing to group discussions and participating actively in class. The role of the teacher shifts to that of a facilitator, whose primary responsibility is to address and correct student errors.

The evaluation process is managed through the designated Learning Management System (LMS) platform. This system aids teachers by providing detailed insights into areas where students may be struggling. Evaluation is not limited to test results; teachers can also utilize the LMS's outline report feature. This feature offers a comprehensive view of each student's activities within the system, including the duration and timing of their study sessions. Consequently, teachers gain a clearer understanding of individual engagement levels and can better assess which concepts need further reinforcement. This detailed tracking allows for a more targeted and effective teaching approach, ensuring that students receive the support they need to succeed.

c. Data Analysis

In this study, the paired t-test was employed to assess whether there was a statistically significant improvement in student learning outcomes between the pre-test and post-test. The results of this analysis are presented in Table 1, which illustrates the paired t-test findings processed using the R software. The analysis involved a sample of 138 students who completed the Learning Management System (LMS) activities successfully. Based on Table 1, there is a significant average increase (p-value less than 0.05) observed between the pre-test and post-test results. It can be concluded that the designed LMS is effective in improving student learning outcomes. However, due to the limited time students had to engage with the teaching materials available on the LMS portal, the observed average growth appears relatively modest.

Table 1. Results of the Paired T-test on Learning Outcomes

N	Pre-Test (Mean)	Post-Test (Mean)	t	p-value
138	7,49	7,97	3,92	0,0001409*

* indicated p-value < 0.05, the average difference is significant

d. Learning Style Prediction Results by AI

The data generated from the developed LMS system were utilized to train the AI model. Compared to the instructor's predictions, the AI model achieved an accuracy of 14.42% using a collaborative filtering approach. This model made predictions based on LMS data, allowing for a more objective basis for recommendations. Table 2 provides detailed information on the comparison of prediction results. As illustrated in Table 2, the instructor's prediction of students with a visual learning style revealed that the AI model projected many of them to have an auditory learning style.

Table 2. Comparison of Learning Style Prediction Results

		Teacher Prediction		
		Visual	**Auditor**	**Kinesthetic**
AI Prediction	**Visual**	12%	3%	7%
	Auditori	36%	4%	11%
	Kinesthetic	14%	9%	4%

e. Outcomes of AI-Driven Group Formation

Table 3 displays the average belief distribution within groups formed by the AI-driven evolutionary algorithm. The student samples were divided into five distinct groups, with the formation process grounded in specific assumptions. The distribution of beliefs across each learning method category was uniformly spread within each group. This evidence suggests that the AI model utilized for group formation successfully adheres to the requirements of Team-Based Learning (TBL), which mandates that group members be diverse and balanced.

Table 3. Percentage of Student Learning Styles Based on Group

	Visual	**Auditory**	**Kinesthetic**
Group 1	34%	37%	29%
Group 2	30%	36%	34%
Group 3	32%	37%	31%
Group 4	31%	38%	31%
Group 5	31%	37%	32%

4 Conclusion and Suggestions

In the context of Team-Based Learning (TBL), the integration of AI-powered online learning platforms offers significant potential for enhancing student learning outcomes. These platforms provide personalized feedback, adaptive learning paths, and real-time analytics, fostering

a more interactive and tailored educational experience. A detailed analysis using paired t-tests demonstrated a statistically significant improvement in average student scores from pre-test to post-test, indicating that the use of AI in TBL not only reinforces content understanding but also promotes better retention and application of knowledge. This approach effectively bridges individual learning needs with collaborative team efforts, driving overall academic success. To further develop the study, future research could explore the specific AI-driven features that contribute most to the observed score improvements, as well as the long-term impact on student engagement and team dynamics. Additionally, the role of AI in facilitating peer interactions and supporting diverse learning styles could provide deeper insights into optimizing TBL environments. However, trial data indicates that only 78% of students have access to devices necessary for utilizing the newly implemented Learning Management System (LMS), leaving 22% of students struggling with online learning. The study also highlighted that elementary school students exhibit challenges in understanding LMS instructions, whether presented via video, written materials, or instructor-led web meetings. Only 68% of participants successfully completed the online learning modules, suggesting a need for more effective instructional support.

The research demonstrated that the AI model, developed using collaborative filtering algorithms, can predict learning styles based on student interactions within the LMS. Additionally, the AI model, which utilized evolutionary algorithms, proved useful in forming TBL groups. Due to the study's short timeframe, a deeper investigation into various factors was not feasible. Future research should incorporate student demographic data, such as gender, age, socioeconomic status, and initial abilities, to gain a more comprehensive understanding.

Based on the findings, schools should address several critical factors for successful online learning implementation, including ensuring device readiness and enhancing students' ability to navigate the LMS. To support students effectively, intensive initial guidance should be provided when starting AI-based online learning using TBL methods. This approach will help students overcome initial technical challenges with their devices. Additionally, future studies could focus on evaluating the types of devices used by students to participate in AI-based online learning. Given that the current AI model was developed using a limited sample size, increasing the data sample in future research will help improve the model's predictive accuracy and reliability.

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