The Development of an Interactive Learning Game for German Vocabulary Level A1.1

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Abstract. The aim of this research is to develop an interactive learning game for German vocabulary level A1.1. This research consist of 4 phases from the explanation of Reeves' development model, which is: 1) Planning; 2) Development; 3) Iterative testing process; 4) Reflection. The data source used is the "Netzwerk neu A1" coursebook by Ernst Klett Sprachen GmbH in 2019, authored by Stefanie Dengler, Paul Rusch, Helen Schmitz, and Tanja Sieber. The results of this research conclude that a vocabulary learning game covering the themes of "Möbel und Geräte" and "Hobbys" is suitable as a learning media. There are a total of 20 words between the two themes. The materials validation expert gave a grade of 92 (Excellent), while the media validation expert gave a grade of 90 (Excellent).

Keywords: Development, Interactive, Game, German, Vocabulary

1 Introduction

Education serves as the backbone of national progress, and language learning plays a crucial role in equipping students with essential communication skills. In Indonesia, the curriculum emphasizes a holistic approach, encouraging educational practices that are not only productive but also innovative and creative. Modern technology has introduced the potential to make learning experiences more interactive and enjoyable, particularly in language education. Yet, despite these advancements, students often find learning a foreign language, such as German, challenging and uninteresting.

German is a relatively new subject SMA (general high schools) and SMK (vocational schools) Teladan. Due to limited resources, students and teachers often rely on basic materials like textbooks, which lack the interactivity that many students prefer. Given the need for supplementary materials, this study explores whether incorporating gaming elements into language education could provide a more engaging learning environment. Video games are particularly popular among young people, with games like “Mobile Legends” and “PUBG” becoming household names. This cultural shift towards gaming presents an opportunity to integrate educational content into a medium students already enjoy, leveraging games as tools to foster language learning.

Research by [1] Amir and Ghaouti (2022:642) supports this approach, emphasizing that “vocabulary plays a very important role in learning a foreign language”. Vocabulary mastery is a foundational aspect of language acquisition, enabling students to engage in meaningful communication and comprehension. [2] Norbert (2019:49) underscores this, noting that “without words, no one can express or understand written or spoken speech”. This study,

ISLALE 2024, November 06, Medan, Indonesia

DOI 10.4108/eai.6-11-2024.2356608

therefore, focuses on vocabulary acquisition as a key component in improving students' ability to learn German effectively. With the integration of a digital vocabulary game, students might find vocabulary learning more engaging and manageable.

Furthermore, a survey conducted by the researchers at SMA and SMK Teladan in Medan revealed that over 53.4% of students perceived vocabulary as the most challenging and essential aspect of learning German, compared to other language skills like speaking, reading, writing, and listening. Additionally, the survey showed that most students felt that traditional materials like videos, songs, and flashcards, though useful, were not fully engaging. Approximately 92.3% of students expressed interest in using a vocabulary-based video game as a learning tool. Given the clear preference for interactive and digital tools among students, this study seeks to create a vocabulary learning game that addresses this need.

2 Theoretical Foundations

2.1 Reeves Design-Based Research Model

This study applies the design-based research model proposed by Reeves, which is particularly suited for educational interventions aimed at solving practical, real-world problems. According to Reeves [3] (Cotton et al., 2009:1368), design-based research is "intended to create innovations that address pressing issues in real settings while simultaneously contributing to theoretical knowledge".

The Reeves model consists of four stages, which are cyclically repeated for refinement:

a. Planning: Identifying and defining the problem, collecting relevant data, and setting the project goals. This phase involves close collaboration with teachers and students to ensure that the solution directly addresses the identified needs.
b. Development: Developing a prototype or initial version of the educational tool. For this study, Construct 3 was used to build a vocabulary game with specific themes (e.g., hobbies and furniture), designed for A1.1-level learners.
c. Repeated Testing: Testing the prototype in the actual educational setting, collecting feedback, and evaluating its effectiveness. This phase allows for iterative refinement, based on feedback from both students and teachers.
d. Reflection: Analyzing the data gathered during testing, reflecting on its effectiveness, and refining the tool. Reflection involves assessing whether the tool meets the learning objectives and making necessary adjustments to improve its usability and educational impact.

2.2 Vocabulary

Vocabulary acquisition is crucial in language learning, as it serves as the foundation for all language skills. As [1] Amir and Ghaouti (2022:642) stated, "vocabulary plays a very important role in learning a foreign language. Without a solid vocabulary base, learners struggle with reading comprehension, writing, speaking, and listening". [2] Norbert (2019:49) adds that "without words, no one can express or understand written or spoken speech," highlighting the essential role of vocabulary in effective communication.

Vocabulary is typically categorized into three types:

a. Active Vocabulary: This includes words that learners know well and use frequently in conversation and writing. Active vocabulary is a key target in language instruction, as it enables students to express themselves with accuracy and fluency.
b. Passive Vocabulary: These are words that learners understand but don't often use in their speech or writing. Expanding passive vocabulary helps students comprehend more complex language structures, enhancing reading and listening skills.
c. Potential Vocabulary: These words are unfamiliar to learners but can be inferred based on context or prior knowledge. Encouraging students to identify and decode potential vocabulary enhances their language comprehension and inference skills.

This study focuses on active vocabulary by incorporating words related to "Hobbys" and "Möbel und Geräte" in the game design. Mastery of these terms is expected to improve students' practical communication abilities in German.

2.3 Video Games

[4] Sari et al. (2020:235) define video games as problem-solving activities conducted in an enjoyable context. A video game is also something that brings joy to players during gameplay. [5] Mitterer and Steiner (2020:19-30) explain that video games have several genres, including:

a. Action Games
   Action games require quick reactions. The main character is not the primary focus.
b. Adventure and Role-Playing Games
   Adventure games primarily involve solving puzzles and experiencing a story. In role-playing games, the characters have various attributes that can be enhanced through battles and the completion of missions.
c. Strategy Games
   Strategy games often involve large-scale conflicts, ranging from individual battles between two armies to world-spanning wars. Most strategy games include a significant narrative component, with numerous characters and decisions that affect the fate of kingdoms and nations.
d. Simulation Games
   The key aspect of simulation games is their attempt to be as realistic as possible. These games aim to replicate real-life situations as authentically as possible.
e. Puzzle, Thinking, and Educational Games
   In puzzle and thinking games, the main focus is on solving challenging problems. These games usually feature simple graphics and often lack a background story. Unlike adventure games, the puzzles are standalone and self-contained.

The genre chosen for this research is puzzle, thinking, and educational games. This genre does not require elaborate graphics but does need quality learning content. To avoid boring the player, a combination of the puzzle, thinking, and educational games genre and the adventure and role-playing genre is used.

2.4 Educational Games

Educational games have proven effective in facilitating language learning by combining educational content with interactive, engaging elements. As [4] Sari et al. (2020:235) explain, "video games can create an environment where players engage in problem-solving, making learning memorable and enjoyable". This gamified approach to education appeals to learners by incorporating elements of play and exploration, reducing the sense of "learning pressure" often associated with traditional methods.

In foreign language learning, educational games provide an interactive way for students to practice vocabulary, grammar, and language structure in a relaxed environment. [6] Alyaz et al. (2022:130) emphasize the advantages of combining educational content with gaming: "Studies on foreign language learning using adventure games highlight the benefits of immersive, game-based environments for vocabulary retention and comprehension". By using games, learners receive immediate feedback on their actions, allowing them to recognize and correct mistakes, enhancing retention and engagement.

The effectiveness of educational games stems from several unique features:

a. Immediate Feedback
   Unlike traditional methods where feedback may be delayed, games provide instant responses, allowing students to quickly understand and learn from their mistakes.
b. Motivation through Challenges
   Games are often structured around levels or missions, which motivate students to progress and reach learning milestones.
c. Active Participation and Control
   Learners actively participate in the learning process, often controlling their paths through the material, which promotes autonomy and sustained interest.

This study's vocabulary game combines these elements, offering students immediate feedback on vocabulary tasks, structuring the game around challenges, and allowing them to progress at their own pace. By gamifying vocabulary learning, the study aims to increase motivation and improve retention.

2.5 Relevance of Prior Studies

Several studies have highlighted the benefits of using games in language learning. For example:

a. Martua (2022) [7] created an English vocabulary game using Construct 2, a previous version of Construct 3. The game was structured around vocabulary quizzes combined with a "challenge and coin collection" mechanism, making it an engaging and memorable learning experience. Similar to this study, Martua's research demonstrated that gamification could help students remember vocabulary more effectively.
   Similarities: Both studies focus on vocabulary acquisition and use Construct software to develop language learning games.
   Differences: Martua's research targeted English language learners at the middle school level, whereas this study focuses on A1.1 German learners at the high school level.

b. Permatasari, Asikin, and Dewi (2022) [8] developed an educational math game, “Matrig,” using Construct 3. Their study utilized a different subject but showed that gamification could make complex subjects like mathematics more approachable and engaging for students.
   Similarities: Both studies use Construct 3 to enhance traditional learning with game elements.
   Differences: The content focus differs, as this study targets German vocabulary while Permatasari’s game was designed for mathematics.
c. Syahidi, Supianto, and Tolle (2019) [9] implemented a game for learning the Banjar language, showing that educational games are effective for regional language acquisition. Their research reinforced the value of gamification for language learning, especially in introducing new vocabulary.
   Similarities: Both studies focus on language acquisition through game-based learning.
   Differences: The Banjar language game used Macromedia Flash, a different development platform, and focused on regional rather than foreign language learning.

3 Research Methodology

3.1 Research Design

This study is a developmental research project utilizing descriptive qualitative analysis. The research is structured around Reeves’ design-based research model, which focuses on real-world problem-solving through iterative phases of planning, creation, testing, and reflection. This approach is ideal for educational interventions, allowing researchers to engage with participants and adapt the tool based on their feedback.

3.2 Data Collection and Sources

The primary data for this research are vocabulary items extracted from the “Netzwerk neu A1” textbook, which is used as a standard learning resource for A1-level German courses. The vocabulary focuses on the topics "Hobbys" and "Möbel," chosen for their relevance and applicability in everyday communication at the A1.1 level. Primary Source were taken from vocabulary content of “Netzwerk neu A1,” authored by Stefanie Dengler, Paul Rusch, Helen Schmitz, and Tanja Sieber, published by Ernst Klett Sprachen GmbH (2019) [10].

3.3 Research Location and Participants

The research was conducted in the Foreign Language Laboratory at UNIMED and at SMA (Senior High School) and SMK (Vocational High School) Teladan in Medan, Indonesia. These schools were chosen due to their inclusion of German in the curriculum and their willingness to participate in technology-enhanced language learning studies.

The participants were students from two classes: X IIS 3 (SMA) and X TKJ 1 (SMK), who participated in game testing and provided feedback through pre-tests and post tests.

3.4 Research Procedures

The study was conducted in four main phases, as outlined by Reeves' design-based model in Fig. 1.

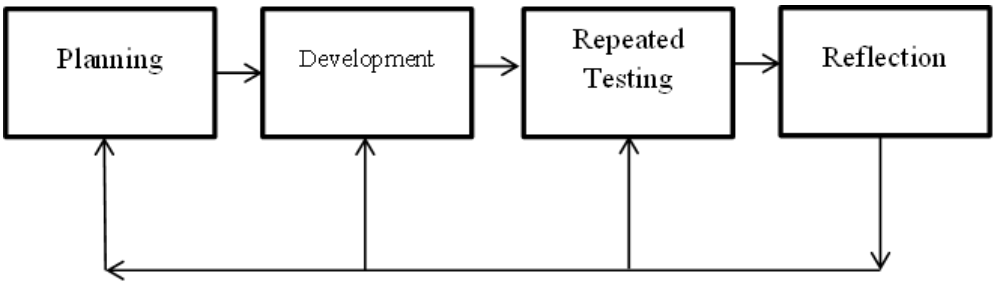


Fig. 1. Reeves' Design Based Model

a. Planing Phase
   1. Problem Identification: Initial discussions with German teachers highlighted challenges related to vocabulary learning, including student disengagement and limited resources.
   2. Data Collection: Surveys were distributed to students to identify their learning preferences and the specific vocabulary topics they found challenging.
   3. Objective Setting: Based on this feedback, the study set out to create a tool that combined educational content with interactive game elements to improve vocabulary retention and student motivation.

b. Development Phase
   1. Game Development: Construct 3 was used to develop the initial version of the game.
   2. Prototype Testing: The initial version was reviewed by German language experts for content accuracy and suitability for A1.1-level learners.

c. Repeated Testing Phase
   1. Pre-Test: Students completed a pre-test to gauge their baseline vocabulary knowledge.
   2. Game Play Sessions: Students played the game over a set period, during which their interactions were monitored, and feedback was collected through observation and questionnaires.
   3. Post-Test: Following the gameplay sessions, students took a post-test to measure any improvements in vocabulary retention.
   4. Feedback Collection: Students and teachers provided qualitative feedback on the game's usability, engagement level, and educational value.

d. Reflection Phase
   1. Data Analysis: Pre- and post-test results were analyzed to determine the game's impact on vocabulary learning. The average scores, along with qualitative feedback, were used to assess the tool's effectiveness.
   2. Revisions: Based on feedback from both students and teachers, improvements were made to the game. These included clearer instructions, additional vocabulary items, and minor adjustments to enhance gameplay and learning outcomes.

3. Validation: The revised game was evaluated by media and content experts, who rated it for quality, relevance, and effectiveness.

4 Results and Discussion

The results are presented in line with the four phases of the Reeves model: planning, creation, repeated testing, and reflection. Each section discusses how the game impacted vocabulary learning and student engagement.

4.1 Planing Phase

Through surveys and discussions with German teachers at SMA and SMK Teladan in Medan, the primary challenge identified was the lack of engaging learning resources. Teachers noted that vocabulary was particularly difficult for students to retain, as traditional teaching methods did not fully capture their interest. Surveys conducted with students revealed that 53.4% identified vocabulary as the most important aspect of learning German as it is showed in Fig. 2. The need for an innovative, interactive tool to support vocabulary learning was clear.

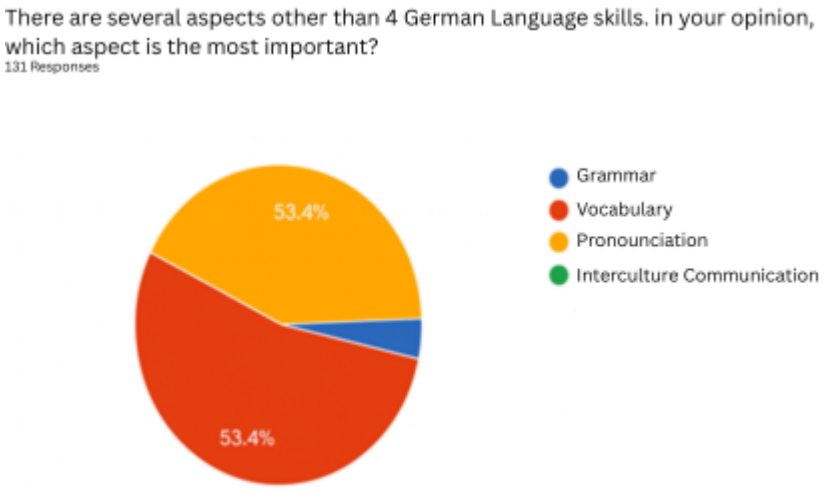


Fig. 2. Survey Results Indicating 53.4% of Respondents Consider Vocabulary (Wortschatz) the Most Important Aspect of Learning German

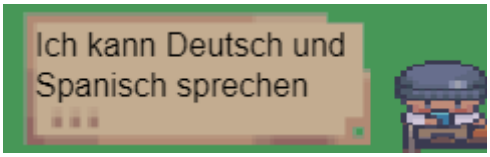
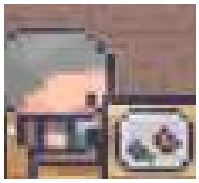
Feedback from the initial survey indicated that students preferred interactive learning tools over traditional materials such as textbooks or flashcards. This insight guided the development of the game, focusing on two themes: “Hobbys” as shown in Table 1 and “Möbel und Geräte” in Table 2. These topics were chosen based on their relevance to students’ current topic during class.

Table 1. Objects for the “Möbel und Geräte” theme.

Pictures	German word
	Der Lerntisch
	Der Lernstuhl
	Der Computer
	Der Schrank
	Das Buch
	Das Bücherregal

Table 2. Objects for the “Hobbys” theme.

Pictures	German Word
	Schwimmen
	Fußball spielen
	Basketball spielen
	Kochen
	Lesen
	Gittare spielen

	Schlagzeug spielen
	Fremdsprache sprechen
	Essen
	Film sehen

4.2 Development Phase

The development phase involved developing a prototype of the vocabulary game using Construct 3, chosen for its user-friendly interface and compatibility with multiple platforms. The game design included:

a. Interactive Vocabulary Challenges: Players matched words with images.
b. Visual: To enhance engagement, the game included images representing vocabulary items.
c. Adventure Elements: Players navigated through levels where they “discovered” new vocabulary, turning learning into an exploration.

The game featured a mix of puzzle-solving and educational challenges to keep the learning experience varied and engaging. The interface was simple (as it is shown in Fig. 3), ensuring that students at the A1.1 level could navigate the game without difficulty.

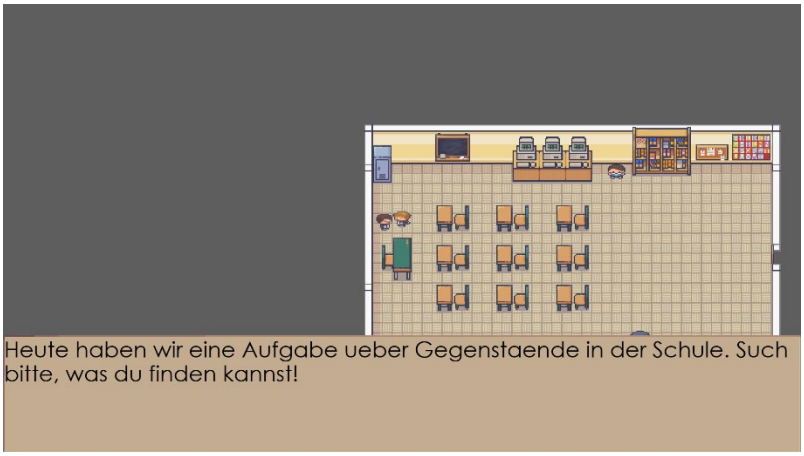


Fig. 3. Interface of the Prototype

Before continuing to the next phase, the prototype was reviewed by language and media experts. The content expert scored the game 92 (rated as "Very Good"), praising the clarity and relevance of the vocabulary exercises. The media expert rated it 90, noting its visual appeal and user-friendliness. These initial validations confirmed that the game was suitable for educational purpose.

4.3 Repeated Testing Phase

The game was tested in two classes: X IIS 3 (SMA) and X TKJ 1 (SMK) in SMA and SMK Swasta Teladan Medan.

4.3.1 Pre-Test

Students completed a pre-test to establish a baseline for their vocabulary knowledge, followed by gameplay sessions over a week. The results of pre-test are as in Fig 4.

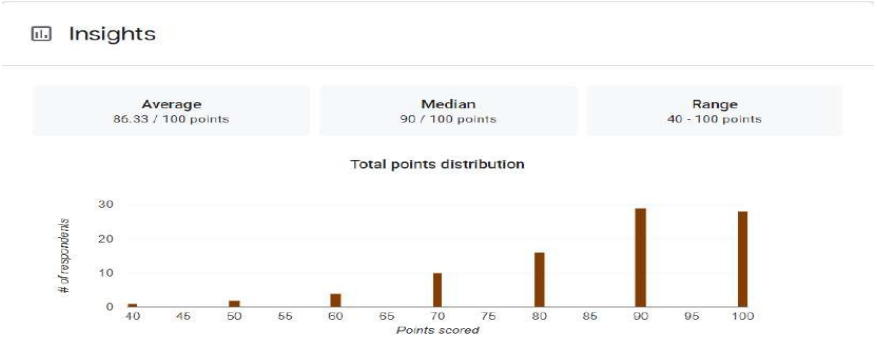


Fig. 4. Results of Pre Test

4.3.2 Gameplay Experience

Students reported that the game was enjoyable and felt more like playing than studying, which motivated them to engage with the material. The combination of puzzle elements and educational content kept the experience stimulating. Observations indicated that students were enthusiastic during gameplay, frequently discussing vocabulary items and strategies with peers. The implementation can be seen in Fig. 5.

Fig. 5. Implementation in Classes

4.3.3 Post Test

Following the gameplay sessions, students took a post-test to measure any improvements in vocabulary retention. The average pre-test score was 86.33, while the post-test average increased to 92.99 (as shown in Fig. 6.), demonstrating a clear improvement in vocabulary knowledge.

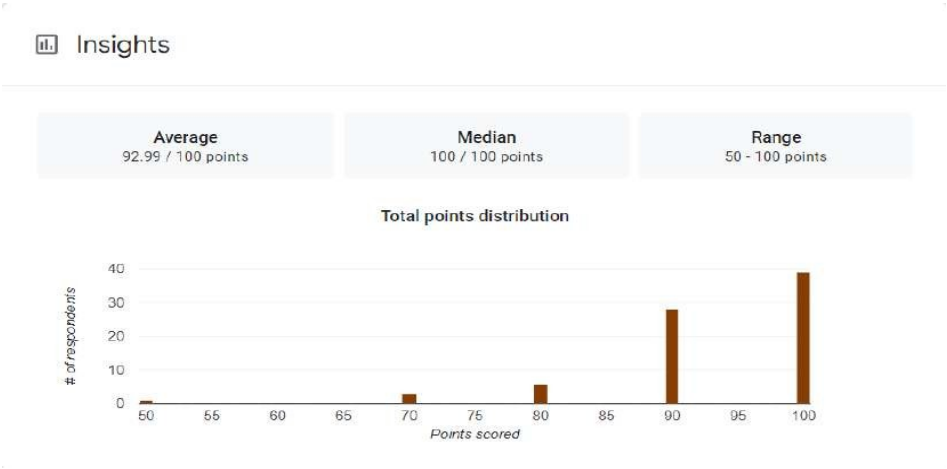


Fig. 6. Results of Post Test

4.3.4 Feedback from Participants

Student and teacher feedback highlighted several strengths of the game:

1. Engagement: Students found the interactive format more engaging than traditional learning methods.
2. Learning Impact: The immediate feedback within the game helped students understand and correct their mistakes, reinforcing learning.

Teachers observed that students who participated in the game-based learning sessions showed more interest and confidence in using new vocabulary. However, some feedback pointed out that instructions needed to be more detailed, which was addressed in the reflection phase.

4.4 Reflection Phase

4.4.1 Analysis of Results

The data showed a significant improvement in students' vocabulary knowledge, as evidenced by the post-test scores. The game's interactive and exploratory format contributed to higher engagement and better retention of vocabulary. The combination of visual, puzzles, and adventure-style navigation proved effective in supporting learning.

4.4.2 Adjustments Based on Feedback

Several improvements were made to the game based on participant feedback:

a. Clearer Instructions: An introductory tutorial was added to guide students through the game mechanics.

b. Expanded Vocabulary: Additional words and phrases were included to provide a more comprehensive learning experience.
c. Enhanced Visuals: Minor graphical adjustments were made to make the game more visually appealing.

4.5 Discussion

The findings align with those of Martua (2022), who observed similar improvements in vocabulary retention through gamified learning tools. Like this study, Martua's research highlighted the importance of interactive elements in keeping students engaged. The current research also confirms Sari et al.'s (2020:235) assertion that "video games create an environment where players engage in problem-solving, making learning memorable and enjoyable". The improvement in test scores supports this claim, showing that the gamification of vocabulary learning can significantly enhance student outcomes.

The use of educational games as supplementary tools can transform traditional language learning, making it more appealing and effective. By incorporating multimedia elements and interactive gameplay, educators can address challenges related to vocabulary retention and student motivation. This study's results suggest that game-based learning could be integrated into the curriculum to complement existing teaching strategies, providing a balanced approach that combines play and learning.

While the study was successful, there were limitations. The game was tested with a relatively small sample size in specific schools, limiting generalizability. Future research should explore testing with larger and more diverse groups. Additionally, while Construct 3 is accessible, creating high-quality games requires time and expertise, which may be a barrier for widespread adoption.

5 Conclusion

The development and implementation of an interactive vocabulary learning game for A1.1-level German learners proved to be successful in enhancing students' vocabulary retention and engagement. By employing Reeves' design-based research model, the study effectively addressed the challenges identified during the initial planning phase and demonstrated how an iterative approach to educational tool development can lead to meaningful improvements in teaching and learning outcomes. The use of Construct 3 to create a vocabulary game provided students with an interactive and enjoyable way to learn new German vocabulary. The average increase from pre-test to post-test scores (86.33 to 92.99) highlighted a significant improvement in vocabulary retention. Students reported that the game's interactive format made learning enjoyable, transforming vocabulary practice from a routine activity into an engaging experience. The use of puzzles and exploration elements kept students motivated and attentive.

Content and media experts confirmed that the game was appropriate for the educational level and provided high ratings for accuracy and user experience. This validation reinforced the potential of the game as a supplementary learning tool in German classes. The study showed that educational games could serve as a valuable supplement to traditional teaching

methods. By integrating game-based learning, teachers can support student motivation, promote active learning, and facilitate better retention of language skills.

Teachers can incorporate such interactive games into their lessons to make language learning more dynamic and appealing. The game developed in this study serves as a template for how vocabulary can be taught in a way that complements existing teaching materials. Teachers could also collaborate with developers or use platforms like Construct 3 to customize similar games for different topics or levels. Students benefit from engaging tools that make learning vocabulary less monotonous and more immersive. The game allows learners to practice in an environment that feels less like studying and more like playing, which can increase their willingness to spend time learning outside the classroom.

6 Challenges and Limitations

While the study achieved its goals, it faced some limitations. The small sample size limited the ability to draw broader conclusions about the game's effectiveness. Additionally, developing high-quality educational games requires technical skills and time, which may pose a challenge for widespread adoption. Future research should explore ways to make game development more accessible to educators.

7 Final Thoughts

The positive results from this study underscore the potential for integrating game-based learning into language education. The interactive vocabulary game created using Construct 3 not only improved students' vocabulary retention but also made learning more engaging and enjoyable. By leveraging the flexibility of educational games, educators can create more personalized and interactive learning experiences that align with students' interests and learning styles.

As technology continues to evolve, the education sector must adapt to incorporate new tools and approaches that resonate with students. This study demonstrates that with careful planning, development, and iterative testing, educational games can be a powerful addition to traditional teaching methods, helping students achieve better learning outcomes in a more enjoyable way.

Future studies should test the game with a larger and more diverse group of students across different schools and regions to assess the generalizability of the findings. This would help determine if the game's effectiveness holds in various educational settings and among students with different backgrounds. Researchers could adapt the game for different proficiency levels (e.g., A2, B1) or other languages to explore its effectiveness in a broader context. By including more complex vocabulary and grammatical structures, the game could be used for intermediate or advanced learners.

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