

Implementation of the MDLC Method for Optimizing Smart Board Functionality in a Sundanese Alphabet Educational Game Application

Miftah Nurjamil*, Yiyi Supendi, Irwin Supriadi

Universitas Langlangbuana, Indonesia

Email: miftahnurjamil21@gmail.com*

Keywords

sundanese script; gamification;
smart board; interactive
multimedia; MDLC.

Abstract

Sundanese script learning in elementary schools still faces obstacles in terms of student involvement and understanding due to the use of conventional methods that tend to be passive. This research aims to develop a Smart Board-based learning game application using the Multimedia Development Life Cycle (MDLC) method and evaluate its effectiveness in improving the quality of learning. The developed app integrates interactive multimedia, gamification, and touch-based interactions to create a more active and engaging learning experience. System testing is carried out using the black box testing method to ensure that all application functions run properly. Evaluations were conducted on 50 elementary school students using a Likert scale questionnaire with indicators of understanding, motivation, and interaction. The results showed that the application obtained an average score of 4.72 which was included in the category of very effective. The motivation aspect has the highest score, followed by interaction and understanding, which shows that the application of gamification and Smart Boards is able to significantly increase student engagement and understanding. Thus, the app can be an effective alternative to interactive learning media as well as support the preservation of local culture through a technology-based approach.

INTRODUCTION

The Sundanese script is a form of cultural heritage that has high historical value and represents the local identity of the people of West Java. The existence of the Sundanese script not only served as a written communication tool in the past but also functions as a cultural symbol that must be preserved by younger generations. However, in learning practices at the elementary school level, mastery of the Sundanese script remains relatively low and suboptimal (Insani & Kholiq, 2025; Santosa et al., 2021).

The main problem faced in learning the Sundanese script lies in the learning methods, which are still conventional (Raden et al., 2020; Wulandari et al., 2023). In this method, the learning process tends to be teacher-centered, where students passively receive material without active interaction. This condition causes students to become less involved in the learning process, resulting in a low level of understanding and reduced learning motivation (Feng & Xiao, 2024; Sari et al., 2018; Syakur et al., 2023).

In addition, the characteristics of the Sundanese script, which has a complex visual form, also present challenges for students in learning it. Clark & Mayer, (2023), without supportive learning media, students tend to experience difficulty recognizing and remembering the script effectively. This indicates that a learning approach is needed that can accommodate students' visual and interactive needs (Insani & Kholiq, 2025; Omoseebi et al., 2024).

Previous research has shown that the use of technology-based learning media, such as e-learning and web-based applications, can improve flexibility and accessibility in the learning process (Nurajizah et al., 2021; Wisnu, 2025). However, without engaging interactive elements, the use of this technology has not been able to significantly increase student engagement. This limitation highlights the need for more interactive and motivating approaches in technology-enhanced learning environments.

In this context, the gamification approach is one of the solutions that can be applied to increase students' learning motivation. Gamification is the application of game elements in non-gaming contexts, such as learning, with the aim of increasing user engagement. Elements such as points, levels, and challenges have been shown to provide stimuli that encourage students to become more active in learning (Hidayat & Syarif, 2023; Twiningsih et al., 2024). In addition, the reward system in gamification can also increase students' intrinsic motivation by providing immediate feedback and recognition for achievement (Wijaya, 2021).

In addition to gamification, the use of interactive technology such as Smart Boards also provides opportunities to create more engaging learning experiences. Smart Boards allow direct interaction through touchscreens, enabling students to actively participate in the learning process. These interactions are not only visual but also involve kinesthetic aspects that can improve students' memory retention (Lestari et al., 2025; Wardani et al., 2022). This multi-sensory engagement supports deeper learning and better information processing.

The urgency of this research is underscored by several factors. First, UNESCO has recognized many local scripts in Indonesia as endangered cultural heritage, necessitating preservation efforts through education. Second, the Indonesian Ministry of Education and Culture's 2024 curriculum emphasizes local content learning, including regional scripts, but provides limited guidance on technology integration. Third, preliminary observations at SD Sukamulya, Tasikmalaya City, revealed that only 35% of fourth-grade students could correctly identify basic Sundanese script characters, and student motivation for learning the script was low because of monotonous teaching methods. Without effective learning media, the transmission of Sundanese script knowledge to younger generations may be severely compromised.

The use of interactive multimedia-based learning media that combines visual, audio, and interactive elements has also been proven to improve students' understanding of the material being taught (Peláez & Solano, 2023). This demonstrates that the integration of various technologies in learning plays an important role in improving the quality of the teaching and learning process. The sustainability of such educational innovations requires careful design and implementation strategies that consider both pedagogical and technological dimensions.

Based on these problems, this study aims to develop a Smart Board-based Sundanese script learning application by integrating gamification and interactive multimedia approaches using the Multimedia Development Life Cycle (MDLC) method (Ramadhan & Herlawati, 2022), as well as evaluating its effectiveness in improving student understanding, motivation, and interaction. The MDLC framework provides a systematic approach to multimedia development that ensures quality and usability of the final product.

The novelty of this research lies in the integration of Smart Board technology, gamification, and kinesthetic-based learning into a single Sundanese script learning application that not only focuses on delivering material but also on improving interaction and students' direct learning experiences.

This literature review aims to provide a theoretical foundation and strengthen the arguments presented in this research. In addition, the literature review is also used to identify developments in previous studies related to the use of technology in learning, especially interactive multimedia, gamification, and the use of Smart Boards to improve learning quality.

The development of information technology has encouraged the emergence of various innovations in learning media, one of which is the use of web-based applications. Web-based learning media provides students with convenient access to learning materials without limitations of space and time. Research has shown that web-based learning applications can increase flexibility and support students' independent learning processes (Nurajizah et al., 2021; Wisnu, 2025). However, the level of interactivity in web-based media remains a challenge that needs to be addressed through innovative design approaches.

To overcome these limitations, interactive multimedia has become one of the most widely used approaches in the development of learning media. Interactive multimedia combines various elements such as text, images, audio, and user interaction into one integrated system. Research shows that the use of interactive multimedia can improve students' understanding of learning materials, especially visual materials (Peláez & Solano, 2023). This is because students can receive information through multiple senses simultaneously, creating richer learning experiences and stronger memory formation.

In addition to interactive multimedia, the gamification approach is also one of the effective solutions for increasing students' learning motivation. Gamification is the application of game elements in learning contexts, such as point systems, levels, and challenges. Research shows that gamification can increase student involvement in the learning process and encourage students to become more active in completing assigned tasks (Hidayat & Syarif, 2023; Twiningsih et al., 2024). In addition, the reward system in gamification also provides positive reinforcement that enhances learning outcomes and persistence (Istiq'faroh, 2024).

In the development of learning technology, the use of interactive devices such as Smart Boards has also become increasingly common. A Smart Board is a technology that allows users to interact directly with a system through a touchscreen. Research shows that the use of Smart Boards in learning can significantly increase student participation because students can become directly involved in the learning process (Lestari et al., 2025; Wardani et al., 2022). This interaction provides a more active and less monotonous learning experience, transforming passive consumption of information into active knowledge construction.

Furthermore, kinesthetic-based learning is also an important factor in increasing learning effectiveness, especially for visual materials such as scripts. Kinesthetic learning involves physical activity in the learning process, such as writing or drawing, which can help improve students' memory of the material being studied (Nugraha, 2022). Other research has also shown that the use of touchscreen-based technology can support kinesthetic learning by providing direct interaction experiences between students and learning materials, engaging motor memory alongside visual and cognitive processing.

In the process of developing learning applications, system development methods also play a very important role. One of the methods widely used in multimedia application development is the Multimedia Development Life Cycle (MDLC). This method consists of systematic stages, starting from concept, design, material collection, assembly, testing, and distribution (Ramadhan & Herlawati, 2022). With clearly defined stages, the application development process can be carried out in a structured manner and produce a system that meets quality standards while remaining flexible enough to accommodate iterative improvements.

Based on a review of various previous studies, it can be concluded that the use of interactive multimedia, gamification, and Smart Board technology each offers advantages in improving learning quality. However, most previous studies developed these learning media separately, meaning they have not yet produced optimal results in improving overall student engagement and understanding.

Therefore, this study seeks to integrate the three approaches—interactive multimedia, gamification, and Smart Board technology—into one Sundanese script learning application developed using the MDLC method. This integration is expected to create a more interactive learning experience, increase student motivation, and strengthen understanding of the material being taught.

RESEARCH METHOD

This research was a type of research and development that aimed to produce a Smart Board-based Sundanese script learning application and evaluate the effectiveness of its use in the learning process.

The method used in the application development was the Multimedia Development Life Cycle (MDLC), which consisted of six main stages: concept, design, material collection, assembly, testing, and distribution (Ramadhan & Herlawati, 2022). This method was chosen because it had a systematic workflow and was suitable for the development of interactive multimedia applications that integrate multiple technological components and pedagogical considerations.

The concept stage was the initial stage that aimed to identify system requirements and determine the objectives of application development. At this stage, an analysis of problems in learning the Sundanese script was conducted, especially those related to students' low involvement and understanding. In addition, user needs were identified to ensure that the developed application was aligned with the characteristics of elementary school students.

The design stage was carried out to develop the user interface and application navigation structure. The design process considered aspects of usability and interactivity so that the application could be easily used by students. At this stage, the integration of gamification elements, such as point and level systems, was also designed.

The material collection stage was the process of gathering materials used in the application, such as Sundanese script content, images, and other multimedia elements. The materials used were tailored to learning needs to ensure relevance to users.

The assembly stage was the application development process in which all designed components were integrated. At this stage, the implementation of the main features—namely the learning menu, practice menu, and gamification-based learning games that supported direct interaction through the Smart Board—was carried out.

The testing stage was conducted to ensure that the application operated according to its intended functions. Testing was carried out using the black-box testing method, which focused on evaluating system functions based on inputs and outputs without examining the internal structure of the program. Testing was conducted on all major application features to ensure that no malfunctions occurred.

The final stage was distribution, which involved implementing the application for users in a learning environment. At this stage, the application was used by students as an interactive learning medium.

The subjects in this study were elementary school students who used the developed learning application. The number of respondents in this study was 50 elementary school students. Data collection was conducted through observations, literature reviews, and questionnaires.

The research instrument used a Likert scale with assessment indicators that included aspects of understanding, motivation, and user interaction. The data obtained were then analyzed by calculating average scores to determine the effectiveness level of the application. The average scores were subsequently categorized into assessment criteria to determine the application's success rate in learning.

By using systematic development methods and measurable evaluation techniques, this research was expected to produce a learning application that not only functioned effectively but also improved the quality of Sundanese script learning.

RESULTS AND DISCUSSION

This research produced a Smart Board-based Sundanese script learning application designed to improve students' understanding, motivation, and interaction in the learning process. This application integrates learning, exercise, and game features in one interactive system, so that students not only receive material, but also directly engage in the learning process.

Main Menu View

The main menu view is the starting page that is displayed when the application is run. This page serves as a navigation hub that connects all the features in the app.



Figure 1. App Main Menu Display

On this page there are three main menus, namely the learning menu, the practice menu, and the game menu. Each menu is equipped with different visual and color icons to make it easier for students to recognize the function of each menu.

Based on the results of using the application, students can quickly understand the function of each menu without requiring significant help from the teacher. This shows that the application interface design has met the usability aspect.

Learning Menu

The learning menu is used to present Sundanese script material to students visually and in a structured manner.



Figure 2. Learning Menu View

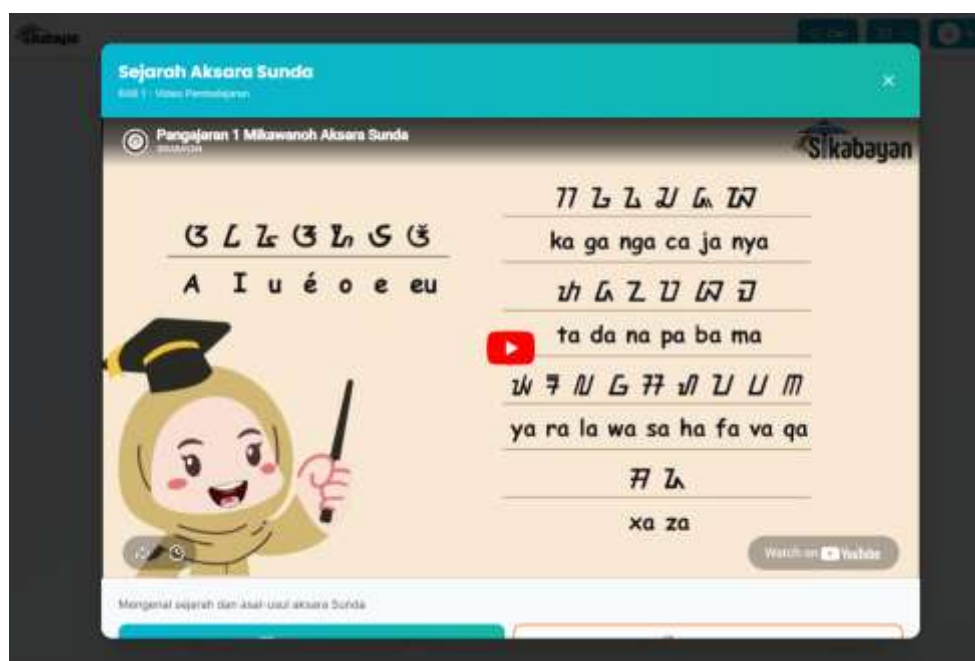


Figure 3. Learning Menu View (watch video)



Figure 4. Learning Menu Display (e-module)

The material is presented in the form of videos and character images accompanied by brief explanations. The presentation is done in stages, starting from basic script to more complex levels. This makes it easier for students to understand the material systematically.

During the use of the app, students show a higher level of attention to the visually presented material. This shows that visual-based learning media is more effective in helping students recognize the form of script.

Exercise Menu

The practice menu is a feature that allows students to practice writing Sundanese characters directly using the Smart Board.

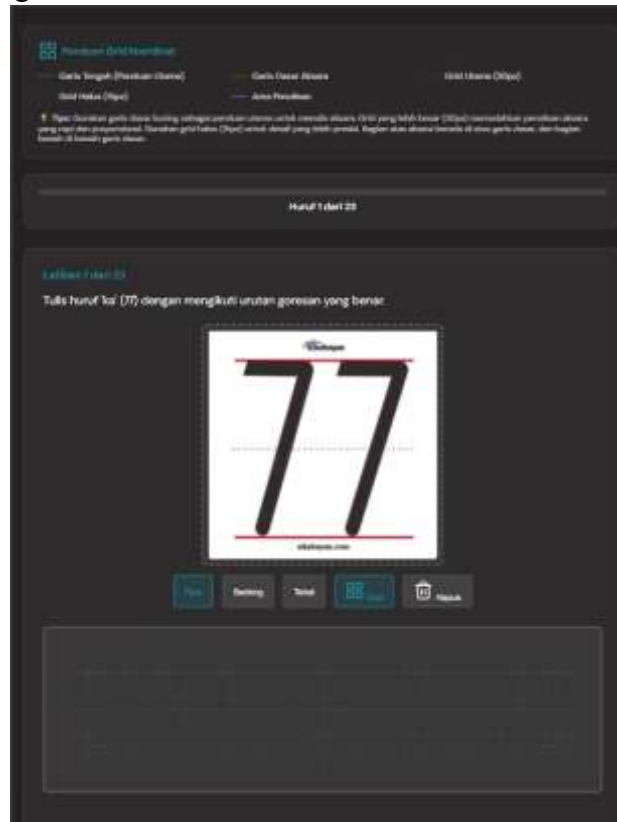


Figure 5. Exercise Menu Display

In this feature, students are asked to write characters according to the example given. The system will respond to the student's writing, so that students can find out the mistakes made.

Direct interaction through touch screens makes students more active in the learning process. Students not only see the material, but also do writing activities, so learning becomes more interactive.

The results of observations showed that students were more enthusiastic in using this feature compared to conventional training methods.

Learning Game Menu

The learning game menu is a key feature in the application that is designed using a gamification approach to increase student motivation and engagement in the learning process. In addition to individual games, the app also provides a group game mode that allows students to play as a team.

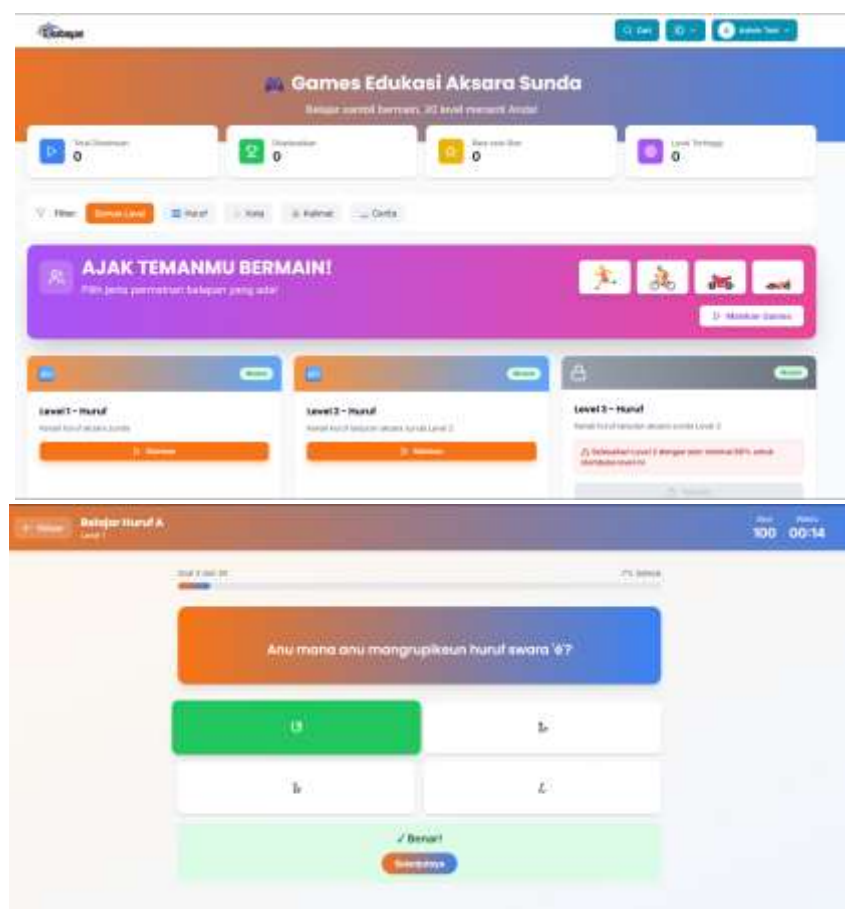


Figure 6. Individual Learning Game Views

In this menu, students are given questions in the form of games that must be solved. Each correct answer will give a point, while an incorrect answer will be given feedback.

The game is designed with a gradual level system. This encourages students to keep trying and improving their abilities. Based on the results of use, students show a high interest in completing each available level.



Figure 7. Group Learning Game View

In this mode, students are divided into two groups, namely Team A and Team B, which compete with each other in answering Sundanese script questions. Each group is given the same question and must choose the correct answer within a predetermined time.

The game is designed in the form of car racing, where each correct answer will make the team's vehicle move forward towards the finish line. This system creates a competitive atmosphere that encourages students to think quickly and work together in teams.

In addition, there is a timer feature that limits the time to answer, so students are required to focus and be responsive to the questions given. Each team's score is displayed live, so students can see the progress of the game in real-time.

Based on the results of observations during the use of the application, this group game mode is able to significantly increase interaction between students. Students not only focus on individual answers, but also discuss and work closely with team members to determine the correct answer.

In addition to increasing motivation, this feature also creates a more fun and competitive learning atmosphere. Students show high enthusiasm during the game, which can be seen from their active involvement in answering questions and the desire to win the game.

Thus, the application of the group game mode in the app not only serves as a medium for learning evaluation, but also as a means to improve cooperation, communication, and student participation in the learning process.

System Testing (Black Box Testing)

The system testing in the Sundanese script learning application was carried out using the black box testing method. This method is used to test the functions contained in the application based on the compatibility between the input provided and the output produced, regardless of the internal structure of the system.

The purpose of this test is to ensure that all features in the application can run as expected and can be used properly by users, especially students as the main user. The test is focused on the main features contained in the application, namely the main menu, learning menu, practice menu, and learning game menu.

The testing process is carried out by running each feature based on the usage scenarios that are common to the user. Each test scenario is designed to see if the system can respond correctly to user input and generate an appropriate output.

Table 1. Testing Menus and features

No	Features	Testing Scenarios	Expected Output	Results
1	Main Menu	Choose a learning, exercise, and game menu	Menus are accessible and move pages correctly	Successful
2	Learning	Display the material of the script	The material appears according to the user's preferences	Successful
3	Exercise	Script input via touch screen	The system responds to input and displays results	Successful
4	Individual Games	Answering questions	The system provides feedback and scores	Successful
5	Group Games	Team A and Team B Interactions	Score and object movements run according to game logic	Successful
6	Timer	Game Deadline	Running and stopping times according to the rules	Successful

Based on the results of the tests that have been carried out, all features in the application can run as expected without significant functional errors being found. This indicates that the developed application has met the functionality aspect of the system.

In addition, the system is also able to respond well to user interactions, both in menu navigation, learning processes, exercises, and games. In the group game feature, the system is able to manage the interaction of two teams simultaneously, including scoring calculations and moving objects in real-time.

Thus, it can be concluded that this Smart Board-based Sundanese script learning application has met functional needs and is ready to be used as an interactive learning medium in the learning process.

Evaluation Results

An evaluation was carried out on 50 respondents who had used the learning application at SD Sukamulya, Tasikmalaya City.

Table 2. Results of Evaluation of the Use of Sundanese Script Learning Games

No	Aspects	Average Score	Percentage	Categories
1	Learning Effectiveness	± 4.71	± 94.2%	Highly effective
2	Reading & Writing Skills	± 4.69	± 93.8%	Highly effective
3	Gamification & Interaction	± 4.73	± 94.6%	Highly effective
4	Use of Smart Boards	± 4.74	± 94.8%	Highly effective
5	Impact on Value	± 4.76	± 95.2%	Highly effective

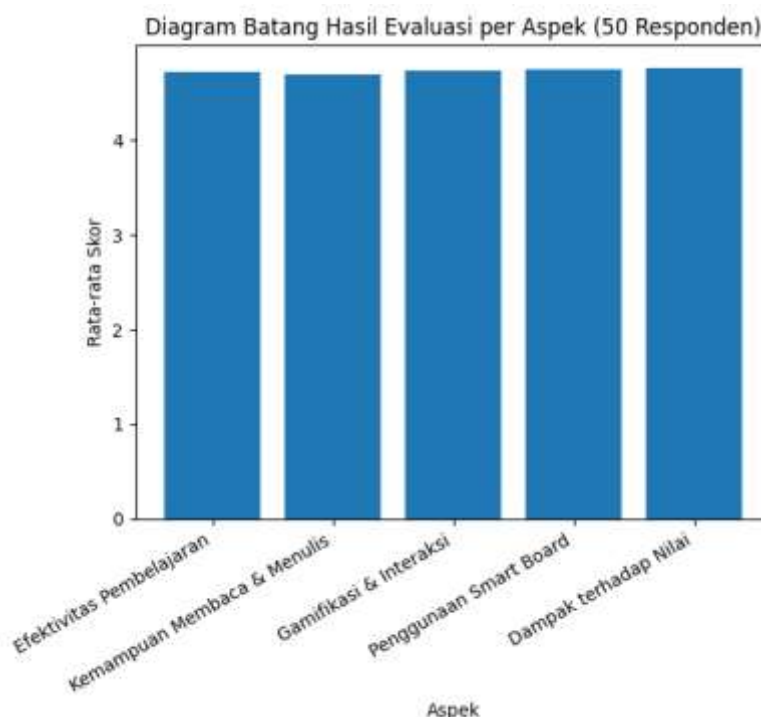


Figure 8. Bar Diagram of the Results of the Evaluation of the Use of Sundanese Script Learning Games

Based on the results of the evaluation of 50 respondents, it was found that all aspects of the assessment showed an average score of 4.72 out of a scale of 5, which was included in the very good category. The learning effectiveness aspect obtained an average score of 4.71, reading and writing skills of 4.69, gamification and interaction of 4.73, use of smart boards of 4.74, and impact on scores of 4.76.

The aspect with the highest score is the impact on grades, which shows that the use of Sundanese script game applications makes a positive contribution to improving student learning outcomes. In addition, the high value of gamification and interaction shows that a game-based approach is able to increase student engagement and learning motivation.

Overall, these results show that the application developed is very effective and feasible to be used as an interactive learning medium in improving students' understanding, skills, and learning outcomes in Sundanese script materials. Thus, the integration of game-based technology and smart boards in learning can be an innovative solution to improve the quality of learning in elementary schools.

Results Analysis

Based on the results of evaluation and observation, the application developed has a positive impact on the learning process. Students show increased participation as well as engagement during the use of the app.

In addition, students also show a tendency to repeat the use of the app, especially on game features, to obtain a higher score. This shows that the app not only serves as a learning medium, but also as a tool capable of increasing learning motivation.

In terms of interaction, the use of Smart Boards allows students to interact directly with the system, so that learning becomes more active and not monotonous.

Comparison with Conventional Methods

When compared to conventional learning methods, this app provides a more interactive learning experience. Students not only receive material, but also practice and interact in person.

This makes it easier for students to understand the material and be more interested in participating in learning.

Research Implications

The results of this study show that the use of technology-based applications can significantly improve the quality of learning. This application can be used as an alternative learning medium that is more interactive and interesting.

In addition, this application can also support the preservation of local culture through a modern technological approach.

Research Novelty

The novelty of this research lies in the integration between Smart Board technology, gamification, and interactive learning in one Sundanese script learning system.

This approach not only improves the delivery of material, but also enhances students' hands-on interaction and learning experience.

CONCLUSION

Based on the results of the research and evaluation involving 50 respondents, the game-based Sundanese script learning media demonstrated a very high level of feasibility and effectiveness. This was reflected in the average scores across five assessment aspects, namely learning effectiveness (4.71), reading and writing skills (4.69), gamification and interaction (4.73), Smart Board usage (4.74), and impact on academic performance (4.76), all of which were categorized as very good. These findings indicate that the application was effective not only in improving students' understanding of Sundanese script materials but also in enhancing their reading and writing skills while providing a more interactive and engaging learning experience through gamification features. Furthermore, the integration of Smart Board technology was proven to support a more active and participatory learning process. Future research is recommended to involve a larger and more diverse sample population, as well as to explore the long-term impact of gamification and interactive multimedia on students' retention and mastery of regional scripts.

REFERENCE

- Clark, R. C., & Mayer, R. E. (2023). *E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning*. John Wiley & sons.
- Clark, R. C., & Mayer, R. E. (2023). *E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning*. John Wiley & Sons.
- Feng, Z., & Xiao, H. (2024). The impact of students' lack of learning motivation and teachers' teaching methods on innovation resistance in the context of big data. *Learning and Motivation*, 87, 102020.
- Hidayat, T., & Syarif, M. (2023). The effectiveness of PBL gamification in regional language learning in elementary schools. *Jurnal Pendidikan Dasar (JPD)*.
- Insani, N. H., & Kholiq, Y. N. (2025). Exploring learning difficulties and causal factors in Javanese scripts: Student and teacher perspectives in Indonesian high school. *Jurnal Pemberdayaan Masyarakat*, 4(3), 642–662.
- Istiq'faroh, N. (2024). Educational games as learning media in the 21st century. *Elementary Journal*.

- Lestari, D. A., et al. (2025). Integration of smart board and web-based learning: Transforming cultural literacy in modern elementary schools. *Jurnal Instructional Technology*.
- Nugraha, S. (2022). Kinesthetic interactivity in touchscreen-based learning media for early childhood. *Jurnal Educational Innovation*.
- Nurajizah, S., et al. (2021). Designing web-based Sundanese script interactive learning media applications. *Jurnal Informatika Khatulistiwa*.
- Omoseebi, A., Ben, A., & Andy, W. (2024). *Institutional challenges in accommodating diverse learning styles*.
- Peláez, C. A., & Solano, A. (2023). A practice for the design of interactive multimedia experiences based on gamification: A case study in elementary education. *Sustainability*, 15(3). <https://doi.org/10.3390/su15032385>
- Raden, A. Z. M., Rustopo, R., & Haryono, T. (2020). Transformation tradition: Incorporating technology and local culture in Sundanese script. *Cultural Syndrome*, 1(2), 133–140.
- Ramadhan, A., & Herlawati. (2022). Implementation of the MDLC method in the development of interactive learning media to know local culture. *Journal of Informatics Engineering (JTI)*.
- Santosa, S., Wakhudin, A. H. S., Suyitno, A., & Ahmad, B. (2021). The effectiveness of Javanese script reading media in improving Javanese script reading skills in elementary schools. In *ICONESS 2021: Proceedings of the 1st International Conference on Social Sciences, ICONESS 2021, 19 July 2021, Purwokerto, Central Java, Indonesia* (p. 411).
- Sari, L. Y., Adnan, M. F., & Hadiyanto, H. (2018). Enhancing students' active involvement, motivation and learning outcomes on mathematical problem using problem-based learning. *International Journal of Educational Dynamics*, 1(1), 309–316.
- Syakur, A., Sudrajad, W., Winurati, S., & Tilwani, S. A. (2023). The motivation of students and their exposure to learning loss after the pandemic. *Studies in Learning and Teaching*, 4(3), 622–633.
- Twiningsih, A., Gunarhadi, & Musadad, A. A. (2024). Gamification-based mobile learning media to improve learning outcomes. *Journal of Educational Technology Letters*.
- Wardani, A. R., et al. (2022). *Utilization of smart whiteboard media in elementary school learning*.
- Wijaya, K. (2021). Application of gamification elements in elementary education: A systematic literature review. *Journal of Educational Technology*.
- Wisnu, I. B. M. W. P. (2025). Who benefits from gamification? The role of web-based learning in elementary education. *Journal of Elementary School Science*.
- Wulandari, L. S., Rosalina, E., & Shomami, A. (2023). Adaptive learning of Sundanese script based on Android games in the digital era. *P2M STKIP Siliwangi*, 10(1), 25–39.