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Inclusive learning innovation with mobile-based bilingual interactive games for slow learner students

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ABSTRACT

This Community Service Program developed a mobile-based bilingual interactive game called "Safari Kingdom" for slow learner students in inclusive education. The purpose of this service is to improve the language and cognitive skills of slow learner students in an inclusive educational environment. The method used is CBPR (Community-Based Participatory Research) which develops games in collaboration with teachers, students, and lecturers in designing innovative learning media that supports students' language and cognitive skills. The development process includes prototyping, initial trials, and ongoing evaluation with feedback from stakeholders. The results of the implementation show that the use of this game has a positive impact on the understanding of slow learner students in bilingual learning, increases learning motivation, and assists teachers in integrating technology into teaching methods. The average quiz score of students increased from 43.6 in conventional learning to 84.6 after using the game. A questionnaire of teachers and guardians of students revealed that 90 percent agreed that the use of games increased learning motivation, while 95 percent supported the effectiveness of mobile game-based learning. The program successfully integrates technology into more inclusive and interactive teaching methods.

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1. INTRODUCTION

SD Muhammadiyah 4 Malang is an educational institution in the heart of Malang city committed to developing quality, Islamic, and character-driven students. Strategically located, this school is a top choice for parents seeking quality education for their children. With complete facilities, SD Muhammadiyah 4 Malang provides a conducive learning environment for students' intellectual, moral, and spiritual growth. A learning environment can be defined as a place or condition that influences the process of human behavior change (Nurdin & Muznir, 2019).

However, like many other educational institutions, this school faces several challenges in implementing education. One major issue is the availability of interactive games tailored to the needs and developmental levels of slow learners. Conventional methods are still often used in the teaching process; teachers frequently focus only on students memorizing ideas or definitions (Fauzan, 2013; Kurniasih et al., 2020). Schools often face difficulties in finding or developing adequate games to help slow learners

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better understand the learning material. Research suggests that using interactive applications improves learning outcomes by making learning enjoyable, thereby increasing students' motivation to learn (Gandasari & Pramudiani, 2021).

Figure 1. SD Muhammadiyah 4 Malang, a community service partner

Another issue is the ineffectiveness of conventional teaching in the context of inclusive education. Rahmi et al. (2024) state that inclusive education accommodates and includes various differences and needs of learners. Teachers need adequate training to choose, adapt, and integrate special learning media, particularly interactive games, into daily teaching and to support slow learners in effectively using these games (Saputra & Febriyanto, 2019). Inclusive education plays a crucial role in ensuring equal access to quality learning for all individuals, regardless of background or special conditions. In this context, slow learners often face complex challenges in understanding and absorbing learning material, which can affect their academic progress and overall well-being. To address these challenges, innovative and inclusive learning approaches become increasingly important (Damanik et al., 2022). In this regard, the use of technology, such as mobile-based bilingual interactive games, has emerged as a promising solution to facilitate learning for slow learners more effectively. Mualif et al. (2024) states that interactive learning media is one of the components that make learning activities more engaging and innovative. Interactive games not only provide a fun and challenging learning environment but can also be customized to meet individual student needs, including their bilingual requirements (Setyorini & Siti, 2021). Rahayu & Riska (2018) add that in the teaching-learning process, utilizing learning media in the form of games is essential to improve English language skills.

Based on the above conditions, there is a need for a touch of science and technology (IPTEKS), particularly in primary education. According to the 1945 Constitution, primary education aims to educate and shape a devout, patriotic, skilled, creative, virtuous, and polite nation capable of solving problems in their environment (Nuraeni et al., 2023; Ramadanis et al., 2023). The goal of this community service program, particularly for inclusive education slow learners, is to provide differentiated learning, namely interactive games specifically designed to suit the understanding level and needs of slow learners, especially in introducing animals in English. Riska & Rahayu (2018) assert that English is important not only for academics but also for communication. Today, English is introduced to children from an early age. Another aim of this game is to enhance learning motivation by incorporating elements of fun and challenge for slow learners who struggle with conventional learning. It facilitates experience-based learning by utilizing interactive features and direct experiences. Through this interactive game, slow learners can actively engage in the learning process, reducing stigma and feelings of inferiority as the game creates a relaxed and pressure-free learning environment for slow learners.

Figure 2 is a depiction of the solutions implemented to address the issues faced by SD Muhammadiyah 4 Malang City.

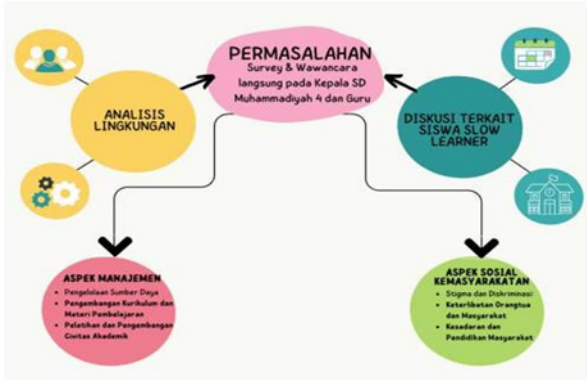


Figure 2. Problem-solving solutions for SD Muhammadiyah 4 Malang City

Based on Figure 2, the issues faced by SD Muhammadiyah 4 Malang City were identified through surveys and direct interviews with the school principal and teachers. These issues were addressed using two methods: environmental analysis and discussions related to slow learners. Based on environmental analysis and discussions, results were obtained in the form of improvements in management aspects and social community aspects. In terms of management, actions included human resource management, curriculum development, and learning material enhancement, as well as training and skill development for the academic community. On the social community aspect, actions addressed stigma and discrimination, parental and community involvement, and public awareness and education. Solutions provided for these issues included the development of an affordable and user-friendly interactive game platform specifically for slow learners, technical training and guidance for teachers and academic staff, and the implementation of interactive games:

2. METHODS

Activity Method

The method used in the community service activities at SD Muhammadiyah 4 Malang City is Community-Based Participatory Research (CBPR). CBR (Community-Based Research) is part of the action research model that actively involves the community in the research implementation. This approach goes beyond designing models formulated by researchers as academics, positioning the community as collaborative partners in every stage of the research (Rosyidah, 2021). The steps of the CBPR method are shown in Figure 3.

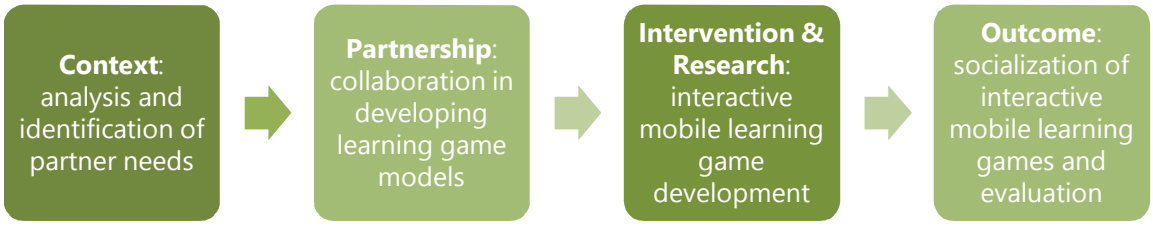


Figure 3. Community-Based Participatory Research (CBPR) method stages

Based on the CBPR method, the stages of community service activities conducted to solve the problems faced by the partner were carried out through several phases explained in Figure 4.

Figure 4. Stages of community service activities

Preliminary Study and Needs Identification

The first method conducted was a preliminary study and needs identification. In this method, a preliminary study was carried out to understand the conditions and challenges faced by slow learners in the context of inclusive education. The identification of slow learners' needs regarding bilingual learning and the use of technology in education was also conducted.

Figure 5. Discussions with the school on identifying the needs of slow learners

Game Design

The next phase was game design. During the game design phase, a concept for a bilingual interactive game was developed to meet the needs and characteristics of slow learners. This phase involved various stakeholders, including teachers, parents, and special education experts, to determine relevant features and game content.

Game Development

After completing the game design phase, the next phase was game development. The game development team began building a mobile-based game prototype based on the designed concept. Feedback from students, teachers, and inclusive education experts was utilized to refine the game prototype continuously.

Phase 1 Testing

In this phase, the initial prototype game was tested with a small group of slow learners from various age levels and backgrounds. Students' responses and feedback were analyzed to identify necessary improvements.

Further Development

In this phase, features were refined and optimized based on the initial testing results and received feedback. Advanced development included adding content, mini-games, and other features that could enhance students' learning experiences.

Phase 2 Testing

The second testing phase involved comprehensive testing of the game with a larger group of slow learners and teachers. The effectiveness of the game in improving bilingual language skills, cognitive abilities, and student participation in learning was evaluated.

Training and Monitoring

During the training and monitoring phase, teachers and educators were trained on using interactive games to support slow learners in inclusive education. Monitoring was conducted to assess the game's usage by students and its impact on learning outcomes and the well-being of slow learners.

Evaluation

In the evaluation phase, the game's effectiveness was periodically assessed, and adjustments or improvements were made based on received feedback. Continuous development strategies were implemented to ensure the program's sustainability and the further development of the game.

3. RESULTS AND DISCUSSION

The community service initiative began with a preliminary study aimed at identifying the conditions, needs, and challenges faced by slow learners in inclusive education. From the study, data indicated that slow learners require interactive learning media that support bilingual capabilities. Based on this information, a mobile-based game with bilingual features was designed, tailored to the characteristics of slow learners.

Development of the Bilingual Interactive Game

In the first phase of implementation, a prototype for a mobile-based game was designed and developed. This game was specifically created for slow learners, featuring bilingual elements to support learning in both English and Indonesian. The process involved analyzing student needs and designing a game concept that was both fun and educational, in line with the cognitive abilities of slow learners. Feedback from inclusive education experts and teachers handling slow learners was used to refine the game features.

Testing

Testing was conducted in two stages: a small-scale trial with a few slow learners of varying ages and backgrounds, followed by large-scale testing. The purpose of these trials was to evaluate the prototype game in real-world scenarios. Responses from students and teachers regarding game usage and learning outcomes were analyzed to identify weaknesses and areas for improvement.

Evaluation

The evaluation phase focused on assessing bilingual comprehension, cognitive skill development, and increased student participation in the learning process.

Introducing the Game to Teachers and Educators

During this phase, the game was introduced to teachers, school principals, and educational staff in inclusive schools. The aim of this introduction was to provide an understanding of how the bilingual interactive game operates and its benefits as a learning tool for slow learners.

Teacher Training

Training sessions were organized to help teachers integrate the game into their daily teaching processes. These sessions included materials on game features, monitoring student progress through the game, and strategies for maximizing the game's benefits for slow learners.

Technology Application for Slow Learners

The game was implemented in classrooms as part of the inclusive education program. Students were given the opportunity to learn through the game, utilizing mobile technology as the primary medium. Monitoring was conducted to observe the impact of game usage on student comprehension, especially in bilingual learning contexts.

Activity Material

This community service program involved providing materials to teachers and parents, beginning with an introduction to inclusive education concepts and the importance of digital media for slow learners. The introduction of the game included a guide on using the bilingual interactive game, covering its features, benefits, and effective usage strategies. The program also included workshops for teachers, offering intensive training on integrating technology into inclusive education. Classroom application guidance was provided, along with monitoring and evaluation of learning outcomes. These stages were designed to ensure the effective development and implementation of the bilingual interactive game in supporting slow learners in inclusive educational settings.

Interactive games have proven effective in various educational contexts due to their ability to enhance student engagement and motivation. In inclusive education, where students of varying abilities learn together, interactive games serve as invaluable tools. These games provide a fun and customizable learning approach tailored to slow learners' needs. Through gamification principles, students experience more active and participatory learning. Beyond academic content, bilingualism in these games expands vocabulary and language skills, improving comprehension of academic materials. Furthermore, accessing materials in two languages fosters cognitive flexibility and deeper understanding, especially in English language studies. Based on the issues faced by partners, several solutions were proposed: (1) Development of an Affordable and User-Friendly Interactive Game Platform: (a) Procurement of innovative technological tools; (b) Collaboration among the PKM team to develop an affordable, user-friendly, and accessible interactive game platform specifically for slow learners; (c) The platform was designed specifically to support inclusive learning with features allowing adjustments and differentiation for individual learning needs; (2) Training and Technical Guidance: (a) Organizing training sessions for teachers and school staff on using the interactive game platform; (b) Integrating interactive game training into the curriculum; (c) Designing appropriate learning activities; (d) Using game data to personalize student learning; (3) Implementation of Interactive Games: (a) The interactive game was implemented with teacher assistance, particularly for slow learners; (b) Motivating slow learners to understand learning

materials through interactive games; (c) Conducting outreach programs for parents to support the use of interactive games in improving the learning of slow learners.

Table 1. Schedule of activities for the community partnership program

Stage(s)	Activities	Objectives
Preliminary Study and Needs Identification	- Conduct direct observations in inclusive schools to understand the conditions of slow learners. - Conduct interviews with teachers, parents, and educators to identify challenges and needs in teaching slow learners. - Analyze inclusive education curricula and evaluate the most effective materials to assist slow learners. - Collect data through surveys to determine the preferences and technological capabilities of students and teachers in using game-based learning media.	- Identify the needs of slow learners in the context of bilingual learning. - Determine the features and design of the game suitable for the characteristics of slow learners. - Gather relevant information for developing interactive games that optimally support the learning process.
Implementation of Interactive Games	- Integrate interactive games into learning activities for slow learners in inclusive schools. - Supervise and assist students as they use the game as part of their learning sessions. - Measure students' understanding through games and evaluate the game's effectiveness in enhancing language and cognitive skills. - Document student interactions with the game, as well as note challenges encountered during implementation.	- Directly observe the effectiveness of interactive games in helping students understand learning materials, particularly in a bilingual context. - Ensure smooth integration of the game into classroom activities. - Identify shortcomings of the game and gather feedback for further development.
Introduction of Interactive Games	- Present the concept and features of the bilingual interactive game to teachers and educators. - Conduct brief trial sessions for teachers so they can understand how the game works and its benefits. - Provide written guides and video tutorials on using the game to support learning for slow learners.	- Provide a comprehensive understanding to teachers and educators about the benefits and how to use the bilingual interactive game. - Ensure teachers feel confident and skilled in utilizing the game as a teaching medium. - Increase teacher participation in integrating technology into inclusive teaching methods.

Socialization

This stage focuses on introducing the Mobile-Based Bilingual Interactive Game Program to various stakeholders, including slow learner students, parents, teachers, and school staff. The activities include: (1) Initial Meeting and Presentation: Organizing an initial meeting with the school and parents to explain the program's objectives, benefits, and implementation plans; (2) Information Distribution: Sharing information through social media platforms, such as YouTube (Asia Institute), Instagram (Asia Institute), YouTube (SD Muhammadiyah 4), Instagram (SD Muhammadiyah 4), and Times Indonesia digital media; (3) Open Discussion: Hosting Q&A and discussion sessions to gather feedback and expectations from stakeholders, ensuring a more effective approach.

Table 2. Mapping of problems, solutions, achievement indicators, and measurable indicators

Problem(s)	Solution(s)	Outcome Indicator	Measurable Indicator
The management of school resources is inadequate for the development of interactive games.	Development of interactive games specifically for slow learner students.	The availability of interactive games to facilitate slow learner students.	- Three themes of interactive games available for slow learner students. - 100 percent active participation of slow learner students.
Teachers are unable to develop curricula and teaching materials for inclusive education.	Collaboration with the PKM team to develop an interactive game platform for inclusive education.	Teachers can develop curricula and teaching materials for inclusive education.	- 100 percent of teachers participate in training on education, game development, and curriculum implementation for inclusive education.
Academic staff, especially teachers, have never attended training on the development and use of interactive games.	Conduct training and technical guidance for teachers and school staff on using the interactive game platform.	Academic staff, especially teachers, acquire knowledge about interactive games.	- 100 percent of teachers' knowledge about interactive games increases. -
Social Aspect - Stigma and Discrimination: Slow learner students face stigma and discrimination from classmates due to slower comprehension of learning materials.	- Motivate students, especially slow learners. - Implement interactive games with teacher guidance for slow learner students.	- Slow learner students are motivated to learn. - Interactive games are implemented in learning activities.	- 100 percent of slow learner students are motivated to learn. - 100 percent of interactive games are implemented by teachers in inclusive education.
Social Aspect - Parental and Community Involvement: There is a need for better understanding of the benefits of interactive games in supporting the development of slow learner students.	Provide education to parents to support the use of interactive games in facilitating the learning of slow learner students.	Parental education supports the utilization of interactive games in student learning.	- Parental education conducted to support the use of interactive games
Social Aspect - Awareness and Education: Society lacks awareness about the needs and potential of slow learner students and the role of interactive games in supporting inclusive education.	Provide educational outreach to parents on the role of interactive games.	Educational outreach provided to parents on the role of interactive games.	- Educational outreach conducted for parents on the role of interactive games.

Training

The training targets teachers of SD Muhammadiyah 4, representatives of parents from grades 1 to 3, second-grade students, and supporting staff involved in the use of the interactive game. The

training activities include: (1) Workshops for Teachers and Parents: Teaching how to use the interactive game application, utilize bilingual features, and support students in using the technology effectively; (2) Technical Training: Explaining how the application aligns with the school curriculum and teaching materials; (3) Usage Simulation: Conducting simulation sessions where teachers, parents, and students can directly practice using the application with technical team assistance.

Technology Implementation

This stage emphasizes the integration of technology into classroom learning activities. The activities include: (1) Game Application Installation: Installing the "Safari Kingdom" game application on mobile devices of teachers and parents, assisted by the PKM implementation team; (2) Integration into Learning Activities: Promoting the use of the application in daily learning processes within inclusive classrooms, with a special focus on slow learner students; (3) Usage Monitoring: Overseeing the application usage in the classroom to ensure its optimal use and alignment with lesson plans, particularly for English lessons on the topic of Animal Introduction.

Mentoring and Evaluation

This stage focuses on providing continuous support to teachers and students while evaluating the program: (1) Technical Assistance: The mentoring team will periodically visit the school to resolve any technical issues or challenges in using the application by students and teachers; (2) Student Performance Evaluation: Conduct evaluations to measure the application's effectiveness in improving the understanding and learning capabilities of slow learner students. This involves monitoring learning outcomes, student engagement, and interviews with teachers and parents; (3) Adjustments: Based on the evaluation results, adjustments to the application features or usage methods will be made to better meet the students' needs.

Products of the PKM Program

The product resulting from the PKM "Bilingual Mobile-Based Interactive Game for Slow Learners in Inclusive Education" program is the mobile game "Safari Kingdom." This game features land and sea animal-themed content with instructional media in both English and Indonesian.

Figure 6. Initial interface of Safari Kingdom game

Results of the PKM Program

Based on the results of the activity on September 4, 2024, it shows that the PKM Mobile-Based Bilingual Interactive Game for Slow Learner Students in Inclusive Education ran successfully. This is evidenced by.

Improvement in student understanding and engagement

After the implementation of the "Safari Kingdom" game, slow learner students showed increased activity and quicker understanding of lesson materials. The bilingual game application (in Indonesian and English) helped students learn the names and characteristics of animals in an enjoyable and interactive way. Observation and evaluation results indicated that students were more motivated to participate in learning, and their engagement during the learning process significantly increased. The students' active participation is shown in the Figure 7.

Figure 7. Training with students

Improvement in teachers' skills in using technology

Teachers and parents involved in this program received training on how to use the application optimally. The documentation of this activity is Figure 8.

Figure 8. Training for parents

The results of the training showed that teachers were not only able to operate the application but also integrate it with teaching strategies in the classroom. Teachers were also trained to guide students in using the application, ensuring students received the appropriate support during the learning process.

Sustained use of the application

The "Safari Kingdom" game application has been implemented in the inclusive classroom teaching and learning activities. Monitoring results indicated that students could easily use the application on tablet devices, and teachers could use the app as a tool to support the learning process. The following image shows the accompanying activities.

The use of the application proceeded as planned, with no significant technical issues during its implementation. The app was also integrated to assist slow learner students in understanding the English subject.

Impact evaluation on learning outcomes

The evaluation of the slow learner students' learning outcomes showed positive results. This is evident from the enthusiasm of students for completing quizzes with high scores. To motivate students further, the PKM team organized a quiz competition and awarded prizes to students with the highest quiz scores. The following are the top three students with the highest scores.

Based on the quiz results and feedback from teachers and parents, this application was considered effective in helping students overcome learning difficulties. Some students who previously struggled to understand lesson materials showed improvement and remained active during learning activities. This aligns with the research findings of Sumiaty et al. (2022), which stated that engaging learning can enhance student motivation and focus.

Sustainability and program development plan

The results of mentoring and evaluations provided valuable insights for further development. The application development team has received feedback from teachers, students, and parents to refine the application's features in the future.

Raising awareness of inclusive education

Through socialization and training, this program successfully raised awareness among teachers, parents, and the wider community about the importance of inclusive education, especially for slow learner students. This program serves as a model that can be adopted by other schools to support students with special needs in a broader educational environment.

Overall, the activity successfully achieved the main objectives of the program, providing positive impacts for students, teachers, and parents, and laid the foundation for further development in the future.

Figure 9. Activity with students
Figure 10. Group photo with teachers and students

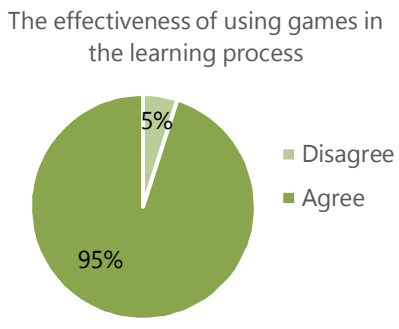
Student Evaluation Results

An evaluation was conducted during this community service activity to measure the competency improvements of students. The evaluation compared quiz results of students learning through conventional methods versus interactive mobile game-based learning. The quiz results are shown in Table 3.

Table 3. Comparison of quiz results before and after using interactive games

Student ID	Score Before	Score After	Student ID	Score Before	Score After
2118	55	75	2134	60	80
2119	60	80	2135	60	90
2120	45	70	2136	65	85
2121	40	70	2137	45	75
2122	60	100	2138	30	80
2124	30	120	2139	25	75
2125	20	70	2140	30	70
2126	30	80	2141	40	80
2127	25	80	2142	50	90
2128	40	85	2143	60	80
2129	50	90	2144	60	75
2130	45	100	2145	40	100
2131	30	120	2146	30	100
2132	40	110	2147	40	70
2133	55	70	2243	50	70
Average score before					43.6
Average score after					84.6
N					30

Based on Table 3, the quiz results indicate that after implementing the interactive mobile game-based learning model, the average quiz score increased significantly to 84.6 compared to 43.6 in conventional learning. This demonstrates that students found it easier and quicker to understand materials through interactive learning games compared to conventional teaching methods. Additionally, the effectiveness of learning activities was supported by a questionnaire involving 40 respondents, comprising 30 teachers and 10 representatives of Grade 2 student guardians from SD Muhammadiyah 4 Malang.



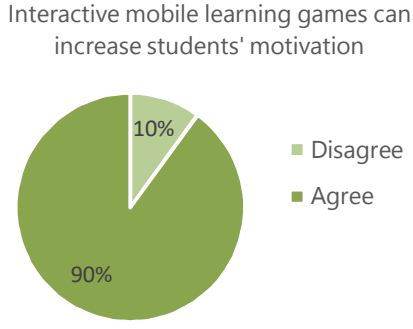


Figure 11. Questionnaire results: Increase in student motivation
Figure 12. Questionnaire results: Effectiveness of mobile games in learning

Based on Figure 11, the questionnaire results show that 90 percent of respondents agreed that student motivation increased. Figure 12 demonstrates that 95 percent of respondents agreed that

learning activities were more effective with the use of mobile games. Overall, this program successfully achieved its primary objectives and positively impacted partners.

4. CONCLUSION AND RECOMMENDATIONS

The Community Partnership Program successfully designed and implemented an educational mobile game called "Safari Kingdom" to support the learning of slow learners in inclusive environments, focusing on improving bilingual skills and cognitive abilities through fun and interactive methods. This initiative utilized the CBPR method, encompassing preliminary studies, prototype development, field trials, and training for teachers and students. The game positively impacted students' understanding, increased their engagement in learning, and equipped educators with the confidence to use technology as an educational tool, making it an innovative solution for the specific needs of slow learners.

This community partnership program requires further development through the addition of new features to the "Safari Kingdom" game. These features could include the customization of difficulty levels based on the individual abilities of slow learner students and the inclusion of more interactive content to enhance other skills, such as numeracy. The scope of the program should also be expanded to more inclusive schools, both at the local and national levels, to ensure that more slow learner students can benefit from interactive game-based learning. Collaboration with educational institutions and local governments is encouraged to support the sustainability and advancement of this program. Assistance from relevant stakeholders would help improve the quality and accessibility of educational technology for students with special needs. This game is envisioned to become an effective and comprehensive learning tool for slow learner students across Indonesia.

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