

Gleaming English game for youth, an android-based game for English literacy improvement: research and development

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ABSTRACT

The integration of educational content with interactive technology in the digital age offers a promising avenue to address literacy challenges. This study primarily presents the development of an Android-based game, gleaming English game for youth (GEMOY), aimed at enhancing English literacy among secondary English as a foreign language (EFL) learner. The game is designed to merge engaging gameplay with educational objectives, specifically targeting improvements in English literacy. The research involved 50 secondary EFL learners and 4 teachers in a needs analysis interview, alongside 3 experts for the validation of materials and media. Employing the research and development (R&D) methodology, the study yielded high content validity index (CVI) scores of 0.9 for educational accuracy, 1.0 for relevance, and 0.85 for clarity, indicating strong alignment with educational standards and appropriateness for the target demographic. These validation results highlight GEMOY's potential to substantially support learners by providing an interactive and enjoyable learning experience. The game's capacity to engage students while addressing critical literacy skills suggests it could contribute to more effective learning outcomes and the overall enhancement of language abilities. Future research should focus on expanding the evaluation of GEMOY's effectiveness through empirical studies that assess its impact on actual learning outcomes.

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1. INTRODUCTION

Technological advancements in the era of Society 5.0 have profoundly impacted students' learning styles. Technology now plays a central role in educational activities, from online PDF textbooks and instructional videos on YouTube to synchronous and asynchronous learning modes [1], [2]. In navigating these technological developments, student literacy levels become paramount. With strong literacy skills, students are not only able to read but also to discern opportunities for critical thinking, effectively consume information, and even produce creative works. According to Bond *et al.* [3], the integration of technology in education enhances students' engagement and motivation, fostering a more interactive and personalized learning experience. Furthermore, the ability to adapt to digital tools and resources is essential for students to thrive in a rapidly evolving digital landscape. As noted by Kong [4] and Musa *et al.* [5], literacy complements traditional literacy by equipping students with the skills needed to analyze, evaluate, and create digital content responsibly. Thus, fostering both traditional and digital literacy is crucial for preparing

students to meet the demands of the 21st century. The World Economic Forum 2015 recommended fundamental literacy and character as essential elements that teachers and students must master. According to the tips.kemdikbud.go.id website in 2021, literacy and numeracy are basic skills that students must possess to adapt to various life contexts. To promote this, the Ministry of Education, Culture, Research, and Technology is enhancing literacy and numeracy through the *Program Kampus Mengajar* (Teaching Campus Program). This program focuses on schools requiring assistance to enhance literacy and numeracy skills, as identified by the results of the national assessment and the *asesmen kompetensi minimum* (AKM).

To delve deeper into this issue, it is important to consider the specific challenges faced by schools. The 2023 national assessment revealed that junior high school or Sekolah Menengah Pertama Negeri (SMPN) 2 Trenggalek and SMPN 2 Dongko Trenggalek scored below the minimum AKM standard, indicating significant deficiencies in student literacy and numeracy. This study sought to investigate the underlying causes of these challenges within SMPN 2 Trenggalek and SMPN 2 Dongko. Interviews with the principal and English teacher confirmed the low AKM scores and highlighted the specific challenges faced by secondary English foreign language (EFL) learners in English literacy. The principal acknowledged that SMPN 2 Trenggalek had been designated a target school for the *Program Kampus Mengajar* due to these deficiencies. Indeed, the English teacher emphasized the students' minimal literacy level in English, particularly in reading comprehension. Furthermore, the study revealed a lack of diverse and engaging learning materials. Interviews with the secondary EFL learners indicated a reliance on students' worksheets, which were often monotonous and lacked visual variation. Additionally, the researcher observed insufficient availability of reading books and textbooks in classrooms and the school library, further exacerbating the literacy challenges. These findings align with broader educational research, indicating that inadequate learning resources and ineffective teaching methods can significantly impact student achievement [6], [7]. Addressing these issues is crucial for improving educational outcomes and meeting the minimum literacy and numeracy standards required for academic success.

One effective approach for literacy learning is game-based learning (GBL). GBL has gained significant attention as an innovative educational approach in recent years. Previous research has shown that GBL is effective in improving a range of academic skills. Nurchintyawati [8] found that a game developed using construct 2 improved student reading competency. Similarly, Liao *et al.* [9] reported that an educational game created with construct 2 was suitable for elementary students to enhance language learning and motivation. In line with the above study, Guan *et al.* [10] supported the use of educational games, indicating high feasibility among primary students. Moreover, Muengsan and Chatwattana [11] also emphasized the engaging and effective nature of GBL.

Although GBL has been widely applied in education, previous studies have primarily focused on elementary school students or specific subjects such as mathematics. To date, there has been limited research on developing Android-based games specifically designed to enhance English literacy among secondary EFL learners. Moreover, conventional teaching methods commonly used in schools often lack engagement and fail to fully support students' literacy development. Therefore, this study aims to bridge this gap by developing an educational game that better aligns with the literacy needs of secondary school students. To this end, the development of a game named gleaming English game for youth (GEMOY) was proposed as a solution, focusing on enhancing literacy skills interactively and enjoyably.

The novelty of this study lies in the development of GEMOY, an Android-based game specifically designed to improve English literacy skills among secondary school students. The GEMOY game sets itself apart from other Android-based learning applications [8], [12] for vocabulary learning and [13] for grammar mastery. While previous games were aimed at strengthening specific language components, GEMOY takes a broader approach by integrating various literacy skills relevant to secondary-level students. Additionally, the game's development relied on Gall's and Borg research and development (R&D) model [14], providing a structured and systematic framework for creating educational tools. The use of construct 3 as the development platform allowed for a visually engaging and interactive experience tailored to the specific needs of secondary EFL learners at SMPN 2 Trenggalek and SMPN Dongko. Ultimately, this research is unique not only in its choice of platform and research subjects but also in its targeted approach to addressing literacy challenges in *Program Kampus Mengajar*.

GEMOY is an Android-based game designed to improve English literacy among students in targeted school of *Program Kampus Mengajar*. Developed using the construct 3 platform and following the Borg and Gall development framework, GEMOY employs a GBL approach. Incorporating engaging gameplay, rewards, and long-term memory encoding strategies, GEMOY aims to increase student engagement, promote learning, and enhance motivation. The game's enjoyable gameplay and rewards foster student engagement, while the encoding of learning material into long-term memory promotes deeper understanding and retention. Additionally, the game triggers endorphin release and provides positive

reinforcement, enhancing student motivation. The game's effectiveness was evaluated through black box testing and T-tests, confirming its feasibility and positive impact on student literacy.

The primary objectives of this study are twofold: to conduct a comprehensive needs analysis to identify the specific literacy challenges faced by secondary English as a foreign language (EFL) learners and to develop a tailored Android-based game, GEMOY, that effectively addresses these needs. This research distinguishes itself from previous studies by focusing on integrating GBL into a mobile platform specifically designed for secondary EFL learners. By combining a rigorous needs analysis with innovative educational technology, this study aims to not only address the immediate literacy challenges faced by EFL students but also to contribute uniquely to the field by demonstrating the potential of mobile GBL in enhancing secondary language learning.

2. METHOD

This research employed the Borg and Gall R&D framework to develop GEMOY, an Android-based game designed to improve English literacy among students. R&D in education involves creating and validating educational products through rigorous testing and revision [15]. Unlike theoretical research, R&D focuses on developing practical tools that enhance learning outcomes. The process began with research and information gathering to identify the specific literacy needs of the target students and gather relevant data. Based on these findings, a planning phase was initiated, outlining the objectives, scope, and methodology of the game development. A preliminary product form was then developed, incorporating initial design concepts and features. To ensure the game's viability, limited testing was conducted with a small group of students to identify potential issues and gather feedback. Following the initial testing, the initial product revision phase involved making necessary adjustments based on the feedback received. The game was then subjected to field testing/large-scale testing with a larger group of students to assess its effectiveness in real-world settings. The sample size for the limited testing phase involved 10 students, while the large-scale field testing included 50 students. A minimum of 30 participants for field testing in educational R&D could ensure adequate data for evaluation and revision [14]. Further operational product revision was carried out to address any additional issues or improve the game's overall performance. Operational field testing was then conducted to validate the revised version and ensure its suitability for widespread implementation. By following the R&D framework, this research ensured that GEMOY is a valuable tool for enhancing student literacy. The development process uses the Borg and Gall R&D cycle, which consists of 10 steps as depicted in Figure 1.

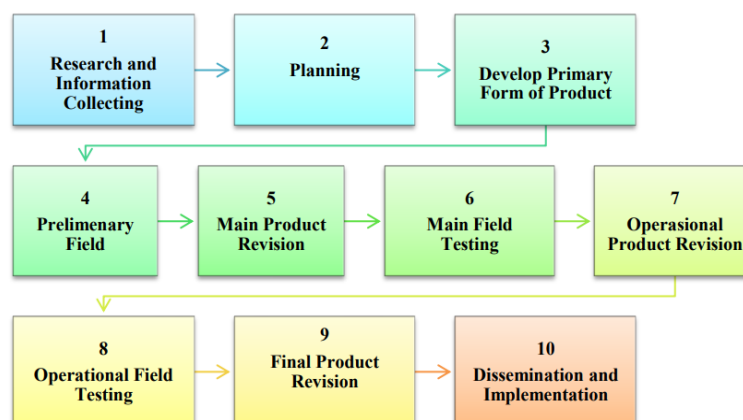


Figure 1. The development cycle of the GEMOY game

The data of this R&D study were collected from interviews, observation, documentation, and a black-box testing. Interviews were used to know the barriers that occurred in the targeted school of *Program Kampus Mengajar*. Observations have been conducted as the preliminary study to identify the teaching and learning condition. Documentation was taken from the result of the school's AKM score to identify that the school is below the standard. Finally, the test was done through black-box testing to examine whether the game was appropriately used. To analyze the data, the researchers employed validation analysis to assess the accuracy of the content and product appropriateness as shown in Table 1.

The CVI score was obtained from the expert additional scores and then divided by the whole score. Then the researcher used a linker scale to interpret CVI score. The study yielded high CVI scores of 0.9 for

educational accuracy, 1.0 for relevance, and 0.85 for clarity, indicating strong alignment with educational standards and appropriateness for the target demographic. Apart from counting the CVI, the researchers counted the reliability of the instruments demonstrated in Table 2.

Getting the instrument's reliability, the researcher counted using Cronbach's alpha. First, the researchers calculated the score of each respondent. Then, the mean of the item. Third, calculated the deviation from the mean ten square them. After that, the variance. After all item variances ($\sum \sigma_i^2$) and the total variance (σ_t^2) are calculated, these values are then substituted into Cronbach's alpha formula. Finally, the researchers got the result that the instruments' reliability was 0.72, with the category of reliable enough or acceptable.

Table 1. Content validity index (CVI) table

No	Aspect of evaluated	Expert 1	Expert 2	Expert 3	CVI score
1.	Educational accuracy	4	4	5	0.9
2.	Relevance and applicability	5	5	5	1.0
3.	Clarity and appropriateness	4	4	4	0.85

Table 2. Instrument's reliability

Respondents	S1	S2	S3	S4	S5	S6	S7	S8	S9
Respondent 1	4	5	4	5	4	5	5	4	5
Respondent 2	5	4	5	5	5	4	4	5	4
Respondent 3	4	4	4	4	4	4	4	4	4

3. RESULTS AND DISCUSSION

The development and implementation of GEMOY, an Android-based game designed to improve English literacy, yielded significant insights and outcomes. This section presents the results derived from the need analysis process, the development process, and the evaluation process. Additionally, it discusses the appropriate android-based model: the "GEMOY" game in enhancing student literacy, drawing qualitative data from need analysis and media validation. The findings are analyzed to develop an appropriate android-game model for enhancing secondary EFL students' literacy.

3.1. The needs analysis process

The research began with a comprehensive needs analysis of SMPN 2 Trenggalek and SMPN 2 Dongko Trenggalek, involving interviews with students, teachers, and principals. This analysis revealed a significant issue of low literacy levels among the students. Based on the identified needs, the researchers focused on developing an innovative solution by analyzing learning materials, teacher practices, and the potential of multimedia tools to address literacy challenges. The decision to create an Android-based game was driven by the belief that a game-based approach could offer a more engaging and effective learning experience for secondary EFL learners.

The interviews with EFL learners, teachers, and school principals have underscored a pressing need for innovative media resources to bolster English literacy. The EFL learners expressed significant challenges in mastering English, particularly in areas that traditional pedagogical approaches have struggled to address. Teachers likewise identified shortcomings in conventional teaching methods and emphasized the efficacy of technology and applications in surmounting these challenges. Furthermore, principals acknowledged the potential of technology, including Android-based games, to improve English literacy. While recognizing varying levels of support and integration within their schools, they expressed openness to incorporating these tools into the curriculum, provided they align with educational goals and enhance student performance. The interviews highlighted a clear demand for innovative media to address gaps in English literacy instruction and foster a more engaging and effective learning experience for students.

3.2. The development process

Following the needs analysis, the researchers designed the game in collaboration with material and design experts. The game's concept focused on enhancing literacy by providing materials on vocabulary, grammar, and reading comprehension. The game development process, the most crucial phase of the project, was carried out using construct 3. 3D models and animations were created with blended software. After two rounds of revisions, the game was successfully developed. The game features both educational materials and interactive game sessions. The six levels of the game are designed to progressively build literacy skills: levels 1 and 2 focuses on vocabulary, levels 3 and 4 on language structure, and levels 5 and 6 on reading comprehension. To start the game, the secondary EFL learners will meet the main menu as Figure 2.

Secondary EFL learners can commence the game by clicking the “start” button. Upon initiating the game, they are presented with a choice of levels, as illustrated in Figure 3. This allows learners to select an appropriate level based on their proficiency and preferences, ensuring a personalized gaming experience.

In Level 1, secondary EFL learners encounter vocabulary expression questions. Each level contains 20 questions, with 10 randomly selected for each session. The game is timed to track the time spent by learners. To foster competition, a scoring system is in place, with each correct answer earning 5 points, as illustrated in Figure 4. Finally, the game provides support and rewards to secondary EFL learners at the end of each level. When they are able to finish perfectly, they can get 4 starts as Figure 5.

GEMOY has been meticulously crafted to align with the educational needs of secondary level learners. This engaging game features multiple levels of interactive gameplay, each designed to enhance English literacy in a fun and effective manner. By incorporating a diverse array of challenging and stimulating activities, GEMOY not only addresses key literacy skills but also sustains student motivation and investment in their learning journey. The carefully curated levels ensure that learners can progressively develop their English proficiency while immersed in an entertaining and enriching experience. GEMOY stands as a dynamic tool to support and advance the literacy development of young learners, transforming language acquisition into an enjoyable and rewarding adventure.



Figure 2. GEMOY game main menu



Figure 3. GEMOY game levels

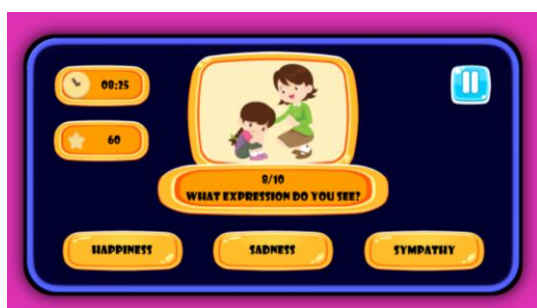


Figure 4. GEMOY level 1 display menu

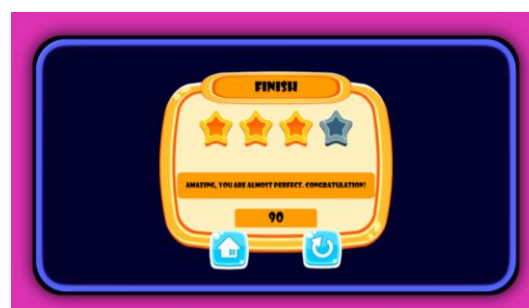


Figure 5. GEMOY reward for finishing the game level

3.3. The evaluation process

To establish the effectiveness and reliability of the GEMOY game, a comprehensive evaluation process was undertaken. This process employed the black box testing methodology to assess the game's functionality and performance. Black box testing allowed us to scrutinize how well the game aligns with its intended objectives and user requirements without delving into its internal code. Furthermore, the content and design of the game underwent rigorous validation by experts in the field to ascertain its applicability and educational value. This dual approach, encompassing functional testing and expert validation, ensured that GEMOY not only operates as intended but also delivers accurate and relevant content, thereby providing a robust and effective tool for enhancing English literacy among secondary-level learners. The researcher subsequently proceeded to validate the game in two distinct phases. Initially, the game's content was validated. Following the material validation, the researcher proceeded to validate the game's media aspects.

The validation process for the GEMOY game materials involved three experts in the field, who meticulously reviewed the educational content to ensure its accuracy and relevance. The experts confirmed that the game's material is both correct and valid for secondary EFL learners. Based on their evaluations, the

CVI scores indicate that the game's content meets the requisite standards and is poised for implementation. The results of the validation are presented in Table 3.

Table 3. Content validity result

Expert	Criteria evaluated	Validity rating	Comments
Expert 1	Educational accuracy	0.9	Material is accurate and suitable for the target audience.
Expert 2	Relevance and applicability	1.0	Content is highly relevant and appropriately aligned with educational goals.
Expert 3	Clarity and appropriateness	0.85	The content is clear and appropriate; minor adjustments are suggested.

Expert 1 focused on the criterion of educational accuracy, assigning a validity rating of 0.9. This score indicates a high level of precision in the content, affirming its suitability for the intended audience. Expert 2 evaluated the relevance and applicability of the material, awarding a perfect score of 1.0, which underscores the content's strong alignment with educational objectives and its pertinence to the learners' needs. Expert 3 assessed the clarity and appropriateness of the content, assigning a validity rating of 0.85. While the content was deemed clear and fitting for the target audience, this expert suggested minor revisions to enhance its overall effectiveness. The cumulative CVI scores from these evaluations confirm that the GEMOY game materials meet the requisite standards for educational content and are well-positioned for use in secondary EFL classrooms. The detailed feedback provided by the experts serves as a critical endorsement of the game's potential to contribute meaningfully to the educational development of its users.

Following the content validity, three media experts were involved in developing the GEMOY game. Media experts conducting black box testing on the GEMOY game follow a structured process. First, they review the game's specifications, objectives, and target audience to develop comprehensive test cases covering various aspects such as navigation, interactive elements, and performance. They then execute these test cases, engaging with the game as end-users to assess its functionality. Results are compared to expectations, and any discrepancies or issues are documented.

Table 3 outlines a comprehensive set of test cases designed to assess the functionality, performance, and user experience of the GEMOY game. Each test case targets a specific aspect of the game, ranging from basic operations like launching the app and navigating between levels to more complex functionalities such as error handling, interactive elements, and audio-visual synchronization. The tests ensure that the game not only functions smoothly but also provide a seamless and engaging user experience. For example, the "game launch" test case confirms that the game opens correctly and displays an intuitive main menu, while the "navigation between levels" test ensures smooth transitions between different stages of the game.

Moreover, the Table 4 highlights the importance of performance, compatibility, and data management in delivering a robust educational game. Tests like "performance and load times" and "compatibility across devices" ensure that the game runs efficiently across various Android devices, providing a consistent experience regardless of hardware differences. Additionally, the "data saving and retrieval" test case underscores the significance of a reliable save system, allowing users to pick up where they left off, which is essential for maintaining long-term engagement and progress in learning. The "pass" status indicates that a specific part of the game or application has passed the test and does not require fixes for the tested feature or functionality. This is an indication that the feature is ready to move to a further stage of development or launch. Therefore, these tests validate that GEMOY is a well-rounded, user-friendly educational tool that is capable of enhancing English literacy through a well-designed and interactive GBL environment.

As the research proposed, this study investigated the effects of GEMOY, an educational game designed to address the literacy needs of secondary EFL learners in Indonesia. While earlier studies have explored the impact of educational games on student engagement and learning outcomes [16], [17], they have not explicitly addressed their influence on specific areas such as vocabulary acquisition and reading comprehension among EFL learners. Findings from this study revealed that traditional teaching methods were insufficiently engaging, contributing to gaps in vocabulary and comprehension skills. GEMOY's game-based approach effectively addressed these challenges by providing a more interactive and motivating learning experience. Consistent with prior research, GEMOY facilitated vocabulary acquisition through multimedia tools that provided repeated exposure and contextual usage of new words [18]–[20]. Its design, featuring interactive exercises and challenges, aligns with recommended vocabulary learning strategies, underscoring the importance of engagement in the learning process [21]–[23]. One of the key findings was the improvement in students' reading comprehension skills, which was attributed to GEMOY's engaging content and interactive design. This supports the notion that GBL can make complex literacy tasks more accessible and less intimidating for learners [23], [24]. By integrating reading exercises within a game

format, GEMOY provided a low-pressure environment for students to practice and improve their reading skills [25]–[27].

The researchers found that teachers reported a significant rise in student motivation and engagement when using GEMOY, compared to traditional teaching methods. This observation aligns with existing research on the significance of enjoyment and motivation in the learning process. Studies have consistently demonstrated that when students find the learning process enjoyable, they are more inclined to engage deeply with the material, resulting in better information retention and a more meaningful learning experience [24], [28], [29]. The enhanced motivation observed with GEMOY can be attributed to its innovative use of game mechanics, which are inherently designed to capture and sustain students' interest. This aspect of GEMOY underscores a broader pedagogical principle: educational tools that tap into students' intrinsic motivations such as curiosity, the desire for mastery, and the enjoyment of challenge tend to be more effective in fostering sustained engagement and deep learning. Research indicates that when educational content connects with students' intrinsic motivations, it not only fosters a more immersive learning experience but also encourages students to actively engage in their learning [20], [30], [31].

Table 4. The result of black box testing

Test case	Objective	Input	Expected result	Actual result	Status
Game launch	Verify that the game launches correctly and displays the main menu.	Tap on the GEMOY app icon.	The game should launch and display the main menu with options such as “start game,” “settings,” and “help.”	The game launches successfully and the main menu is displayed as expected.	Pass
Navigation between levels	Check if users can navigate between different levels smoothly.	Complete level 1 and tap the “next level” button.	The game should transition to level 2 without any issues.	The transition to level 2 is smooth and without errors.	Pass
Functionality of interactive elements	Ensure that interactive elements such as buttons and quizzes are functioning correctly.	Tap on various buttons and interact with quiz questions in level 1.	Buttons should respond to taps, and quiz questions should be interactive and accept input.	All interactive elements respond correctly and function as intended.	Pass
Audio and visual synchronization	Verify that audio cues and visual elements are synchronized properly.	Engage with elements that trigger audio cues, such as pronunciation exercises.	Audio cues should match the corresponding visual elements in real-time.	Audio and visual elements are well synchronized, with no noticeable delays.	Pass
Error handling and feedback	Test how the game handles incorrect inputs and provides feedback.	Provide incorrect answers in a quiz.	The game should display appropriate feedback and hints for incorrect answers.	The game correctly displays feedback and provides hints when incorrect answers are submitted.	Pass
Performance and load times	Assess the game's performance and load times.	Measure the time it takes to load different levels and transition between them.	Load times should be reasonable and within acceptable limits.	Load times are quick and transitions between levels are smooth.	Pass
Compatibility across devices	Ensure that the game is compatible with different Android devices.	Test the game on various Android devices with different screen sizes and operating system versions.	The game should function properly on all tested devices.	The game performs well across different devices with no compatibility issues.	Pass
Data saving and retrieval	Verify that the game saves user progress and retrieves it accurately.	Play the game, complete some levels, and exit. Reopen the game to check if progress is saved.	The game should save progress and retrieve it accurately upon reopening.	User progress is saved and retrieved correctly.	Pass

The success of GEMOY in engaging students underlines the importance of integrating elements of play and interactivity into educational design. By aligning educational goals with the mechanics of play, GEMOY creates a learning environment that is both enjoyable and pedagogically sound. This approach not only boosts students' immediate engagement but also supports long-term retention and application of knowledge. When students are actively involved in the learning process, they are more likely to internalize and transfer what they have learned [32]. Teachers reported that GEMOY was easy to integrate into the existing curriculum, and its use enhanced classroom instruction. This aligns with research suggesting that when educational technology is aligned with curriculum goals and is user-friendly, it can significantly

improve teaching effectiveness [33]. The positive reception from teachers underscores the importance of providing adequate training and support for educators to effectively implement new technologies in their teaching practices [34]–[36].

Compare with other paper before, by this study GEMOY proved effective, the findings also highlighted challenges related to access to technology, such as limited availability of devices and inconsistent internet connectivity. This is a common issue in implementing educational technology in developing regions, where infrastructure may not always support widespread use of digital tools [37]–[39]. Addressing these challenges is crucial for ensuring that all students can benefit from tools like GEMOY, as emphasized in the literature on digital equity in education [40], [41]. The rigorous validation process for GEMOY, including both content and media aspects, was reflected in the positive student outcomes. CVI scores indicated that the game's educational content was both accurate and relevant, which is critical for the success of any educational tool [42]–[44]. The findings support the view that thorough validation processes contribute to the effectiveness of educational technologies, ensuring that they meet pedagogical standards and user needs [45].

This study demonstrated that GEMOY has the potential to be adapted for use in other languages and educational contexts, beyond its initial implementation in Indonesian schools. This echoes research on the scalability of educational technologies, which emphasizes the importance of adapting tools to fit diverse learning environments while maintaining their core educational value [46], [47]. The scalability of GEMOY presents an opportunity to address literacy challenges in a variety of EFL settings, providing a flexible solution that can be tailored to local needs. The resulting high CVI scores of 0.9 for educational accuracy, 1.0 for relevance, and 0.85 for clarity demonstrate the content's alignment with educational standards and its suitability for secondary EFL learners. The detailed feedback provided by the experts not only underscores the content's strengths but also identifies areas for minor improvement, ensuring the game's effectiveness in achieving its educational objectives. The current findings with GEMOY further reinforce the effectiveness of GBL in educational settings. The high CVI scores indicate that the game's content was both accurate and relevant, supporting the notion that well-designed educational games can significantly enhance learning outcomes. This is consistent with Haryanto's [48] findings, where the use of Algorithm in game development led to improved student learning. Similarly, GEMOY's suitability for EFL learners echoes the ideas by Botes [49] who emphasized the importance of aligning game content with the developmental needs of students.

The findings of GEMOY provide conclusive evidence on the validation process, which incorporated valuable feedback from students and teachers, not only affirming its pedagogical soundness but also ensuring its feasibility for classroom implementation. media experts conducted black box testing to evaluate the game's technical aspects. By systematically reviewing the game's specifications, objectives, and target audience, and rigorously testing various elements such as navigation, interactive elements, and performance, the media experts ensured that the game meets necessary technical standards. This is consistent with the findings of Imbovah *et al.* [7] and Zaric *et al.* [50] who underscored the imperative of aligning educational technology with practical classroom needs. The positive student outcomes achieved through GEMOY further substantiate Yu *et al.* [51] assertion that GBL is an effective approach to fostering student interest and promoting active learning. The game's ability to engage students and enhance their learning experiences demonstrates the power of GBL in creating a more dynamic and effective educational environment. The development and validation of GEMOY, supported by its high CVI scores and positive student outcomes, align with and extend the findings of previous research on GBL. The use of game design tools like Construct 2, the focus on content relevance and appropriateness, and the emphasis on student engagement are all factors that contribute to the success of GBL, as demonstrated by GEMOY. These findings reinforce the value of GBL in educational settings and underscore the importance of rigorous validation processes to ensure the effectiveness and sustainability of educational technologies.

4. CONCLUSION

The implementation of the GEMOY game has significant implications for improving English literacy among secondary EFL learners. By integrating educational content into an engaging and interactive game format, GEMOY provides a dynamic platform that can capture the interest of students who may find traditional learning methods less motivating. The game's design focuses on key literacy skills, such as vocabulary acquisition, reading comprehension, and grammar, tailored to the needs of secondary learners. This approach not only makes learning more enjoyable but also promotes consistent practice and reinforcement of language skills outside the classroom, potentially leading to improved academic performance and greater language proficiency.

GEMOY, validated by experts for its content accuracy and educational relevance, holds promise as an effective tool for supporting secondary EFL learners in their literacy development. The high CVI scores indicate that the educational materials within the game are well-aligned with learning objectives and

effectively meet the needs of the target audience. This validation underscores GEMOY's potential to significantly aid learners by providing an interactive and enjoyable learning experience. The game's ability to engage students while addressing essential literacy skills can contribute to more effective learning outcomes and overall enhancement of language abilities.

Future research should focus on expanding the scope of GEMOY's effectiveness by conducting empirical studies to evaluate its impact on actual learning outcomes. Researchers should consider implementing longitudinal studies to assess how sustained use of the game influences literacy development over time. Additionally, gathering feedback from a larger and more diverse group of users could provide valuable insights into the game's strengths and areas for improvement. Exploring the integration of advanced features, such as adaptive learning algorithms or multiplayer modes, could further enhance the game's educational value and user engagement.

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C : **C**onceptualization

M : **M**ethodology

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O : Writing - **O**riginal Draft

E : Writing - Review & **E**diting

Vi : **V**isualization

Su : **S**upervision

P : **P**roject administration

Fu : **F**unding acquisition

CONFLICT OF INTEREST STATEMENT

The researchers declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. Furthermore, no competing political, personal, religious, ideological, academic, or intellectual interests are related to this study. Researchers state no conflict of interest.

INFORMED CONSENT

This study does not involve any personal or identifiable information that requires legal protection, so informed consent was not necessary.

ETHICAL APPROVAL

This study involved several students and teachers (human participants). The research involving human participants has complied with all relevant national regulations and institutional policies following the principles of the Helsinki Declaration. It has been approved by the ethics committee of Universitas Islam Balitar.

DATA AVAILABILITY

The data that support the findings of this study are openly available in <https://drive.google.com/drive/folders/1qvZs-5WQcJUdpABmRL37stfNb0zuv9LX?usp=sharing>

REFERENCES

- [1] J. Richard, "Technology in language teaching today," *Indonesian JELT*, vol. 10, no. 1, pp. 18–32, 2015.
- [2] H. Legi, D. Damanik, and Y. Giban, "Transforming education through technological innovation in the face of the era of society 5.0," *Educenter: Jurnal Ilmiah Pendidikan*, vol. 2, no. 2, 2023.
- [3] M. Bond, S. Bedenlier, V. I. Marín, and M. Händel, "Emergency remote teaching in higher education: mapping the first global online semester," *International Journal of Educational Technology in Higher Education*, vol. 18, no. 1, p. 50, Dec. 2021, doi: 10.1186/s41239-021-00282-x.
- [4] S. C. Kong, "Developing information literacy and critical thinking skills through domain knowledge learning in digital classrooms: an experience of practicing flipped classroom strategy," *Computers and Education*, vol. 78, pp. 160–173, 2014, doi: 10.1016/j.compedu.2014.05.009.
- [5] Musa, B. A. C. Wulan and A. Wahab, "Building smart and good citizens in the digital era through citizenship education in Indonesia," *International Journal of Scientific Research*, vol. 1, no. 1, pp. 20–28, 2024.
- [6] K. A. Adebayo, N. Ntokozo, and N. Z. Grace, "Availability of educational resources and student academic performances in South Africa," *Universal Journal of Educational Research*, vol. 8, no. 8, pp. 3768–3781, 2020, doi: 10.13189/ujer.2020.080858.
- [7] M. A. Imbovah, C. I. Mackatiani, K. N. Getange, and S. Bogonko, "Students' completion rates: implications for teaching and learning resources in secondary schools in Kenya," *Journal of Education and Practice*, vol. 9, no. 24, pp. 38–43, 2018.
- [8] I. Nurchintyawati, "Android based educational game in learning and teaching English vocabulary," *Journal of Applied Linguistics*, vol. 2, no. 1, pp. 13–18, 2022, doi: 10.52622/joal.v2i1.44.
- [9] C. H. D. Liao, W. C. V. Wu, V. Gunawan, and T. C. Chang, "Using an augmented-reality game-based application to enhance language learning and motivation of elementary school EFL students: a comparative study in rural and urban areas," *Asia-Pacific Education Researcher*, vol. 33, no. 2, pp. 307–319, 2024, doi: 10.1007/s40299-023-00729-x.
- [10] X. Guan, C. Sun, G. jen Hwang, K. Xue, and Z. Wang, "Applying game-based learning in primary education: a systematic review of journal publications from 2010 to 2020," *Interactive Learning Environments*, vol. 32, no. 2, pp. 534–556, 2024, doi: 10.1080/10494820.2022.2091611.
- [11] S. Muengsan and P. Chatwattana, "The game-based learning (GBL) platform with generative ai to enhance digital and technology literacy skills," *Higher Education Studies*, vol. 14, no. 1, p. 46, 2024, doi: 10.5539/hes.v14n1p46.
- [12] R. Li, "Does game-based vocabulary learning app influence chinese EFL learners' vocabulary achievement, motivation, and self-confidence?," *SAGE Open*, vol. 11, no. 1, p. 21582440211003092, 2021, doi: 10.1177/21582440211003092.
- [13] N. Sutanti, B. Ulum, and Y. Farinawati, "Implementation of android-based game 'climbing castle' to improve grammar mastery: a classroom action research to grade 8 students at SMPN 3 Sutojayan Blitar," *JOSAR (Journal of Students Academic Research)*, vol. 9, no. 2, pp. 213–219, 2024, doi: 10.35457/josar.v9i2.3940.
- [14] M. D. Gall, J. P. Gall, and W. R. Borg, *Applying educational research: how to read, do, and use research to solve problems of practice*. Pearson Education, 2014.
- [15] E. Widyastuti and Susiana, "Using the addie model to develop learning material for actuarial mathematics," *Journal of Physics: Conference Series*, vol. 1188, p. 012052, Mar. 2019, doi: 10.1088/1742-6596/1188/1/012052.
- [16] J. L. Plass, B. D. Homer, and C. K. Kinzer, "Foundations of game-based learning," *Educational Psychologist*, vol. 50, no. 4, pp. 258–283, 2015, doi: 10.1080/00461520.2015.1122533.
- [17] M. Qian and K. R. Clark, "Game-based learning and 21st century skills: a review of recent research," *Computers in Human Behavior*, vol. 63, pp. 50–58, 2016, doi: 10.1016/j.chb.2016.05.023.
- [18] M. Chowdhury et al., "Digital game-based language learning for vocabulary development," *Computers and Education Open*, vol. 6, p. 100160, 2024, doi: 10.1016/j.cao.2024.100160.
- [19] E. Novia, A. Sudirman, and A. F. Novari, "The effect of cue card media towards students' vocabulary mastery at the eight grade of SMP IT Daarul Uzma Picung in academic years 2023/2024," *Journal on Education*, vol. 06, no. 03, pp. 16111–16121, 2024.
- [20] R. Zhang, D. Zou, and G. Cheng, "Self-regulated digital game-based vocabulary learning: motivation, application of self-regulated learning strategies, EFL vocabulary knowledge development, and their interplay," *Computer Assisted Language Learning*, pp. 1–43, May 2024, doi: 10.1080/09588221.2024.2344555.
- [21] D. Zou, Y. Huang, and H. Xie, "Digital game-based vocabulary learning: where are we and where are we going?," *Computer Assisted Language Learning*, vol. 34, no. 5–6, pp. 751–777, Jul. 2021, doi: 10.1080/09588221.2019.1640745.
- [22] H. Shamsudin, H. Hashim, and M. M. Yunus, "Integration of asynchronous and synchronous gameplay to improve pupils' vocabulary," *Creative Education*, vol. 10, no. 12, pp. 3101–3106, 2019, doi: 10.4236/ce.2019.1012234.
- [23] Y. Zheng et al., "Effects of digital game-based learning on students' digital etiquette literacy, learning motivations, and engagement," *Heliyon*, vol. 10, no. 1, 2024, doi: 10.1016/j.heliyon.2023.e23490.
- [24] T. Aragonéz, I. Saur-Amaral, and M. Gouveia, "GAME-based learning in higher education: a systematic literature review," in *13th International Conference on Education and New Learning Technologies*, IATED, Jul. 2021, pp. 1849–1856, doi: 10.21125/edulearn.2021.0432.
- [25] A. Capodiecì, C. Cornoldi, E. Doerr, L. Bertolo, and B. Carretti, "The use of new technologies for improving reading comprehension," *Frontiers in Psychology*, vol. 11, p. 751, 2020, doi: 10.3389/fpsyg.2020.00751.
- [26] A. B. Ivgin and H. Akcay, "The impact of using educational and digital games on middle school students science achievement," *International Journal of Technology in Education*, vol. 7, no. 3, pp. 386–416, 2024, doi: 10.46328/ijte.781.

- [27] D. Susilawati, P. D. Iswara, and A. N. Aeni, "Development of digital literacy educational game for elementary school students to be wise in using the internet," *Journal of Education Research*, vol. 5, no. 1, pp. 525–536, 2024, doi: 10.37985/jer.v5i1.896.
- [28] A. Khaldi, R. Bouzidi, and F. Nader, "Gamification of e-learning in higher education: a systematic literature review," *Smart Learning Environments*, vol. 10, no. 1, p. 10, 2023, doi: 10.1186/s40561-023-00227-z.
- [29] S. L. Fitzgerald and C. Fitzgerald, "Make learning fun," in *12th International Conference on Education and New Learning Technologies*, IATED, Jul. 2020, pp. 8111–8119, doi: 10.21125/edulearn.2020.2026.
- [30] I. Buchem, A. Mc Elroy, and R. Tutul, "Designing and programming game-based learning with humanoid robots: a case study of the multimodal 'make or do' English grammar game with the pepper robot," in *ICERI2022 Proceedings*, IATED, Nov. 2022, pp. 1537–1545, doi: 10.21125/iceri.2022.0403.
- [31] A. Dhamija and D. Dhamija, "Amalgamation of game-based learning with interactive instructional strategies for active learner engagement," in *Handbook of Research on Acquiring 21st Century Literacy Skills Through Game-Based Learning*, IGI Global, 2022, pp. 31–57.
- [32] A. May, "Gamification, game-based learning, and student engagement in education," Winona State University, 2021.
- [33] I. S. Redjeki and R. Muhajir, "Gamification in efl classroom to support teaching and learning in 21st century," *JEES (Journal of English Educators Society)*, vol. 6, no. 1, pp. 68–78, 2021, doi: 10.21070/jees.v6i1.882.
- [34] Z. Y. Avci, L. M. O'Dwyer, and J. Lawson, "Designing effective professional development for technology integration in schools," *Journal of Computer Assisted Learning*, vol. 36, no. 2, pp. 160–177, 2020, doi: 10.1111/jcal.12394.
- [35] R. Taheri, N. Zandi, and V. Mousavi, "Empowering educators: the critical role of teacher education programs in advancing digital literacy skills," *Library Progress International*, vol. 44, no. 3, 2024.
- [36] W. Martin, S. Strother, M. Beglau, L. Bates, T. Reitzes, and K. McMillan Culp, "Connecting instructional technology professional development to teacher and student outcomes," *Journal of Research on Technology in Education*, vol. 43, no. 1, pp. 53–74, 2010.
- [37] L. Q. Warsi and Y. Rani, "Analysis of teachers' readiness in using digital technology for students' learning: problems and potential solutions," *Human Nature Journal of Social Sciences*, vol. 5, no. 2, pp. 292–305, 2024, doi: 10.71016/hnjss/t32ny040.
- [38] Y. Kamat and S. Nasnodkar, "A survey on the barriers and facilitators to edtech adoption in rural schools in developing countries," *International Journal of Intelligent Automation and Computing*, vol. 2, no. 1, pp. 32–51, 2019.
- [39] M. Rahiem, "Technological barriers and challenges in the use of ICT during the COVID-19 emergency remote learning," *Universal Journal of Educational Research*, vol. 8(11B), 2020, doi: 10.13189/ujer.2020.082248.
- [40] C. A. Eden, O. N. Chisom, and I. S. Adeniyi, "Promoting digital literacy and social equity in education: lessons from successful initiatives," *International Journal of Management & Entrepreneurship Research*, vol. 6, no. 3, pp. 687–696, 2024, doi: 10.51594/ijmer.v6i3.880.
- [41] L. Weisberg and K. Dawson, "Picturing digital equity in the curriculum: cultivating preservice teachers' digital equity mindsets in a technology integration course," *Computers and Education*, vol. 211, p. 104988, 2024, doi: 10.1016/j.compedu.2024.104988.
- [42] C. Steinkuehler and K. Squire, "Gaming in educational contexts," in *Handbook of educational psychology*, Routledge, 2024, pp. 674–695.
- [43] L. Castillo-Cuesta, "Using digital games for enhancing EFL grammar and vocabulary in higher education," *International Journal of Emerging Technologies in Learning*, vol. 15, no. 20, pp. 116–129, 2020, doi: 10.3991/ijet.v15i20.16159.
- [44] A. Tinterri, F. Pelizzari, M. Di Padova, F. Palladino, G. Vignoli, and A. Dipace, "Automating board-game based learning. a comprehensive study to assess reliability and accuracy of AI in game evaluation," *Intelligenza Artificiale*, vol. 18, no. 1, pp. 103–119, 2024, doi: 10.3233/IA-240030.
- [45] D. Larsen-Freeman, *Techniques and principles in language teaching*. Second. New York: Oxford University Press, 2000, doi: 10.18172/jes.83.
- [46] A. O. Dagunduro, C. F. Chikwe, O. A. Ajuwon, and A. A. Ediae, "Adaptive learning models for diverse classrooms: enhancing educational equity," *International Journal of Applied Research in Social Sciences*, vol. 6, no. 9, pp. 2228–2240, 2024, doi: 10.51594/ijarss.v6i9.1588.
- [47] M. Murtaza, Y. Ahmed, J. A. Shamsi, F. Sherwani, and M. Usman, "AI-based personalized e-learning systems: issues, challenges, and solutions," *IEEE access*, vol. 10, pp. 81323–81342, 2022, doi: 10.1109/ACCESS.2022.3193938.
- [48] Y. Haryanto, "Designing educational games with fisher yates shuffle method in early childhood at TKIT Al Muqorrobin based on android," *Instal: Jurnal Komputer*, vol. 15, no. 02, pp. 414–423, 2023, doi: 10.54209/jurnalkomputer.v15i02.165.
- [49] W. Botes, "Demonstrating pedagogical content knowledge through the development of educational science board games," *European Journal of STEM Education*, vol. 9, no. 1, p. 1, 2024, doi: 10.20897/ejsteme/14136.
- [50] N. Zaric, R. Roepke, V. Lukarov, and U. Schroeder, "Gamified learning theory: the moderating role of learners' learning tendencies," *International Journal of Serious Games*, vol. 8, no. 3, pp. 71–91, 2021, doi: 10.17083/IJSG.V8I3.438.
- [51] Z. Yu, M. Gao, and L. Wang, "The effect of educational games on learning outcomes, student motivation, engagement and satisfaction," *Journal of Educational Computing Research*, vol. 59, no. 3, pp. 522–546, 2021, doi: 10.1177/0735633120969214.

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