Available Online at www.ijcsmc.com

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology

ISSN 2320–088X
IMPACT FACTOR: 7.056

IJCSMC, Vol. 15, Issue. 3, March 2026, pg.41 – 50

A Hybrid Play-Game-Based Learning Approach to Developing an Educational English Literacy App for Early Learners

Lowie V. Libongcogon[1]; Glen Mae A. Ferrer[2]; Arlene Jane A. Dionaldo[3]; Michael Marvin P. Cruz[4]; Dexter G. Dandan[5]

[12345]College of Computer Studies Central Philippines State University, San Carlos City, Negros Occidental, Philippines
[1] lowielibongcogon@gmail.com; [2] glenmaeferrer9@gmail.com; [3] dionaldoarlenejane@gmail.com; [4] michaelmarvincruz@cpsu.edu.ph; [5] dexterdandan@cpsu.edu.ph

DOI: https://doi.org/10.47760/ijcsmc.2026.v15i03.005

Abstract: In today's technology-driven world, digital tools present a valuable opportunity to enhance traditional methods of teaching, particularly in early childhood education where engaging young learners is critical. By thoughtfully integrating interactive applications into literacy instruction, educators can transform foundational skills into playful, motivating, and developmentally appropriate experiences. This study introduces the Hybrid Play-Game-Based Learning Framework, a pedagogical model that integrates the principles of Play-Based Learning (PBL) and Game-Based Learning (GBL) with the systematic instructional design of the ADDIE model to develop an educational mobile application for enhancing English literacy among early learners. Recognizing the importance of engaging and developmentally appropriate digital tools in early childhood education, the framework balances child-led exploration with structured gameplay, creating learning experiences that are both enjoyable and effective. Following the ADDIE model, the research employed a descriptive-developmental design to guide the planning, creation, and evaluation of the application. Additionally, the app integrates AI technologies that meaningfully adds interactivity, enabling it to become more responsive to learner input and needs. Results revealed high levels of agreement on the app's usability and design to learners that indicates that the hybrid framework effectively supports early literacy learning by balancing imaginative exploration with structured gameplay. Thus, this hybrid framework offers developers and educators a structured yet flexible model to transform traditional learning materials into innovative, technology-supported educational tools.

Keywords: ADDIE, Educational App, English Literacy, Game-Based Learning (GBL), Play-Based Learning (PBL)

I. INTRODUCTION

Literacy is a foundational skill that shapes a child's academic and personal development [1]. Early literacy acquisition is critical, as it lays the groundwork for future language skills, reading comprehension, and cognitive growth [2]. As young learners are naturally curious and playful, educational strategies must be developmentally appropriate and engaging to foster a love for learning. The early years are a critical period for developing literacy, making it imperative to implement effective, enjoyable, and interactive learning experiences that cater to children's needs and learning styles. With the increasing integration of technology in education, mobile applications have become powerful tools in facilitating early learning. However, many existing apps lack a strong pedagogical foundation, limiting their effectiveness.

In the Philippine context, recent data underscores the importance of strengthening English literacy from an early age. A survey by Social Weather Stations (SWS) conducted in 2023 reveals that at least 47 percent of Filipinos have the ability to think in English. Furthermore, 69 percent of Filipinos reported being able to write in English, while 55 percent can speak the language. Notably, the usage of the English language has reached its highest level since September 2000. Despite these promising figures, an article from the Philippine Institute for Development Studies (PIDS) highlights concerns from foreign business groups, emphasizing the need for the country to boost efforts to halt the decline in English proficiency.

Technology has emerged as a transformative force in educational practices, especially with the proliferation of mobile devices. Mobile devices have developed into a comprehensive suite of applications, support, and assistance for educational institutions, and technology is changing how education is provided as well as how information is located and shared [3]. [4] also added that learning can be improved and better understood with the help of mobile technologies. Educational applications (apps) are increasingly used in early childhood classrooms and homes to complement traditional literacy instruction. However, many of these digital tools prioritize entertainment over pedagogy, lacking alignment with research-based educational principles. This often results in missed opportunities to optimize the potential of technology for meaningful learning. As [5] points out, mobile devices can be utilized to help university students develop these skills even though they may have contributed to the increased demand for globally competent people. This demonstrates how mobile devices could be best positioned as a multipurpose tool that is prepared to help students acquire these abilities.

Gamification, the process of incorporating game elements into non-game contexts, has increasingly gained traction in educational institutions as a strategy to capture learners' attention and improve engagement [6][7]. By integrating features such as points, levels, leaderboards, and rewards, gamification transforms traditional learning tasks into interactive experiences. In early childhood education, this approach helps sustain interest and motivation, particularly in literacy, where repetition and practice are essential. Research indicates that gamified learning environments can lead to improved cognitive performance, heightened participation, and increased enjoyment [8], making the educational process more effective and appealing for young learners.

To address this gap, the present study introduces an educational mobile application grounded in a hybrid play-game-AI-based learning approach. This multi-layered framework combines the strengths of Play-Based Learning (PBL), which emphasizes child-led exploration and creativity, with Game-Based Learning (GBL), which introduces structured goals, immediate feedback, and motivational elements to sustain engagement. Beyond merging these pedagogical foundations, the study also integrates the ADDIE model to guide the systematic design, development, and evaluation of the application which ensures that every phase remains learner-centered and pedagogically grounded. Furthermore, AI integration is leveraged to enhance interactivity and personalization, including real-time voice recognition and adaptive feedback that make the learning experience more engaging and responsive to individual learners' needs. The purpose of this study is to develop and evaluate an English literacy mobile application for young children that applies this hybrid framework. By thoughtfully combining PBL, GBL, ADDIE, and AI, the study aims to demonstrate how technology can meaningfully improve literacy outcomes, and provide educators, developers, and researchers with a practical model for designing innovative, pedagogically sound educational tools in early childhood education.

II. RELATED LITERATURE

II.A. Play-Based Learning Theory

Play is essential for preparing children for adulthood. By boosting adjustment, enhancing language, and lowering social and emotional issues, play accelerates early development from 33% to 67% [9]. PBL is a pedagogical approach that emphasizes the integral role of play in promoting children's cognitive, emotional, and social development. It encourages exploration, experimentation, and storytelling, providing a foundation for critical skills such as creativity, problem-solving, and language acquisition.

In early childhood education, the potential of play-based pedagogy to support children's holistic development was further supported by [10], who employed a qualitative method under the Participatory Action Learning and Action Research (PALAR) design. Their findings emphasized that PBL should be widely applied in both educational and social settings to nurture all aspects of young children's growth especially in cognitive, social, emotional, and physical. PBL also shows a potential powerful approach for introducing foundational concepts in

Science education. A study focused on early physics education emphasizes the role of free play as a vehicle for learning, particularly in kindergartens. [11] presents an innovative didactic strategy that integrates physics learning into children's self-directed and action-oriented play. Through this approach, children are not merely passive recipients of knowledge but are encouraged to explore and discover physical laws through hands-on, playful experiences. Their study also offers practical examples of how kindergarten teachers can identify and support physics-related learning opportunities that naturally emerge during free play, thereby aligning educational goals with the intrinsic interests and activities of young learners. Incorporating the ADDIE model, [12] also integrated PBL into the development of an audio-visual learning medium focused on locomotor movement for young learners. The instructional tool, grounded in play-based activities, proved to be highly effective in physical education (PE), achieving a viability score of 92.5%. This illustrates how learnings can be enhanced when aligned with the principles of PBL, leading to more engaging and impactful learning experiences in early education settings.

The scope of PBL extends also beyond early childhood education. In primary education, a study by [13] examined the implementation of PBL in the Ruhango sector's primary schools and found that both Science and Elementary Technology (SET) and English language teachers, along with headteachers, held positive perceptions of the approach. They observed that PBL contributed significantly to improving learner performance, especially in SET and English subjects. Furthermore, the study highlighted that PBL fosters essential learner attributes such as independence, autonomy, and problem-solving which are the qualities crucial for academic success and lifelong learning. The scope of PBL extends beyond early childhood and primary education. In higher education, [14] explored its application through a case study in a first-year college cinema course. The intervention aimed to address declining student interest and found that play-based strategies increased student motivation, creativity, and resilience. Their small-scale action research project demonstrated the value of PBL even in adult learning environments, showing its versatility and effectiveness across educational levels.

The mentioned studies underscore the broad applicability and benefits of play-based learning. From early childhood to tertiary education, PBL has been shown to support academic achievement, foster holistic development, and enhance learner engagement. Schools and institutions need to figure out how to use play to enhance class time and keep students interested in what they are learning.

II.B. Game-Based Learning Theory

GBL incorporates key elements of game design, such as points, levels, feedback, and challenges, into educational settings to increase learner engagement and motivation. By embedding these mechanics within learning activities, GBL fosters persistence, emotional investment, and enjoyment, encouraging students to achieve educational objectives more effectively. As noted by [15], students showed a preference for game-based lectures, finding them more engaging and interactive, which suggests that gamification is well-suited for instructional design, especially in language learning environments.

Despite the widespread integration of digital technologies in education, many educators still lack deep awareness of the pedagogical value of digital games, particularly in the context of language instruction at the primary level. Given that modern learners are digital natives, there is a growing recognition that video games can serve as effective tools for second language acquisition. Research shows that non-native English speakers have benefited significantly from educational games designed to support language learning [16].

Several studies affirm the positive impact of GBL on language education. For example, [17] found that educators believe GBL provides a fun and engaging way to teach English, improving both interest and academic achievement. Similarly, [18] demonstrated that young learners showed increased vocabulary proficiency after participating in game- and song-based learning activities, with pre- and post-test results confirming significant improvement. A literature review by [19] further supports the effectiveness of GBL in enhancing student engagement, motivation, and confidence. It highlighted how students actively participated in vocabulary learning and developed greater self-assurance in communication when learning occurred through interactive games.

In the context of foreign language learning among adults, GBL has also shown promise. For instance, [20] found that implementing game-based methods in English as a Foreign Language (EFL) classrooms reduced learner anxiety and boosted motivation. Educational games were perceived by both students and teachers as an enjoyable and effective instructional tool. At the tertiary level, a study by [21] examined higher education students' perspectives on GBL in English language acquisition. Using a mixed-method approach, including questionnaires and interviews, the research revealed that students largely viewed GBL as a dynamic and impactful alternative to traditional methods, aligning with broader findings in the literature. Evidence from [22] involving Thai pharmacy students showed that GBL strategies significantly improved vocabulary, pronunciation, grammar, and self-confidence. The use of educational games tailored to GBL principles resulted in measurable improvements in language proficiency. Likewise, in an online learning context, another study employing

diagnostic tools, pre- and post-tests, and semi-structured interviews demonstrated that Genially-based games could enhance EFL learners' academic performance, particularly in vocabulary acquisition.

Collectively, these studies underscore the growing recognition of GBL as a powerful tool for language instruction. The consistent findings across various educational levels and contexts suggest that educational games, when thoughtfully designed and implemented, can effectively support vocabulary development, learner motivation, and language confidence. These insights emphasize the importance of further investment in the design and integration of GBL approaches, especially in the context of foreign language education in both physical and digital classrooms.

III. METHODOLOGY

III.A. Research Design

This study adopts a descriptive-developmental research design, with the primary focus on conceptualizing, developing, and presenting a novel hybrid instructional framework for early childhood literacy. The research is not merely concerned with creating a digital learning tool, but rather with demonstrating how the strategic integration of PBL, GBL, and the ADDIE instructional design model can guide the structured development of an educational application that is developmentally appropriate, engaging, and pedagogically grounded.

III.B. Participants

The target users of the developed application are early learners of Grade 3, primarily enrolled in early primary education of Ramon Magsaysay Elementary School (RMES) located in San Carlos City of Negros Occidental. This age group is considered the foundational stage for literacy development, where children begin to acquire essential skills such as letter recognition, phonemic awareness, pronunciation, vocabulary building, and story comprehension. The app is particularly designed to support learners who benefit from interactive, play-based approaches and those who may need additional reinforcement beyond traditional instruction. Additionally, the application accommodates the developmental characteristics of young children by offering age-appropriate graphics, auditory prompts, and intuitive navigation. Teachers and parents also serve as secondary users who facilitate or monitor the app's usage, providing supplementary support to the learning process.

III.C. Hybrid Framework Model Integration

Through the literature review, it becomes evident that both PBL and GBL play significant roles in enhancing the quality of instruction. Building on these established benefits, the present study integrates these approaches within the proposed hybrid framework to design a literacy application tailored for early learners. The development of the educational application was guided by the proposed Hybrid Play-Game-Based Learning Framework, which systematically combines pedagogical strategies from PBL and GBL to create an engaging and developmentally appropriate learning tool. Specifically, the application’s design integrates exploratory interaction, storytelling, and the use of multimedia that directly reflect principles of PBL. These elements encourage children to discover, imagine, and explore language through natural, self-directed engagement, fostering creativity and cognitive development. Figure 1 shows the hybrid design framework integrating PBL and GBL components into an educational application.

In parallel, key components rooted in GBL were incorporated to enhance structure, motivation, and learner persistence. These include a scoring and points system, leveled difficulty, lock/unlock mechanisms to guide progression, and immediate feedback that informs learners of their performance in real time. Importantly, the concept of GBL adopted in the application was based on the elements and foundation of game-based learning introduced by [23], emphasizing the importance of balancing challenge and skill to maintain learner engagement.

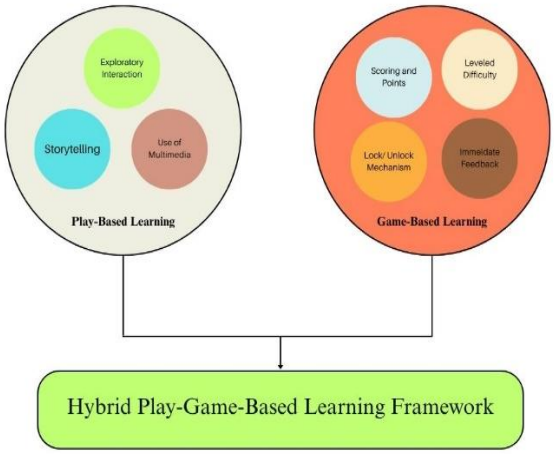

Fig. 1 Blending play and game-based learning in a hybrid model

Figure 2 shows the proposed Hybrid Play-Game-Based Learning Framework which holds significant potential for wider application in educational technology. It offers a replicable model that can be adapted across various subjects and age groups, especially in early childhood education where cognitive, linguistic, and affective development are tightly interwoven. By demonstrating how PBL and GBL can coexist in a structured development model, this framework addresses the common shortcomings of many educational apps, either being overly entertainment-focused or rigidly academic, by delivering a balanced, purposeful learning experience. Importantly, the integration of the ADDIE model within this framework ensures that the design and development process remains systematic, iterative, and learner-centered that supports both pedagogical soundness and practical implementation. Several studies have shown that the ADDIE model is effective in guiding the systematic development of educational games [24][25][26], ensuring that design decisions are pedagogically grounded and responsive to learner needs. This provides developers, educators, and instructional designers with a guideline for integrating theory-based pedagogical strategies into technology-mediated learning tools.

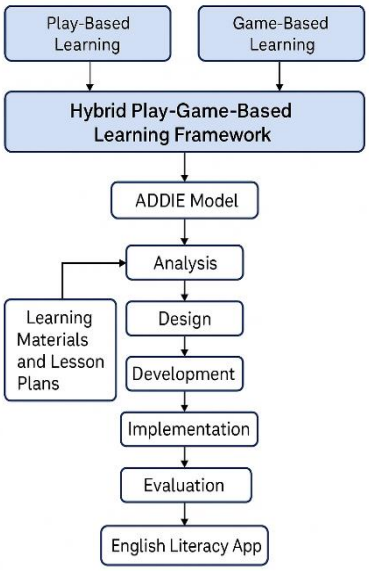

Fig. 1 Proposed Hybrid Framework Model for developing educational app

This study does more than develop a literacy app; it pioneers a conceptual and developmental framework that can serve as a reference model for future educational application development. The successful implementation of this hybrid framework offers evidence of its feasibility and relevance in enhancing early literacy outcomes, and it opens a pathway for further research and innovation in hybrid learning design.

IV. RESULTS AND DISCUSSION

IV.A. ADDIE Model Implementation

The development of the English literacy application was guided by the ADDIE instructional design model, which consists of five phases: Analysis, Design, Development, Implementation, and Evaluation. Each phase was informed by and integrated with the pedagogical principles of PBL and GBL, creating a unified framework that ensured developmental appropriateness, learner engagement, and pedagogical soundness.

IV.B. Analysis

During the analysis phase, the foundational requirements for developing the English literacy application were identified. This included determining the target users which are the Grade 3 students of RMES, who are in the emergent stages of literacy development. The literacy skills to be addressed were selected based on essential early learning competencies, such as phonemic awareness, pronunciation, rhyming, vocabulary, and comprehension. Crucially, the content and activity ideas incorporated into the app were derived from the Reading Exercises and Progress Monitoring Checklist of Project PENCIL (Persevering, Enduring, and Nurturing Culture of Instruction and Literacy), a literacy initiative implemented by the Schools Division of San Carlos City of the Department of Education. These materials served as pedagogically sound references aligned with national literacy goals and classroom practices. The analysis phase also examined the digital readiness of the learners and the practicality of mobile app deployment in both classroom and home learning contexts.

IV.C. Design

The Design phase focused on structuring the app's components and translating learning objectives into interactive features that incorporate PBL and GBL elements. Activities were intentionally planned to reflect playful exploration while integrating gamified elements like point systems, level progression, and instant feedback. For example, the "Learn Alphabet" feature was designed to encourage active participation through voice interaction, while also using a locked progression system to ensure mastery before advancement. Similarly, "Rhyming Words" and "Word Puzzle" features were designed with graded levels (easy, medium, hard) to provide differentiated challenges that support sustained motivation and skill development. Figure 3 presents the overview of the application.

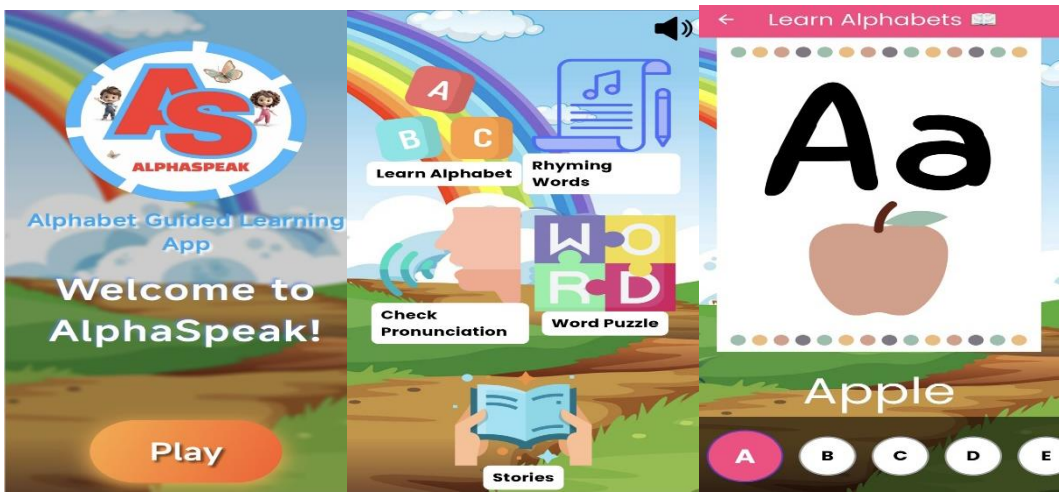

Fig. 3 User interface of AlphaSpeak

IV.D. Development

In the development phase, the actual creation of the educational application was undertaken. Based on the designs and content identified earlier, the app was developed using Android Studio as the integrated development environment (IDE), along with Dart and Flutter for cross-platform mobile application development. These technologies enabled the creation of a visually appealing and interactive user interface optimized for Android devices. To enhance speech and pronunciation features, the development introduced AI integration aimed at making learner interactions more adaptive and engaging. As noted by previous research, AI integration supports the development of highly effective instructional tools that contribute to better learning quality [27].

Specifically, Text-to-Speech (TTS) packages provided natural-sounding pronunciation feedback, while Flutter's speech-to-text packages allowed the app to recognize learners' voices and detect pronunciation accuracy in real time. This AI-driven voice recognition enables personalized, immediate feedback, strengthening phonemic awareness and proper pronunciation. When compared to traditional approaches, research indicates

that AI-based speech recognition technology provides a more effective way to improve English pronunciation [28][29]. Additionally, gamified elements such as point systems, leveled tasks, drag-and-drop mechanics, and progress tracking were implemented to increase motivation and sustain learner engagement.

Figure 4 (a) (b) (c) shows AlphaSpeak's interactive activities which are based on the blended theory of PBL and GBL. Each activities are AI-enabled to allow the interaction of application to the early learners.

IV.E. Implementation

The implementation phase focuses on the strategic deployment of the developed application within the school system. After the application's development, it was introduced to key stakeholders including school administrators, academic heads, and the school principal. The initial feedback and orientation sessions were conducted to ensure alignment with institutional goals and instructional practices. It is planned that the application will be implemented within the current school year, targeting Grade 3 learners as part of a literacy intervention. Furthermore, the application is intended to be integrated into the existing Project PENCIL of the Schools Division of San Carlos City, complementing ongoing reading and monitoring programs.

IV.F. Evaluation

Finally, the evaluation phase centers on assessing the application's potential effectiveness as a tool for enhancing English literacy among Grade 3 students. In the initial stage, feedback was gathered from teachers who are directly responsible for teaching English and reading. Their insights were essential in determining whether the application aligns with classroom objectives and supports existing instructional strategies. A structured feedback form was used to assess the app's usability, engagement level, and educational value. The frequency of responses was analyzed to determine the level of agreement among teachers regarding the app's potential as a literacy enhancement tool. If positive outcomes are sustained, the application may be formally integrated into the school's literacy initiatives.

IV.F.1. Usability Evaluation of AlphaSpeak

This section present and analyze the results gathered from the evaluation of the developed English literacy application using the Hybrid Play-Game-Based Learning Framework. A total of 15 respondents participated in the evaluation, including Grade 3 teachers from RMES, the English coordinator, and faculty members and instructors from higher education institutions who specialize in Early Childhood Education and English. The evaluation tool consisted of two main dimensions: Usability and Appeal. Each dimension was assessed using a set of statements, and responses were interpreted based on the frequency of answers using a Likert scale: Strongly Agree (SA), Agree (A), Neutral (N), Disagree (D) and, Strongly Disagree (SD).

The usability of the app was evaluated through 10 key questions. The results are shown in Table 1.

TABLE I
FREQUENCY DISTRIBUTION OF TEACHER RESPONSES ON USABILITY PARAMETERS (N=15)

Indicators	***SA***	***A***	***N***	***D***	***SD***
1. The application makes learning the alphabet fun.	12	3	–	–	–
2. The integration of AI in pronunciation check helps improve speech.	11	3	1	–	–
3. The word puzzle is fun and helps with spelling.	11	4	–	–	–
4. The pronunciation feedback is clear and helpful.	9	5	1	–	–
5. The application is easy to use, even without instructions.	15	–	–	–	–
6. The application helps children learn new words.	13	2	–	–	–
7. The features enhancing the child's learning level.	12	3	–	–	–
8. The rhyming words feature is easy to use.	9	4	2	–	–
9. The application responds quickly when tapped or spoken to.	15	–	–	–	–
10. The voice in the application is clear and understandable.	10	5	–	–	–

Legend. SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, VD = Very Disagree

The data in Table 1 indicate a very high level of agreement among respondents regarding the app's functional effectiveness. The strongest consensus was observed in statements such as "The application is easy to use, even without instructions" and "The application responds quickly," where 100% of respondents strongly agreed. High levels of strong agreement also support that the interactive features such as pronunciation checks and word puzzles are effective tools for reinforcing early literacy skills. These results affirms with the findings of [9], where teachers noted that educational apps based on play-based approaches with gamification are highly engaging and more effective at quickly sparking children's interest compared to traditional paper worksheets. This also suggests that the results supported [15] assertion that gamification is a good fit for instructional design, particularly in language learning environments, not only for students but also for teachers.

IV.F.2. Design Evaluation of AlphaSpeak

The second part of the questionnaire focused on evaluating the application's design interface and visual appeal. Table 2 presents the distribution of responses.

TABLE III
FREQUENCY DISTRIBUTION OF TEACHER RESPONSES ON DESIGN PARAMETERS (N=15)

Indicators	***SA***	***A***	***N***	***D***	***SD***
1. The buttons and icons are easy to recognize.	15	–	–	–	–
2. The application layout is clean and simple.	14	1	–	–	–
3. The pictures and words can be clearly seen.	15	–	–	–	–
4. The application looks colorful and inviting.	13	2	–	–	–
5. The background music is enjoyable but not distracting.	15	–	–	–	–
6. The colors and images attract children's attention.	14	1	–	–	–
7. The design makes it easy to focus on learning.	12	3	–	–	–
8. The application is easy to navigate for children.	12	3	–	–	–
9. The interface of the application is pleasant to see.	10	5	–	–	–
10. The overall design makes the application enjoyable.	13	2	–	–	–

Legend. SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, VD = Very Disagree

The results from Table 2 show overwhelmingly positive feedback concerning the aesthetic and functional design of the application. Respondents strongly agreed that the interface is user-friendly, visually engaging, and conducive to children's learning. Features such as clear visuals, intuitive layout, and appealing color schemes were particularly well-received. All respondents agreed or strongly agreed that the overall design makes the app enjoyable, confirming the successful integration of play-based aesthetics with game-based interaction.

IV.F.3. Interpretation

The results support the effectiveness of the Hybrid Play-Game-Based Learning Framework in the development of this educational app. The strong teacher agreement on both functionality and design parameters suggests that the application not only meets usability standards but also aligns with educational best practices for early literacy. Importantly, the feedback validates that the combination of playful interaction (PBL) and structured gamified learning (GBL), guided by a systematic design model (ADDIE), can result in a product that is pedagogically sound, technically functional, and engaging for learners.

This supports the idea that an app should involve a degree of agency, enabling children to actively participate, make choices, and feel ownership over their learning, while also recognizing and trusting them as capable, autonomous agents of their own playful learning journeys [9]. Moreover, the results of this study also align with the findings of [15][16][19][20], which emphasized that game-based lectures in the context of language instruction using digital technologies can be an effective tool to support language learning. These findings highlight the model's potential to serve as a replicable framework for future educational technology development efforts, especially in contexts aiming to modernize and enhance traditional literacy instruction through interactive digital tools.

V. CONCLUSION

This study successfully introduced and applied the Hybrid Play-Game-Based Learning Framework for Educational App Development, a novel model that merges the exploratory and imaginative strengths of PBL with the structured, motivational elements of GBL, all guided by the systematic phases of the ADDIE instructional design model. The development of the English literacy mobile application demonstrates the framework's effectiveness in creating an engaging, developmentally appropriate, and pedagogically sound digital learning tool for early learners. The application can not only addresses essential literacy competencies but also fosters intrinsic motivation and sustained engagement through the integration of voice interaction, gamified challenges, and interactive storytelling. The results affirm that the thoughtful combination of PBL and GBL strategies with integration of AI can significantly enhance early childhood learning experiences, especially when embedded within a structured development process like ADDIE.

Beyond its immediate impact, the proposed framework model offers a replicable and scalable model for educators, researchers, and developers seeking to transform traditional teaching methods, printed modules, or workbooks into interactive digital applications. As technology continues to reshape educational environments, schools and institutions that adopt such innovative models gain significant advantages in terms of learner engagement, instructional efficiency, and adaptability to diverse learning needs. This is particularly relevant in the post-pandemic era, where digital learning solutions are not only supplemental but often essential.

VI. FUTURE WORKS

Future researchers and developers are encouraged to adopt and expand this framework model as an instructional design model when developing e-learning applications not only for English literacy, but also across other fields and educational contexts. By doing so, they can create engaging, entertaining, yet pedagogically sound digital tools that align with 21st-century learning demands. Beyond replication, future studies could also explore the significance of the developed application on actual learner performance and outcomes in English literacy to better understand its practical educational impact. Additionally, researchers and developers might consider integrating more advanced AI features such as adaptive learning algorithms that personalize content based on learner progress, or AI-driven analytics that help teachers track development. However, it is essential to carefully consider the ethical boundaries and developmental appropriateness of AI technologies, ensuring they support and enrich the learning experience without compromising the well-being and autonomy of young learners.

REFERENCES

[1]. O. N. Saracho, "Literacy and language: new developments in research, theory, and practice," *Early Child Development and Care*, vol. 187, no. 3–4. Taylor & Francis, pp. 299–304, 2017.

[2]. P. Klass, J. S. Hutton, and T. G. DeWitt, "Literacy as a distinct developmental domain in children," *JAMA Pediatr.*, vol. 174, no. 5, pp. 407–408, 2020.

[3]. S. Criollo-C, A. Guerrero-Arias, Á. Jaramillo-Alcázar, and S. Luján-Mora, "Mobile learning technologies for education: Benefits and pending issues," *Appl. Sci.*, vol. 11, no. 9, p. 4111, 2021.

[4]. M. L. Bernacki, J. A. Greene, and H. Crompton, "Mobile technology, learning, and achievement: Advances in understanding and measuring the role of mobile technology in education," *Contemp. Educ. Psychol.*, vol. 60, p. 101827, 2020.

[5]. E. M. Fox, "Mobile technology: a tool to increase global competency among higher education students," *Int. Rev. Res. Open Distrib. Learn.*, vol. 20, no. 2, 2019.

[6]. N. Zeybek and E. Saygı, "Gamification in education: Why, where, when, and how?—A systematic review," *Games Cult.*, vol. 19, no. 2, pp. 237–264, 2024.

[7]. A. Christopoulos and S. Mystakidis, "Gamification in education," *Encyclopedia*, vol. 3, no. 4, pp. 1223–1243, 2023.

[8]. A. Manzano-León *et al.*, "Between level up and game over: A systematic literature review of gamification in education," *Sustainability*, vol. 13, no. 4, p. 2247, 2021.

[9]. S. Paracha, G. Hagan-Green, L. Hall, and K. Macfarlane, "Special iApps: Play-based Learning for Children with Severe Intellectual Disabilities," in *Proceedings of the 10th International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion*, 2022, pp. 100–106.

[10]. P. Lunga, S. Esterhuizen, and M. Koen, "Play-based pedagogy: An approach to advance young children's holistic development," *South African J. Child. Educ.*, vol. 12, no. 1, p. 1133, 2022.

[11]. N. Glauser-Abou Ismail, A. Pahl, and R. Tschiesner, "Play-based physics learning in kindergarten," *Educ. Sci.*, vol. 12, no. 5, p. 300, 2022.

[12]. J. Arfi, A. Wahyuri, G. Gusril, W. Rasyid, and Y. Ockta, "Developing Engaging Audio-Visual Learning Media for Basic Locomotor Patterns through Play-Based Activities for Early Learners," *J. Educ. Teach. Learn.*, vol. 9, no. 1, pp. 40–46, 2024.

[13]. D. Muhawenimana and J. de D. A. Ngabonziza, "The Influence of Play Based Learning Project on Learner Performance in Science and Elementary Technology and English Language Subjects," *African J. Empir. Res.*, vol. 5, no. 2, pp. 558–567, 2024.

[14]. L. Henderson, "Learning to Play with Film: Play-Based Learning in a Tertiary Film Studies Classroom.," *Film Educ. J.*, vol. 5, no. 2, pp. 93–101, 2022.

[15]. M. Hartt, H. Hosseini, and M. Mostafapour, "Game on: Exploring the effectiveness of game-based learning," *Plan. Pract. Res.*, vol. 35, no. 5, pp. 589–604, 2020.

[16]. S. Adipat, K. Laksana, K. Busayanon, A. Asawasowan, and B. Adipat, "Engaging students in the learning process with game-based learning: The fundamental concepts.," *Int. J. Technol. Educ.*, vol. 4, no. 3, pp. 542–552, 2021.

[17]. A. Ghazy, M. Wajdi, C. Sada, and I. Ikhsanudin, "The use of game-based learning in English class," *J. Appl. Stud. Lang.*, vol. 5, no. 1, pp. 67–78, 2021.

[18]. I. Fauzi, "Improving vocabulary through implementing song and game-based learning strategy of English for young learners," *Yavana Bhasha J. English Lang. Educ.*, vol. 5, no. 1, pp. 22–33, 2022.

[19]. N. S. Ling and A. Abdul Aziz, "The effectiveness of game-based learning strategies on primary ESL learners' vocabulary learning," *Int. J. Acad. Res. Progress. Educ. Dev.*, vol. 11, no. 2, pp. 845–860, 2022.

[20]. A. A. A. Ahmed *et al.*, "Investigating the Effect of Using Game- Based Learning on EFL Learners' Motivation and Anxiety," *Educ. Res. Int.*, vol. 2022, no. 1, p. 6503139, 2022.

[21]. N. M. Jamaatthuddin and S. Or-Kan, "An examination on the students' perceptions towards the effectiveness of using game-based learning in learning the English language for students in higher education," *Int. J. Acad. Res. Bus. Soc. Sci.*, vol. 11, no. 8, pp. 1689–1714, 2021.

[22]. J. Methaneethorn, P. Sudchada, and S. Insuk, "Game-based learning for teaching English to Thai pharmacy students," *Kasetsart J. Soc. Sci.*, vol. 42, no. 3, pp. 617–622, 2021.

[23]. J. L. Plass, B. D. Homer, and C. K. Kinzer, "Foundations of game-based learning," *Educ. Psychol.*, vol. 50, no. 4, pp. 258–283, 2015.

[24]. F. Ranuharja, G. Ganefri, B. R. Fajri, F. Prasetya, and A. D. Samala, "Development of interactive learning media edugame using ADDIE model," *J. Teknol. Inf. Dan Pendidik.*, vol. 14, no. 1, pp. 53–59, 2021.

[25]. M. T. Ghozali, "Mobile app for COVID-19 patient education–Development process using the analysis, design, development, implementation, and evaluation models," *Nonlinear Eng.*, vol. 11, no. 1, pp. 549–557, 2022.

[26]. O. C. Falode, K. Dome, E. J. Chukwuemeka, and M. E. Falode, "Development of an interactive mobile application for learning undergraduate educational technology concepts," *Int. J. Prof. Dev. Learn. Learn.*, vol. 4, no. 1, p. ep2204, 2022.

[27]. L. Chen, P. Chen, and Z. Lin, "Artificial intelligence in education: A review," *IEEE access*, vol. 8, pp. 75264–75278, 2020.

[28]. V. H. Dja'far and F. N. Hamidah, "Improving english pronunciation skills through ai-based speech recognition technology," *Ethical Ling. J. Lang. Teach. Lit.*, vol. 11, no. 2, 2024.

[29]. D. Abimanto and W. Sumarsono, "Improving English pronunciation with AI speech-recognition technology," *Acitya J. Teach. Educ.*, vol. 6, no. 1, pp. 146–156, 2024.

