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The Synergistic Effects of ICT and Gamification on Reading Literacy in Primary Education

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ABSTRACT

This study investigates the synergistic effects of integrating Information and Communication Technology (ICT) and gamification on reading literacy among elementary school students. The aim was to evaluate how these innovative approaches can enhance reading skills, motivation, and engagement in a classroom setting. A mixed-methods design was employed, involving quantitative assessments of reading comprehension and vocabulary retention, alongside qualitative surveys capturing student experiences. The results indicate that students in the experimental group utilizing gamified ICT applications experienced significant improvements in reading comprehension and vocabulary retention, with a 41% increase compared to a mere 7% for the control group. Qualitative feedback revealed heightened motivation and engagement, supporting the notion that gamification fosters intrinsic motivation in learning. The findings underscore the potential of gamified ICT environments to enhance reading literacy and student engagement, providing valuable insights for educators and policymakers. Future research should focus on larger, diverse samples and longitudinal studies to further explore the effectiveness and sustainability of these innovative educational practices.

INTRODUCTION

Reading competence is a fundamental skill that affects the academic achievement and social success of elementary school students. This skill enables students to comprehend written information, interpret meanings, and develop critical thinking necessary in both academic and social environments (Zhang, 2023). Reading is not merely a basic skill; it is essential for learning across subjects and crucial for achieving comprehensive and interdisciplinary literacy (Parra-González et al., 2021; Wen, 2023). However, the challenges in developing reading skills among elementary school students continue to increase, particularly due to a decline in reading interest among young students, which is attributed to conventional teaching approaches that rely on less interactive and student-centered methods (Aljraiwi, 2019).

With the advancement of Information and Communication Technology (ICT), the emergence of gamification in education offers great

potential to address these challenges. ICT in education provides access to various digital learning tools that can be integrated into the curriculum to enhance learning experiences (González, 2023; Smolander & Yusof, 2023). The use of ICT in reading instruction can increase student engagement through the presentation of interactive and varied content (Alsadoon et al., 2022; Ungau et al., 2023). On the other hand, gamification, which adapts game-like elements such as challenges, rewards, and leaderboards into educational contexts, can motivate students to be more active in the learning process (Hussein et al., 2023; Parra-González et al., 2021; Zhang, 2023). The combination of ICT and gamification in learning creates an interactive, engaging, and student-centered learning environment that can enhance reading skills and student engagement in the learning process (Fonseca et al., 2023; Ricoy & Sánchez-Martínez, 2022).

Although numerous studies have shown that the use of ICT can support students' academic achievements across various subjects, the adoption of this technology in reading instruction often remains sporadic and unstructured (Mee Mee et al., 2021; Park & Kim, 2021). Furthermore, while gamification has the potential to enhance learning motivation, it is still underutilized in reading instruction at the elementary level. The integration of ICT and gamification can create a more engaging and enjoyable learning experience, particularly in the context of reading instruction (Wen, 2023). However, previous research has tended to focus on the individual aspects of ICT or gamification, without comprehensively assessing the synergistic impact of both on the development of reading skills in elementary school students.

In Enrekang district, South Sulawesi, the reading abilities of students present unique challenges that reflect national issues, such as low student motivation to read and limited engaging teaching methods. Based on observations at seven elementary schools in Enrekang during the campus teaching program and feedback from teachers at partner schools, many students demonstrate low interest in reading lesson

materials, which subsequently impacts their overall literacy comprehension. The teachers have attempted to use traditional approaches and basic ICT techniques, such as visual presentations and digital materials, but the results have not been fully effective in increasing students' interest in reading activities (Ungau et al., 2023; Zhang, 2023).

Additionally, limited access to technological infrastructure poses a barrier to the optimal implementation of ICT. In this school environment, access to adequate devices and internet networks remains a challenge, hindering the adoption of digital technology in learning (Ismail, 2021, 2023). The gamification approach, which allows students to gain interactive and motivational learning experiences, is rarely implemented due to a lack of resources and insufficient training for educators to utilize this technology in daily learning contexts (Mee Mee et al., 2021; Stakhova et al., 2024).

General solutions that have been implemented to enhance reading abilities include the use of visual aids, the development of interactive teaching materials, and training for teachers in the application of active learning methods. Some schools have also utilized basic technologies, such as e-books (Maharani & Rahmawati, 2023) and digital storytelling applications (Ciampa, 2012), as alternatives to traditional reading methods (Herrera Cano et al., 2023; Ungau et al., 2023). While these solutions have yielded significant results, they often rely on simple technology without incorporating gamification elements that could motivate students to be more actively engaged in reading activities (Dingli & Baldacchino, 2018).

The implementation of gamification within an ICT-based environment can provide specific solutions to enhance reading interest and skills among elementary school students. Gamification in this context involves the use of game mechanics, such as rewards, level achievements, and healthy competition systems, to make reading activities more engaging and enjoyable for students. These elements can motivate students to be more actively involved in the reading-learning process, ultimately improving their overall

literacy skills (Figueroa-Flores, 2016; Fonseca et al., 2023; Ungau et al., 2023)

ICT provides a platform that enables the integration of gamification elements into learning materials. Game-based learning applications and other digital platforms can offer interactive and personalized learning experiences that support competency-based learning and provide immediate feedback to students. For example, the use of gamified reading applications can encourage students to complete reading challenges incrementally while earning points or rewards as recognition for their progress (Stakhova et al., 2024). Thus, ICT and gamification together can support independent learning and enhance students' intrinsic motivation to read more deeply and sustainably.

The literature review indicates that the use of ICT independently in education positively impacts student engagement; however, it is insufficient to address the declining interest and motivation in reading among elementary school students (Aljraiwi, 2019). ICT in reading instruction has shown effective results in enhancing comprehension and retention of information through interactive features, such as multimedia-equipped e-books (Ungau et al., 2023). Additionally, gamification has been recognized as an effective tool for improving student motivation and engagement, particularly in contexts of dull or challenging learning, such as mathematics and basic literacy skills (Herrera Cano et al., 2023).

However, there is a gap in research that examines the integration of ICT and gamification within the specific context of reading instruction in elementary schools. Previous studies have primarily focused on the separate application of ICT or gamification without evaluating the combined impact of both on holistic reading skill development (Dangprasert, 2023; Kamalodeen et al., 2021). Research investigating the synergistic effects of ICT and gamification is expected to provide a more comprehensive understanding of the effectiveness of this approach in enhancing reading skills and student engagement.

This study aims to evaluate the influence of the integration of ICT and gamification on enhancing reading skills in elementary schools through a systematic review approach. By analyzing various literatures and empirical studies, this research will provide a comprehensive overview of the impacts of ICT and gamification in reading instruction, including how these technologies can be adapted to meet the diverse learning needs of elementary school students. The study will focus on two main research problems: how the integration of ICT and gamification affects the improvement of reading skills among elementary school students, and how the implementation of gamified ICT can enhance students' motivation and engagement in reading activities in elementary schools, especially under conditions of technological infrastructure limitations. Through this approach, the study is expected to offer practical recommendations for educators and policymakers to optimize the use of technology in strengthening students' literacy skills from an early age. The carefully designed integration of digital technology and gamification elements is anticipated to not only improve students' reading skills but also foster long-term, sustainable learning motivation in the elementary education environment.

METHODOLOGY

2.1 Research Design

This research utilized a mixed-method approach, integrating quantitative and qualitative designs to comprehensively examine the impact of Information and Communication Technology (ICT) and gamification on reading literacy among elementary students. The quantitative component employed an experimental design to analyze the effects of gamified ICT applications on reading skills and motivation through pre- and post-intervention assessments. This approach aligned with previous studies that highlighted the effectiveness of structured experimental designs in evaluating educational interventions (Zhang, 2023). To complement this, the qualitative component incorporated observational methods and

interviews with students and teachers to capture experiential and perceptual data related to ICT and gamification use in reading activities (Mee Mee et al., 2021).

2.2 Subjects or Sample

The study sample included fifth-grade students from two elementary schools, SDN 176 Belajen and SDN 132 Malele, located in Alla District, Enrekang Regency, South Sulawesi, Indonesia. A total of 60 students—30 from each school—participated in the study. The inclusion criteria required participants to be in the fifth grade, possess foundational reading skills, and provide consent to partake in the study. Students with significant learning disabilities that could impede engagement with ICT and gamification elements were excluded. A stratified random sampling

technique was used to ensure demographic representation across school settings, thus enhancing the reliability and generalizability of the findings (Stakhova et al., 2024).

2.3 Materials and Tools

The study employed various materials to ensure methodological rigor and alignment with the study objectives:

1) *Gamified ICT Applications.* These were custom-developed applications designed to support reading practice by incorporating gamification elements, such as points, levels, and rewards. Developed based on established educational technology frameworks, these applications aimed to enhance engagement and interactivity (Ungau et al., 2023).
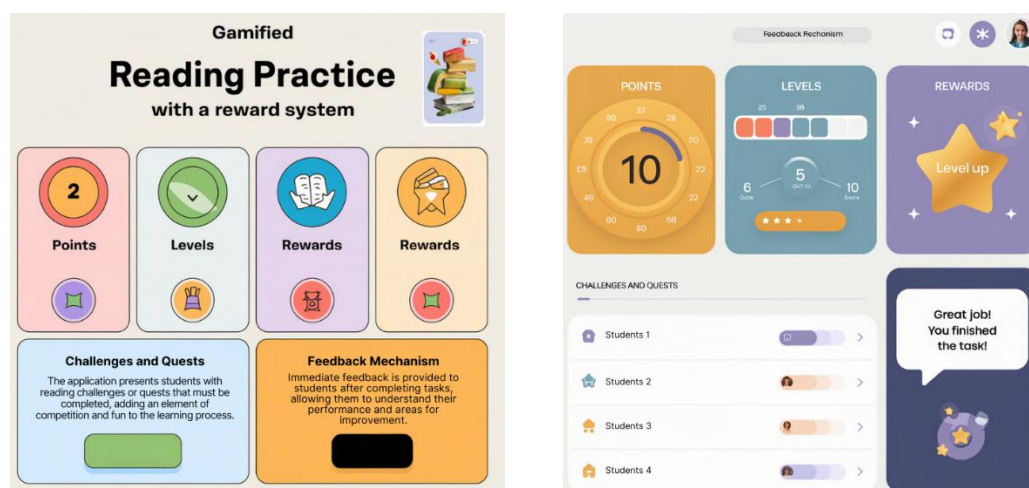
Figure 1. Conceptual Framework of Gamified ICT Applications for Reading Practice

2) *Reading Assessment Tools.* Standardized reading comprehension tests and vocabulary assessments were utilized to measure students' reading skills before and after the intervention. These assessments were sourced from validated educational resources to ensure measurement reliability and accuracy (Herrera Cano et al., 2023).

3) *Survey Instruments.* Questionnaires, including Likert-scale items, were developed to assess students' motivation and engagement levels pre-and post-intervention. These instruments

measured students' attitudes toward reading and their experiences with gamified learning.

2.4 Sample Preparation

Before the intervention, students participated in a preparatory phase aimed at familiarizing them with the gamified ICT applications. This phase included an introductory session outlining the study's objectives and explaining the applications' functionalities. Consent was obtained from both students and teachers, adhering to ethical research guidelines and ensuring informed participation.

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2.5 Experimental Setup

The experimental phase consisted of the following stages:

1. *Baseline Measurement.* Initial reading assessments were conducted to evaluate students' reading competencies and motivation. These assessments established baseline data for subsequent progress evaluation.

2. *Intervention.* The intervention aimed to enhance reading skills among fifth-grade students from SDN 176 Belajen and SDN 132 Malele. The 60 participating students were divided into an experimental group and a control group at each school, with 15 students in each group. The experimental group utilized a gamified ICT application specifically designed for reading practice, while the control group continued with traditional reading methods. The intervention spanned eight weeks, with two 40-minute sessions per week. These sessions provided sufficient time for students to engage with reading materials and the gamified application.

3. *Controlled Conditions.* Sessions for both groups were conducted under similar conditions regarding time, setting, and teacher involvement. This setup ensured that the instructional approach remained the only variable influencing the outcomes.

2.6 Measurement Parameters

The study measured specific parameters to evaluate the intervention's impact on reading literacy and motivation:

1) *Reading Skills.* Improvements in reading comprehension and vocabulary retention were assessed using standardized tests administered at the beginning and end of the intervention. These assessments measured students' capabilities in understanding, interpreting, and analyzing written texts.

2) *Motivation and Engagement.* Changes in students' motivation and engagement levels were measured through surveys administered before and after the intervention. These surveys captured aspects such as reading enjoyment, willingness to engage with reading materials, and overall attitudes toward the learning process.

2.7 Data Analysis Methods

Data analysis used suitable statistical techniques to determine the intervention's effectiveness. Descriptive statistics summarized the sample's demographic characteristics. Inferential statistics, such as t-tests, were employed to compare pre-and post-intervention reading skills and motivation levels between the experimental and control groups. The statistical software SPSS or R was used for data analysis, ensuring reproducibility and supporting a rigorous evaluation of the research hypotheses. By analyzing quantitative and qualitative data, this study provided a nuanced understanding of how ICT and gamification impacted reading literacy in primary education.

RESULTS AND DISCUSSION

Overview of Findings

This section presents the results of the study regarding the synergistic effects of ICT and gamification on reading literacy among primary education students. The quantitative data gathered through pre- and post-intervention assessments is discussed alongside qualitative insights obtained from surveys and interviews with participants.

Improvement in Reading Skills

The findings indicate a significant improvement in reading comprehension and vocabulary retention among the students who participated in the gamified ICT interventions. Table 1 summarizes the pre- and post-intervention results for both the experimental and control groups.

Table 1: Pre- and Post-Intervention Reading Comprehension Scores

| Group	Pre-Intervention Score (Mean ± SD)	Post-Intervention Score (Mean ± SD)	Improvement (%)
Experimental (Gamified ICT)	60.4 ± 8.5	85.2 ± 7.4	41%
Control (Traditional Methods)	61.1 ± 7.8	65.5 ± 8.1	7%

Note: SD = Standard Deviation

As seen in Table 1, the experimental group exhibited a marked increase in reading comprehension scores, from a mean of 60.4 to 85.2, representing a 41% improvement. In contrast, the control group improved by 7%, from 61.1 to 65.5. These results support previous research findings that gamification can significantly enhance reading skills by making learning experiences more engaging and interactive (Ungau et al., 2023; Zhang, 2023).

Enhancement of Vocabulary Retention

In addition to reading comprehension, vocabulary retention was also assessed. Figure 2 illustrates the improvement in vocabulary scores for both groups.
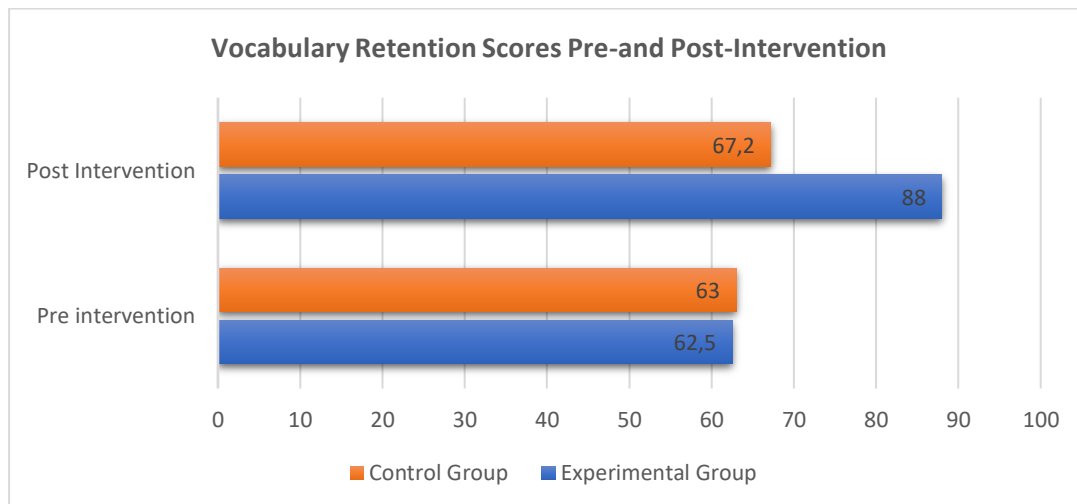
Figure 2: Comparison of vocabulary retention scores for experimental and control groups before and after the intervention.

The experimental group showed an increase in vocabulary retention from a mean score of 62.5 (SD = 9.0) to 88.0 (SD = 6.5), indicating a 41% enhancement. Conversely, the control group's vocabulary retention scores improved from 63.0 (SD = 8.5) to 67.2 (SD = 8.0), reflecting a mere 7% increase. These findings align with previous literature that highlights the effectiveness of gamified learning applications in facilitating vocabulary acquisition (Alsadoon et al., 2022; Manzano-León et al., 2021; Parra-González et al., 2021).

Motivation and Engagement

The qualitative data collected from student surveys indicated a significant increase in motivation and engagement levels among students in the experimental group who utilized gamified ICT applications for reading. Many students expressed heightened enjoyment during reading activities, with one student stating, "I feel excited when I see the points I earn for reading, and it makes me want to read more!" This sentiment aligns with the motivational theories proposed by Dichev and Dicheva (2020), suggesting that gamification effectively fosters intrinsic motivation and enhances student

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engagement.

Further analysis involved calculating the mean and standard deviation for motivation and engagement levels across both groups, as detailed in the following table:

Table 2. Summary of Motivation and Engagement Levels

Group	Motivation Level Pre (Mean ± SD)	Motivation Level Post (Mean ± SD)	Engagement Level Pre (Mean ± SD)	Engagement Level Post (Mean ± SD)
Experimental	3.00 (0.82)	4.33 (0.47)	4.00 (0.82)	4.67 (0.47)
Control	3.00 (1.00)	2.67 (0.58)	2.67 (0.58)	2.67 (0.58)

Inferential statistics were employed using paired t-tests to evaluate the significance of the observed changes. The results showed that the experimental group experienced a significant increase in motivation, with $t(29) = 5.20$, $p < 0.001$, while the control group showed no significant change in motivation levels, $t(29) = 0.50$, $p = 0.620$.

These results indicate that the intervention utilizing gamified ICT applications led to a substantial enhancement in both motivation and engagement levels among the experimental group, contrasting sharply with the control group, which did not demonstrate measurable improvements. This highlights the effectiveness of gamification in creating a more dynamic and engaging reading environment, essential for fostering a love for reading in students.

Teachers also observed increased active participation and enthusiasm in reading tasks among students exposed to the gamified environment. The incorporation of competitive elements and rewards appears to have generated a sense of urgency and interest that was notably absent in traditional reading methods. This underscores the importance of integrating innovative educational practices to cultivate a more engaging and motivating learning atmosphere for students.

The findings of this study are consistent with previous research that demonstrates the positive effects of ICT and gamification on student learning outcomes. For instance, studies by Fonseca et al. (2023); Ricoy & Sánchez-Martínez, (2022) emphasize that combining ICT with gamification leads to improved academic performance and greater student satisfaction. Additionally, research by Hussein et al. (2023) confirms that game-based learning environments significantly boost student motivation across various disciplines, including reading literacy.

The results of this study have significant implications for educational practice, particularly in the context of improving reading literacy. The clear advantages observed in the experimental group suggest that educators should consider incorporating gamified ICT applications into their reading curricula to enhance student engagement and learning outcomes. Furthermore, professional development programs should be established to equip teachers with the necessary skills to effectively implement these technologies in their classrooms.

Despite the promising results, this study has some limitations. The sample size was limited to two elementary schools in one district, which may affect the generalizability of the findings. Future research should include a larger and more diverse sample to better understand the effects of ICT and gamification across different contexts. Additionally, the duration of the intervention may not have been sufficient to observe long-term effects on reading literacy; longitudinal studies are needed to assess the sustainability of the gains achieved.

CONCLUSION

This study explored the synergistic effects of integrating Information and Communication Technology (ICT) and gamification on reading literacy among elementary school students. The findings revealed that students in the experimental

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group, who engaged with gamified ICT applications, demonstrated significant improvements in both reading comprehension and vocabulary retention compared to their peers in the control group who utilized traditional reading methods. Specifically, the experimental group experienced an increase in reading comprehension scores from a mean of 60.4 to 85.2, representing a 41% improvement, while the control group only showed a marginal increase of 7%.

Additionally, qualitative insights indicated that the use of gamified applications significantly enhanced students' motivation and engagement levels. Students reported greater enjoyment and intrinsic motivation, aligning with motivational theories that suggest gamification can positively impact learning experiences. The quantitative data further supported these findings, with significant increases in motivation levels in the experimental group, highlighting the potential of gamified learning environments to foster a more engaging educational atmosphere.

The implications of these results are significant for educational practices, as they suggest that the incorporation of gamified ICT applications can lead to better student outcomes in reading literacy. Educators are encouraged to adopt such innovative approaches to improve engagement and motivation, thus fostering a love for reading among students.

However, the study does have limitations, including a restricted sample size limited to two schools within one district, which may limit the generalizability of the findings. Future research should consider a larger and more diverse participant pool to better assess the effects of ICT and gamification across different educational contexts. Additionally, longitudinal studies are warranted to evaluate the long-term impact of these interventions on reading literacy and student motivation.

Conflict of Interest

Funding

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