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The Impact of Digital Game-Based Learning on Children's Self-Efficacy and Reading Success

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Abstract

Numerous studies have indicated that digital games offer a valuable learning experience for young language learners by fostering self-efficacy in English acquisition. Despite this, there remains a dearth of research investigating the impact of digital games on children's self-efficacy and reading achievements. The current study aims to fill this gap by examining (1) the impact of digital games on children's self-efficacy and (2) the effect of digital games on children's reading achievements. An exploratory sequential design was employed, integrating both quantitative and qualitative methods. The study involved 144 young learners in Indonesia who participated in eight treatment sessions using digital games as a learning tool. After these sessions, participants completed a post-test comprising 20 reading items to assess their reading achievements. Observations during the treatment sessions explored the implementation of digital games and their impact on self-efficacy, supplemented by interviews with 15 children to gain deeper insights into their experiences and perceptions. The findings revealed that digital games foster self-efficacy through four mechanisms: mastery experience, vicarious experience, verbal persuasion, and emotional state. These mechanisms are integrated into the game's content, levels, feedback, and challenging activities. The implications suggest that carefully designed digital games can significantly enhance self-efficacy and reading achievements among young learners, offering educators a valuable tool for improving educational outcomes. Future research should explore the long-term effects of digital game-based learning and identify the most effective game features, while also addressing challenges such as equitable access to technology and balancing screen time with other activities.

Keywords: DGBL, self-efficacy, reading achievement, young learners

INTRODUCTION

Digital games have increasingly become an integral part of educational settings, transforming traditional learning approaches into interactive and engaging experiences. The rise of digital game-based learning is driven by its potential to capture students' interest and

enhance their learning outcomes through immersive and interactive content (Anastasiadis et al., 2018; Davis & Lang, 2012; Randall et al., 2013). In the realm of language learning, research conducted by Alyaz and Genc (2016) on digital games have shown promise in providing rich, contextualized experiences that can support the development of language skills. Digital game learning also offers immediate feedback, adaptive challenges, and opportunities for repeated practice, digital games create a supportive environment that can bolster learners' confidence and competence (Erhel & Jamet, 2013; Yang, 2012). This approach leverages the natural appeal of games to create a motivating and stimulating environment, making it particularly effective learners.

In the context of language learning, a study by Govender and Arnedo-Moreno (2022) evaluated the use of a visual novel game to improve reading and comprehension skills. The study concluded that this game-based system was an innovative and exciting approach to language learning. Additionally, another study on the impact of mobile digital games in learning Arabic at the tertiary level found that digital game-based learning significantly improved students' learning achievement and enhanced their Arabic vocabulary acquisition (Ghani et al., 2022). Another study examined the efficacy of a digital game-based learning resource in enhancing kindergarten pupils' knowledge of the alphabet, with a specific focus on vowels (Cornito, 2023).

Despite the potential benefits of digital game-based learning, being a digital native does not guarantee proficiency in reading, especially in English as a Foreign Language (EFL). Some children may struggle with reading for various reasons, such as misunderstanding its purpose or finding it boring because their school books lack relatable characters, situations, and settings (Morgan, 2013). Children entering kindergarten and early elementary grades may have had limited literacy experiences from birth, resulting in poor vocabulary development and a lack of awareness of print and literacy concepts. Additionally, some children may lack vocabulary knowledge, background knowledge, and the ability to infer meanings, while others may have limited experience with foreign languages (Chun et al., 2016).

Significant shifts in the educational process, including changes in reading habits (Putro & Lee, 2017) and information-seeking behaviors (Rutherford, 2018), highlight the crucial role of self-efficacy in reading. Furthermore, digital games can significantly enhance self-efficacy by providing learners with mastery experiences, opportunities for vicarious learning, positive feedback, and emotional engagement. Self-efficacy refers to an individual's belief in their innate ability to achieve goals (Bandura, 1994). It reflects students' confidence in their capabilities to manage their emotions, motivation, and behavior during the learning process. These cognitive self-evaluations are closely linked to academic performance, as students tend to feel more capable and place higher value on their tasks when they achieve success (Reichwein Zientek et al., 2019). Therefore, to be effective, educational games should include appropriate challenges that foster a sense of self-efficacy in students (Johnson and Mayer, 2010). Successful game-based learning must consider learners' self-efficacy to enhance their overall learning experience.

Digital game-based learning (DGBL) has been found to significantly impact children's self-efficacy and reading achievement. A study conducted by Ramli et al. (2022) demonstrated that a DGBL application based on constructivist theory positively affected primary school students' self-efficacy and mathematics achievement. Another study by

Cornito (2023) examined the efficacy of a digital game-based learning resource in enhancing kindergarten pupils' knowledge of the alphabet, specifically focusing on vowels. This study showed that the interactive learning resource effectively increased pupils' alphabet knowledge, as evidenced by a notable improvement in their pre-test scores. Additionally, a meta-analysis of studies on digital game-based STEM education revealed that DGBL positively affects students' learning achievement (Wang et al., 2022). Study by Yang & Feng, (2023) also found that collaborative behaviors in digital game-based learning are crucial for effective learning, with communication and coordination between learners being positively correlated with learning achievement.

Nevertheless, the previously mentioned studies leave some unclear points regarding how DGBL improves children's self-efficacy in reading. These studies also did not specifically address whether DGBL significantly affects children's reading achievement. Therefore, the impact of DGBL on children's self-efficacy and reading achievement remains open to debate, providing opportunities to fill these gaps in the literature. Several scholars have expressed concern about the lack of empirical evidence regarding the academic value of digital game-based learning. Hence, a comprehensive and coherent study is needed to demonstrate the effectiveness of this technology in early childhood education (Lin et al., 2020).

Therefore, the objective of this research is to address the gaps in understanding how digital game-based learning (DGBL) affects children's self-efficacy and reading achievement. While previous studies have highlighted the potential benefits of DGBL, they have not specifically explored its impact on reading proficiency. This study aims to investigate whether DGBL can significantly enhance children's self-efficacy in reading and improve their reading achievement. By providing empirical evidence, this research seeks to demonstrate the academic value of DGBL in early childhood education and contribute to a more comprehensive understanding of its effectiveness in fostering reading skills among digital natives.

METHOD

This study employed an exploratory sequential mixed-methods design (Creswell & Creswell, 2022). The research began with qualitative data collection and analysis, including observations and interviews, to explore the influence of Digital Game-Based Learning (DGBL) on children's self-efficacy. This phase addressed gaps in previous research that relied solely on quantitative methods. Subsequently, a quantitative experimental study using a posttest-only control group design was implemented to assess the impact of DGBL on reading achievement, thereby strengthening the overall validity of the research.

The study population comprised 200 sixth-grade students (aged 12-14) from an Indonesian primary school. These participants had access to mobile devices and parental consent for their use in learning. Following informed consent procedures, 144 students (52 males, 92 females) were selected through intact-group sampling and randomly assigned to either a control group (n=72) or an experimental group (n=72). Additionally, 15 students from the experimental group, chosen based on their engagement or improvement during the DGBL intervention, were purposively sampled for semi-structured interviews.

The Digital Game-Based Learning (DGBL) tool used in the study was e-CALF, a digital game designed to be contextual, attractive, logical, and fun. The experimental group began by using e-CALF games installed on their mobile phones. The game covered topics such as

Seasons, Tourism, Directions, and Airport, each comprising six levels. Levels 1 and 2 focused on vocabulary building, Levels 3 and 4 on fill-in-the-blank tasks, and Levels 5 and 6 on comprehension skills. Furthermore, students were instructed to carefully read the instructions to ensure proper gameplay. After installing the e-CALF APK, students could open the application and choose from three options: Play, Options, and Exit. They could turn off the music by selecting the music icon under Options. By clicking Play, they could choose a topic and start with the first level, progressing through subsequent levels. In the game, students would drag coloring pins to the correct answers and receive immediate feedback. To complete each level, they had to finish tasks within a time limit.

After completing the experimental study, qualitative data were collected through semi-structured interviews with 15 students in Indonesia. Each 30-minute interview aimed to explore the students' opinions on their learning engagement with e-CALF. The interviews followed a protocol with specific questions about the game. After all treatments were administered, both groups took a post-test in the 10th meeting, which lasted about 60 minutes. Given the mixed-methods nature of this study, two distinct approaches to data analysis were employed. Qualitative data, derived from semi-structured interviews, were analyzed using Creswell & Poth's (2016) data analysis spiral, progressing from raw audio recordings to a comprehensive narrative report. After transcribing the interviews and conducting member checking, an inductive thematic analysis (Braun & Clarke, 2012) was performed.

At the end of the experiment, a post-test was administered, consisting of 30 items including vocabulary, fill-in-the-blank, and comprehension questions. These items were validated by two experts and piloted in another school, resulting in the removal of ten items and the revision of seven items. The final test comprised 20 items with a reliability score of 0.90. Moreover, quantitative data from the post-test were analyzed using SPSS 24.0. An independent samples t-test was conducted to assess the impact of the DGBL intervention on reading achievement.

FINDING AND DISCUSSION

Impact of DGBL on Children's Self-Efficacy

Digital Game-Based Learning (DGBL), as implemented through the e-CALF platform, emerged as a viable alternative to traditional English reading instruction. Observations and interviews conducted during this study revealed that DGBL significantly enhanced students' engagement and learning outcomes. The structured and interactive nature of e-CALF provided a rich learning environment that effectively supported the development of reading skills. Students reported increased motivation and confidence, citing the immediate feedback and progressive challenges as key factors in their improved self-efficacy and reading achievement. These findings underscore the potential of DGBL to transform traditional educational approaches and foster a more engaging and effective learning experience.

One of the key findings from the interviews was that students initially struggled with the time constraints and text length in the higher levels of the game. However, many children developed effective coping mechanisms in response to these challenges, which further enhanced their self-efficacy. For example, student 2 explained, *"At first, I struggled with the time constraints in the higher levels. But then I started to develop my own strategies to cope*

with it. For example, I made sure to prioritize understanding the questions first, so I could manage my time better." This strategy allowed the student to focus on the relevant information, manage their time more effectively, and complete the tasks more efficiently. This adaptive approach not only helped them overcome the difficulties presented by the higher levels but also contributed to an increase in their self-confidence and ability to handle challenging tasks.

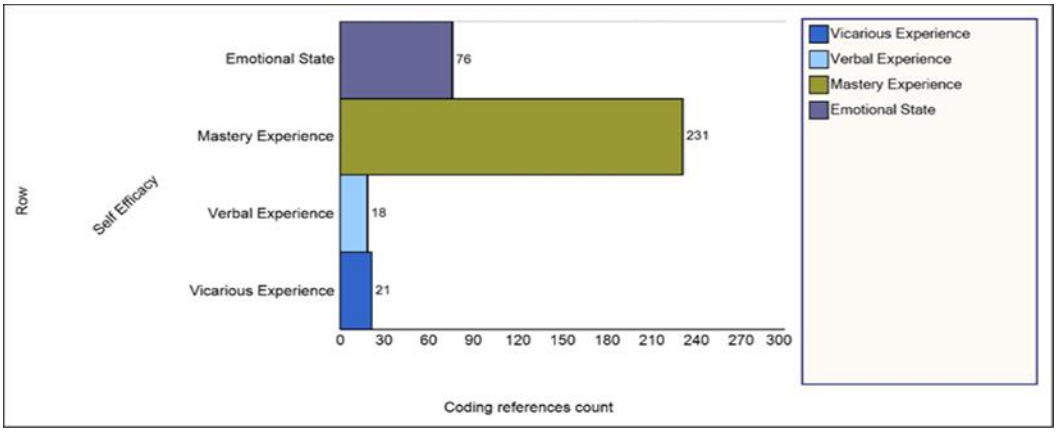

Figure 2. Factors of Self-Efficacy Facilitated by DGBL

Mastery experience, the most prominent factor facilitated by Digital Game-Based Learning (DGBL), emphasizes repeated success as a catalyst for self-efficacy. The structured levels and clear goals within e-CALF allowed children to achieve a sense of mastery. This was reflected in student 4 remark*: "After the first few tries; I noticed that reading the questions first made a big difference. By the second meeting, I was completing levels much quicker."* This strategic development is supported by the observed decrease in time taken to complete later levels. As students continued to engage with the game, their ability to devise and implement effective strategies, such as reading the questions first, contributed to their increased efficiency and confidence in tackling the challenges presented by the game.

The progressive difficulty levels in e-CALF ensure a balance of challenge and success, which is crucial for self-efficacy development. Students noted that the gradual increase in complexity was both motivating and engaging. Student 5 explained, *"Understanding level 3 and 4 was easier because the words were introduced earlier. It helps a lot to be familiar with the game as the challenges get harder."* This indicates that early exposure to vocabulary in the initial levels helped students feel more confident and prepared as they advanced to more difficult levels. The familiarity with the game mechanics and content allowed them to tackle the higher levels with greater ease and enthusiasm, thereby fostering their self-efficacy and sustaining their engagement with the learning process.

The collaborative learning environment fostered vicarious experiences, which is another key component of self-efficacy. Observing peers' gameplay provided valuable learning opportunities and motivation. Student 7 noted, "*It's motivating to see my friends succeed in the game. It makes me believe I can do it too."* This illustrates how watching classmates succeed not only offered practical insights into gameplay strategies but also boosted students' confidence in their own abilities. The shared experiences and visible success of peers reinforced the students' belief in their capacity to achieve similar success, thereby enhancing their self-efficacy and encouraging continued engagement with the game.

The instructor's role in modeling gameplay and offering encouragement also contributed significantly to vicarious experiences and student confidence. One student shared, *"Moreover, the teacher was friendly and explained well. I did not feel nervous at the beginning because it was exemplified by the teacher how to play."* This highlights the importance of the teacher's involvement in demonstrating how to play the game and providing support. By observing the teacher's example, students felt more at ease and confident in their ability to engage with the game. The friendly and clear guidance from the teacher helped alleviate initial nervousness, making the learning process smoother and more enjoyable. This support was crucial in fostering a positive learning environment and enhancing students' self-efficacy.

e-CALF's immediate positive feedback, delivered through music and sound effects, proved crucial for self-efficacy development in young learners. This finding aligns with research demonstrating the impact of positive verbal persuasion on self-efficacy and achievement. One student expressed, *"I like how the game responds with sounds when I get an answer right or wrong. It helps me know how I'm doing."* This highlights the role of auditory feedback in maintaining student engagement and motivation. The immediate response to their actions, whether correct or incorrect, provided a sense of accomplishment and encouragement. The feedback sounds helped students understand their progress and reinforced their efforts, thereby enhancing their self-efficacy and making the learning experience more enjoyable and effective.

DGBL Effect of Children's Reading Achievement

To evaluate the impact of Digital Game-Based Learning (DGBL) on children's reading achievement, an experimental design was employed with two groups: a control group (n=72) and an experimental group (n=72). The experimental group received the DGBL intervention using the e-CALF platform, while the control group followed traditional instruction methods. After the intervention period, both groups completed a post-test consisting of 20 reading comprehension questions. This post-test aimed to measure changes in reading ability and assess the effectiveness of DGBL in improving reading skills compared to traditional instruction.

Table 1. Variabilities of children' reading achievement in DGBL and non-DGBL

Groups	N	Minimum	Maximum	Mean	Std. Deviation	Variance
DGBL	72	70.00	100.00	86.5278	8.98508	80.732
Non-DGBL	72	50.00	90.00	71.3889	10.65536	113.537

Table 1 presents the reading achievement scores for both the experimental (DGBL) group and the control (non-DGBL) group. The experimental group achieved a higher average score (M = 86.53) with less variability (SD = 8.99) compared to the control group, which had a lower average score (M = 71.39) and greater variability (SD = 10.66). This indicates that students who participated in the DGBL intervention demonstrated superior reading achievement compared to those who received traditional instruction.

Table 2. One sample test

Variable	F	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Reading	1.575	142	.000	15.13889	1.64261	11.892	18.386

The findings indicate a significant improvement in reading achievement for students who participated in the DGBL intervention compared to those who received traditional instruction. The experimental group's scores were, on average, 15.14 points higher than those of the control group, with a high level of statistical significance ($p = 0.000$). This demonstrates the effectiveness of DGBL in enhancing reading skills among students. Furthermore, the integration of technology, particularly digital game-based learning (DGBL), has revolutionized English language instruction by providing engaging and interactive learning experiences. Although DGBL is becoming more common in educational settings, its impact on children's self-efficacy and reading achievement is still being explored. This study aimed to fill these knowledge gaps by examining how DGBL influences self-efficacy and reading outcomes in young learners.

The findings on how Digital Game-Based Learning (DGBL) influences children's self-efficacy in reading activities revealed that DGBL enhances self-efficacy through four sources, as outlined in Bandura's (1994) theoretical framework: mastery experience, vicarious experience, verbal persuasion, and emotional state. Children engaging in DGBL gained substantial mastery experiences through the acquisition of linguistic knowledge and reading skills. According to Cohen (2016), the game not only increased self-efficacy but also sustained this effect weeks after playing. Enjoyment of the game was a strong predictor of self-efficacy increases, with empathic concern, eudaimonic entertainment use motivation, and character identification driving this enjoyment. Similarly, Yang et al. (2016) found that the game had a significant positive influence on learners' self-efficacy and English learning performance. Their study revealed that higher self-efficacy led to better English learning outcomes, underscoring the critical role of self-efficacy in educational performance. These findings suggest that DGBL is a powerful tool in fostering children's self-efficacy and enhancing their reading abilities.

Students with higher self-efficacy consistently outperformed their peers with lower self-efficacy, underscoring the importance of fostering self-belief through engaging and interactive learning experiences. Feedback and verbal persuasion provided during gameplay encouraged task completion, aligning with studies highlighting the positive impact of these factors on self-efficacy (Hakulinen et al., 2013; Yang, 2012). Although DGBL can introduce challenges that may lead to stress and anxiety, these emotional responses can be mitigated through strategic approaches, ensuring that DGBL continues to foster positive self-efficacy.

Besides, Regarding the impact of DGBL on children's reading achievement, the study's findings indicate a significant positive effect. The experimental group, which engaged in DGBL, outperformed the control group on a reading comprehension post-test. This aligns with existing research demonstrating the effectiveness of DGBL in improving reading skills (Girmen & Kaya, 2019). The widespread adoption of Digital Game-Based Learning (DGBL) is

driven by technological advancements and its appeal to learners. Hwang and Wu (2012) highlighted the trends and advancements in digital game-based learning research, suggesting that more technology-based learning will occur and that educational computer games could play an important role in education. Similarly, Lin and Hou (2016) noted that games can increase children's motivation for trials and errors, ultimately leading to their advancement. Lee and Jonson-Reid (2016) also noted that children in primary grades can distinguish between self-efficacy and self-concept, with task-specific self-efficacy significantly influencing reading achievement. They also found that student motivation significantly mediated the relationship between self-efficacy and reading achievement, highlighting the critical role of motivation in educational success.

Statistical analysis revealed a strong relationship between children's self-efficacy and reading achievement. The four sources of self-efficacy fostered by DGBL, particularly mastery experience, positively influenced children's belief in their abilities (Hakulinen et al., 2013; McDaniel et al., 2012), which, in turn, enhanced their learning performance. Additionally, Digital Game-Based Learning (DGBL) significantly enhances children's motivation, which is crucial for reading achievement. Hung and Young (2015) observed that game-embedded handheld devices fostered group interdependence, improving learner immersion and interaction. They proposed that such interactions could become a new form of literacy in participatory culture. Kao (2014) suggests that digital games providing focused correction on errors are more effective than traditional teacher corrections. These findings highlight the potential of DGBL to enhance learning outcomes through increased motivation and interactive learning experiences. These findings suggest an interconnectedness between motivation, self-efficacy, and reading achievement within the context of this study. In conclusion, DGBL can serve as a valuable tool for improving both self-efficacy and reading achievement in young learners. By providing engaging experiences, fostering motivation, and cultivating self-belief, DGBL offers a promising approach to enhancing English language learning outcomes.

CONCLUSION

The main objectives of this study were to investigate the effects of Digital Game-Based Learning (DGBL) on children's self-efficacy and reading achievement. The findings revealed that DGBL promotes self-efficacy through four factors: mastery experience, vicarious experience, verbal persuasion, and emotional state. Notably, the development of self-efficacy emerged as a crucial predictor linking DGBL to improved reading achievement. With its engaging and challenging features, DGBL offers a promising approach to enhancing children's learning experiences. The study also confirmed that DGBL has a significant positive effect on children's reading achievement, supporting previous research while providing qualitative insights into how DGBL facilitates these improvements. However, the study was limited by the absence of quantitative data on children's self-efficacy to support the qualitative findings. Future research should incorporate quantitative measures to provide more comprehensive results. Despite its limitations, this study contributes to our understanding of the relationship between DGBL, self-efficacy, and reading achievement.

Teachers should consider using DGBL to facilitate children's self-efficacy, as the findings suggest that DGBL effectively provides children with the four sources of self-efficacy. DGBL can enhance children's reading achievement by providing practice in

linguistic knowledge and reading skills through its interactive features. By incorporating enjoyable and engaging activities like DGBL, teachers can help reduce students' anxiety and depression, thereby strengthening their self-efficacy. In conclusion, DGBL can serve as an effective tool for educators to enhance both self-efficacy and reading achievement in young learners, providing a fun, challenging, and supportive learning environment.

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