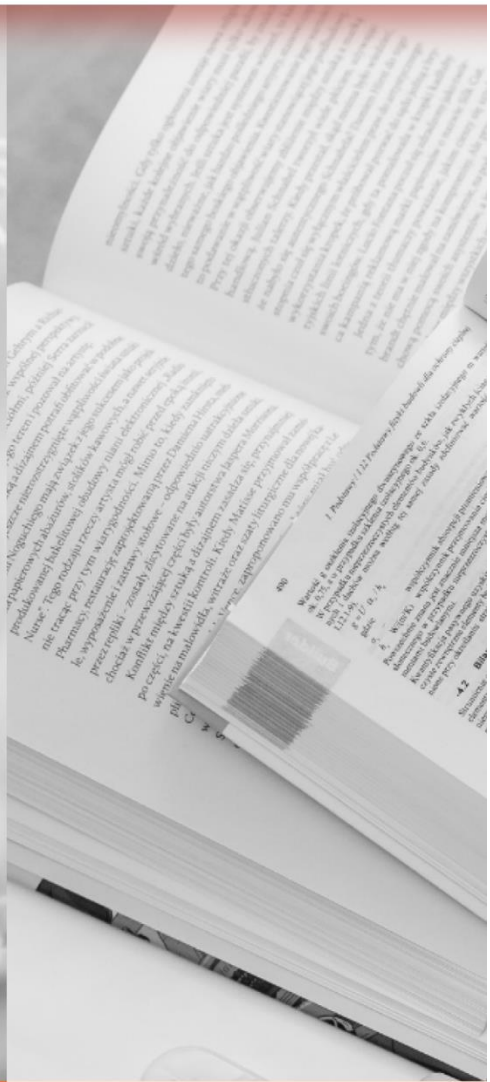
IJMSHE

ISSN: 3082-3021

International Journal of Multidisciplinary Studies in Higher Education

Volume 1, Issue 1 | 2024



Davao City, Philippines, 8000

ISSN: 3082-3021 (Online)

IJMSHE

International Journal of Multidisciplinary Studies in Higher Education

IJMSHE | Vol. 1 No.1 | 2024

DOI: https://doi.org/10.70847/586368

A Systematic Review on The Effectiveness of Digital Game-Based Learning in the Development of Vocabulary Skills

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Article Information

Received:
September 29, 2024
Accepted:
October 28, 2024
Published:
November 13, 2024

Abstract

This systematic review examines the effectiveness of digital game-based learning (DGBL) for vocabulary development across diverse educational contexts. Through an analysis of experimental studies conducted between 2014 and 2024, the study highlights how DGBL significantly enhances learner engagement and vocabulary retention, particularly for communicative ability. Important variables that greatly influence these results include learner age, game design, and previous gaming experience. Recommendations for educators, policymakers, and future research are provided, emphasizing the importance of context-sensitive DGBL implementation in vocabulary instruction.

Keywords

DGBL; Vocabulary skills, Communicative Competence

Introduction

Digital game-based learning (DGBL) has emerged as an innovative tool for vocabulary acquisition, capturing significant attention due to its potential to improve learner motivation and engagement. The increasing use of digital games in education addresses the need for more interactive methods that enhance vocabulary retention and language competence. Research demonstrates that DGBL can significantly enhance vocabulary learning by fostering a contextualized, motivating environment. In language education, one of the key areas where DGBL shows significant promise is vocabulary acquisition. Vocabulary serves as the foundation of communicative competence, and its mastery is critical for students' ability to read, write, speak, and listen effectively (Pratiwi et al., 2024; Tao et al., 2023). Without a strong vocabulary, even a sound understanding of grammar offers little communicative value (Suwanasilp & Durongbhandhu, 2023; Dağdeler, 2023). Therefore, innovative methods that engage learners and support vocabulary retention are essential for language development. Prior research has demonstrated that DGBL can enhance vocabulary retention, motivate learners, and create a more contextualized learning environment (DeHaan et al., 2010; Vnucko et al., 2024).

Indeed, the engaging features of gaming environments have shown the potential to foster motivation, recall, task switching, immediate feedback, and interaction, all of which can increase learners' autonomy and engagement (Vnucko et al., 2024). The immersive and engaging nature of digital games provides unique opportunities for vocabulary learning. Interactive platforms such as Google Form, Socrative, Quizizz, Quizlet, and Kahoot! have been shown to effectively support vocabulary learning by engaging students in fun, game-like activities that increase retention (Pratiwi et al., 2024). Obenza-Tanudtanud and Obenza (2024) also found that DGBL positively influences academic performance, particularly in language acquisition among grade six pupils. Furthermore, digital games boost learner autonomy, improve recall, and provide immediate feedback, all of which are key to vocabulary development (Plass et al., 2015).

While DGBL's potential is widely recognized, research findings on its effectiveness in vocabulary acquisition remain inconsistent. Some studies suggest digital games are particularly beneficial for receptive word knowledge, such as recognition and recall (Gao & Gee, 2023), while others highlight the impact of specific game types on memory enhancement (Pratiwi et al. 2024). Moreover, the long-term effects of DGBL on vocabulary retention and the influence of contextual factors, such as digital game design and learner characteristics, are still underexplored. Obenza and Mendoza (2021) emphasize the role of communicative activities in improving students' language competence, which suggests that the effectiveness of DGBL could depend on its ability to create interactive and communicative environments for learners. However, research findings remain inconsistent, with some studies indicating stronger impacts in specific contexts, such as receptive word knowledge or the design of the gaming intervention (Gao & Gee, 2023). This systematic review seeks to bridge these gaps by synthesizing evidence on the effectiveness of DGBL in vocabulary skill development across different learner populations and educational settings.

Objectives: This review aims to evaluate:

1. The overall effectiveness of DGBL on vocabulary retention and acquisition.
2. The role of contextual factors, such as digital game design and learner characteristics, in moderating DGBL outcomes.
3. The potential long-term impacts of DGBL on learners' vocabulary skills.

Materials and Methods

This systematic review's main goal is to evaluate how well digital game-based learning (DGBL) works for enhancing vocabulary and gathering information through a process of reviewing articles on a specific topic based on a research question, and following a review protocol, the level of evidence and quality of each publication were evaluated, complying with eligibility criteria (Tirajaya et al., 2024).

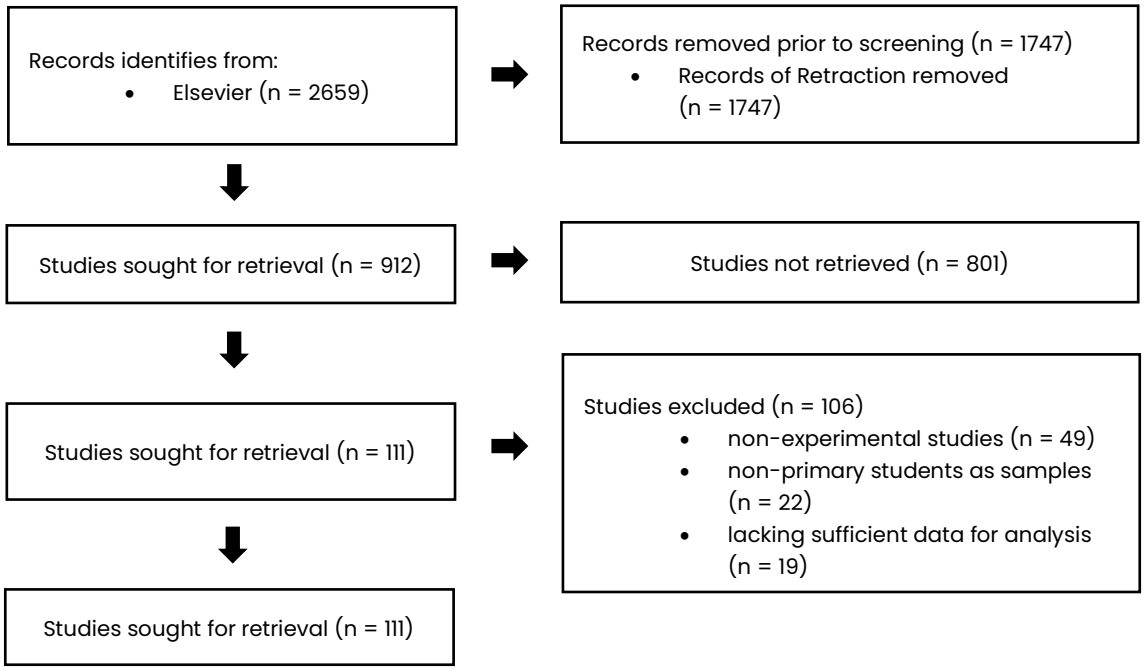

Figure 1. Flowchart of article selection process.

The review followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure a transparent and rigorous selection process. Searches were conducted in databases such as Elsevier and Scopus using Boolean operators and combinations of keywords like "digital game-based," "vocabulary skills," and "experimental." The search was limited to articles published between 2014 and 2024. Additionally, only experimental or quasi-experimental studies that explicitly examined vocabulary acquisition using DGBL with elementary students as samples were included. Studies focusing on broader language skills without explicit vocabulary measurements or lacking sufficient data for analysis were excluded.

A flowchart showing the study selection process is included, highlighting the number of articles initially identified (n = 2659), screened, and ultimately included (n = 111). This visual representation ensures transparency. 2,659 articles were initially found in the search, which was done using Elsevier and Boolean operators to combine keywords like "digital game-based," "vocabulary skills," and "experimental." Filters were used to focus on research from the social sciences, psychology, and arts, and humanities (n = 890) and limit the selection to peer-reviewed research publications (n = 1,747) published between 2014 and 2024 (n = 1,310). This helped to narrow the results. 111 open-access publications were ultimately located and brought in for further examination. However, only 5 studies were found to have qualified the criteria.

Through an article selection process, the publications were analyzed to ensure that the articles met the eligibility requirements and addressed the study issue. Furthermore, to certify methodological rigor and transparency, the selection will be documented using PRISMA flow diagram (Moher et al., 2009). Information

on study design, sample size, game type, and vocabulary measures were extracted using a structured data extraction form. The methodological rigor of each study was assessed using the Cochrane Risk of Bias Tool (Higgins et al., 2020), ensuring that only high-quality studies were included in the synthesis.

To synthesize the results, the review will offer a comprehensive overview of the available evidence on the effectiveness of DGBL in vocabulary development. The primary objectives of this review are to highlight effective DGBL strategies, identify gaps in the literature, and offer practical recommendations for researchers and educators. By consolidating findings from various studies, the review will provide valuable insights into the potential of digital games as a tool for vocabulary enhancement in educational settings.

Results

The table includes numerous studies that show how digital game-based learning (DGBL) improves vocabulary development. The findings demonstrate that utilizing DGBL in conjunction with traditional teaching methods can significantly enhance students' vocabulary development. This is mostly because the engaging and interactive qualities of digital games motivate students to engage more actively in the learning process. The reviewed studies span a broad range of digital games, from general language games to educational tools specifically designed for vocabulary enhancement.

Still, several factors affect how successful DGBL is. How helpful DGBL can be depends on several factors, including age groups, linguistic ability, previous gaming experience, and learning environment. Furthermore, research has indicated that learning outcomes are influenced by the kind of language being targeted, whether it be active or passive, as well as the length of digital game exposure. Vocabulary improvement is often greater in larger, more complex challenges—particularly those with diverse participants and extended digital game sessions.

The study concludes that DGBL is an effective method for improving vocabulary. When it comes to language acquisition, students who use digital games frequently perform better than those who just use traditional approaches. While DGBL offers clear benefits, successful implementation in education requires careful planning and consideration. Additional investigation is required to enhance DGBL for various student demographics and academic settings, guaranteeing that its advantages can be completely experienced in a range of learning contexts.

2.1. Subsection

2.1.1. Subsubsection

The table provides a comprehensive overview of several studies focused on the use of digital and non-digital interventions in vocabulary development. Each study employs a quasi-experimental design, making them valuable in exploring the effectiveness of interventions in real-world educational settings. This discussion will interpret the key findings, methodological approaches, and implications of each study in relation to the overarching theme of vocabulary skill development through various educational tools.

The Victory of a Non-Digital Game over a Digital One in Vocabulary Learning (Naderi & Moafian, 2023)

This study compares the effectiveness of non-digital versus digital games in enhancing vocabulary acquisition among elementary English as a Foreign Language (EFL) learners. Interestingly, the results indicate that non-digital games were more effective than their digital counterparts. The non-digital group showed a more substantial improvement from pre-test (15.50) to post-test (18.35) and delayed post- test (17.97) scores, while the

digital group showed a decline in vocabulary retention over time.

This finding challenges the common assumption that digital games are inherently superior for vocabulary acquisition. One possible explanation is that non-digital games may involve more direct human interaction, which can enhance engagement and facilitate learning through immediate feedback and socialization. Additionally, non-digital games might present less cognitive overload, allowing learners to focus more effectively on the target vocabulary. Future research could explore whether a hybrid approach, combining the interactive elements of digital games with the personal engagement of non-digital games, might provide an optimal learning experience.

Using Multimodal Educational Apps to Increase the Vocabulary of Learners (Lee & Aspiranti, 2023)

This study highlights the impact of multimodal educational apps on vocabulary acquisition, particularly comparing two experimental groups (one using the app with recorded word explanations and one using the app alone) and a control group. The group using the app with recorded explanations showed the highest vocabulary gains, with a gain score of 2.39 compared to the control group's 0.55. Even the group using only the app without explanations saw gains, though these were more modest (0.75). The results suggest that multimodal educational apps are effective tools for vocabulary learning, particularly when they incorporate additional supports like recorded explanations. The success of these apps may lie in their ability to present information in multiple formats (e.g., visual, auditory), which caters to different learning styles and enhances retention. Furthermore, the app's interactive nature likely encourages active learning, which is known to facilitate deeper cognitive processing of vocabulary. This study supports the integration of technology-enhanced learning tools in modern classrooms, particularly for learners who may benefit from differentiated instruction.

Efficacy of Berni: A Software for Preschoolers at Risk of Dyslexia (Romero et al., 2023)

This study focuses on preschoolers at risk of dyslexia, comparing the effectiveness of the Berni software against traditional learning methods. The experimental group using the Berni software showed significant improvements, with pre-test and post-test scores increased from 39.64 to 67.52, compared to the control group's smaller gain (39.34 to 51.85).

The significant improvement in the experimental group underscores the potential of specialized digital tools to address early literacy challenges. The Berni software appears to provide targeted support for at-risk learners by offering structured, adaptive learning experiences tailored to individual needs. This is particularly important for young learners, as early intervention can play a critical role in mitigating long-term learning difficulties. The study emphasizes the importance of technology in providing scalable, individualized instruction for learners with specific educational needs.

Overcoming Illiteracy Through Game-Based Learning in Refugee Camps and Urban Slums (Pynnönen et al., 2022)

This study examines the use of digital game-based learning tools to improve literacy skills among marginalized, out-of-school children aged 5 to 8 in refugee camps and urban slums. The results show that children in the experimental group achieved higher literacy scores compared to the control group, particularly in letter naming (50.4% vs. 34.4%) and rhyme recognition (75.3% vs. 35.6%).

The findings suggest that digital game-based learning can serve as an effective educational intervention, even in low-resource environments. This is particularly significant in contexts where traditional educational infrastructures are limited or inaccessible. The interactive, engaging nature of digital games may help compensate for the lack of formal education by promoting active learning and offering immediate feedback, which fosters skill development. This study highlights the potential of educational technology to bridge educational gaps in vulnerable populations,

offering a scalable solution for improving literacy in underserved communities.

The Role of Bilingual Discussion Prompts in Shared E-Book Reading (Yang et al., 2022)

This study explores how bilingual discussion prompts in shared e-book reading affect vocabulary acquisition and story comprehension among young English language learners (ELLs). The experimental group that used bilingual prompts showed significantly higher story comprehension (19.39 vs. 14.59 in the control group) and story retelling scores (15.09 vs. 11.67), though both groups made similar gains in English receptive vocabulary.

The use of bilingual discussion prompts appears to offer an effective strategy for improving both comprehension and retelling abilities among ELLs, likely because the prompts provide scaffolding that bridges gaps in understanding. Bilingual prompts allow learners to draw on their native language as a cognitive resource, which supports deeper engagement with the content. This aligns with research suggesting that learners benefit from instruction that incorporates their linguistic and cultural backgrounds. The inclusion of interactive features, such as a questioning avatar, further enhanced the learning experience by promoting active participation. This study reinforces the importance of culturally responsive digital tools in supporting language development for diverse learners.

2.2. Figures, Tables, and Schemes

Figure 1. Collected data from reviewed publications (See appendix 1)

Discussion

Across these studies, several key themes emerge regarding the use of digital and non-digital tools in vocabulary development. First, both digital and non-digital games can effectively promote vocabulary acquisition, though the context and learner characteristics significantly influence their effectiveness. Non-digital games may offer advantages in fostering social interaction and direct feedback, while digital tools provide scalability and access to individualized learning.

There are particular advantages to digital game-based learning (DGBL) for a variety of age groups, levels of proficiency, and learner needs. For younger learners, age-appropriate, interactive designs encourage sensory learning while to accommodate the social and practical learning preferences of teens and adults, DGBL can present complicated terminology and replicate real-world applications. Furthermore, simple, repetitive digital games that concentrate on high-frequency vocabulary are beneficial for beginners, whereas digital games that are culturally inclusive, context-rich, and require advanced language use are beneficial for intermediate and advanced learners. Lastly, through multilingual alternatives and customized paths for more inclusive, individualized learning experiences, DGBL's adaptability also supports learners with special needs and those from culturally and linguistically diverse backgrounds.

Second, multimodal apps and bilingual supports demonstrate that technology-enhanced learning tools are particularly effective when they cater to diverse learning needs, offering multiple forms of input and scaffolding for learners with different abilities. Importantly, the findings suggest that educational technologies can serve as powerful interventions for at-risk populations, such as preschoolers with dyslexia or marginalized children in low-resource settings.

Finally, while digital tools show considerable promise, they should be integrated thoughtfully into pedagogical frameworks that consider learner characteristics, context, and long-term retention. Further research is needed to explore the sustainability of vocabulary gains over time and to refine these tools for broader application in diverse educational settings.

These studies collectively underscore the importance of combining technological innovation with sound pedagogical principles to maximize learning outcomes. As

educational environments continue to evolve, the role of digital tools in enhancing language learning, particularly vocabulary acquisition, will likely expand, offering new opportunities for inclusive, engaging education.

Conclusion

The findings of this systematic review emphasize how digital game-based learning (DGBL) can be a useful method for vocabulary acquisition, with specific advantages like improved student autonomy, retention, and engagement. Findings highlight DGBL's adaptability to a variety of educational contexts by demonstrating that it works best when tailored to student age, language proficiency, and gaming experience. The necessity for well-crafted games that strike a balance between cognitive stress and educational content is one of the limits that still exist, along with conflicting findings among research. For DGBL to be completely accessible to a diverse range of learners, more study should be done on its long-term effects on vocabulary retention and its flexibility in meeting different educational demands.

Recommendation

For Educators: Select games that cater to students' age, language proficiency, and cultural backgrounds, integrating and aligning game activities with specific vocabulary goals to ensure they complement the curriculum. Utilize the data-tracking features in educational games to assess student progress. Finally, combine digital game-based learning (DGBL) with traditional methods, such as interactive group discussions or storytelling, to enhance engagement and support vocabulary learning through diverse modes of interaction.

For Researchers: Future studies should focus on the long-term retention effects of DGBL and its impact on different learner populations.

For Policymakers: Invest in premium, flexible DGBL resources and make the relevant devices and internet available throughout the learning environments. Educators should also be offered professional development to be able to choose and combine DGBL and traditional methods in order to raise motivation and achieve better vocabulary acquisition outcomes. Moreover, creating a systematic evaluation and feedback strategy will assist in improving the implementation of DGBL, guaranteeing efficiency in the use of resources for successful vocabulary growth.

Limitations

While this review provides valuable insights into the effectiveness of educational technology, the heterogeneity of the interventions and contexts limits the generalizability of the findings. Additionally, the lack of long-term follow-up data in some studies raises questions about the sustainability of the observed gains.

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Suggested citation:

Morales, L. M., Castillo, J. R., & Cuarte, R. (2024). A Systematic Review on the Effectiveness of Digital Game-Based Learning in the Development of Vocabulary Skills. International Journal of Multidisciplinary Studies in Higher Education, 1(1), 55–62. https://doi.org/10.70847/586368

Appendix I

RESEARCH TITLE	AUTHOR	YEAR	RESEARCH DESIGN	PARTICIPANTS	NUMBER OF PARTICIPANTS	GROUPS	STATISTICAL ANALYSIS	HYPOTHESIS TESTING (RESULTS)	MEANS SCORES AND GAIN SCORE	CONCLUSION
The Victory of a Non-Digital Game over a Digital One in Vocabulary Learning	(Naderi & Moafian, 2023)	2023	Quasi-experimental design	Elementary EFL Learners	58 students were interviewed but only 40 students are Elementary.	Non-Digital Game Group Digital Game Group	ANCOVA QUADE'S ANCOVA TEST	The hypothesis being tested might be that non-digital games are more effective than digital ones for vocabulary learning.	Digital Group Pretest- 18.05 Post-test - 16.20 Delayed post- test - 15.70 Non-digital group Pre-test - 15.50 Post-test - 18.35 Delayed post-test - 17.97	The study's conclusion likely emphasizes that nondigital games are more effective in enhancing vocabulary learning than digital games.

Using Multimodal Educational Apps to Increase the Vocabulary of Learners	(Lee & Aspiranti, 2023)	2023	Quasi-experimental design	Elementary Students	69 students	Experimental (App plus recorded explanation and app only) and Control group	ANOVA PAIRED T- TEST	The results showed a statistically significant difference in vocabulary gains between the experimental and control groups, indicating that using multimodal educational apps improved vocabulary learning.	Control Group Pre-test - 2.30, Post-test - 1.75, Gain Score - 0.55 Experimental Group (App plus recorded explanation) Pre-test - 5.30 Post-test - 7.67 Gain Score - 2.39 Experimental Group (App only) Pre-test Score - 7.13 Post-test - 7.88 Gain Score - 0.75	The study concluded that multimodal educational apps are effective in improving vocabulary learning. Learners who used the apps showed greater

Efficacy of Berni: A Software for Preschoolers at Risk of Dyslexia	(Romero et al., 2023)	2023	Quasi-experimental design	Pre-schoolers	417 preschoolers aged 4 and 5 years old	Experimental using the Berni method Control group using the traditional method	IBM SPSS STATISTICS 23 ANCOVA	While the exact p-values or significance levels were not provided in the visible sections, the study aimed to demonstrate a statistically significant improvement in language acquisition among Berni preschoolers.	Control group Pre-test - 39.34 Post-test - 51.85 Experimental group Pre-test - 39.64 Post-test - 67.52	The study concluded that Berni software effectively supports language development and literacy acquisition in preschoolers at risk of dyslexia. Preschoolers using the software showed improvement in comparison to traditional earning methods.
Overcoming illiteracy through game-based learning in refugee camps and urban slums	(Pynnönen et al., 2022)	2022	Quasi-experimental design	Marginalized, most vulnerable, and out-of-school children aged between 5 and 8	359 children	Experimental group (Children who engaged in digital game-based learning activities) Control group (Children who followed traditional literacy development methods without the digital game-based interventions)	ANOVA PAIRED T-TEST	The study hypothesized that children exposed to digital game-based learning would show greater improvements in literacy skills compared to those following traditional methods. The results supported this hypothesis, showing a significant improvement in literacy scores among children who used the digital game-based learning tools.	Control group Letter name - 34.4 % Letter sound - 21.3 % Rhyme 1 - 13.0 % Rhyme 2 - 35.6 % Words Read - 14.2 % Experimental group	The study found that the intervention children achieved or surpassed the learning gains of a control group studying through formal education. These results suggest that digital games show promise for improving early-grade literacy, even in low-resource contexts.

									Letter name - 50.4 % Letter sound - 21.3 % Rhyme 1 - 45.8 % Rhyme 2 - 75.3 % Words Read - 36.5 %	
The role of bilingual discussion prompts in shared E-book reading	(Yang et al., 2022)	2022	Qualitative and Quantitative	English language learners aged 3–7	107 parent-child pairs	Experimental / Treatment Group Control Group	MANOVA	The study found that using bilingual discussion prompts in a multimedia interactive e- book improved young English language learners' story comprehension and retelling. Children who read with these prompts performed better than those without them, though both groups made similar gains in English vocabulary. Parents naturally used effective reading strategies without formal training, and the e-book encouraged children to become active storytellers. The inclusion of a questioning avatar also helped children form connections with story characters. Overall, the findings suggest that such e- books can be valuable educational tools	Control group Story Comprehension 14.59 Story Retelling 11.67 Story Receptive Vocabulary 13.79 Story Expressive Vocabulary 13.4 Experimental group	The study found that bilingual discussion prompts in e-books significantly improved children's story comprehension and retelling in an EFL setting. These prompts enabled parents to naturally support their children's learning without formal training. The interactive features, like a questioning avatar, also boosted children's motivation. The study highlights the potential of low-cost e-book apps as effective tools to reduce educational inequity, especially for children from low income, multilingual backgrounds.

								for families from diverse linguistic backgrounds.	Story Comprehension 19.39 Story Retelling 15.09 Story Receptive Vocabulary 13.83 Story Expressive Vocabulary 15.11	