

AI-Customized Digital Picture Books to Enhance Vocabulary Learning in Early ELT Classrooms: A Quasi-Experimental Study

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Abstract

Artificial intelligence (AI) is increasingly shaping English language teaching by enabling personalized and multimodal instructional approaches. This study investigates the use of AI-customized digital picture books (DPBs) to enhance vocabulary learning in early primary classrooms. The novelty of this work lies in transforming prescribed textbook units into AI-generated, curriculum-aligned digital stories that integrate synchronized text, visuals, audio narration, and interactive features to support vocabulary acquisition. A five-week quasi-experimental design is implemented with 38 Grade 2 and Grade 3 learners following the NCERT curriculum. Vocabulary development is examined through pre- and post-assessment alongside classroom observations and teacher reflections. The findings indicate clear improvement in learners' word recognition, contextual understanding, pronunciation, and sentence usage after engagement with AI-customized DPBs. Qualitative insights further show increased learner engagement, confidence, and active participation during multimodal reading sessions. The results demonstrate that carefully designed AI-supported digital materials, when integrated with teacher mediation, create cognitively supportive and socially interactive environments for vocabulary development. This study contributes to the growing field of AI-enhanced language education by presenting an empirically grounded model for integrating generative AI tools into early ELT practice.

Keywords— *AI in early ELT, digital picture books, multimodal learning, vocabulary development, young learners*

I. INTRODUCTION

Vocabulary Importance in Early ELT

Vocabulary knowledge is widely recognized as a central component of language proficiency and literacy development. It underpins learners' ability to comprehend texts, express meaning, and participate effectively in communication. Research consistently demonstrates that lexical knowledge is a strong predictor of reading comprehension and overall

academic achievement (Nation, 2001). Furthermore, systematic and meaningful vocabulary instruction—particularly the development of high-utility academic words—plays a critical role in supporting language growth in school contexts (Beck et al., 2013).

In early English Language Teaching (ELT) classrooms, vocabulary development is especially significant. Primary learners are in a formative stage of linguistic and cognitive growth, and early exposure to meaningful vocabulary shapes later literacy outcomes. Young

learners acquire vocabulary more effectively when words are introduced through contextualized input, repetition, visual support, and interactive engagement rather than isolated memorization. However, vocabulary instruction in many early ELT settings continues to rely heavily on textbook-based word lists, which often lack sufficient multimodal support to sustain attention or promote deep understanding. Given that children are naturally responsive to stories, imagery, and sound, vocabulary teaching in primary classrooms requires more engaging and developmentally appropriate approaches. Embedding vocabulary within meaningful narrative and visual contexts can strengthen comprehension and retention.

Digital Picture Books

Digital Picture Books (DPBs) have gained attention as a practical tool for improving vocabulary instruction in primary classrooms. Unlike printed books, DPBs combine text, images, audio narration, and sometimes simple interactive features within a story format. This combination creates a richer learning experience that can capture children's interest and maintain their attention. When vocabulary is presented within stories supported by visuals and sound, learners are more likely to understand how words function in real-life contexts.

The strength of DPBs lies in their ability to connect words with images and meaningful situations. For example, when children see an illustration while hearing and reading a word, they can form stronger mental connections. Audio narration also supports pronunciation and listening skills, while visual cues help clarify meaning. Interactive elements, such as clickable words or animations, encourage active participation rather than passive reading. Instead of learning isolated vocabulary items, students encounter words within engaging narratives, which makes learning more natural and enjoyable. DPBs also support diverse learners. Visual and audio scaffolds can assist children who need additional support, while interactive elements can motivate reluctant learners. By combining multiple modes of input, DPBs create inclusive and learner-centered environments. However, many available digital storybooks are pre-designed and may not fully match specific classroom needs or textbook content. This limitation highlights the need for more adaptable and customized digital resources.

AI-Customized Digital Picture Books

Recent developments in Artificial Intelligence (AI) offer new possibilities for designing customized Digital

Picture Books that align closely with classroom objectives. AI tools allow teachers to transform traditional textbook lessons into interactive digital stories that include target vocabulary, relevant visuals, and supportive narration. Using generative AI platforms such as ChatGPT and Gemini, educators can adapt vocabulary content, simplify explanations, generate contextual sentences, and design story-based materials that suit their learners' levels.

AI customization goes beyond simply converting print materials into digital form. It allows teachers to adjust vocabulary difficulty, include culturally relevant examples, and design multimodal elements that support comprehension. For young learners, this flexibility is particularly valuable because it enables instruction to be tailored to their developmental stage and learning pace. By combining text, visuals, and audio in meaningful ways, AI-customized DPBs can help reduce confusion and strengthen memory retention. Although digital storybooks have shown positive effects in vocabulary learning, research on AI-customized DPBs in early ELT remains limited, especially at the primary school level. There is a need for empirical evidence that examines not only vocabulary improvement but also classroom experiences and teacher perspectives. Therefore, the present study explores the impact of AI-customized Digital Picture Books on vocabulary development among young learners through a structured classroom intervention, combining quantitative and qualitative data to understand their effectiveness in early ELT settings.

II. LITERATURE REVIEW

Vocabulary Acquisition and Picture Books

Vocabulary acquisition is a critical component of early literacy development, particularly in Grades 2 and 3 when learners transition from basic decoding to more complex academic reading. At this stage, lexical knowledge significantly influences comprehension, fluency, and content learning. For English language learners (ELLs), vocabulary development is especially important, as many enter school with limited exposure to academic English (Sedita, 2023). Research shows that vocabulary grows most effectively when learners encounter words repeatedly in meaningful contexts rather than through isolated memorization (Gersten et al., 2007). Picture books have long been recognized as effective tools for supporting vocabulary learning in early classrooms.

Children's books expose learners to richer language than everyday conversation, offering opportunities to engage with new vocabulary embedded in narrative contexts. Through illustrations and storytelling, learners infer meaning and build semantic connections (Sénéchal et al., 1995). Shared reading practices further enhance vocabulary development by providing structured discussion and guided interaction around texts (Logan et al., 2019). These practices align with Vygotsky's (1978) Sociocultural Theory, which emphasizes the importance of social interaction in learning. Vocabulary development occurs not only through exposure but also through guided discussion, questioning, and collaborative engagement. When teachers scaffold reading and discuss new words within stories, learners internalize vocabulary more effectively. Thus, picture books support vocabulary acquisition both cognitively and socially.

Digital Picture Books

With technological advancement, traditional picture books have evolved into Digital Picture Books (DPBs), which integrate multimedia features such as audio narration, animations, interactive hotspots, and contextual glosses (Li & Bus, 2023). These digital enhancements create multimodal learning environments that engage learners through visual, auditory, and interactive channels. The effectiveness of DPBs is supported by Dual Coding Theory (Paivio, 2007), which proposes that memory operates through interconnected verbal and visual systems. When vocabulary is presented simultaneously through text and corresponding imagery, learners form dual mental representations, strengthening recall. In DPBs, synchronized narration and illustrations activate both systems, enhancing vocabulary retention.

Similarly, Mayer's (2021) Cognitive Theory of Multimedia Learning suggests that learning improves when verbal and visual information are meaningfully integrated. Well-designed DPBs align text, images, and audio to reduce cognitive overload and support deeper processing. However, not all digital enhancements are beneficial. Sweller's (2019) Cognitive Load Theory warns that excessive animations or irrelevant multimedia elements can overwhelm working memory, particularly for young learners. Therefore, effective DPBs must balance engagement with cognitive clarity. Interactivity further distinguishes DPBs from traditional print books. Features such as tappable words, embedded pronunciation guides, and contextual glosses promote active engagement rather than passive reading (Tunkiel & Bus, 2022).

However, research indicates that interactivity is most effective when directly tied to instructional goals. Decorative animations that do not support vocabulary learning may distract learners and reduce comprehension (Kucirkova et al., 2021). Thus, pedagogical alignment is central to the success of digital materials. Narrative context continues to play an important role within DPBs. Stories provide repeated exposure to vocabulary within meaningful situations, allowing learners to infer meaning and strengthen retention. Emotional engagement with story characters and events further supports memory encoding (Andrä et al., 2020). In this way, DPBs extend the strengths of traditional picture books while adding multimodal and interactive dimensions.

AI in Education and Customized DPBs

The integration of Artificial Intelligence (AI) into education introduces new possibilities for customizing Digital Picture Books. Recent systematic reviews highlight the growing role of AI in enabling personalized and adaptive learning environments across educational contexts (Wang et al., 2024). AI-driven systems are increasingly used to support differentiated instruction, multimodal engagement, and intelligent feedback mechanisms that respond to learners' individual needs. Generative AI tools such as ChatGPT and Gemini allow teachers to adapt textbook content into interactive, vocabulary-focused digital narratives tailored to learners' proficiency levels. AI can generate contextual sentences, simplify complex vocabulary, and embed multimodal supports aligned with curricular goals. Research indicates that AI-supported personalization enhances learner engagement and supports instructional innovation when pedagogically guided (Younas et al., 2025).

AI customization strengthens the pedagogical value of DPBs by enabling differentiated instruction. Teachers can design stories that reflect learners' cultural contexts and adjust vocabulary difficulty according to classroom needs. From a pedagogical perspective, personalized AI systems offer opportunities for adaptive scaffolding, though effective implementation requires thoughtful instructional design and teacher mediation (Vorobyeva et al., 2025). From a cognitive perspective, AI-customized DPBs can integrate visual, auditory, and textual elements in ways that support dual coding (Paivio, 2007) and multimedia learning principles (Mayer, 2021). When designed carefully, such materials reduce unnecessary cognitive load (Sweller, 2019) and promote focused attention on essential vocabulary. However, the pedagogical effectiveness of AI tools

depends on structured integration rather than technological novelty alone.

Research Gap

Although previous research has demonstrated the effectiveness of picture books and digital storybooks in supporting vocabulary acquisition. No empirical studies to date have examined AI-customized DPBs in primary ELT classrooms using mixed-method designs. Existing literature often explores multimedia learning or AI applications separately, but few studies integrate cognitive theories, sociocultural perspectives, and classroom-based interventions to evaluate vocabulary outcomes among young learners. Moreover, there is a need for mixed-method research that combines quantitative measures of vocabulary improvement with qualitative insights from teacher mediation and classroom engagement. Addressing this gap, the present study investigates how AI-customized DPBs influence vocabulary development among Grade 2 and 3 learners within a structured instructional framework.

Research Questions

- 1. What is the effect of AI-customized Digital Picture Books (DPBs) on vocabulary development among Grade 2 and 3 learners in early ELT classrooms?
- 2. How do students engage with AI-customized Digital Picture Books, and what are teachers' perceptions of their effectiveness in supporting vocabulary development?

Theoretical Framework

This study is grounded in an integrated theoretical framework that combines sociocultural and cognitive perspectives to explain how AI-customized Digital Picture Books (DPBs) support vocabulary development in early ELT classrooms. Vygotsky's (1978) Sociocultural Theory highlights the importance of teacher guidance and peer interaction in facilitating the internalization of new vocabulary through scaffolded discussion and shared reading. From a cognitive perspective, Paivio's (2007) Dual Coding Theory suggests that learning is strengthened when verbal information is paired with corresponding visual representations, enabling learners to form interconnected memory pathways. Similarly, Mayer's (2021) Cognitive Theory of Multimedia Learning emphasizes that meaningful integration of text, visuals, and audio enhances comprehension by supporting dual-channel processing. Complementing these principles, Sweller's (2019) Cognitive Load Theory underscores the need to design digital materials that minimize extraneous cognitive demands so learners can focus on essential vocabulary. Together, these theoretical perspectives provide a coherent foundation for examining how well-designed, teacher-mediated AI-customized DPBs can enhance vocabulary acquisition among young learners in early ELT contexts. These theoretical perspectives collectively justify the integration of AI-customized DPBs as a cognitively and socially mediated instructional approach.

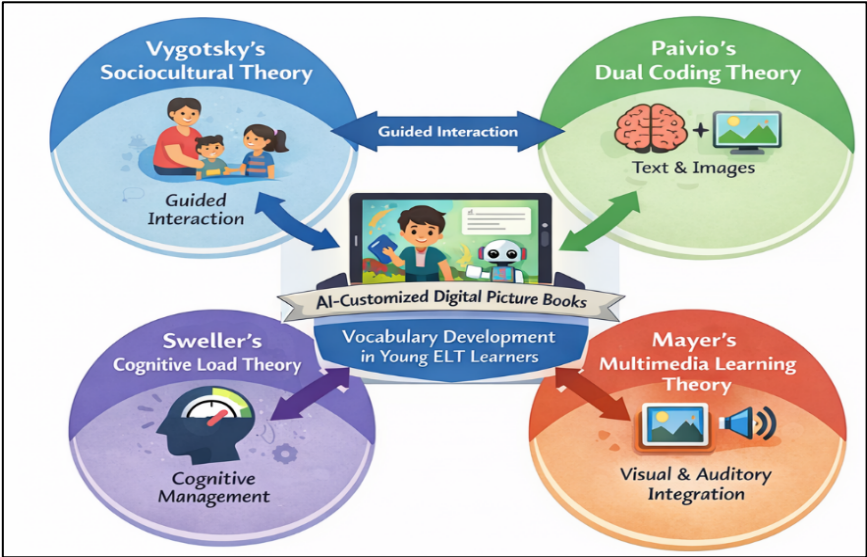


Fig.1. Theoretical Model for AI-Customized DPBs

The above figure illustrates the integrated theoretical foundation of the study. Vygotsky's Sociocultural

Theory emphasizes guided interaction and teacher mediation in vocabulary learning. Paivio's Dual Coding

Theory highlights the integration of verbal and visual systems in memory formation. Mayer’s Cognitive Theory of Multimedia Learning supports the meaningful alignment of text, visuals, and audio to enhance comprehension. Sweller’s Cognitive Load Theory underscores the importance of reducing extraneous cognitive demands in multimedia design. Together, these theories inform the use of AI-customized Digital Picture Books (DPBs) to support vocabulary development among young learners in early ELT classrooms.

III. RESEARCH METHODOLOGY

Research Design

This study adopted a mixed-method quasi-experimental design to examine the effect of AI-customized Digital Picture Books (DPBs) on vocabulary development in early ELT classrooms. A pre-test–post-test approach was employed to measure changes in students’ vocabulary knowledge following a five-week instructional intervention. Quantitative data were collected through structured vocabulary assessments, while qualitative data were gathered through classroom observations and teacher reflections to provide additional insight into learner engagement and instructional effectiveness.

Participants

The participants were 38 students enrolled in Grades 2 and 3 at a private primary school following the NCERT curriculum. The students, aged approximately 7–9 years, were learning English as part of their regular school program and represented mixed proficiency levels typical of early ELT classrooms. In addition, five English language teachers contributed qualitative data through structured reflections and classroom observations. Necessary permissions were obtained from the school administration, and parental consent was secured prior to the study.

Procedure

The study was conducted over five weeks during regular English instructional plan detail plan find table.1. In the first week, students completed a vocabulary pre-test to establish baseline knowledge. Selected units from the prescribed textbook were then transformed into AI-customized Digital Picture Books using generative AI tools such as ChatGPT and Gemini. During the intervention, teachers implemented the DPBs through guided reading, interactive discussion, and vocabulary-focused activities. Students engaged with multimodal features such as synchronized text, visuals, and audio support. Teacher mediation was incorporated through questioning, clarification of meanings, and reinforcement activities. At the end of the five-week intervention, students completed a post-test to measure vocabulary gains. A paired-sample t-test was conducted.

Table 1. Five-Week Intervention Plan

Week	Focus	Activities	Teacher Role
Week 1	Pre-test & Introduction	Conduct pre-test; introduce AI-customized DPBs; demonstrate text, visuals, and audio features	Explain objectives; model guided reading
Week 2	Visual & Contextual Learning	Guided reading of DPB Unit 1; picture–word matching; vocabulary discussion	Scaffold meaning through visuals; ask comprehension questions
Week 3	Interactivity & Pronunciation	DPB Unit 2; clickable glosses; audio pronunciation practice; pair activities	Provide pronunciation support; monitor engagement
Week 4	Contextual Usage	Sentence formation; short storytelling using target words; mini digital tasks	Support vocabulary uses in sentences; guide storytelling
Week 5	Review & Post-test	Vocabulary recap through DPBs; interactive revision; conduct post-test	Reinforce learning; administer assessment

Pre-Test

A vocabulary pre-test was conducted to assess students’ baseline knowledge of selected words from Grade 2, Unit 1: *Good Morning* (Poem) and Grade 3, Unit 2: *Seeing Without Seeing*. A total of 25 target vocabulary items were selected from these units and later incorporated

into the AI-customized Digital Picture Books used during the intervention. The test consisted of five task types: picture–word matching, multiple-choice meaning recognition, fill-in-the-blanks, sentence construction, and oral word identification. Each section contained five items, with one mark awarded per correct response,

resulting in a total score of 25 marks. The assessment measured both receptive and productive vocabulary knowledge.

The mean pre-test score of the 38 learners was 10.4 (SD = 2.8), with a median score of 10, indicating limited to moderate baseline vocabulary knowledge. Most scores

fell within the low to medium range (6–12 marks), reflecting developing vocabulary proficiency prior to the intervention. The vocabulary development rubric was developed for this study based on established principles of analytic rubric design and formative assessment (Andrade, 2000; Brookhart, 2013)

Table 2. Vocabulary Development Assessment Rubric

Criteria	Excellent	Good	Developing	Beginning
Word Recognition	Identifies all words correctly	Few errors	Recognizes some words	Struggles to identify words
Meaning	Clear understanding in context	Minor support needed	Partial understanding	Limited understanding
Usage	Uses words correctly in sentences	Minor errors	Limited sentence use	Unable to use words properly
Pronunciation	Clear and accurate	Minor errors	Noticeable difficulty	Incorrect pronunciation
Engagement	Actively participates	Participates regularly	Needs prompting	Passive participation



Fig.2. Sample AI-Customized DPBs Pages from Grade 2 (Left) and Grade 3 (Right)
Post-Test

The vocabulary development rubric had a maximum score of 20 marks, derived from five criteria evaluated on a four-point scale. Students’ total scores were categorized into four performance levels to interpret vocabulary growth. Scores ranging from 14–19 were classified as High, indicating strong vocabulary development; 9–14 as Medium, reflecting moderate proficiency; 5–9 as Low, indicating limited vocabulary control; and 1–5 as Needs Support, suggesting minimal vocabulary knowledge requiring significant

instructional assistance. This classification helped identify learners’ proficiency levels before and after the AI-customized Digital Picture Book intervention and supported comparative analysis of vocabulary improvement. Following the five-week AI-customized Digital Picture Book (DPB) intervention, a post-test was administered using the same format and scoring criteria as the pre-test. The assessment measured students’ receptive and productive vocabulary knowledge, including word

recognition, contextual understanding, sentence usage, and pronunciation.

The results demonstrated notable improvement in vocabulary performance. The mean post-test score increased to 16.8 (SD = 2.4), compared to the pre-test mean of 10.4 (SD = 2.8). The median post-test score was 17, indicating a clear shift toward higher vocabulary

proficiency. Most students scored within the high-performance range (14–19 marks), reflecting substantial vocabulary growth following the intervention. The reduction in standard deviation further suggests improved consistency in learners' performance. These findings indicate that the AI-customized DPB intervention positively influenced vocabulary development among Grade 2 and 3 learners.

Table 3. Comparison of Pre-Test and Post-Test

Test	Mean	SD	Median	Performance Range
Pre-Test	10.4	2.8	10	6–12 (Low–Medium)
Post-Test	16.8	2.4	17	14–19 (High)

Table 3 presents the descriptive statistics comparing students' vocabulary performance before and after the AI-customized Digital Picture Book (DPB) intervention. The mean pre-test score was **10.4 (SD = 2.8)**, with a median of **10**, reflecting low to moderate baseline vocabulary knowledge. Following the five-week intervention, the mean post-test score increased to **16.8 (SD = 2.4)**, with a median of **17**, indicating a clear improvement in vocabulary proficiency. The majority of students shifted from the low-medium performance range (6–12 marks) to the high range (14–19 marks).

Statistical analysis indicated that the increase in vocabulary scores was **significant ($p < .001$)**, demonstrating that the improvement observed after the intervention was unlikely due to chance. The reduction in standard deviation in the post-test further suggests greater consistency in students' performance. Overall, the findings indicate that the AI-customized DPB intervention contributed to meaningful vocabulary development among Grade 2 and Grade 3 learners.

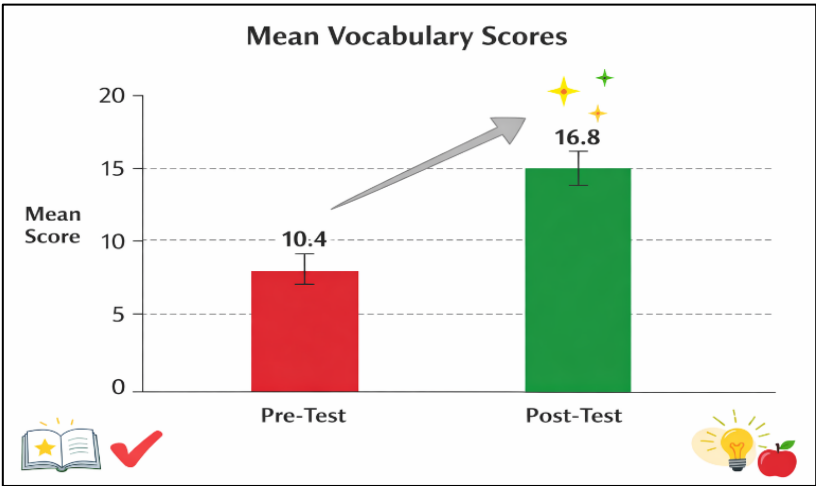


Fig.3. Mean Scores of Pre- and Post- Test

The figure illustrates the comparison of mean vocabulary scores before and after the five-week AI-customized Digital Picture Book (DPB) intervention. The red bar represents the pre-test mean score (10.4), while the green bar represents the post-test mean score (16.8). The visual comparison shows an increase of **6.4** in the mean vocabulary score following the intervention. Horizontal grid lines enhance clarity and allow for easier

interpretation of score differences. This upward shift visually reinforces the statistical findings ($p < .001$), demonstrating that the five-week DPB intervention contributed significantly to vocabulary development among Grade 2 and Grade 3 learners.

Data Analysis

The mixed-method analysis revealed substantial improvement in students' vocabulary performance following the five-week AI-customized Digital Picture Book (DPB) intervention. Quantitative findings indicated that the mean pre-test score of 10.4 (SD = 2.8) increased to 16.8 (SD = 2.4) in the post-test, reflecting a mean gain of 6.4 points. Statistical analysis confirmed that this improvement was significant ($p < .001$), indicating that the vocabulary gains were unlikely due to chance. A clear shift was observed from the low-medium performance range to the high range after the intervention, demonstrating meaningful vocabulary growth among Grade 2 and Grade 3 learners.

Classroom observations provided further evidence of instructional impact. During DPB sessions, students appeared more attentive and actively engaged compared to traditional textbook lessons. They responded enthusiastically to interactive features, particularly audio pronunciation tools and visual glosses. Repeated exposure to vocabulary within narrative contexts enabled learners to infer meanings more confidently and use target words during discussions, supporting findings that contextualized and multimodal vocabulary presentation enhances retention and comprehension (Paivio, 2007; Mayer, 2021).

Qualitative insights were derived from classroom observations and teacher reflections during the five-week intervention. Observations indicated that students were noticeably more attentive and engaged during AI-customized Digital Picture Book (DPB) sessions compared to conventional textbook-based instruction. Learners interacted actively with multimodal features, including visuals, synchronized text, and audio narration, which appeared to support vocabulary comprehension and recall. Increased participation during guided discussions further suggested improved learner confidence and motivation, consistent with sociocultural perspectives emphasizing guided interaction in vocabulary development (Vygotsky, 1978).

T1 noted, *"Students were more confident in answering vocabulary questions when they saw the pictures along with the words."* This reflection reflects the theme of visual scaffolding and confidence building, indicating that the integration of images with text strengthened comprehension and reduced hesitation in vocabulary use, aligning with dual coding principles (Paivio, 2007).

T3 reflected, *"Through the DPBs, children understood the meaning better instead of just memorizing words."* This

comment highlights the theme of contextual and narrative-based learning, suggesting that embedding vocabulary within meaningful story contexts promoted deeper semantic understanding rather than surface-level memorization, consistent with multimedia learning theory (Mayer, 2021).

T4 observed, *"Interactive features engaged students focused, and they repeated pronunciation without fear."* This observation represents the theme of interactive engagement and pronunciation reinforcement, demonstrating that multimodal elements encouraged repeated exposure and active participation in vocabulary practice while maintaining manageable cognitive demands (Sweller, 2019).

The thematic analysis reveals three dominant dimensions: visual reinforcement, narrative contextualization, and interactive engagement. These interconnected themes help explain the quantitative gains observed in the post-test results. The integration of multimodal design with teacher-guided mediation appears to have created a supportive and cognitively balanced learning environment that enhanced both receptive and productive vocabulary development among young learners in early ELT classrooms.

Ethical Considerations

Permission to conduct this study was obtained from the head of the participating institution. Informed consent was also taken from the parents or guardians of all student participants before the study began. Teachers who shared their reflections participated voluntarily and were informed about the purpose of the research.

To protect privacy and confidentiality, the name of the school has not been mentioned in this paper. Individual students' marks and personal details have not been disclosed. All data are presented in summarized form, and teacher responses are identified using codes (e.g., T1, T3, T4). The study followed ethical guidelines for research involving human participants and ensured that no student was disadvantaged academically or personally during the intervention.

IV. CONCLUSION

This study examined the impact of AI-customized Digital Picture Books (DPBs) on vocabulary development among Grade 2 and Grade 3 learners in early ELT classrooms. The findings demonstrated that integrating multimodal digital resources into structured classroom instruction can meaningfully enhance vocabulary acquisition. Students showed clear improvement in

word recognition, contextual understanding, pronunciation, and sentence usage following the five-week intervention.

Beyond measurable gains, qualitative insights revealed increased learner engagement, confidence, and participation during vocabulary activities. Visual scaffolding, narrative embedding of target words, and interactive pronunciation features contributed to deeper semantic understanding rather than rote memorization. These outcomes align with principles of dual coding and multimedia learning, which emphasize the integration of verbal and visual input to strengthen retention and comprehension (Paivio, 2007; Mayer, 2021).

Teacher mediation further reinforced vocabulary retention through guided discussion and contextual practice, consistent with sociocultural perspectives on scaffolded learning (Vygotsky, 1978).

Overall, the study underscores the pedagogical value of AI-supported Digital Picture Books as an innovative and practical approach to vocabulary instruction in early ELT settings. When thoughtfully designed to minimize cognitive overload and maximize meaningful engagement (Sweller, 2019), AI-customized DPBs can create cognitively supportive learning environments that promote sustained vocabulary growth. More broadly, the findings suggest that carefully integrated AI tools can complement teacher-led instruction and contribute to the evolving landscape of technology-enhanced language education in primary classrooms.

Limitations

Despite its positive findings, the study has several limitations. First, the use of free versions of AI tools limited the ability to convert entire textbook units simultaneously; content had to be transformed page by page, which was time-consuming and may affect scalability in larger implementations. Second, the study was conducted within a single private school context, which may limit generalizability to other educational settings, particularly government schools with differing technological resources.

Additionally, teachers had limited prior training in AI-integrated instructional design. While orientation was provided, more comprehensive professional development could enhance effective implementation. Technological infrastructure, including stable internet access and availability of digital devices, also presents practical challenges for broader adoption. Furthermore, the absence of a control group and the relatively short duration of the intervention restrict the ability to make

broader causal claims or assess long-term vocabulary retention. Future research may address these limitations by expanding to diverse school contexts, incorporating structured teacher training programs, and examining longitudinal vocabulary outcomes.

Suggestions

Based on the findings of this study, it is suggested that AI-customized Digital Picture Books (DPBs) be incorporated as a supplementary strategy for vocabulary instruction in early ELT classrooms. Teachers should integrate multimodal features—such as visuals, audio narration, and interactive vocabulary supports—alongside guided discussion to enhance comprehension and retention. Effective implementation requires pedagogical alignment and purposeful teacher mediation rather than reliance on technological novelty alone (Wang et al., 2024; Younas et al., 2025). Structured professional development programs are recommended to strengthen teachers' ability to design and implement AI-supported instructional materials effectively.

Schools and policymakers should also consider improving digital infrastructure to facilitate sustainable technology integration. For future research, longer-term studies are recommended to examine vocabulary retention beyond short-term interventions. Comparative studies across diverse educational settings, including government and rural schools, would enhance generalizability. Further investigation into the impact of AI-customized DPBs on other language skills, such as reading comprehension and speaking fluency, would contribute to a broader understanding of AI-supported multimodal learning in early ELT contexts.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request. Due to ethical considerations and institutional policies protecting the privacy of participating students and teachers, individual-level data cannot be made publicly available. All reported results are presented in aggregated form to ensure confidentiality.

CONFLICTS OF INTEREST

The author declares that there is no conflict of interest regarding the publication of this paper.

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AUTHORS' CONTRIBUTIONS

Conceptualization, S.B.; Methodology, S.B.; Software, S.B.; Validation, S.B.; Formal Analysis, S.B.; Investigation, S.B.; Resources, S.B.; Data Curation, S.B.; Writing – Original Draft Preparation, S.B.; Writing – Review & Editing, S.B.; Visualization, S.B.; Supervision, S.B.; Project Administration, S.B.; Funding Acquisition, Not applicable.

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Author's Bio

Banoth Suresh is a Ph.D. Research Scholar in English Language Education at the English and Foreign Languages University (EFLU), Hyderabad, India. His primary research interests include artificial intelligence (AI)-based tools in English Language Teaching (ELT), technology-enhanced language learning, and vocabulary development among young and secondary school learners. He is particularly interested in exploring the use of AI-powered educational tools, digital storytelling, and digital picture books to enhance vocabulary acquisition, learner engagement, and English language proficiency. His research focuses on the pedagogical integration of emerging technologies to develop innovative, interactive, and learner-centred approaches to English language teaching and learning.

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