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Academia Open

Vol. 11 No. 2 (2026): December
DOI: 10.21070/acopen.11.2026.14978

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Contextual Artificial Intelligence Digital Storybooks Support Early Reading In Slow Learners: Buku Cerita Digital Kecerdasan Buatan Kontekstual Mendukung Membaca Permulaan Pembelajar Lambat

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Abstract

General Background Early reading is a fundamental literacy skill that enables students to comprehend educational materials across all subjects. **Specific Background** First-grade students at risk of slow learning often struggle with letter-sound correspondence and phonological awareness when taught using traditional printed materials. **Knowledge Gap** Previous research has primarily explored static visual media without integrating a contextual pedagogy with generative artificial intelligence to provide adaptive instruction. **Aims** This study investigates how a contextual digital storybook assisted by Gemini technology can support the literacy skills of first-grade students at risk of slow learning. **Results** A Classroom Action Research conducted over two cycles revealed that student achievement increased from pre-intervention scores of 37 percent and 46 percent to 89 percent and 95 percent, successfully surpassing the 80 percent mastery threshold. **Novelty** This research integrates generative algorithms with contextual pedagogy to create adaptive, multisensory learning materials tailored specifically for early elementary students with cognitive challenges. **Implications** Educational practitioners should utilize generative tools to create customized, context-based visual and auditory materials that accommodate the diverse cognitive needs present in inclusive classrooms.

Highlights

- ♦ Generative technology produces familiar visualisations that maintain visual attention during literacy instruction.
- ♦ Multisensory educational media accommodate the cognitive load of pupils struggling with phonological awareness.
- ♦ Adaptive instructional adjustments like slower transitions and clearer audio ensure sustained classroom participation.

Keywords

Generative Technology; Phonological Awareness; Multisensory Media; Literacy Instruction; Action Research

Published date: 2026-07-23

INTRODUCTION

Early reading is a vital literacy skill that underlies students' academic achievement in elementary education. Early reading assists students to learn to recognise letters, the relationship between letters and their corresponding sounds, and to combine them into meaningful syllables and words. Almost all school subjects require students to read and understand written information. Therefore, mastery of early reading is a prerequisite to the development of higher-order literacy skills. Early reading is the first step in learning the alphabetic code, which allows students to recognise linguistic symbols and transform them into meaningful sounds (Puspa et al., 2023). Therefore, inability to develop early reading skills at the beginning of formal education may adversely affect students' academic achievement in later stages of learning. A group of learners who require special consideration in early reading instruction are students who are at risk of being slow learners. These students tend to have slightly below average cognitive abilities and require more time to process information than their peers. Common difficulties are limited phonological awareness, limited short-term memory capacity, difficulty in associating letters with their corresponding sounds and difficulty in blending syllables into meaningful words. Thus, these learners require contextual, multi-sensory and repetitive teaching methods that allow meaningful learning experiences (Clara et al., 2018; Pratiwi & Setyawan, 2021).

The same problems were also found in students of SDN 006 Sangatta Selatan in first grade. Initial classroom observations revealed that two students had characteristics that would make them at risk for slow learning, especially in the area of early reading. Both students found it very hard to identify letter-sound matches, read consonant-vowel combinations, and put syllables together to read simple words such as *baju* ("shirt"). In addition, the classroom teaching was mainly based on the conventional black and white printed storybooks that were not enough to attract the attention of students and keep them engaged. As a result, students rapidly lost concentration, minimally participated during lessons, and showed low motivation to read practice. The solution of these problems is instructional media that can provide meaningful learning experiences in accordance with the characteristics of students. An alternative that is promising is the digital storybook based on contextual teaching and learning (CTL). The CTL approach emphasises the importance of creating relevance and meaning in learning by connecting learning to students' real-life experiences (Johnson, 2021). By weaving stories that are closely connected to students' daily lives, learners practise identifying letters and words and building meaning from reading materials in authentic contexts.

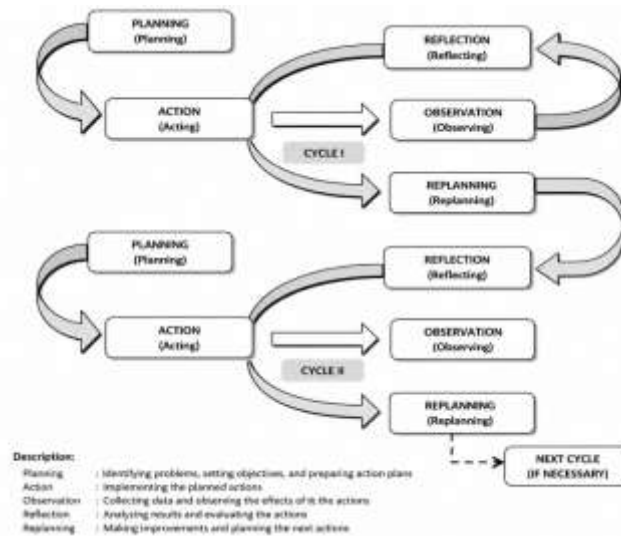
In this study, we improved the digital storybook by incorporating Gemini Artificial Intelligence (AI), a generative AI technology that can generate contextualised stories, illustrations and learning materials based on students' immediate environment. This technology enables teachers to create adaptive, engaging instructional content that addresses the needs of diverse learners. The use of illustration, voice narration, animation and interactive storytelling in a multisensory stimulation leads to the improvement of visual attention, phonological awareness and higher active engagement in reading activities. Moreover, generative AI in education offers teachers the opportunity to develop more personalised and flexible learning experiences (Kucirkova, 2021; Chiu, 2023).

Previous studies have shown that visual learning media are effective to improve early reading skills. As stated by Rabiatussani (2023), classroom observation was an effective teacher in identifying students' challenges in early identification of letters and sounds. Furthermore, et al. (2025) reported that the interactive flipbook media was effective in improving the early reading skills of slow learners with structured interventions using a Single Subject Research (SSR) design. Likewise, Miftahul Haqqah (2023) found in a study that illustrated storybooks significantly improved the early reading achievement of elementary students through Classroom Action Research. But in the previous studies, they have usually studied traditional visual media or simple digital learning media. Until now, research has not combined the Contextual Teaching and Learning (CTL) approach and Generative Artificial Intelligence to support early reading learning. Most of the previous studies also employed descriptive or Single Subject Research designs, not Classroom Action Research designs, which are designed to systematically improve classroom instructional practices. Therefore, there is a research gap in the development of adaptive, contextual, and multisensory digital learning media to improve the early reading skills of students with slow learning risk in the early years of elementary school.

To fill this void, this study seeks to suggest a new instructional approach by employing a CTL-based digital storybook with the assistance of Gemini Artificial Intelligence to improve the early reading skills of first-grade students at risk of slow learning. It is expected that the proposed learning media can provide more interactive, adaptive and meaningful learning experiences by integrating contextual learning principles with generative AI technology through stories that closely reflect students' everyday environments. This study aims to improve the early reading skills of first grade students at risk of slow learning at SDN 006 Sangatta Selatan through the implementation of a CTL-based digital storybook assisted by Gemini Artificial Intelligence.

METHOD

Figure 1. Research Flow of Classroom Action Research Based on the Kemmis and McTaggart Model.



This research uses Classroom Action Research (CAR) method with Kemmis and McTaggart model consisting of four stages, namely planning, action, observation, and reflection. This research was conducted in two cycles at SDN 006 Sangatta Selatan in the 2025/2026 academic year. The participants were 18 first grade students but the intervention was focused on two students who were identified by classroom observations and psychological assessment results to be at risk for slow learning. This research was conducted to improve students' early reading skills by using a digital storybook assisted by Gemini Artificial Intelligence (AI) based on Contextual Teaching and Learning (CTL). The planning phase in each cycle consisted of preparing lesson plans, preparing CTL-based digital storybook learning materials made with Gemini AI, and preparing observation sheets and oral reading tests. In the action stage students were engaged in contextual reading activities with digital storybooks that contained familiar objects and situations in their daily lives. The CTL elements embedded in the learning process included constructivism, inquiry, questioning, learning community, modelling, reflection and authentic assessment. The classroom observations were conducted collaboratively by a fellow teacher to record students' participation, engagement, phonological awareness, and reading performance. The reflection stage was employed to evaluate the results of each cycle and to formulate improvements for the next cycle. Data were collected through oral reading tests and observation of the classroom. The oral test was to know the students' ability in reading syllables and simple words correctly and fluently, while the observation sheet was to know the students' participation in the learning process. All research instruments were validated by expert judgement before implementation. Quantitative data were analysed descriptively using percentage scores to compare students' early reading achievement among the pre-action stage, Cycle I, and Cycle II. Descriptive analysis of qualitative data from classroom observations was employed to explain changes in student learning behaviours and effectiveness of the implemented instructional intervention.

RESULT AND DISCUSSION

Pre-Intervention Description

This Classroom Action Research was conducted in SDN 006 Sangatta Selatan, East Kutai Regency, East Kalimantan, Indonesia. The school is an inclusive elementary school with adequate educational facilities including comfortable classrooms, library, internet access, and Smart TVs installed in every classroom to support technology-enhanced learning. The purpose of this study was to implement Contextual Teaching and Learning (CTL)-based Digital Storybook assisted by Gemini Artificial Intelligence (AI) to improve early reading skills of students at risk of slow learning. In this study, the researcher was the classroom teacher and the school principal was the observer to observe the implementation of the intervention during the research process. Before the intervention, a pre-intervention assessment was conducted to determine the initial early reading skills of the students. The assessment was carried out on 13 April 2026 and comprised an oral reading test that included ten items of consonant-vowel (CV-CV) syllables and simple words that are commonly used in students' everyday life. The pre-test is intended to assess the students' ability to identify the letter-sound correspondence, blend syllables into meaningful words, and demonstrate reading fluency and pronunciation accuracy before the implementation of the CTL-based Digital Storybook assisted by Gemini AI.

The pre-test showed that most of the students already had adequate early reading skills. Of the 18 students who took part in the study, 16 students (88.89%) achieved the very good category while the two students who were the subject of this study, MSB and MFR, had reading abilities that fell below the expected mastery criteria. The MSB scored 30 (37%) and was rated as very low, and the MFR scored 37 (46%) and was rated as low. The results indicate that both participants experienced significantly more difficulties with early reading than their peers and, therefore, required individualised instructional

support. The classroom observations conducted at the time of the pre-test also revealed that the problems encountered by both participants were not limited to their low achievement scores. MSB had considerable difficulty in blending letters into syllables and combining syllables into meaningful words. The student was asked to read words like batu ("stone") and bara ("charcoal"). She pronounced each letter separately, mixed up letter sounds frequently, and took a long time to finally produce the whole word. These manifestations show poor phonological awareness and letter and sound blending, resulting in low reading fluency and accurate pronunciation.

MFR, on the other hand, was able to recognise most alphabet letters and read simple syllables, but still had difficulties when blending multiple syllables into complete words. MFR frequently paused between syllables, repeated pronunciations several times and hesitated when faced with unfamiliar letter combinations while assessing. Most words were eventually pronounced correctly, but the reading process was slow and lacked fluency. These results indicate that the main difficulty of MFR was in automatic word recognition, not in basic letter identification. In summary, the pre-intervention results indicate that the two participants had different profiles of early reading difficulties. MSB was struggling at the foundational level of mapping written symbols to their associated sounds and blending them into syllables. MFR was beyond letter recognition, but still needed help developing fluent word reading. These differences were the basis for designing differentiated instructional interventions using Contextual Teaching and Learning (CTL)-based Digital Storybook assisted by Gemini Artificial Intelligence. The instructional media were deliberately developed to provide contextual illustration, audio pronunciation and interactive reading activities that were tailored to each student's learning needs, which were expected to gradually improve their early reading skills in the next cycles of action research.

Implementation of Cycle I

The first cycle was done in two learning sessions and ended with an oral post-test to know the early reading development of the students. Before the intervention, the researcher prepared lesson plans, a digital storybook based on the CTL approach assisted by Gemini Artificial Intelligence (AI), tools for oral reading assessment, and classroom observation sheets. Learning materials were designed with simple CV-CV syllables and words related to students' daily experiences. The implementation of the intervention was carried out in collaboration with the classroom teacher as the researcher. The observer of the implementation of the learning activities was the school principal. In the first meeting, the learning activities were aimed at introducing students to the CTL-based digital storybook by using contextual objects they were familiar with, such as baju ("shirt"). The teacher helped students to link visual representations created by Gemini AI to letter-sound correspondences, breaking down syllables and combining them into simple words. Key elements of the CTL approach including constructivism, inquiry, questioning, learning community, modelling, reflection and authentic assessment were integrated in the learning process. The majority of students were enthusiastic about the digital learning media at this stage, although the two target students still required intensive guidance to read and blend the syllables into complete words.

The second meeting was about how students can combine syllables to form real words, especially with the context vocabulary such as batu, bara, and bata. Both target students were more confident and participated in the classroom activities more than in the first meeting. They were more willing to answer the teacher's questions, identify syllables shown in the digital storybook, imitate pronunciation models presented via the audio feature, and read simple words independently. While reading fluency was not yet at the mastery level expected, important gains in students' phonological awareness, visual attention and active participation throughout the learning process were observed. Overall, the implementation of Cycle I showed that the integration of CTL approach with a Gemini AI-assisted digital storybook provided a more engaging and interactive learning environment compared to the conventional reading instruction. Use of contextual illustrations, pronunciation in the auditory mode and guided reading activities were employed to foster more active participation of students and to reduce their reluctance to read aloud. However, there were still some challenges. For example, the clarity of the audio needed to be improved, more repetition needed to be provided, and the pace of story presentation needed to be modified to better match the learning characteristics of students at risk of slow learning. The results were used to refine the instructional strategy in the next cycle.

The observer also assessed the fidelity of the instructional process and students' participation during the learning activities via classroom observation to further evaluate the implementation of Cycle I. The findings of the classroom observation are presented in Table 1.

Table 1. Teacher Observation Results on the Implementation of CTL-Based Digital Storybook Learning in Cycle I

Variable	CTL Phase	Meeting 1 Score	Meeting 2 Score	Average	Percentage
CTL-Based Digital Storybook	Constructivism	5	6	5.5	68.8%
CTL-Based Digital Storybook	Inquiry	5	7	6.0	75.0%
CTL-Based Digital Storybook	Questioning	5	6	5.5	68.8%
CTL-Based Digital Storybook	Learning Community	7	7	7.0	87.5%
CTL-Based Digital Storybook	Modelling	7	7	7.0	87.5%
CTL-Based Digital Storybook	Reflection	1	3	2.0	50.0%
CTL-Based Digital Storybook	Authentic Assessment	2	3	2.5	62.5%
Total Score (Cycle I)		32	39	35.5	74.0%
Percentage		66%	81%		

The results of the teacher observation on the implementation of the CTL-based Digital Storybook assisted by Gemini Artificial Intelligence in Cycle I are presented in Table 1. Results show a positive improvement from the first to the second meeting. The total observation score increased from 32 (66%) classified as Good in the first meeting to 39 (81%) classified as Very Good in the second meeting. The average implementation score was 74%, which means most of the stages of the CTL learning model were implemented appropriately during the instructional process. The highest implementation scores

(87.5%) were for the Learning Community and Modelling phases among the seven CTL phases, indicating the consistency of the collaborative learning activities and teacher demonstrations. On the contrary, the components of Reflection (50.0%) and Authentic Assessment (62.5%), obtained the lowest scores which suggested that these aspects would benefit from further improvements. Classroom observations also showed that the pace of delivering the story and the clarity of the audio needed to be adjusted to better suit the learning characteristics of students at risk of slow learning. Based on these findings, the instructional strategy was refined in Cycle II.

Table 2. *Student Participation Observation Results in Cycle I*

Participant	Meeting 1	Meeting 2	Average
MSB	67%	71%	69%
MFR	69%	73%	71%

The observation results of students' participation in the implementation of Cycle I are summarised in Table 2. Both research participants demonstrated incremental gains in classroom engagement across the two meetings. Student MSB increased from 67% in the first meeting to 71% in the second meeting with an average participation score of 69%. Also, student MFR increased from 69% to 73% with the average score of 71%. Classroom observations revealed that both students paid more attention to the contextual illustrations provided in the digital storybook and were more willing to answer questions from the teacher and to take part in reading activities. Both students still required teacher support in identifying and pronouncing unknown syllables but demonstrated greater confidence, classroom engagement, and readiness to read aloud than in the initial learning condition. The results show that the CTL-based Digital Storybook assisted by Gemini AI positively influenced the students' engagement in early reading instruction.

The effectiveness of the intervention was assessed by comparing the early reading performance of the students before the implementation of the CTL-based Digital Storybook assisted by Gemini Artificial Intelligence (AI) and after completion of Cycle I. The students' ability to recognise syllables, to blend syllables with meaningful words and to read simple contextual vocabulary accurately and fluently were compared. The intervention was deemed successful if the students reached the pre-set mastery criterion of 80%. Table 3 displays the comparison of Cycle I pre-intervention and post-test results.

Table 3. *Comparison of Early Reading Skills Between the Pre-Intervention and Cycle I Post-Test*

No.	Participant	Pre-Intervention	Cycle I Post-Test	Improvement
1	MSB	37%	57%	20%
2	MFR	46%	66%	20%

As illustrated in Table 3, both subjects showed measurable improvement in early reading skills after the implementation of CTL-based Digital Storybook assisted by Gemini AI. Performance of student MSB improved from 37% at pre-intervention stage to 57% after Cycle I. Student MFR's performance improved from 46% to 66%. Both participants performed equally well with an increase of 20 percentage points indicating the instructional intervention was effective in improving their ability to recognise syllables and read simple contextual words. Although a great deal of progress was made, neither participant attained the predetermined mastery criterion of 80%. When both students were observed in the classroom, they appeared to have gained confidence in identifying letters, blending syllables and reading familiar words. But they still struggled to read fluently, especially when they encountered new combinations of syllables or longer words. These findings indicate that the intervention implemented in Cycle I had started to improve students' early reading performance but needed further refinement to maximise the learning gains.

Implementation of Cycle II

Cycle II was conducted to address the shortcomings identified in Cycle I, which included the clarity of audio in the digital storybook, the speed of slide transitions, and the necessity of more personal assistance for students at risk of slow learning. The Cycle I lesson plans were retained and some instructional enhancements were introduced: clearer audio output, slower visual transitions on the Smart TV, and more intensive teacher orientation during oral reading activities. The refinements were intended to create a better learning environment for students, better suited to their pace of reading and individual learning needs. Cycle II implementation comprised two instructional meetings following the same CTL framework as in the previous cycle. In the first meeting, students were introduced with additional consonant-vowel (CV-CV) syllables and contextual vocabulary such as *baja*, *baki*, *baru*, *bayi* and *baca*. The learning activities included contextual illustrations by Gemini AI, interactive questioning, collaborative learning, modelling with audio pronunciation and authentic assessment. Students showed more curiosity, participated actively in identifying syllables and were more confident in reading contextual words presented through the digital storybook in comparison to Cycle I.

The second meeting was about independent reading practice by gradually reducing the teacher's help so that the students could recognise syllables and words by their visual memory and previous learning experiences. Students were engaged in the Smart TV, responded positively to the teacher's questions, and collaborated with their peers in small-group activities. The improved audio quality and slower slide transitions allow both students to follow the reading activities more easily and to pronounce simple words more fluently and confidently. These changes also led to higher levels of classroom engagement and less reliance by students on ongoing teacher prompts. In general, the instructional modifications made during Cycle II fostered a learning environment that was more supportive and interactive for students at risk of slow learning. Contextual learning activities, AI generated visual stories, clearer audio modelling, individualised guidance and peer collaboration combined to achieve noticeable improvements in students' phonological awareness, reading fluency, classroom participation and self-confidence. These findings suggest that the changes made after Cycle I were successful in solving the problems

encountered during the first implementation.

The effectiveness of the instructional implementation in Cycle II was then assessed in classroom observations conducted by the observer to investigate the fidelity of the learning procedures and the participation of the students during the intervention. The results of the classroom observation are shown in Table 4.

Table 4. *Teacher Observation Results on the Implementation of CTL-Based Digital Storybook Learning in Cycle II*

Variable	CTL Phase	Meeting 1 Score	Meeting 2 Score	Average	Percentage
CTL-Based Digital Storybook	Constructivism	8	8	8.0	100.0%
CTL-Based Digital Storybook	Inquiry	7	8	7.5	93.8%
CTL-Based Digital Storybook	Questioning	8	8	8.0	100.0%
CTL-Based Digital Storybook	Learning Community	6	8	7.0	87.5%
CTL-Based Digital Storybook	Modelling	5	8	6.5	81.3%
CTL-Based Digital Storybook	Reflection	3	3	3.0	75.0%
CTL-Based Digital Storybook	Authentic Assessment	3	4	3.5	87.5%
Total Score (Cycle II)		40	47	43.5	90.6%
Percentage		83%	97%		

Table 4 shows the results of the teacher observation in the implementation of Digital Storybook based on CTL assisted by Gemini Artificial Intelligence in Cycle II. The results indicate a significant increase in the implementation of instruction compared to Cycle I. The total observation score increased from 40 (83%) in the first meeting to 47 (97%) in the second meeting, resulting in an overall implementation average of 90.6%, which is in the very good category. The improvements that were made after Cycle I were successfully implemented during the whole learning process. The stages of Constructivism and Questioning were perfectly implemented (100%), while the stages of Inquiry, Learning Community and Authentic Assessment were also highly implemented. These results indicate that the teacher was more able to implement the CTL learning procedures more successfully and consistently in Cycle II due to the clearer audio, the slower story transitions, and the more intensive individualised guidance.

Table 5. *Student Participation Observation Results in Cycle II*

Participant	Meeting 1	Meeting 2	Average
MSB	77%	83%	80%
MFR	79%	87%	83%

Table 5 shows the results of the classroom observation concerning students' participation during Cycle II. In Cycle II, both participants showed higher levels of engagement than those observed in Cycle I. Student MSB increased from 77% in the first meeting to 83% in the second meeting, with an average participation score of 80%. Likewise, MFR rose from 79% to 87% with an average of 83%. Classroom observations showed increased confidence, attention and engagement of students. MSB was more willing to read aloud, answer questions from the teacher, and participate in group activities with little help. Similarly, MFR showed more independence in recognising syllables, saying contextual words, and helping classmates in group work. The results of this study indicate that the instructional refinements introduced in Cycle II were successful in increasing students' active involvement during the learning process.

The reflection stage of Cycle II was conducted to assess the success of the instructional improvements implemented after Cycle I was completed and to find out if the research goals had been attained. The assessment was based on data from classroom observation, records of student participation and the result of the post-test. Overall results suggested that the refinements made in Cycle II (e.g., clearer audio output, slower story transitions, and more intensive individualised guidance) substantially improved the instructional process and students' early reading performance.

Table 6. *Comparison of Teacher Observation Results Between Cycle I and Cycle II*

Observation	Average	Category
Cycle I	73%	Good
Cycle II	90%	Very Good
Improvement	17%	

Table 6 indicates that the instructional implementation quality improved from 73% in Cycle I to 90% in Cycle II, representing an overall improvement of 17 percentage points. The results show that the changes in learning that were carried out after Cycle I were successfully applied in the learning process. The better classroom performance was manifested in the more effective use of the CTL-based Digital Storybook assisted by Gemini AI. The clearer audio narration, slower slide transitions and individualised teacher support helped students to follow the learning activities more comfortably and actively. The improvements also increased the overall implementation fidelity of the CTL learning model, resulting in a more interactive, student-centered learning environment.

Table 7. *Comparison of Student Participation Between Cycle I and Cycle II*

Participant	Cycle I	Cycle II	Improvement	Category
MSB	69%	80%	11%	Very Good
MFR	71%	83%	12%	Very Good

Table 7 shows the comparison of student participation in the two action research cycles. The engagement was higher in both

participants during classroom activities. The student MSB increased from 69% in Cycle I to 80% in Cycle II and MFR increased from 71% to 83%. The improvement was 11% and 12% respectively. The increased participation rate indicates that students are more confident, attentive and willing to participate in contextual reading activities. In Cycle II, both students were more proactive in identifying syllables, answering the teacher's questions, reading out loud, and working with their friends. The findings of this study indicate that AI-aided digital storybooks in conjunction with contextual learning were successful in encouraging active engagement among students with slow-learning tendencies.

Table 8. *Comparison of Early Reading Post-Test Results Between Cycle I and Cycle II*

Participant	Cycle I Post-Test	Cycle II Post-Test	Improvement
MSB	57%	89%	32%
MFR	66%	95%	29%

Table 8. Comparison of Students' Early Reading Achievement in Post-Test of Cycle I and Post-Test of Cycle II. Both participants showed significant gains in their blending of syllables and reading of meaningful contextual words. Student MSB went from 57% to 89% and MFR went from 66% to 95%. Both participants met the predetermined mastery criterion of 80%. The improved reading performance of the students indicates that the instructional modifications made in Cycle II have successfully remedied the shortcomings of the previous cycle. Students developed more phonological awareness, reading fluency, and pronunciation accuracy with better audio, slower presentation of digital story slides, and intensive individualised guidance. Consequently, both participants were in the very good category. This means that the objectives of this action research in the classroom have been successfully achieved. The results of the study ended the intervention at the end of Cycle II, since all the predetermined indicators of success were met.

Analysis of Student Participation During Cycle I and Cycle II

The observation results show that the use of Contextual Teaching and Learning (CTL) based Digital Storybook assisted by Gemini Artificial Intelligence (AI) started to have a positive impact on the students' participation in early reading instruction. Overall, the average of the two participants' participation scores reached 69.8%, which is in the good category. Highest participation levels were observed during the constructivism and modelling phases with both phases scoring 87.5%. The students were very enthusiastic in these activities, relating the written text with the visual illustrations created by the AI, observing the teacher's models of pronunciation, and imitating the pronunciation of syllables and simple words via the audio features of the digital storybook. These results suggest that learning experiences that were contextual, visual, and multisensory contributed significantly to students' attention and engagement in the learning process. Despite these encouraging results, certain instructional components still needed to be improved. The lowest achievement was achieved in reflection phase (50.0%) followed by activity of inquiry with the identification of new vocabulary (56.5%). The results suggest that both participants still had difficulties in recalling previously learned material and in independently identifying new vocabulary. In addition, students still needed repeated guidance to summarise the lesson at the end of each session. Based on the results of Cycle I, the instructional strategy in Cycle II was improved through more intensive individual guidance, more interactive questions, and further optimisation of the audio and visual features of the digital storybook to promote greater student participation, critical thinking, and independent learning.

Instructional improvements in Cycle II resulted in a dramatic increase in student involvement. The average score of participation increased to 81.8% which is in the very good category. The highest achievement was in the constructivism stage, where the indicator of relating text with images was 100% and the indicator of answering guiding questions and identifying syllables was 93.8%. During the learning process, there was an increase in confidence of both participants in identifying syllables, pointing to words on the Smart TV, and associating AI generated images with objects in their surroundings. As for the authentic assessment phase, the students scored 93.8% in oral reading which shows a significant progress in reading simple words accurately, fluently and independently. There were very significant improvements in most of the instructional components, but some areas still needed support. The reflection phase was again the lowest performing component at 62.5% as both participants struggled to recall previously learned materials independently. Similarly, the learning community phase, especially the activity of listening to the pronunciation of the teacher or peers, reached 68.8%, which means that students still needed guidance to maintain attention in collaborative learning. The findings suggest that individualised instruction, repeated phonological practice and continued reading activities to build working memory, maintain attention and promote reading independence still are beneficial to students who are at risk for being a slow learner. However, the overall results indicated that the use of the Contextual Teaching and Learning (CTL)-based Digital Storybook assisted by Gemini Artificial Intelligence (AI) was effective in increasing student participation and engagement in early reading instruction compared to Cycle I.

The comparison between Cycle I and Cycle II shows a significant increase in the participation of students and their early reading performance after the implementation of Contextual Teaching and Learning (CTL)-based Digital Storybook assisted by Gemini Artificial Intelligence (AI). In Cycle I, both participants still depended heavily on teacher support to identify syllables and to read single words. With the instructional improvements made in cycle II such as clearer audio, slower slide transitions, more intense individual guidance, and more opportunities for independent inquiry, both students were more confident and actively engaged in classroom activities. This improvement was especially evident in the Inquiry and Authentic Assessment stages where the students found new vocabulary on their own and read whole contextual words correctly. These findings are suggestive of a direct contribution of greater student engagement in the learning process to better early reading performance.

In general, student participation rose steadily over the two research cycles. The students' MSB increased from 67% at the first meeting of Cycle I to 83% at the second meeting of Cycle II. The MFR increased from 69% to 87%. Increased participation was correlated with improved reading fluency, accuracy of pronunciation and self-confidence in oral reading

activities. The results indicate that the integration of contextual learning with AI-generated visual stories proved effective in fostering student motivation to be more active, independent and motivated in the learning process. In general, the achievement of early reading skills of students also continued to improve during the classroom action research. In the pre-intervention stage both participants exhibited very low performances in reading: 37 % for MSB and 46 % for MFR. Their scores had gone up to 57% and 66% respectively after Cycle I but neither participant had achieved the pre-determined criterion of mastery of 80%. With the improvements in the learning process in Cycle II, the two students have successfully achieved the mastery criteria, with the acquisition of scores of 89% (MSB) and 93% (MFR). The results showed that the CTL-based Digital Storybook assisted by Gemini Artificial Intelligence effectively improved the early reading skills of students at risk of slow learning.

Both participants showed a significant improvement in their performance categories during the course of the study, based on the assessment criteria. At the pre-intervention stage, the students were assigned to the very low and low categories. After the intervention was applied, both participants improved gradually and reached the very good level at the end of Cycle II. Also, the quality of instructional implementation improved from 73% (Good) in Cycle I to 90% (Very Good) in Cycle II, and average student participation improved from about 70% (Good) to 81.5% (Very Good). The results of this study add further evidence to the effectiveness of the CTL-based Digital Storybook assisted by Gemini Artificial Intelligence in improving both the learning process and students' early reading achievement.

Discussion

The results of this classroom action research indicate that the use of a Digital Storybook based on Contextual Teaching and Learning (CTL) assisted by Gemini Artificial Intelligence (AI) is effective in improving the early reading skills of first-grade students at risk of slow learning. The improvement was evident in the continuous enhancement of students' reading achievement through research cycles. The average reading mastery was 41.5% in the pre-intervention, 61.5% after the Cycle I, and 92.0% at the end of Cycle II. This incremental improvement shows that the instructional intervention was successful in improving the students' skills in identifying syllables, blending them to meaningful words, and reading simple contextual vocabulary independently. Reading performance improved for students and instruction was more successfully delivered throughout the research. The teacher observation score steadily improved from 66% in Cycle I Meeting 1 to 97% in the final meeting of Cycle II. The greatest gains were seen in the Constructivism phase (68.8% to 100%) and in the Inquiry phase (75.0% to 93.8%). The findings suggest that students might be able to construct meaning through authentic learning experiences, instead of memorising letter symbols, by using contextual learning activities and AI-generated digital storybooks. The finding aligns with Dalman's (2020) argument that early reading instruction should provide concrete and meaningful learning experiences before abstract symbolic recognition. Likewise, Fatmawati (2022) also states that students with slow learning characteristics need to be supported by concrete visual aids to connect the abstract letter symbols with meaningful words.

Another important finding was the role of Gemini AI-created illustrations in boosting students' attention and learning engagement. The contextual images provided by the digital storybook reduced the cognitive load on students and facilitated them in associating written words to common objects in their daily life. This is in line with Wibawa (2024) who states that meaningful visual media can reduce the perceptual and cognitive load in the learning process especially for students with learning difficulties. Likewise, Rahim (2020) states that attractive visuals enhance reading development by increasing learners' attention, motivation, and comprehension. The use of contextual illustrations and interactive audio has created an effective instructional environment that can maintain the attention of students at risk of slow learning throughout the learning activities, because these students generally have shorter attention spans and are easily distracted (Hidayat, 2023).

Classroom observations revealed significant behavioural changes in both research participants. At the beginning of the year, MFR was easily distracted and needed teacher redirection when engaged in reading activities. However, MFR was more mindful of the digital display, took part actively in the discussions, and could link textual words with contextual illustrations on her own, following the instructional changes introduced in Cycle II. Similarly, MSB was at first hesitant to interact with the digital media and needed a lot of help from the teacher, but was gradually gaining more confidence in identifying syllables, pointing at words on the Smart TV and reading them aloud independently. These improvements demonstrate that the integration of visual illustrations, audio pronunciation and contextual learning activities in a multisensory environment has successfully promoted a greater autonomy of the learners. This finding is in line with the principles of multisensory learning proposed by Arsyad (2021) and Sutirman (2021), who argue that the integration of visual and auditory stimuli is helpful for reading acquisition because it improves phonological awareness and memory retention.

This finding is also consistent with the previous research by Ayesha, Saniya, et al. (2025) who found that interactive visual media significantly improved the early reading skills of students with slow learning characteristics through structured and repetitive instructional interventions. However, this study is an extension of the previous research by integrating Contextual Teaching and Learning (CTL) and Gemini Artificial Intelligence to create adaptive digital storybooks based on students' learning context. The AI-enabled digital storybook offered contextual visualisations, interactive audio, and meaningful learning experiences that are distinct from traditional printed materials or static digital media and enabled students to become more active, confident, and independent readers. Hence, this study offers new empirical evidence that the integration of contextual pedagogy and generative AI technology offers an effective instructional strategy to improve the early reading skills of students at risk of slow learning in inclusive elementary classrooms.

CONCLUSION

The result of this classroom action research is that the application of Contextual Teaching and Learning (CTL) based Digital Storybook assisted by Gemini Artificial Intelligence (AI) has been able to improve the early reading skills of first-grade

students at risk of slow learning in SDN 006 South Sangatta. The students' average early reading achievement gradually improved from the pre-intervention stage (41.5%) to the Cycle I (61.5%) and the Cycle II (92.0%). Furthermore, the student participation also increased from 70.0% (Good) in Cycle I to 81.5% (Very Good) in Cycle II and the quality of instructional implementation increased from 73.5% to 90.0%. The findings indicate that the combination of CTL with AI-assisted digital storybooks through contextual visualisations, interactive audio, inquiry-based activities, collaborative learning, modelling, reflection and authentic assessment has been successful in enhancing students' phonological awareness, reading fluency, engagement in learning and independence in early reading instruction. The findings of this study indicate that schools should optimally utilise digital learning facilities to enable innovative literacy teaching approaches for students with different learning needs. It is encouraging for educational practitioners to use context-based digital storybooks and generative AI technologies for early reading instruction by customising learning materials to the traits and developmental stages of learners. Moreover, future research is recommended to investigate the effectiveness of AI-assisted learning media with larger samples, different grade levels, and broader educational contexts to increase the body of evidence on the use of artificial intelligence to improve early literacy skills.

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