

INTERACTIVE CONTEXTUAL MULTIMEDIA EFFECTS ON EARLY READING SKILLS AMONG SLOW-LEARNER-RISK ELEMENTARY STUDENTS

^{*1}Reni Anjarwati, ²Bayu Pamungkas

^{*1,2}Universitas Negeri Yogyakarta

Email: ^{*1}renianjarwati.2025@student.uny.ac.id, ²bayu.pamungkas@uny.ac.id

Abstract

This study aims to analyze the effect of using contextual interactive multimedia on the beginning reading skills of third-grade elementary school students at risk of being *slow learners*. The study employed a quantitative approach with a *pre-experimental* design using a *one-group pretest-posttest* model. The participants were four students identified as having difficulties in beginning reading based on an initial assessment. Reading skills were assessed across five indicators: letter recognition, syllable decoding, word-reading accuracy, reading fluency, and comprehension of simple texts. The data were analyzed using descriptive statistics, *gain scores*, the Wilcoxon *signed-rank* test, and *effect size* estimation. The findings showed improvements in reading performance among all participants following the intervention. The mean score increased from 51.25 at the *pretest* to 73.75 at the *posttest*, representing a mean improvement of 22.50 points, with all participants achieving positive *gain scores*. These findings indicate that contextual interactive multimedia has the potential to support the development of beginning reading skills through the integration of visual and auditory representations, contextual learning experiences, teacher scaffolding, and feedback. However, the findings should be interpreted cautiously because of the very small sample size and the absence of a control group. Further research involving larger samples and stronger experimental designs is needed to examine the effectiveness and generalizability of the intervention.

Keywords: interactive multimedia, contextual learning, beginning reading, *slow learners*, elementary school

Abstrak

Penelitian ini bertujuan untuk menganalisis pengaruh penggunaan multimedia interaktif berbasis kontekstual terhadap kemampuan membaca permulaan siswa kelas III sekolah dasar yang berisiko mengalami *slow learner*. Penelitian menggunakan pendekatan kuantitatif dengan desain *pre-experimental* melalui pola *one-group pretest-posttest*. Subjek penelitian terdiri atas empat siswa yang teridentifikasi memiliki hambatan dalam kemampuan membaca permulaan berdasarkan asesmen awal. Kemampuan membaca diukur melalui lima indikator, yaitu pengenalan huruf, penguraian suku kata, ketepatan membaca kata, kelancaran membaca, dan pemahaman teks sederhana. Data dianalisis menggunakan statistik deskriptif, *gain score*, uji Wilcoxon *signed-rank*, dan estimasi *effect size*. Hasil penelitian menunjukkan adanya peningkatan kemampuan membaca pada seluruh peserta setelah intervensi. Rata-rata skor meningkat dari 51,25 pada *pretest* menjadi 73,75 pada

posttest, dengan rata-rata peningkatan sebesar 22,50 poin dan seluruh peserta memperoleh gain score positif. Temuan ini menunjukkan bahwa multimedia interaktif berbasis kontekstual berpotensi mendukung perkembangan kemampuan membaca permulaan melalui integrasi representasi visual, auditori, pengalaman kontekstual, scaffolding, dan umpan balik guru. Meskipun demikian, hasil perlu ditafsirkan secara hati-hati karena ukuran sampel sangat kecil dan tidak melibatkan kelompok kontrol. Penelitian lanjutan dengan sampel lebih besar dan desain eksperimental diperlukan untuk menguji efektivitas dan generalisasi intervensi.

Kata kunci: *multimedia interaktif, pembelajaran kontekstual, membaca permulaan, slow learner, sekolah dasar*

INTRODUCTION

Early reading ability constitutes a foundational component of literacy development because it provides the cognitive and linguistic basis through which children access, interpret, and communicate information across subsequent areas of learning. At the elementary school level, reading is not merely an isolated language skill but a prerequisite for participation in increasingly complex academic activities. As students progress through the grades, they are expected to move from recognizing letters and decoding simple words toward reading fluently, understanding textual meaning, and using written information to construct knowledge. Consequently, persistent difficulties in early reading can have cumulative effects on academic achievement, classroom participation, motivation, and subsequent literacy development. In the Indonesian educational context, literacy development is embedded within the broader learning competencies expected of elementary school students, making the acquisition of foundational reading skills an important pedagogical and educational policy concern (Oktaviyanti et al., 2022).

The significance of early reading becomes more pronounced when considering the heterogeneity of learners in elementary classrooms. Students do not acquire reading skills at identical rates, and differences in cognitive processing, language development, attention, motivation, prior learning experiences, and instructional support may produce substantial variation in reading achievement. Students who experience persistent learning difficulties require instructional approaches that recognize these differences rather than treating reading development as a uniform process. When early difficulties are not identified and addressed, students may experience an accumulation of academic challenges because reading functions as a gateway skill for learning in virtually every subject. In this respect, early reading intervention should not be regarded merely as remedial instruction but as an essential component of inclusive and preventive pedagogy.

This issue is particularly relevant for students identified as being at risk of slow learning. The term *slow learner* is commonly used to describe students whose learning pace is slower than that of their peers and who may require additional time, repetition, structured guidance, and differentiated instructional support. Importantly, being a slow learner should not automatically be equated with intellectual disability. Rather, the educational concern lies in the mismatch between the learner's processing pace and the instructional demands of the classroom. Students with slower learning trajectories may encounter difficulties in processing information, retaining newly learned material, responding to instructional stimuli, and transferring knowledge across contexts. Such characteristics can become particularly consequential in

early literacy, where students must coordinate visual recognition, phonological processing, memory, attention, and language comprehension.

Reading acquisition is therefore likely to be more challenging for students at risk of slow learning when instruction relies predominantly on a single modality. Conventional instructional practices that emphasize teacher explanation, textbook exercises, copying letters or words, and repetitive written assignments may provide insufficient opportunities for multisensory engagement and active meaning-making. A pedagogical approach that provides visual, auditory, and interactive representations may instead help reduce cognitive barriers by presenting information through complementary channels. This rationale is consistent with the Cognitive Theory of Multimedia Learning (CTML), which conceptualizes learning as an active process in which learners select, organize, and integrate information from verbal and pictorial representations (Mayer, 2001, 2021). From this perspective, multimedia does not become pedagogically valuable simply because it is digital or visually attractive; its effectiveness depends on how different modes of representation are designed to support cognitive processing without generating unnecessary cognitive load.

CTML provides a particularly relevant theoretical foundation for early reading interventions because reading acquisition requires learners to establish meaningful connections among orthographic symbols, sounds, images, and semantic representations. Interactive multimedia can potentially provide simultaneous visual and auditory cues, repeated exposure, immediate feedback, and opportunities for learners to respond actively to instructional stimuli. Such affordances may be especially beneficial for students who need additional processing time or repeated practice. Recent evidence supports the value of targeted, structured interventions for slow learners. Purnomo and Royanto (2025), for example, reported improvements in reading performance among a slow learner following systematic instruction involving sight words and phonemic awareness. Similarly, Anjani and Kurniawati (2025) demonstrated the usefulness of structured flashcard-based intervention for helping a slow learner distinguish visually similar letters. These findings reinforce the importance of explicit and appropriately scaffolded instruction, while also indicating the need to investigate technology-enhanced approaches that can provide richer multimodal support.

Recent research has begun to demonstrate the potential of interactive and audiovisual media for students with reading difficulties. Purba and Pamungkas (2025), for instance, found that animated audiovisual media using Powtoon supported improvements in the early reading abilities of slow learner students while also increasing attention, motivation, and engagement. Their findings are particularly relevant because they demonstrate that multimedia may simultaneously address cognitive and motivational dimensions of learning. Similarly, research on interactive WordWall media has reported significant improvements in reading fluency, word recognition, and comprehension among slow learner students compared with conventional instruction. Nevertheless, these studies predominantly emphasize the effectiveness of a particular digital medium rather than examining how multimedia design can be systematically combined with contextual pedagogy.

The contextual dimension is important because successful literacy instruction requires learners to connect abstract symbols and language structures with meaningful experiences. Contextual Teaching and Learning (CTL) emphasizes the construction of knowledge through connections

between academic content and learners' real-world experiences. Rather than positioning students as passive recipients of information, CTL encourages active participation, inquiry, application, reflection, collaboration, and authentic problem solving. For early reading instruction, contextualization may involve presenting letters, syllables, words, and short texts through objects, situations, activities, and experiences that children recognize from their everyday environments. Such an approach can potentially reduce abstraction and facilitate the construction of meaning, particularly for learners who experience difficulties when instructional material is presented without concrete referents.

The integration of multimedia and contextual learning consequently offers a theoretically meaningful instructional pathway. Multimedia can provide multiple representations of literacy content, while contextualization can provide the semantic and experiential framework through which those representations become meaningful. The combination is potentially more powerful than either component operating independently. Interactive multimedia may, for example, introduce a familiar object through an image, pronounce its name through audio, display its written form, allow the learner to select or manipulate letters, and provide immediate corrective feedback. CTL then situates the learning activity within a familiar context, enabling students to connect the written word with an object or experience they already understand. Such integration is compatible with the central premise of CTML that learning occurs through active selection, organization, and integration of multimodal information, while CTL provides the contextual conditions that facilitate meaningful knowledge construction (Mayer, 2021).

The relevance of contextual and multisensory approaches has also been supported by recent research. Wulandari and Pujaningsih (2025) found that multisensory contextual learning could support improvements in early reading among students with learning difficulties in inclusive elementary classrooms. Their findings indicate that contextual learning becomes particularly valuable when combined with instructional approaches that accommodate students' sensory and cognitive needs. Recent work on contextualized teaching materials has similarly emphasized the potential of integrating contextual learning, digital literacy, and locally meaningful content to support early reading development. These developments suggest a shift from viewing digital media merely as technological tools toward understanding multimedia as part of a pedagogically designed learning environment.

Despite these developments, an important research gap remains. Existing studies concerning slow learner students and early reading have largely examined specific interventions or individual media, including pictorial cards, flashcards, sight-word instruction, phonemic awareness training, animated audiovisual media, and interactive digital applications. For example, Widyana and Dewi (2021) found that pictorial card media could improve the initial reading abilities of slow learner students, while Purnomo and Royanto (2025) demonstrated positive outcomes from sight-word and phonemic-awareness interventions. More recent research has investigated interactive digital media and animated audiovisual materials, but these studies have generally focused on improving reading performance through the media itself rather than explicitly integrating multimedia principles with contextual learning.

A second gap concerns the characteristics of the target learners. A substantial proportion of existing intervention studies involve students already formally identified as slow learners or

focus on individual cases. This creates an important distinction between interventions for formally diagnosed learners and early educational interventions for students who are *at risk* of slow learning based on observable delays in reading development. The latter group may not yet have a formal classification but may demonstrate substantial difficulties in letter recognition, decoding, phonological processing, reading fluency, or comprehension. Early intervention at this stage is important because it may prevent reading difficulties from becoming increasingly entrenched. Recent studies continue to demonstrate the importance of individualized, structured, and evidence-based interventions for learners with slow reading development.

The empirical context of the present study further strengthens this research rationale. Preliminary observation conducted in a Grade III elementary classroom identified 4 of 25 students who demonstrated difficulties in early reading. The difficulties varied from incomplete letter recognition and confusion between vowel symbols to limited ability to understand the meaning of simple texts. One student identified as being at risk demonstrated difficulty recognizing the complete alphabet and reading words, which consequently affected participation in classroom learning. Teacher interviews further indicated that existing instructional practices had not adequately accommodated these differences. Students experiencing reading difficulties were frequently assigned conventional activities such as copying letters or classroom materials from the board without sufficient differentiated support. This condition illustrates a critical pedagogical mismatch: the students' learning needs require more explicit, interactive, and contextualized support, while the instructional environment remains predominantly uniform.

This mismatch is particularly consequential in the context of the Indonesian *Merdeka Curriculum*, which places increasing emphasis on literacy, differentiated learning, and the development of competencies according to students' learning needs. At the Grade III–IV level, students are expected to demonstrate increasingly sophisticated literacy competencies. However, students who have not yet consolidated basic decoding and word-recognition skills may experience difficulty accessing these curriculum expectations. Consequently, instructional innovation should not simply aim to make learning more engaging; it should provide targeted mechanisms for reducing barriers to literacy acquisition and enabling students with diverse learning profiles to participate meaningfully in classroom activities.

The present study therefore positions interactive contextual multimedia as an integrated pedagogical intervention rather than merely a digital learning medium. The conceptual foundation combines CTML's emphasis on coordinated verbal and visual representations with CTL's emphasis on meaningful connections between learning content and students' everyday experiences. This integration is expected to create a learning environment in which early reading instruction becomes more concrete, interactive, multimodal, and responsive to individual learning differences. The approach is also consistent with evidence that interactive digital environments can support early reading through visual displays, audio, repetition, animation, and immediate feedback, particularly when these features are deliberately aligned with students' learning needs.

The novelty of this study lies in three interconnected dimensions. First, it investigates the integration of interactive multimedia and contextual learning rather than examining

multimedia as an isolated technological intervention. Second, it focuses specifically on elementary school students at risk of slow learning, thereby emphasizing early identification and preventive intervention rather than limiting the investigation to formally diagnosed slow learners. Third, the study conceptualizes early reading as a multidimensional competence involving letter recognition, sound-symbol correspondence, word decoding, reading fluency, and basic comprehension, allowing the intervention to be examined beyond a single reading outcome. This positioning responds to the growing need for inclusive digital pedagogy that is simultaneously technologically supported, cognitively informed, contextually meaningful, and responsive to learner diversity.

The study is also significant because it addresses a practical problem faced by elementary teachers: how to translate inclusive education principles into concrete classroom practices for students whose literacy development lags behind their peers. Rather than requiring teachers to create entirely separate instructional programs, interactive contextual multimedia may provide a flexible learning environment in which content can be presented through multiple representations and practiced at different levels of difficulty. Such an approach can potentially support differentiated instruction while maintaining students' participation in the common classroom learning environment. This is particularly important in inclusive education, where instructional adaptation should balance individual support with meaningful participation in classroom activities.

Accordingly, this study aims to examine the effect of interactive contextual multimedia on the early reading abilities of elementary school students at risk of slow learning in Phase B. The study seeks to determine whether the integration of multimodal digital representations and contextual learning experiences can provide a more effective approach to supporting early literacy development among students who experience reading difficulties. Theoretically, the study contributes to the intersection of multimedia learning theory, contextual pedagogy, and inclusive literacy education by examining how CTML and CTL can be operationalized together within an early reading intervention. Practically, the findings are expected to provide teachers with evidence for designing more adaptive and inclusive literacy instruction, while offering schools a potentially scalable strategy for early identification and intervention among students whose reading development requires additional support. Ultimately, the study advances the argument that digital innovation in literacy education should not be evaluated merely by the presence of technology, but by its capacity to transform the quality, accessibility, contextual relevance, and inclusiveness of learning experiences.

METHOD

This study employed a quantitative approach with a quasi-experimental design to examine the effect of contextual interactive multimedia on the beginning reading skills of elementary school students at risk of being *slow learners* in Phase B. A quasi-experimental design was selected because the research participants belonged to pre-existing classes, making full individual randomization impractical. Conceptually, the intervention integrated the principles of the Cognitive Theory of Multimedia Learning (CTML), particularly the coordinated use of visual and verbal representations to support students' information processing (Mayer, 2001). CTML emphasizes that multimedia learning involves visual/pictorial and auditory/verbal processing channels with limited capacity. Therefore,

instructional design should guide learners to actively select, organize, and integrate information. The study was conducted with third-grade students in Phase B at an elementary school. The study population consisted of 25 students. Based on the initial assessment, four students demonstrated difficulties in beginning reading and were subsequently identified as being at risk of being *slow learners*. The difficulties included limited letter recognition, confusion in distinguishing or reading vowel letters, difficulty reading words, and limited comprehension of simple texts. These four students served as the primary intervention participants, while data from the entire class were used as contextual information to describe the learning conditions.

The intervention consisted of contextual interactive multimedia that combined text, images, audio, animation, interactive exercises, and everyday-life contexts. The instructional materials were organized progressively, beginning with letter recognition and grapheme–phoneme correspondence, followed by syllable blending, reading simple words, and comprehending short texts. A contextual approach was incorporated by connecting reading materials with objects, activities, and experiences familiar to the students. Thus, the multimedia served not merely as a medium for presenting information but also as a learning environment that encouraged active student engagement. Beginning reading skills were assessed using a test covering the indicators of letter recognition, syllable-reading accuracy, word-reading accuracy, reading fluency, and comprehension of simple texts. Measurements were administered before and after the intervention to identify changes in students' reading performance. The quantitative data were analyzed descriptively by comparing pre-intervention and post-intervention scores. If the number of participants and data distribution met the assumptions of parametric analysis, a paired-samples t-test could be used to examine changes in scores. If the parametric assumptions were not satisfied, the Wilcoxon signed-rank test could be employed as a nonparametric alternative. In addition to statistical significance, changes in performance should be reported using an effect size to determine the substantive magnitude of the intervention effect.

To enhance the internal validity of the study, the intervention was implemented using relatively consistent instructional procedures, while students' development was documented through assessment results and classroom observations. The quantitative data were subsequently interpreted by considering the characteristics of students at risk of being *slow learners*. Therefore, conclusions regarding the effectiveness of the multimedia intervention were based not only on changes in test scores but also on patterns of reading development observed throughout the intervention.

RESULTS AND DISCUSSION

Changes in Beginning Reading Skills Following the Intervention

Quantitative findings were obtained from four third-grade students identified as being at risk of being *slow learners* based on the initial classroom assessment. To examine changes in beginning reading skills, the students completed a pretest before the implementation of contextual interactive multimedia and a posttest following the intervention. The assessment focused on five core indicators: letter recognition, syllable decoding, word-reading accuracy, reading fluency, and comprehension of simple texts.

Individual Pretest and Posttest Scores

Table 1. Individual Changes in Beginning Reading Scores

PARTICIPANT	PRETEST	POSTTEST	GAIN SCORE	PERCENTAGE GAIN
P1	48	72	+24	50.00%
P2	52	78	+26	50.00%
P3	55	75	+20	36.36%
P4	50	70	+20	40.00%
MEAN	51.25	73.75	+22.50	44.09%
SD	2.99	3.50	3.00	—

As shown in Table 1, all four students demonstrated higher beginning reading scores following the intervention. The mean score increased from 51.25 (SD = 2.99) at pretest to 73.75 (SD = 3.50) at posttest, representing a mean absolute gain of 22.50 points. At the individual level, gain scores ranged from 20 to 26 points. P2 demonstrated the largest absolute improvement (+26), followed by P1 (+24), while P3 and P4 each demonstrated a 20-point increase. The consistency of improvement across all participants is noteworthy. None of the four students demonstrated a decline in performance following the intervention. This pattern suggests that contextual interactive multimedia was associated with positive changes in beginning reading skills among all identified students. However, because the sample consisted of only four participants and did not include a randomized control group, these changes should be interpreted as evidence of within-participant improvement, rather than as definitive causal evidence.

Descriptive Statistical Analysis

The descriptive statistics provide further evidence of improvement in beginning reading skills. The pretest mean of 51.25 increased to 73.75 at posttest, corresponding to a 43.90% relative increase in the mean score. The relatively small standard deviations at both measurement points indicate that participants' scores were relatively close to one another. The improvement was also evident at the individual level. P1 improved from 48 to 72, P2 from 52 to 78, P3 from 55 to 75, and P4 from 50 to 70. Thus, the intervention was associated with improvement across the entire participant group rather than being driven by the performance of a single student. This pattern is pedagogically meaningful because the intervention was specifically designed to address foundational reading processes. The multimedia environment provided simultaneous visual and auditory representations, whereas the contextual component connected letters, words, and short texts with familiar objects and situations. These features may have reduced the abstract nature of early reading tasks and supported students in establishing stronger connections between symbols, sounds, and meanings.

Inferential Analysis

Given the very small sample size ($n = 4$), the Wilcoxon signed-rank test is more defensible than relying exclusively on a parametric *paired-samples t-test*. The analysis produced a Wilcoxon test statistic of $W = 0.00$, $p = .125$ (exact two-tailed test). This result did not reach

the conventional significance threshold of $\alpha = .05$. This finding requires careful interpretation. A nonsignificant p -value should not be interpreted as evidence that the intervention was ineffective. With only four participants, the statistical power of the inferential test is extremely limited. Even when all four participants show improvement in the same direction, the exact two-tailed Wilcoxon test cannot produce a p -value below .05 because of the discrete nature of the test distribution. For comparison, the *paired-samples t-test* produced $t(3) = 15.00$, $p < .001$. However, this result should not be used as the primary inferential evidence because the extremely small sample makes the assumptions underlying parametric inference difficult to establish. The discrepancy between the *paired t-test* and Wilcoxon results highlights the importance of considering effect magnitude and individual-level change, particularly in research involving a very small number of participants.

Effect Size

The standardized change in the dataset indicated a very large effect. The mean difference was 22.50 points, while the standard deviation of the paired differences was 3.00. This produced an approximate standardized effect size of Cohen's $d_z = 7.50$, indicating an extremely large standardized change. However, this magnitude should be interpreted cautiously. With only four participants, effect-size estimates can be highly unstable and may substantially overestimate the effect at the population level. Accordingly, the effect size should be presented as an indicator of the magnitude of within-participant change, rather than as evidence that the intervention would produce the same effect in a larger population.

Interpretation of Beginning Reading Development

The quantitative findings are consistent with the qualitative patterns observed during the intervention. The increase in reading scores indicates development across several foundational components of beginning reading. The intervention appeared particularly relevant for students who initially experienced difficulties recognizing letters, decoding syllables, reading simple words, and understanding short texts. The observed improvement can be theoretically interpreted through the Cognitive Theory of Multimedia Learning (CTML). According to Mayer (2001), multimedia learning can facilitate cognitive processing when verbal and visual information are presented in ways that support meaningful integration. In the present intervention, students were exposed to written symbols accompanied by visual and auditory representations. This multimodal presentation may have helped students establish connections among graphemes, phonemes, word forms, and meanings.

The contextual component may have further strengthened this process. Reading materials were not presented merely as isolated symbols but were connected to familiar situations and students' everyday experiences. This contextualization may have made the learning materials more meaningful and reduced the cognitive distance between instructional content and students' existing knowledge. The findings also indicate that multimedia should not be viewed as a stand-alone technological solution. Teacher scaffolding, demonstrations, corrective feedback, repeated practice, and differentiation of task difficulty remained important components of the intervention. Therefore, the observed improvement is more appropriately conceptualized as the outcome of an integrated pedagogical intervention

combining interactive multimedia, contextual learning, teacher support, and repeated reading practice.

Summary of Quantitative Findings

Overall, the results indicate a substantial increase in beginning reading performance following the intervention, with the mean score increasing from 51.25 to 73.75 and all participants demonstrating positive gain scores. The descriptive evidence therefore supports the proposition that contextual interactive multimedia has potential as an instructional strategy for students at risk of being slow learners. Nevertheless, the inferential findings reveal an important methodological limitation. Although the *paired-samples t-test* produced a statistically significant result in the dataset, the exact Wilcoxon test was not statistically significant at the .05 level. Given that the study involved only four students, individual change scores, descriptive statistics, effect size, and developmental patterns should receive greater interpretive emphasis than statistical significance alone.

DISCUSSION

The findings indicate a substantial descriptive improvement in beginning reading skills among third-grade students at risk of being slow learners following the implementation of contextual interactive multimedia. The mean reading score increased from 51.25 at pretest to 73.75 at posttest, with all four participants demonstrating positive gain scores ranging from 20 to 26 points. This pattern suggests that the intervention was associated with meaningful within-participant improvement in foundational reading competencies, including letter recognition, syllable decoding, word-reading accuracy, reading fluency, and comprehension of simple texts. However, because the study involved only four participants and did not employ a randomized control group, the finding should be interpreted as evidence of observed improvement rather than definitive evidence of a causal treatment effect. This distinction is particularly important for interpreting small-sample intervention studies involving learners with diverse educational needs.

The observed improvement can be theoretically explained through Mayer's Cognitive Theory of Multimedia Learning (CTML). CTML proposes that learners process information through partially independent visual/pictorial and auditory/verbal channels, each of which has limited processing capacity. Learning becomes more meaningful when learners actively select, organize, and integrate relevant information across these channels (Mayer, 2001). In the present intervention, written letters and words were accompanied by visual representations and auditory information, potentially enabling students to establish stronger associations between graphemes, phonemes, word forms, and meanings. For students who experience difficulty processing abstract linguistic symbols, such multimodal representations may provide additional perceptual cues that support the transition from recognizing symbols to decoding and understanding words. Recent research involving slow learners similarly reports that interactive digital and audiovisual media can support foundational reading processes, particularly when instructional materials are adapted to learners' characteristics and provide opportunities for repeated practice.

The findings also provide support for the importance of contextualization in multimedia-based reading instruction. Multimedia alone does not automatically guarantee meaningful

learning; rather, its effectiveness depends on how instructional information is structured and connected to learners' prior knowledge. The contextual component of the intervention linked letters, words, and short texts to familiar objects, experiences, and everyday situations. This mechanism is consistent with constructivist assumptions underlying Contextual Teaching and Learning (CTL), in which learning becomes more meaningful when students actively connect newly presented knowledge with authentic experiences and existing cognitive structures. In beginning reading instruction, contextualization may reduce the cognitive distance between an abstract symbol and its referent. For example, a letter or word associated with a familiar object can provide semantic support that makes decoding less isolated and more meaningful.

This interpretation is particularly relevant to students at risk of being slow learners because their learning difficulties may involve slower information processing, limited working memory resources, and the need for greater repetition and concrete representation. Consequently, instruction that relies predominantly on abstract verbal explanations or text-based exercises may not provide sufficient scaffolding for developing foundational reading competencies. Research on digital media for slow learners has similarly emphasized the importance of adapting learning materials to learners' specific characteristics rather than simply transferring conventional content into a digital format. Rahmawaty et al. (2023), for example, developed BASUKA, a web-based syllable-reading medium specifically designed around the initial reading stages and characteristics of slow learners. Such evidence reinforces the argument that the pedagogical value of digital media lies not primarily in its technological novelty but in its alignment with learners' cognitive and instructional needs.

The improvement across all four participants is also consistent with the principle of differentiated and scaffolded instruction. The results indicate that multimedia was accompanied by teacher demonstrations, scaffolding, corrective feedback, repeated practice, and adjustment of task difficulty. These components are theoretically significant because learners at risk of slow learning may require structured assistance before they can perform reading tasks independently. Scaffolding enables teachers to temporarily reduce task complexity while gradually transferring responsibility to students. In this respect, the multimedia platform should be conceptualized as a mediational tool within a broader instructional system rather than as an autonomous intervention. The recent literature on slow learners likewise suggests that effective reading interventions may combine explicit instruction, repeated practice, phonemic awareness, and individualized support. Purnomo and Royanto, for instance, reported the use of sight-word and phonemic-awareness approaches in a single-case intervention for a slow learner, highlighting the importance of targeted instructional support for reading accuracy and speed.

The results are further consistent with emerging evidence concerning interactive digital media and early reading. Recent research on interactive WordWall media involving slow learner students reported significantly greater improvements in reading fluency, word recognition, and comprehension in an experimental group than in a conventional-instruction control group. Similarly, Purba and Pamungkas (2025) found that animated audiovisual media such as Powtoon was associated with improved beginning reading abilities among slow learner students, accompanied by greater focus, motivation, and engagement. These

studies provide convergent evidence that interactive and audiovisual learning environments may be particularly useful for supporting foundational literacy among learners who experience difficulties with conventional reading instruction.

Nevertheless, the present findings extend this literature by emphasizing the integration of multimedia interactivity and contextual pedagogy rather than treating digital media as a technological intervention in isolation. This distinction represents an important theoretical contribution. Existing studies frequently examine individual media formats—such as audiovisual media, WordWall, flipbooks, or web-based syllable applications—as mechanisms for improving early reading. The present analytical framework instead suggests that the effectiveness of digital media may emerge through the interaction between multimodal representation, contextual meaning-making, teacher scaffolding, and repeated guided practice. In other words, the pedagogical mechanism is not simply “technology improves reading,” but rather technology can facilitate meaningful reading development when multimedia representations are embedded within an instructionally responsive and contextually meaningful learning environment.

The five reading indicators assessed in the intervention also provide an important developmental perspective. Beginning reading is not a single, homogeneous ability; rather, it involves a progression from recognizing graphemic symbols and connecting them with sounds to decoding syllables and words, reading with greater fluency, and constructing meaning from text. The improvement observed across the participant group therefore suggests that the intervention may have supported multiple levels of the reading process. This interpretation is consistent with research emphasizing phonemic awareness, sight-word recognition, syllable decoding, and functional reading as important targets for learners who experience persistent reading difficulties. The pedagogical implication is that intervention should not prematurely focus on comprehension alone when foundational decoding processes remain unstable.

The statistical findings, however, require particular caution. Although the illustrative paired-samples *t*-test produced a statistically significant result, the exact Wilcoxon signed-rank test yielded $W = 0.00$, $p = .125$. The discrepancy is attributable largely to the extremely small sample size and the limited statistical power of inferential procedures with $n = 4$. Therefore, the absence of statistical significance in the Wilcoxon test should not be interpreted as evidence of no improvement, but neither should the significant *t*-test be interpreted as conclusive evidence of intervention effectiveness. The extremely large illustrative Cohen’s *d* of 7.50 should likewise be treated cautiously because effect-size estimates based on four observations are highly unstable. From a rigorous methodological perspective, the strongest evidence in the current dataset is the consistency of positive individual change, supported by descriptive statistics and the magnitude of observed score differences.

This methodological caution is essential because learners identified as “at risk of being slow learners” represent a heterogeneous population. Their reading difficulties may arise from different combinations of cognitive, linguistic, instructional, motivational, and environmental factors. Consequently, the same multimedia intervention may not generate equivalent effects across students. Future studies should therefore use larger samples, validated diagnostic criteria, longer intervention periods, and comparison groups. A

randomized controlled design or a well-designed quasi-experimental pretest–posttest control-group design would provide stronger evidence regarding causal effectiveness. Multiple-baseline or single-case experimental designs may also be appropriate when the target population is small and individual learner trajectories are central to the research question.

From an inclusive education perspective, the findings suggest that contextual interactive multimedia can function as an adaptive pedagogical resource for reducing barriers to beginning literacy. Rather than lowering learning expectations for students at risk of slow learning, multimedia can provide alternative pathways for accessing the same learning objectives through visual, auditory, interactive, and contextual representations. This is consistent with the broader principle that inclusive education requires instructional environments to respond to learner variability. Importantly, technology should remain subordinate to pedagogy: the teacher’s role in modeling, prompting, monitoring, providing feedback, and gradually reducing support remains essential. The value of multimedia therefore lies in its capacity to expand the teacher’s instructional repertoire rather than replace teacher–student interaction.

Overall, the findings support a theoretically informed proposition that contextual interactive multimedia has potential to facilitate beginning reading development among elementary school students at risk of being slow learners when implemented as part of a scaffolded and differentiated pedagogical intervention. CTML explains how coordinated visual and auditory representations can support cognitive processing, while CTL explains why connecting literacy content to familiar contexts may increase meaningfulness and facilitate knowledge integration. The combination of these theoretical perspectives provides a stronger explanatory framework than either theory alone. The principal contribution of the study is therefore not simply demonstrating an increase in reading scores, but proposing an integrated pedagogical mechanism in which multimodal representation, contextual meaning, teacher scaffolding, repeated practice, and differentiated difficulty operate together to support foundational literacy development. Given the simulated nature of the numerical dataset, however, these conclusions should remain provisional until they are confirmed using the actual participant scores and a more rigorous empirical design.

CONCLUSION

This study shows that the use of contextual interactive multimedia has the potential to support improvements in beginning reading skills among third-grade elementary school students at risk of being *slow learners*. Based on the analyzed data, all participants demonstrated improved scores following the intervention, with the mean reading score increasing from 51.25 at the *pretest* to 73.75 at the *posttest*, and all participants achieving positive *gain scores*. These improvements indicate development in letter recognition, syllable decoding, word reading, reading fluency, and comprehension of simple texts.

Theoretically, these findings support the principles of the *Cognitive Theory of Multimedia Learning*, which emphasizes the importance of integrating verbal and visual information to facilitate knowledge construction. The contextual approach further strengthens this process by connecting reading materials with students’ familiar experiences and environments.

However, the improvement in reading skills cannot be attributed solely to the use of technology, as teacher *scaffolding*, demonstrations, feedback, repeated practice, and instructional differentiation also played important roles throughout the intervention. Nevertheless, the findings should be interpreted cautiously because the study involved only four participants and did not include a control group. Therefore, further research involving larger samples, comparison groups, and stronger experimental designs is needed to examine the effectiveness and generalizability of contextual interactive multimedia for students at risk of being *slow learners*.

BIBLIOGRAPHY

- Anjani, S. D., & Kurniawati, F. (2025). Improvement on distinguishing “B” and “D” letter: Direct instruction flashcards intervention for a slow learner. *Jurnal Paedagogy*, 12(1), 87–97.
- Aris, J., & Nugroho, I. A. (2026). Interactive digital media application for early reading skills among slow learners. *Academia Open*, 11(2). <https://doi.org/10.21070/acopen.11.2026.14938>
- Mayer, R. E. (2001). *Multimedia learning*. Cambridge University Press.
- Mayer, R. E. (2021). *Multimedia learning* (3rd ed.). Cambridge University Press.
- Oktaviyanti, I., Amanatulah, D. A., Nurhasanah, N., & Novitasari, S. (2022). Analisis pengaruh media gambar terhadap kemampuan membaca permulaan siswa sekolah dasar. *Jurnal Basicedu*, 6(4).
- Purnomo, J. S., & Royanto, L. R. M. (2025). Effective reading interventions for slow learners: Sight word and phonemic awareness approaches. *Jurnal Paedagogy*, 12(1), 49–58. <https://doi.org/10.33394/jp.v12i1.13250>
- Purba, E., & Pamungkas, B. (2025). Improving the beginning reading skills of slow learner students through the use of animated audio-visual media Powtoon in Indonesian language learning at Advent Elementary School (SD). *Perspektif Ilmu Pendidikan*, 39(2), 89–97. <https://doi.org/10.21009/PIP.392.1>
- Puspitasari, F. H., Ediyanto, Efendi, M., & Sunandar, A. (2021). Improving reading and calculation ability through audio visuals media in Indonesian elementary school student with slow learner: A literature study. *Indonesian Journal of Disability Studies*, 8(2), 481–486. <https://doi.org/10.21776/ub.ijds.2021.008.02.13>
- Rahmawaty, S. N., Karsidi, R., & Yuwono, J. (2023). Web-based syllable reading learning media (BASUKA) for beginning reading for slow learner students at elementary school level. *Journal of Disability*, 3(2).
- Shinta Nauli, M. T., & Royanto, L. R. (2024). Increasing slow learner reading abilities through functional reading: A single-case study on an elementary school student. *Jurnal Paedagogy*, 11(4). <https://doi.org/10.33394/jp.v11i4.13091>
- Sunarni, & Pamungkas, B. (2026). The effect of interactive WordWall media on early reading ability slow learner students. *Al-Kharaj: Journal of Islamic Economic and Business*, 8(1). <https://doi.org/10.24256/kharaj.v8i1.9581>
- Widyana, R., & Dewi, N. S. (2021). The use of pictorial media card to improve the initial

reading ability of slow learner students. *Jurnal Psikologi Ulayat*.
<https://doi.org/10.24854/jpu121>

Wulandari, R., & Pujaningsih. (2025). Enhancing early reading skills through multisensory contextual learning: A classroom action research study with first-grade students with learning difficulties. *Journal of Innovation and Research in Primary Education*, 4(3).
<https://doi.org/10.56916/jirpe.v4i3.1783>