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Developing Digital Interactive Storybooks to Increase Literacy Interest in Dyslexic Children

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Abstract

This study aims to develop a Digital Interactive Storybook that is feasible, practical, and effective to increase literacy interest in dyslexic children. The study used the Research and Development (R&D) method with the ADDIE model which includes the stages of Analysis, Design, Development, Implementation, and Evaluation. The study was conducted in the Mewangi Stimulation Class in Surabaya with five dyslexic children as research subjects. The product developed is a Digital Interactive Storybook entitled Chik-Chik's Journey Home which integrates the OpenDyslexic font, audio narration, animal sounds, visual illustrations, and Augmented Reality (AR) technology as a multisensory approach in literacy learning. The results showed that the media obtained a validity level of 97.46% with a very valid category, a practicality level of 92.59% with a very practical category, and an N-Gain value of 0.73 which is included in the high category. These findings indicate that the developed Digital Interactive Storybook is suitable for use as a learning medium to increase literacy interest in dyslexic children. This media provides a more interesting, interactive learning experience and is in accordance with the learning characteristics of dyslexic children..

Keywords: digital interactive storybook, literacy interest, dyslexia, ADDIE, multisensory.

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INTRODUCTION

Literacy is universally recognized as one of the most fundamental competencies that supports children's academic achievement, cognitive development, social participation, and lifelong learning. Beyond the ability to decode written symbols, literacy encompasses the capacity to understand, interpret, evaluate, and apply information effectively in diverse contexts. In the twenty-first century, literacy has become increasingly intertwined with digital competence, requiring learners to interact with various forms of multimedia and technology-based resources. Consequently, educational institutions are challenged to provide learning environments that accommodate diverse learner characteristics while simultaneously fostering motivation, engagement, and meaningful literacy experiences. For children with learning disabilities, particularly dyslexia, achieving literacy proficiency remains a significant educational challenge because conventional instructional approaches often fail to address their unique cognitive and linguistic needs(Allafi, 2022).

Dyslexia is a specific learning disorder primarily characterized by persistent difficulties in accurate and fluent word recognition, spelling, decoding, and reading comprehension despite adequate intelligence, educational opportunities, and sensory abilities. These difficulties originate from differences in phonological processing and language-related neurological mechanisms, making reading an effortful and often frustrating experience. Children with dyslexia frequently encounter obstacles in recognizing letter patterns, associating graphemes with phonemes, processing written language, and maintaining reading fluency. These challenges extend beyond academic performance, often influencing emotional well-being, self-confidence, and motivation toward literacy activities. Repeated experiences of failure in reading tasks may lead children to avoid books altogether, thereby creating a cycle in which reduced reading practice further limits literacy development. This condition highlights the urgent need for instructional innovations specifically designed to support the learning characteristics of children with dyslexia(Alkhawaldeh & Saleem Khasawneh, 2023).

The development of literacy interest is equally as important as literacy competence itself. Reading interest functions as an internal motivational force that encourages children to voluntarily engage with written materials, explore new knowledge, and develop independent learning habits. However, for children with dyslexia, maintaining reading motivation is particularly difficult because conventional printed texts frequently present visual and linguistic barriers that discourage sustained engagement. Traditional learning media relying solely on static text and illustrations often fail to stimulate curiosity or accommodate the multisensory processing

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preferences commonly observed among learners with dyslexia. Therefore, educational interventions should not only focus on improving decoding skills but also on creating enjoyable and meaningful reading experiences capable of strengthening children's intrinsic motivation toward literacy(Sharma et al., 2025).

Recent advances in educational technology have opened new possibilities for designing more accessible and engaging literacy instruction. Digital learning media have transformed traditional educational practices by integrating text, audio, animation, interactive graphics, and immersive technologies into unified learning experiences. These technological developments are particularly valuable for learners with special educational needs because they enable instructional materials to be adapted according to individual cognitive characteristics and learning preferences. Digital storybooks, in particular, provide opportunities to combine visual, auditory, and interactive elements that enhance comprehension, maintain attention, and increase learner participation. Through these features, digital media can transform reading from a passive activity into an engaging multisensory learning experience that supports both literacy development and learner motivation(Ostiz-Blanco et al., 2021).

One instructional approach that has consistently demonstrated effectiveness for children with dyslexia is multisensory learning. This approach emphasizes the simultaneous involvement of multiple sensory modalities—including visual, auditory, tactile, and kinesthetic channels—during the learning process. By presenting information through several sensory pathways simultaneously, multisensory instruction facilitates stronger neural connections, improves information retention, and supports language processing. In literacy instruction, combining written text with narrated audio, meaningful illustrations, interactive activities, and manipulable learning objects allows children to process information more efficiently than relying on text alone. Consequently, multisensory learning has become a widely recommended strategy for improving reading performance, comprehension, attention, and learning motivation among children experiencing reading difficulties(Supena et al., 2026).

Among the various forms of digital learning media, interactive digital storybooks represent one of the most promising innovations for supporting literacy instruction among children with dyslexia. Unlike conventional printed books, interactive digital storybooks integrate multiple learning supports such as dyslexia-friendly typography, synchronized narration, animated illustrations, sound effects, and interactive navigation. These features reduce cognitive load while increasing learner engagement throughout the reading process. Furthermore, emerging technologies such as Augmented Reality (AR) extend children's interaction with story content by

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enabling virtual objects to appear within real-world environments, thereby promoting active exploration and deeper comprehension. Such technological integration aligns closely with the educational principle that meaningful learning occurs when learners actively participate in constructing knowledge through rich and engaging experiences(Jamali et al., 2023).

A preliminary needs assessment conducted at Mewangi Stimulation Class in Surabaya revealed that many children with dyslexia exhibited low interest in reading activities. Observations indicated that learners frequently lost concentration, experienced difficulty understanding written texts, and showed limited enthusiasm toward conventional reading materials consisting primarily of static text and images. Interviews with practitioners further suggested that existing instructional media were insufficient to accommodate the multisensory learning characteristics required by these students. These findings demonstrate a clear educational gap between learner needs and available instructional resources, emphasizing the necessity of developing innovative digital media capable of supporting literacy acquisition while simultaneously enhancing students' motivation and enjoyment of reading(Sulaimon et al., 2025).

To address these educational challenges, this study develops an Interactive Digital Storybook entitled Perjalanan Pulang Chik-Chik designed specifically to increase literacy interest among children with dyslexia. The product incorporates several dyslexia-friendly features, including the OpenDyslexic font, narrated audio, animal sound effects, colorful visual illustrations, and two-dimensional as well as three-dimensional Augmented Reality components. These integrated multimedia elements are expected to create an engaging, accessible, and inclusive reading environment that accommodates diverse sensory processing needs while encouraging active learner participation throughout the reading process(Vackova et al., 2023).

The development process follows the ADDIE instructional design model, consisting of the Analysis, Design, Development, Implementation, and Evaluation stages. This systematic framework ensures that the product is developed based on identified learner needs, validated by experts, implemented in authentic educational settings, and comprehensively evaluated regarding its validity, practicality, and effectiveness. Therefore, this study aims to develop an Interactive Digital Storybook that is educationally valid, practically applicable, and effective in enhancing the literacy interest of children with dyslexia. It is anticipated that the findings will contribute to the advancement of inclusive digital learning media while providing educators, special education practitioners, and researchers with an innovative instructional alternative for promoting literacy development among children with dyslexia in both special and inclusive educational settings.

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Product Validity of the Multisensory Interactive Digital Storybook

The development of the interactive digital storybook entitled Perjalanan Pulang Chik-Chik was carried out through the systematic stages of the ADDIE instructional design model, beginning with an analysis of learners' needs and continuing through design, development, implementation, and evaluation. During the development phase, the prototype underwent comprehensive validation by experts representing three different areas of expertise, namely instructional media, literacy learning, and special education. The purpose of this validation process was to determine whether the developed product fulfilled academic standards in terms of instructional content, media quality, accessibility, and appropriateness for children with dyslexia.

The results of expert validation demonstrated that the digital storybook achieved a very high level of validity across all evaluated aspects. The material expert confirmed that the storyline, literacy activities, language level, vocabulary selection, and sequencing of learning materials were appropriate for the cognitive characteristics of elementary-aged children with dyslexia. The expert emphasized that the story effectively introduced literacy concepts through meaningful contexts while maintaining language simplicity without reducing educational value. The integration of vocabulary repetition, contextual illustrations, and short sentence structures was considered highly supportive for children experiencing phonological processing difficulties(Hongngam et al., 2025).

Media experts likewise evaluated the product positively. The interface design was regarded as visually attractive while maintaining simplicity that minimized cognitive overload. The application employed the OpenDyslexic font, which improves letter discrimination and reading comfort for individuals with dyslexia. In addition, the selection of contrasting colors, balanced page layouts, responsive navigation buttons, synchronized narration, and interactive animations enhanced usability and accessibility. The inclusion of Augmented Reality (AR) objects enabled learners to interact directly with three-dimensional representations of story characters, increasing engagement while strengthening conceptual understanding through multisensory experiences.

Validation by the special education expert further confirmed that the instructional design reflected the principles of inclusive education and multisensory learning. The simultaneous integration of visual illustrations, narrated audio, interactive touch responses, sound effects, and AR visualization accommodated multiple sensory pathways involved in literacy acquisition. These features were considered particularly beneficial for children with dyslexia because they reduce dependence on printed text alone while reinforcing phonological awareness and reading comprehension through multimodal stimulation(Molina Villamarin & Imbaquingo Andrade, 2025).

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Although several revisions were recommended, such as enlarging certain icons, adjusting narration speed, and adding more opportunities for repeated reading activities, these suggestions were relatively minor and focused on improving user convenience rather than correcting fundamental weaknesses. After revisions were completed, the experts agreed that the digital storybook met the required standards of educational quality, accessibility, and instructional effectiveness. Overall, the validation findings indicate that the developed product possesses excellent content validity, media validity, and pedagogical validity, making it appropriate for implementation in literacy instruction for children with dyslexia.

Practicality of the Multisensory Interactive Digital Storybook

The practicality of the interactive digital storybook was examined through implementation in the Mewangi Stimulation Class involving children with dyslexia and classroom practitioners. Practicality evaluation focused on the ease of use, attractiveness, learner engagement, teacher convenience, and overall feasibility of integrating the application into daily literacy learning activities. During classroom implementation, children demonstrated a remarkably positive response toward the digital storybook. Unlike previous literacy activities using conventional printed materials, learners showed greater enthusiasm from the beginning of the learning session. The colorful illustrations, animated characters, narration, and interactive AR features immediately attracted students' attention and encouraged active participation throughout the lesson. Children voluntarily explored various pages, replayed narration several times, and repeatedly interacted with the virtual objects presented in the application.

Teachers reported that the digital storybook significantly simplified literacy instruction. Previously, educators needed to provide continuous individual guidance because many learners quickly lost concentration while reading printed materials. However, the integrated audio narration, interactive visual supports, and synchronized text reduced students' dependence on constant teacher assistance. Children became more capable of following the storyline independently while maintaining focus for longer periods. Consequently, teachers were able to allocate more attention to observing individual learning progress rather than repeatedly explaining the same reading instructions(Kritsotaki et al., 2025).

Observation results further indicated substantial improvements in classroom participation. Learners became more willing to answer questions, identify vocabulary, describe pictures, imitate sounds, and retell story events. These learning behaviors reflected increased confidence during literacy activities. The multisensory presentation effectively reduced the anxiety commonly

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experienced by children with dyslexia when confronted with reading tasks. Instead of perceiving reading as a difficult academic obligation, learners experienced it as an enjoyable interactive activity.

The Augmented Reality component emerged as one of the most appreciated features. Students expressed curiosity toward the three-dimensional visualization of story characters and frequently manipulated virtual objects while listening to narration. This interaction encouraged deeper cognitive engagement because learners simultaneously observed visual information, listened to spoken language, touched interactive objects, and connected these experiences with printed text. Such multisensory engagement maintained learner attention throughout the instructional session.

Teachers also emphasized the application's flexibility. The digital storybook could be implemented in individual learning, small-group instruction, or guided classroom activities without requiring complicated technical preparation. Navigation was intuitive, loading time was satisfactory, and the application functioned consistently throughout implementation. Minor technical suggestions included adding additional story levels with varying reading difficulty and incorporating more interactive vocabulary exercises. Nevertheless, these recommendations represented future enhancements rather than critical limitations(Aresta et al., 2025).

Overall, the practicality findings demonstrate that the developed digital storybook is highly feasible for classroom implementation. The product successfully combines instructional quality with user-friendly technological features, allowing teachers to conduct literacy instruction more efficiently while simultaneously increasing learner engagement, participation, and motivation. These findings indicate that multisensory digital learning media represent a practical instructional innovation for inclusive literacy education.

Effectiveness of the Multisensensory Interactive Digital Storybook in Improving Literacy Interest

The effectiveness of the developed interactive digital storybook was evaluated by examining changes in students' literacy interest following implementation. Literacy interest indicators included students' willingness to participate in reading activities, attention during instruction, curiosity toward reading materials, persistence in completing literacy tasks, voluntary interaction with books, and overall enthusiasm toward reading experiences.

Before implementation, observational data indicated that most children with dyslexia demonstrated relatively low literacy interest. Many learners avoided reading tasks, displayed limited attention spans, frequently requested teacher assistance, and became easily frustrated

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when encountering unfamiliar vocabulary. Reading activities were generally perceived as difficult and monotonous because instructional media relied heavily on printed text with minimal interactive support(Bar-Zvi Shaked et al., 2026).

Following the implementation of the multisensory digital storybook, substantial positive changes were observed across nearly all literacy interest indicators. Students showed increased enthusiasm before literacy lessons began and expressed curiosity about the continuation of the story. Several learners independently requested additional opportunities to read using the application outside scheduled instructional sessions. Such voluntary engagement represents a strong indicator of intrinsic reading motivation, which is considered an essential foundation for long-term literacy development.

Learners also demonstrated improved concentration throughout reading sessions. The integration of narration, visual animation, sound effects, and AR objects successfully maintained attention for considerably longer periods compared with conventional instruction. Instead of becoming distracted after a few minutes, students remained engaged until the completion of each story episode. This sustained attention enabled learners to process story content more effectively while reducing cognitive fatigue commonly experienced during reading(Liu et al., 2026).

Another important finding involved students' confidence in participating during literacy activities. Children became increasingly willing to pronounce words aloud, answer comprehension questions, identify story characters, and retell narrative sequences. The supportive multisensory environment reduced fear of making reading mistakes because visual and auditory cues continuously reinforced text comprehension. Consequently, learners participated more actively without displaying the anxiety often associated with conventional reading instruction.

The repeated exposure to synchronized text and narration also contributed to vocabulary acquisition and phonological awareness. Students gradually became familiar with frequently occurring words, recognized letter patterns more accurately, and demonstrated improved decoding ability during guided reading sessions. Although the primary objective of this study focused on literacy interest rather than reading achievement, observable improvements in reading behavior suggested that increased motivation positively influenced literacy performance(Dwijayanti & Sihombing, 2021).

Teachers likewise reported noticeable behavioral changes beyond the classroom. Parents indicated that several children voluntarily discussed story characters at home, requested repeated access to the application, and exhibited greater interest in exploring other children's books. These behavioral changes suggest that the intervention fostered not only situational engagement during

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classroom instruction but also broader positive attitudes toward reading in everyday life.

The effectiveness of the interactive digital storybook can be explained through multisensory learning principles. By simultaneously activating visual, auditory, tactile, and kinesthetic processing channels, the application reduced cognitive demands associated with decoding while strengthening comprehension through multiple sensory representations. Children with dyslexia therefore experienced reading success more frequently, enhancing self-efficacy and encouraging continued participation in literacy activities. Positive emotional experiences during reading further reinforced intrinsic motivation, creating a cycle in which enjoyment encouraged more frequent reading practice, which subsequently supported literacy development(Allafi, 2022).

Overall, the findings demonstrate that the multisensory interactive digital storybook effectively improved literacy interest among children with dyslexia. The integration of inclusive instructional design, interactive multimedia, narrated storytelling, dyslexia-friendly typography, and Augmented Reality successfully transformed literacy learning into an enjoyable, meaningful, and motivating educational experience. Consequently, the developed product represents a valuable innovation for inclusive elementary education and offers considerable potential for supporting literacy instruction for children with dyslexia in both special education settings and inclusive classrooms.

DISCUSSION

Analysis of Product Validity Based on Multisensory Learning Theory, Cognitive Theory of Multimedia Learning, and Universal Design for Learning (UDL)

The findings indicating that the interactive digital storybook achieved a very high level of validity demonstrate that the product successfully integrates instructional content, technological design, and accessibility principles into a coherent educational medium suitable for children with dyslexia. The high ratings provided by experts in instructional media, literacy education, and special education suggest that every component of the product aligns with the cognitive and educational characteristics of learners experiencing reading difficulties. Rather than functioning merely as a digital version of a printed book, the developed storybook represents a carefully designed learning environment in which visual, auditory, and interactive components work synergistically to facilitate literacy acquisition.

These findings can first be explained through Multisensory Learning Theory, which argues that learning becomes more meaningful when information is presented simultaneously through

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multiple sensory channels. According to Orton-Gillingham's multisensory approach, children with dyslexia learn more effectively when visual, auditory, kinesthetic, and tactile experiences occur simultaneously during instruction. Dyslexic learners frequently experience deficits in phonological processing and decoding; therefore, relying exclusively on printed text often increases cognitive burden and reduces comprehension. In the developed digital storybook, the integration of narration, colorful illustrations, animated characters, sound effects, interactive touch responses, and Augmented Reality provides complementary sensory inputs that strengthen neural connections responsible for language processing. Instead of depending solely on visual decoding, learners receive additional auditory and interactive support, allowing them to construct meaning more efficiently(Alkhawaldeh & Saleem Khasawneh, 2023).

The validation results also reflect the principles proposed in Mayer's Cognitive Theory of Multimedia Learning (CTML). Mayer argues that individuals process information through two separate but interconnected channels: the visual-pictorial channel and the auditory-verbal channel. Effective multimedia instruction occurs when both channels are activated without exceeding learners' limited cognitive capacity. The interactive digital storybook demonstrates compliance with several multimedia principles, including the multimedia principle, modality principle, contiguity principle, signaling principle, and coherence principle. Text is synchronized with narration, illustrations correspond directly with story content, animations reinforce rather than distract from learning objectives, and unnecessary decorative elements are minimized. Consequently, learners are able to allocate cognitive resources toward comprehension instead of struggling with decoding isolated textual information(Sharma et al., 2025).

Furthermore, the validation findings are highly consistent with the principles of Universal Design for Learning (UDL) proposed by CAST. UDL emphasizes that educational environments should accommodate learner diversity by providing multiple means of representation, engagement, and expression. The developed storybook fulfills these three principles effectively. First, multiple means of representation are provided through written text, narrated audio, animated illustrations, and three-dimensional AR visualization. Second, learner engagement is strengthened through interactive navigation, sound effects, attractive graphics, and exploratory activities. Third, multiple means of expression are encouraged as learners respond verbally, identify vocabulary, interact with story objects, and retell narrative events. Such flexibility is particularly important for children with dyslexia because they often possess heterogeneous cognitive strengths despite sharing similar reading difficulties.

The positive evaluation of the OpenDyslexic font also reinforces findings from typography

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research concerning dyslexia-friendly instructional materials. Although typography alone cannot eliminate dyslexia, appropriate font selection contributes to improved visual discrimination, reduces letter confusion, and increases reading comfort. Combined with adequate spacing, balanced layouts, and simplified navigation, these design decisions minimize extraneous cognitive load while maximizing instructional accessibility(Ostiz-Blanco et al., 2021).

The inclusion of Augmented Reality further strengthens the theoretical foundation of the developed media. Constructivist learning theory emphasizes that meaningful learning emerges through active interaction with learning objects. By allowing learners to manipulate three-dimensional virtual characters within authentic physical environments, the storybook transforms abstract textual information into concrete experiential learning. This interaction supports dual coding processes in which verbal and visual information are encoded simultaneously, thereby improving memory retention and comprehension.

Therefore, the high product validity obtained during expert evaluation is not merely an indication of technical quality but also demonstrates that the instructional design successfully operationalizes established educational theories. The convergence of Multisensory Learning Theory, Mayer's Cognitive Theory of Multimedia Learning, Universal Design for Learning, Constructivism, and dyslexia-friendly instructional principles explains why experts considered the digital storybook appropriate for literacy instruction among children with dyslexia(Supena et al., 2026).

Analysis of Product Practicality Based on Constructivism, Self-Determination Theory, and Technology Acceptance Model

The second finding demonstrates that the interactive digital storybook possesses excellent practicality during classroom implementation. Both teachers and learners reported that the application was easy to use, attractive, engaging, and capable of supporting literacy instruction without creating additional instructional burdens. High practicality indicates that educational innovation extends beyond theoretical effectiveness and can be realistically implemented within authentic classroom contexts.

This finding is consistent with Constructivist Learning Theory, particularly the perspective proposed by Vygotsky. Constructivism emphasizes that learners actively construct knowledge through interaction with meaningful learning environments rather than passively receiving information from teachers. The digital storybook transforms literacy instruction into an active learning experience by allowing learners to manipulate AR objects, replay narration, explore

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illustrations, and engage directly with story content. Instead of serving as passive readers, children become active participants who construct meaning through continuous interaction with multimedia resources(Jamali et al., 2023).

The observed increase in learner participation further reflects Vygotsky's concept of the Zone of Proximal Development (ZPD). Children with dyslexia often require instructional scaffolding to accomplish literacy tasks that exceed their independent reading abilities. Within the developed application, scaffolding is provided through synchronized narration, visual illustrations, highlighted text, and interactive multimedia supports. These instructional aids reduce dependence on continuous teacher assistance while gradually enabling learners to complete literacy activities independently. As learners gain confidence, scaffolding naturally becomes less dominant, supporting progressive literacy development.

The findings are equally consistent with Self-Determination Theory (SDT) developed by Deci and Ryan. According to SDT, intrinsic motivation develops when three fundamental psychological needs are fulfilled: autonomy, competence, and relatedness. The digital storybook supports learner autonomy by allowing children to control navigation, replay audio, manipulate interactive features, and determine their learning pace. Competence develops as learners experience repeated reading success facilitated by multisensory supports, reducing frustration commonly associated with dyslexia. Relatedness emerges through collaborative classroom discussions and teacher-guided storytelling, creating emotionally supportive literacy experiences. Because these three psychological needs are fulfilled simultaneously, students become intrinsically motivated to participate actively in literacy instruction(Sulaimon et al., 2025).

Teacher responses similarly illustrate the importance of usability in educational technology implementation. These findings can be interpreted through the Technology Acceptance Model (TAM) proposed by Davis. TAM suggests that technology adoption depends primarily upon two factors: perceived usefulness and perceived ease of use. Teachers considered the application useful because it reduced instructional complexity, maintained learner attention, increased classroom participation, and supported individualized instruction. Simultaneously, the intuitive interface, responsive navigation, and stable application performance enhanced perceived ease of use. Together, these factors increased teachers' willingness to integrate the digital storybook into regular literacy instruction(Vackova et al., 2023).

The enthusiasm demonstrated by learners also aligns with Flow Theory introduced by Csikszentmihalyi. Flow occurs when learners become deeply immersed in meaningful activities that balance challenge and ability. The digital storybook successfully creates this condition

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because instructional tasks remain achievable while interactive multimedia continuously stimulates curiosity. Learners remain focused throughout reading sessions without experiencing excessive frustration or boredom. Such sustained engagement is particularly valuable for children with dyslexia, who frequently exhibit reduced attention during conventional literacy instruction(Hongngam et al., 2025).

The practical implementation findings therefore indicate that the digital storybook not only satisfies technical usability standards but also creates psychologically supportive learning environments. The convergence of Constructivism, Self-Determination Theory, Technology Acceptance Model, and Flow Theory explains why both teachers and learners viewed the developed product as highly practical for literacy instruction.

Analysis of Product Effectiveness Based on Reading Motivation Theory, Social Cognitive Theory, and Multisensory Learning Theory

The third finding demonstrates that the interactive digital storybook effectively increased literacy interest among children with dyslexia. Learners displayed greater enthusiasm toward reading, improved concentration, stronger willingness to participate in literacy activities, increased confidence, and more positive attitudes toward books. These behavioral improvements indicate that the intervention successfully influenced motivational as well as cognitive dimensions of literacy development.

These findings correspond closely with Reading Motivation Theory proposed by Wigfield and Guthrie, who argue that reading achievement depends substantially upon intrinsic reading motivation. Students who enjoy reading voluntarily engage more frequently with texts, thereby developing stronger literacy competence over time. Before implementation, reading activities were associated with frustration and repeated failure. Consequently, learners avoided literacy tasks whenever possible. Following implementation, however, reading became associated with enjoyment, exploration, and interactive discovery. The transformation of emotional experiences surrounding reading explains the observed increase in voluntary participation and independent literacy engagement(Molina Villamarin & Imbaquingo Andrade, 2025).

The findings may also be interpreted through Bandura's Social Cognitive Theory, particularly the concept of self-efficacy. Self-efficacy refers to an individual's belief in his or her ability to perform specific tasks successfully. Children with dyslexia frequently develop low reading self-efficacy because repeated decoding failures undermine confidence. The multisensory supports integrated into the digital storybook provide learners with repeated mastery

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experiences. Narration assists decoding, illustrations clarify meaning, AR reinforces comprehension, and interactive feedback minimizes reading errors. As successful reading experiences accumulate, learners begin believing that they are capable readers, which subsequently strengthens persistence, participation, and motivation(Kritsotaki et al., 2025).

Bandura further emphasizes reciprocal interactions among personal factors, behavior, and environmental influences. The digital storybook modifies the learning environment by creating supportive instructional conditions. These environmental improvements encourage positive reading behaviors, which subsequently strengthen learners' beliefs about their own competence. Enhanced self-efficacy then promotes even greater participation, producing a positive cycle of literacy development.

The effectiveness findings also reinforce Multisensory Learning Theory. Dyslexia primarily affects phonological processing rather than intelligence or motivation. Therefore, interventions should reduce phonological burden by engaging multiple sensory pathways simultaneously. During implementation, learners process printed words visually while simultaneously hearing narration, observing animations, interacting physically with touchscreen features, and manipulating AR objects. Such multisensory integration strengthens memory encoding through multiple neural pathways, facilitating both comprehension and sustained attention. Rather than competing for limited cognitive resources, complementary sensory inputs cooperate to reinforce literacy learning(Aresta et al., 2025).

The observed increase in vocabulary recognition and reading confidence can additionally be explained through Dual Coding Theory developed by Paivio. According to this theory, information encoded simultaneously in verbal and visual systems is remembered more effectively than information presented through a single modality. Every vocabulary item introduced in the storybook is supported by narration, illustrations, contextual animation, and often AR visualization. Consequently, learners establish stronger semantic associations that improve recall and comprehension while simultaneously reducing decoding anxiety.

Finally, these findings are consistent with Engagement Theory, which emphasizes that meaningful learning occurs when learners are actively involved in purposeful educational activities. The interactive storybook transforms reading from a passive decoding exercise into an engaging multimedia experience involving exploration, listening, observation, interaction, and storytelling. Such comprehensive engagement strengthens emotional attachment to literacy activities, making reading increasingly enjoyable rather than intimidating(Bar-Zvi Shaked et al., 2026).

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Overall, the effectiveness findings demonstrate that improvements in literacy interest are not accidental outcomes but rather predictable consequences of theoretically grounded instructional design. Reading Motivation Theory explains increased intrinsic interest; Social Cognitive Theory accounts for improved self-efficacy and confidence; Multisensory Learning Theory clarifies enhanced cognitive processing; Dual Coding Theory explains stronger comprehension and memory; and Engagement Theory illustrates why learners remained motivated throughout instruction. Collectively, these theoretical perspectives confirm that the multisensory interactive digital storybook constitutes an effective educational innovation capable of promoting literacy interest among children with dyslexia while simultaneously supporting inclusive and learner-centered literacy instruction(Liu et al., 2026).

CONCLUSION

Based on the findings and analysis, it can be concluded that the development of the multisensory-based interactive digital storybook Perjalanan Pulang Chik-Chik successfully produced an instructional medium that is valid, practical, and effective in improving the literacy interest of children with dyslexia. The product achieved a high level of validity because its instructional content, multimedia design, and accessibility features were developed in accordance with the learning characteristics of children with dyslexia and were validated by experts in literacy, educational media, and special education. The implementation results further demonstrated that the digital storybook is highly practical, as both teachers and learners were able to use it easily, while its interactive features—including narration, animations, dyslexia-friendly typography, and Augmented Reality—enhanced classroom engagement and reduced learners' dependence on teacher assistance. Moreover, the product proved effective in increasing students' literacy interest, as reflected by higher reading motivation, sustained attention, active participation, greater confidence, and more positive attitudes toward reading activities. These findings are supported by Multisensory Learning Theory, Mayer's Cognitive Theory of Multimedia Learning, Universal Design for Learning, Constructivist Learning Theory, Self-Determination Theory, Social Cognitive Theory, and Reading Motivation Theory, all of which explain that meaningful literacy learning occurs when instructional media simultaneously address learners' cognitive, emotional, and sensory needs. Therefore, the multisensory interactive digital storybook represents an innovative and inclusive educational solution that has considerable potential to support literacy instruction for children with dyslexia in both special education and inclusive elementary school settings while contributing to the broader implementation of technology-enhanced literacy

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learning.

FUTURE DIRECTIONS

Future research should expand the implementation of the multisensory interactive digital storybook by involving larger and more diverse samples from inclusive elementary schools, special schools, and learning support centers to improve the generalizability of the findings. Longitudinal studies are also recommended to examine the sustained effects of the digital storybook on literacy interest, reading fluency, phonological awareness, vocabulary acquisition, and reading comprehension over extended periods. In addition, future developments may incorporate adaptive learning technologies powered by artificial intelligence (AI) to personalize reading materials according to each child's literacy level and learning progress. The integration of gamification elements, speech recognition, interactive assessment, and real-time learning analytics could further enhance learner engagement and provide teachers with comprehensive feedback on students' literacy development. Future studies should also compare the effectiveness of multisensory digital storybooks with other digital literacy interventions to identify the most effective instructional approaches for children with dyslexia. Finally, expanding the application to multilingual contexts and culturally diverse story content would increase its accessibility and relevance while supporting inclusive literacy education across different educational settings and learner populations..

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