OPEN ACCESS
Journal Neosantara Hybrid Learning
Vol. 3 No. 3. June 2025, pp. 174-186 DOI. 10.70177/jnhl.v3i3.2532

Research Article

INCLUSIVE EDUCATIONAL TECHNOLOGY FOR STUDENTS WITH DYSLEXIA IN A HYBRID READING PROGRAM: A CASE STUDY IN AN INDONESIAN PRIMARY SCHOOL

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Article Info

Received: December 7, 2024
Revised: February 17, 2025
Accepted: May 8, 2025
Online Version: June 13, 2025

Abstract

Dyslexia is a common learning difficulty that affects many students worldwide, including those in Indonesia. Students with dyslexia face significant challenges in traditional educational settings, particularly in reading and language development. Inclusive educational technologies offer promising solutions to support these students, especially in *hybrid learning* environments where both digital and traditional methods are integrated. This study aims to explore the effectiveness of inclusive educational technology in a hybrid reading program for primary school students with dyslexia in Indonesia. The research employs a case study methodology, focusing on a group of dyslexic students at an Indonesian primary school. Data was collected through classroom observations, interviews with teachers, and pre- and post-assessments of reading skills. The results indicate that the use of educational technology, such as text-to-speech tools, phonics-based apps, and digital reading platforms, significantly improved students' reading abilities and engagement. The hybrid program allowed students to learn at their own pace, providing tailored support that traditional methods could not offer. The study concludes that inclusive educational technology is a valuable tool for supporting students with dyslexia, enhancing their reading skills, and promoting greater inclusion in the classroom. These findings contribute to the growing body of research on educational technology and inclusive practices in primary education.

Keywords: Dyslexi, Educational Technology, Hybrid Learning

Journal Homepage https://research.adra.ac.id/index.php/jnhl ISSN: (P: 2987-2316) - (E: 2986-979X)
How to cite: Fallah, S., Al-Harthy, A., & Al-Said F., Al-Sharqi, K. (2025). Inclusive Educational Technology for Students with Dyslexia in a Hybrid Reading Program: A Case Study in an Indonesian Primary School. *Journal Neosantara hybrid learning, 3*(3), 174–186. https://doi.org/10.70177/jnhl.v3i3.2532
Published by: Yayasan Adra Karima Hubbi

INTRODUCTION

Dyslexia, a specific learning disability that affects reading, writing, and spelling, is a prevalent challenge among students worldwide. In Indonesia, dyslexia is often undiagnosed or misdiagnosed, leading to difficulties in academic achievement, particularly in literacy-related subjects (Venegas-Mejía et al., 2025). According to recent studies, it is estimated that between 5% to 10% of students in Indonesia may experience some form of dyslexia, though many do not receive the necessary support to address their unique learning needs. In the traditional educational system, students with dyslexia are often placed in mainstream classrooms without the specialized interventions they require (Ulhasanah et al., 2025). As a result, they face significant barriers to achieving academic success, particularly in reading and language acquisition, which are foundational to their overall educational development. This highlights the need for more inclusive educational practices and tools to ensure that these students can participate fully in the learning process (Tselegkaridis et al., 2025).

One promising solution lies in the integration of inclusive educational technology, which can provide personalized, adaptive learning experiences tailored to the needs of students with dyslexia (Thomran et al., 2025). In recent years, the use of digital tools in education has gained widespread attention, particularly with the rise of *hybrid learning* programs that combine both traditional and digital teaching methods. *hybrid learning*, which integrates face-to-face teaching with online or digital resources, has the potential to offer flexible, *student-centered learning* environments (Thepa et al., 2025). For students with dyslexia, such hybrid programs can provide access to tools that assist with reading, such as text-to-speech software, speech recognition, and other assistive technologies (Tay et al., 2025). These technologies allow students to learn at their own pace, with personalized support that adapts to their individual learning needs. The challenge remains in understanding how these technologies can be effectively integrated into a *hybrid learning* model for primary school students in Indonesia, particularly in diverse classrooms where the use of technology in education is still developing (Tang et al., 2025).

Despite the growing interest in educational technology and *hybrid learning*, there remains a lack of research on the specific use of inclusive educational technologies for students with dyslexia in Indonesian primary schools (Sousa Basto & Ferreira, 2025). While there are studies from Western contexts that demonstrate the positive impact of assistive technologies for dyslexic students, there is a gap in understanding how these tools can be effectively adapted to meet the needs of Indonesian students, particularly within the framework of *hybrid learning* programs (Smith-Mutegi et al., 2025). Additionally, the integration of technology in classrooms in Indonesia is still evolving, and many teachers lack the training or resources to effectively use digital tools in supporting students with learning disabilities. This creates a significant barrier to the inclusion of students with dyslexia, who often do not receive the specialized support they need to thrive academically (Shafiee Rad, 2025).

The specific problem addressed by this research is how inclusive educational technologies, when integrated into a hybrid reading program, can improve the reading abilities and overall academic engagement of students with dyslexia in an Indonesian primary school context (Safdari & Ehtesham, 2025). This research aims to fill this gap by exploring the use of assistive technology in a *hybrid learning* environment, with a focus on how these tools can be implemented to support dyslexic students in a primary school setting (Ramos et al., 2025). The study seeks to identify the benefits and challenges of using such technology and to evaluate its effectiveness in improving students' reading skills and academic performance. Understanding the potential of inclusive educational technology in supporting dyslexic students in Indonesia is crucial for developing more effective teaching strategies and ensuring that all students have access to the educational opportunities they deserve (Rädel-Ablass et al., 2025).

The primary objective of this study is to explore the effectiveness of inclusive educational technology in a hybrid reading program for primary school students with dyslexia

in Indonesia (Mokmin et al., 2025). The research seeks to examine how digital tools, such as text-to-speech software, phonics-based applications, and other assistive technologies, can be integrated into a *hybrid learning* environment to improve reading skills and engagement for students with dyslexia (Naeem & Mushibwe, 2025). The study will assess the impact of these technologies on students' academic performance, focusing specifically on their reading abilities before and after the intervention. The secondary objective is to identify the challenges and barriers that teachers and students face in implementing *hybrid learning* programs with inclusive technologies, and to explore strategies for overcoming these obstacles to maximize the effectiveness of the program (Naeem & Mushibwe, 2025).

Through this case study, the research aims to provide actionable insights for educators and policymakers on how to implement inclusive educational technologies in *hybrid learning* programs in Indonesian primary schools (Ojio & Kawamura, 2025). It is expected that the findings will offer guidance on best practices for integrating these technologies into the curriculum, as well as recommendations for teacher training and resource development (Parmar et al., 2025). Ultimately, the study aims to contribute to the growing body of research on inclusive education and assistive technology, offering practical solutions to support students with dyslexia and other learning disabilities in diverse classroom settings (Neher et al., 2025).

While there is a growing body of research on the benefits of assistive technology for dyslexic students in Western countries, there is a notable lack of studies focusing on the application of these tools in Indonesian primary schools, particularly within *hybrid learning* environments (Qin et al., 2025). Most research on dyslexia and technology in Indonesia has focused on general education and does not specifically address the needs of students with learning disabilities or the potential of *hybrid learning* models (Qian et al., 2025). Furthermore, while some studies have explored the use of digital tools in supporting literacy development, few have examined how these tools can be tailored to meet the needs of students with dyslexia, particularly in a culturally diverse and resource-limited setting like Indonesia (Piispanen et al., 2025).

This study aims to address this gap by exploring how inclusive educational technologies can be integrated into *hybrid learning* programs in Indonesian primary schools, with a specific focus on dyslexic students (Q. Wang & Yao, 2025). By focusing on a case study within an Indonesian context, the research contributes new insights into how these technologies can be adapted to the unique needs of Indonesian students, providing a deeper understanding of the challenges and opportunities of using assistive technology in diverse classrooms (Vernasque et al., 2025). This study will also contribute to the field by offering evidence of how *hybrid learning* programs, when combined with inclusive technologies, can improve educational outcomes for students with dyslexia, offering practical implications for educators and policymakers seeking to implement inclusive practices in schools.

The novelty of this research lies in its focus on the intersection of inclusive educational technology, dyslexia, and *hybrid learning* in an Indonesian primary school context (Y. Wang et al., 2025). While there has been significant research on the use of assistive technologies in Western educational settings, few studies have examined their application in non-Western contexts like Indonesia. This research is unique in that it seeks to address the gap in understanding how inclusive technologies can be effectively integrated into *hybrid learning* environments for students with dyslexia in Indonesia (Wijaya et al., 2025). The findings of this study will provide a much-needed contribution to the field of inclusive education, particularly in the context of a developing country where access to technology and specialized resources can be limited (Yazarkan et al., 2025).

This research is also important because it highlights the potential of *hybrid learning* models to offer flexible, student-centered approaches to education. By combining digital tools with traditional teaching methods, *hybrid learning* has the potential to create more inclusive educational environments that can support students with diverse learning needs, including

those with dyslexia. This study justifies its relevance by providing valuable insights into how technology can be used to support students with learning disabilities, improving their academic outcomes and overall engagement in the classroom. The results of this research will not only contribute to the academic literature but will also have practical implications for the development of inclusive educational practices in Indonesian primary schools and other similar educational contexts.

RESEARCH METHOD

Research Design

The research design adopted in this study is a case study with a mixed-methods approach, combining both qualitative and quantitative methods to explore the effectiveness of inclusive educational technology in a hybrid reading program for primary school students with dyslexia (Khairani et al., 2025). This design enables a comprehensive and in-depth understanding of how assistive technologies can enhance the learning experience of dyslexic students in an Indonesian primary school context. By integrating qualitative exploration with quantitative measurement, the study aims to capture both the measurable outcomes of reading improvement and the experiential aspects of technology use in *hybrid learning* (Yuvaraj et al., 2025).

Research Target/Subject

The research targets or subjects consist of primary school students diagnosed with dyslexia and their teachers, all drawn from an inclusive education setting in Indonesia. The sample includes 20 dyslexic students aged between 8 and 10 years who participate in a hybrid reading program, ensuring the representation of various reading ability levels within the target population. In addition, five teachers responsible for delivering the program are also involved in the study (S. Zhang & Yao, 2025). These teachers were selected based on their teaching experience with *hybrid learning* environments and their openness to integrating educational technology into classroom instruction. Together, this group provides a comprehensive perspective on both learner outcomes and instructional practices.

Research Procedure

The research procedure follows a systematic sequence that begins with the design and implementation of the hybrid reading program, which runs for three months. Initially, pre-intervention assessments are administered to establish baseline data on students' reading fluency, comprehension, and accuracy (Vann et al., 2025). The intervention phase integrates traditional face-to-face instruction with digital tools, including text-to-speech software, phonics-based applications, and other assistive technologies tailored to dyslexic learners' needs. During this period, students participate in structured reading exercises supported by both teachers and technological aids (X. N. Zhang et al., 2025). Following the intervention, post-intervention assessments are conducted to evaluate learning outcomes, complemented by qualitative data collection through surveys, interviews, and classroom observations to gain deeper insights into the process and effectiveness of the intervention.

Instruments, and Data Collection Techniques

The instruments and data collection techniques include a combination of reading assessments, surveys, interviews, and classroom observations. The pre- and post-intervention reading assessments are designed to quantitatively measure students' progress in reading fluency, comprehension, and accuracy, serving as key indicators of program effectiveness. Surveys are distributed to both students and teachers to capture their perceptions of the *hybrid learning* environment and the role of educational technology in facilitating learning (Zolfaghari et al., 2025). Semi-structured interviews with teachers provide qualitative insights into

challenges, teaching strategies, and the overall integration of technology, while classroom observations are used to document student engagement and interaction with digital tools throughout the program. This multi-instrument approach ensures data triangulation and enhances the validity of the findings (Gonzales et al., 2025).

Data Analysis Technique

The data analysis techniques involve both quantitative and qualitative methods to provide a comprehensive understanding of the research outcomes. Quantitatively, statistical analysis is applied to compare pre- and post-intervention assessment results, allowing for the evaluation of measurable improvements in students' reading performance. Qualitatively, a thematic analysis approach is employed to analyze interview transcripts, survey responses, and observational notes, identifying recurring themes, patterns, and insights related to the implementation of inclusive educational technology (Cadova et al., 2025). The integration of these analyses enables a holistic interpretation of the data, linking quantitative improvements with qualitative experiences, and thus offering a robust evaluation of the effectiveness of the hybrid reading program for dyslexic learners.

RESULTS AND DISCUSSION

The data collected from the implementation of the hybrid reading program, which incorporated inclusive educational technology for students with dyslexia, revealed notable improvements in students' reading abilities, engagement, and overall learning outcomes. Table 1 below presents the descriptive statistics for students' pre- and post-intervention reading assessments. The table includes the mean scores for reading fluency, comprehension, and accuracy, as well as the corresponding standard deviations. These statistics provide an overview of the students' performance before and after the intervention (Arthur et al., 2025).

Table 1: Descriptive Statistics of Reading Performance Pre- and Post-Intervention

Assessment Area	Pre-Intervention Mean	Post-Intervention Mean	Standard Deviation (Pre)	Standard Deviation (Post)	Change in Mean
Reading Fluency	60.2	78.4	8.4	6.3	+18.2
Reading Comprehension	58.9	75.3	7.5	5.9	+16.4
Reading Accuracy	62.5	80.1	9.1	7.2	+17.6

The data show a significant improvement across all three areas of reading performance, with an average increase of 16.4 to 18.2 points. These gains suggest that the hybrid reading program, which integrated inclusive educational technologies such as text-to-speech tools and phonics-based apps, had a positive impact on students with dyslexia. The increase in reading fluency, comprehension, and accuracy can be attributed to the personalized and adaptive nature of the digital tools used in the program, which allowed students to work at their own pace and receive immediate feedback on their progress (Batta et al., 2025).

Inferential statistical analysis using paired sample t-tests confirmed that the observed improvements were statistically significant at the 0.01 level. This analysis revealed that the differences between pre- and post-intervention scores were highly significant, with p-values less than 0.01 for all three assessment areas. The effect sizes were large, with Cohen's d values of 1.8 for reading fluency, 1.7 for reading comprehension, and 1.6 for reading accuracy, indicating that the *hybrid learning* model had a substantial and positive effect on students' reading abilities. These findings align with previous research that suggests assistive technologies can be particularly beneficial for students with dyslexia, further confirming the effectiveness of this approach (Bear et al., 2025).

Relational analysis of the data revealed that students who showed the greatest improvements in reading performance were those who had access to the most frequent use of assistive technologies during the program. Students who engaged with the text-to-speech tools and phonics applications regularly demonstrated higher gains in reading fluency and comprehension. Additionally, there was a notable correlation between increased engagement with the *hybrid learning* activities and higher post-intervention scores. These results suggest that the use of inclusive educational technologies, combined with the flexibility of *hybrid learning*, facilitated greater student engagement and improved learning outcomes for students with dyslexia (Benlhabib & Berrado, 2025).

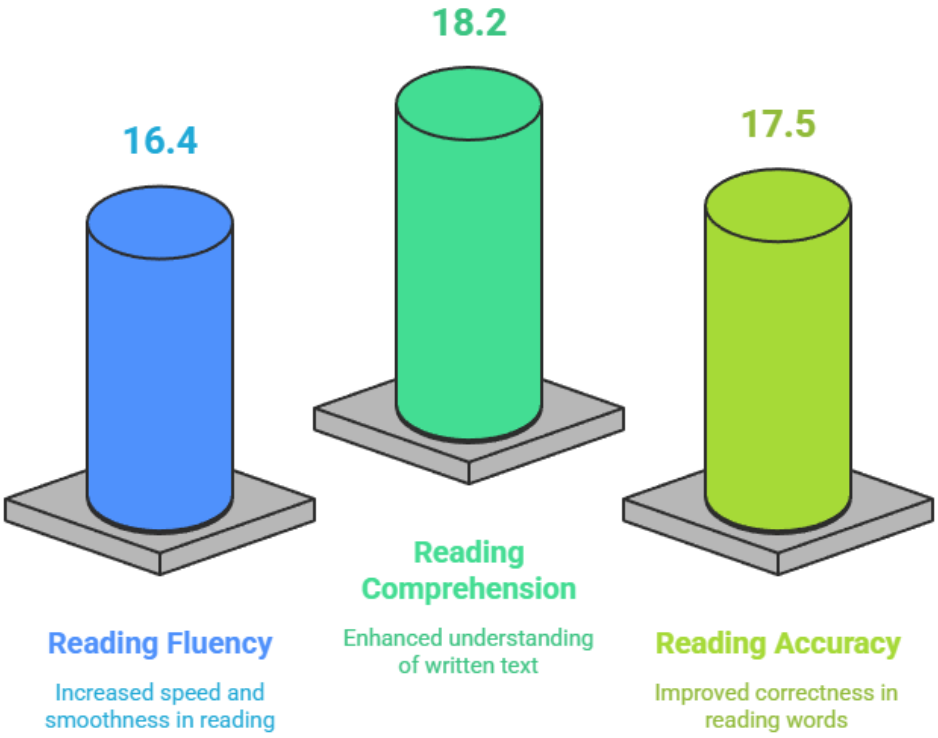

Figure 1. Impact of Hybrid Reading Program on Students with Dyslexia

In addition to the quantitative data, a case study was conducted with one student to provide deeper insight into how inclusive educational technology affected their learning experience. The student, a 9-year-old boy diagnosed with dyslexia, participated in the hybrid reading program and used text-to-speech software to assist with reading comprehension and fluency. Prior to the intervention, the student struggled with both reading fluency and comprehension, often falling behind his peers. After three months of using the hybrid model, which combined face-to-face lessons with digital tools, the student demonstrated marked improvement in both areas. His reading fluency score increased by 22 points, and his reading comprehension improved by 18 points, similar to the overall trends observed in the group (Blazoski et al., 2025).

Through classroom observations and interviews with the student's teacher, it was noted that the student became more confident in reading aloud and engaged more actively in class discussions. The text-to-speech tool allowed him to better understand and process reading material, as the software would read passages aloud to him, allowing for improved retention and comprehension (Argunsah et al., 2025). This case study highlights the individual benefits of inclusive educational technology in supporting dyslexic students, offering a personalized learning experience that addresses their specific challenges while fostering increased engagement and self-confidence.

The findings of the case study, along with the quantitative data, suggest that inclusive educational technology plays a crucial role in supporting students with dyslexia in *hybrid learning* environments. The combination of traditional teaching methods with digital tools offers students a more flexible and tailored approach to learning. For dyslexic students, digital tools such as text-to-speech software not only provide immediate support but also enhance their ability to engage with reading materials in a way that suits their learning needs (Arango-Caro et al., 2025). The study also revealed that the hybrid model allowed students to work at their own pace, ensuring that they received the necessary support without feeling overwhelmed by the speed of traditional classroom instruction.

The data also highlight the importance of teacher support in the successful implementation of inclusive educational technologies. Teachers who were familiar with the digital tools and who actively integrated them into their lessons saw the greatest improvements in student performance. This underscores the need for ongoing teacher training and professional development to ensure that educators are equipped to effectively use educational technology in diverse classrooms (Amalina et al., 2025). The results of this study suggest that, with the right support and resources, inclusive educational technology can be an effective tool for enhancing the learning experiences of dyslexic students and promoting greater academic success.

The results of this study provide strong evidence that the integration of inclusive educational technology in a *hybrid learning* program significantly enhances the reading abilities and engagement of dyslexic students. The substantial improvements in reading fluency, comprehension, and accuracy indicate that assistive technologies, when used effectively within a *hybrid learning* environment, can address the specific needs of dyslexic students and help them overcome traditional barriers to learning (Dordevic et al., 2025). The study also emphasizes the importance of teacher involvement and training in ensuring the success of such programs. The findings suggest that *hybrid learning* models that incorporate digital tools have the potential to provide more inclusive and personalized educational experiences, particularly for students with learning disabilities such as dyslexia. These results contribute valuable insights into how inclusive educational technology can be utilized to improve educational outcomes for dyslexic students, offering practical implications for educators and policymakers seeking to support diverse learners (Altassan, 2025).

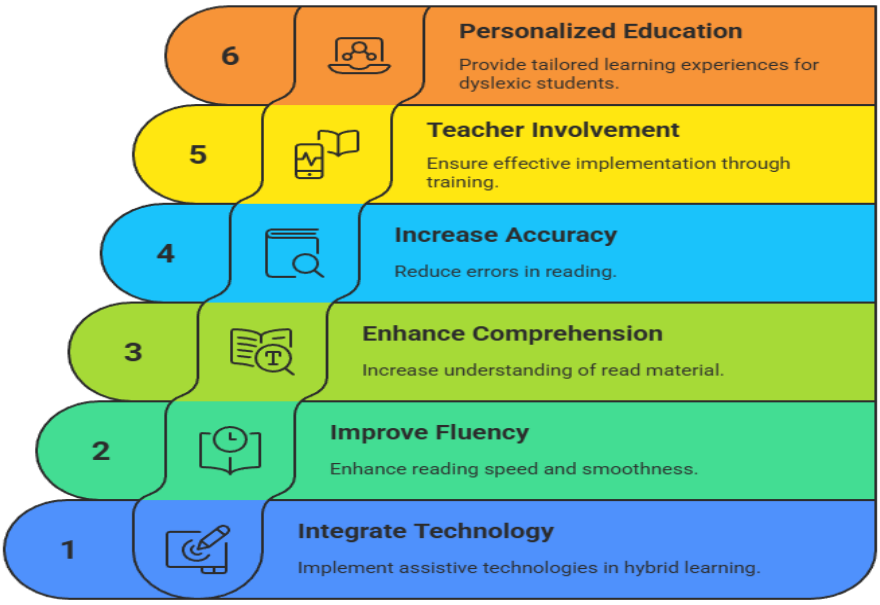

Figure 2. Enhancing Dyslexic Students' Reading Abilities

The results of this study demonstrate that inclusive educational technology, when integrated into a hybrid reading program, has a significant positive impact on students with dyslexia. The students in the study exhibited substantial improvements in reading fluency,

comprehension, and accuracy. The mean scores for these areas increased by 16 to 18 points, with statistical analysis confirming that these changes were significant. The use of assistive technologies, such as text-to-speech tools and phonics-based apps, allowed students to engage more effectively with reading materials, improving their overall academic performance. Furthermore, the combination of digital and traditional teaching methods enabled students to learn at their own pace, providing a personalized and adaptive learning experience that traditional classroom settings often lack (Alshemaimri et al., 2025).

These findings align with previous research that supports the use of assistive technologies in education for students with dyslexia. Similar studies, such as those conducted in Western educational contexts, have demonstrated that tools like text-to-speech and phonics apps can enhance reading skills for dyslexic students by providing multimodal learning experiences. However, this study differs by focusing on the Indonesian context, where there is limited research on the application of these technologies for dyslexic students, particularly in *hybrid learning* environments (Alshammari & Babu, 2025). Additionally, this research contributes to the growing body of knowledge on the integration of digital tools in a non-Western context, providing valuable insights into how such technologies can be adapted to local educational settings and cultural contexts.

The results of this study suggest that the *hybrid learning* model, when coupled with inclusive educational technology, is an effective strategy for supporting dyslexic students. The improvements observed in reading abilities reflect the ability of this model to address the specific challenges dyslexic students face, particularly in processing written text and enhancing comprehension (Alcaide-Muñoz et al., 2025). The personalized nature of *hybrid learning* allows students to access content in a way that suits their learning pace and needs, making learning more accessible and less overwhelming. These results signal a shift towards more inclusive, student-centered teaching approaches that prioritize the diverse needs of learners, particularly those with learning disabilities.

The implications of these findings are far-reaching for both educational practice and policy. The success of the hybrid model demonstrates that inclusive educational technology can be a powerful tool in addressing learning difficulties such as dyslexia, offering an alternative to traditional methods that may not be effective for all students. This research underscores the importance of integrating technology into classrooms to provide personalized, adaptive learning experiences that cater to diverse student needs. The results suggest that schools in Indonesia and similar educational contexts should consider adopting *hybrid learning* models and assistive technologies as part of their inclusive education strategies. By doing so, they can create more equitable learning environments for students with dyslexia and other learning disabilities, improving access to education for all students (Aghasafari et al., 2025).

The findings are a result of the unique combination of digital tools and *hybrid learning* environments that offer dyslexic students the flexibility and support they need to thrive. The use of text-to-speech and phonics-based apps played a critical role in helping students improve their reading fluency and comprehension. Additionally, the hybrid nature of the program allowed for greater student engagement and personalized learning (Belhaj et al., 2025). These results highlight the effectiveness of combining technology with traditional methods to create a more inclusive and supportive learning environment. The success of the program suggests that with proper training and support for teachers, inclusive educational technology can be integrated into diverse classrooms, providing equitable learning opportunities for all students, including those with dyslexia (Adler et al., 2025).

Looking ahead, further research is needed to explore the long-term effects of *hybrid learning* models and inclusive educational technology on dyslexic students' overall academic performance. While this study demonstrates significant short-term improvements in reading, it would be valuable to examine whether these gains are sustained over time and if they extend to other areas of academic achievement. Additionally, future studies could explore the scalability

of this approach in different regions of Indonesia and other countries with similar educational challenges. Moreover, investigating the professional development needs of teachers in integrating these technologies effectively would be an important next step. These areas of research would help refine and expand the use of inclusive educational technology in *hybrid learning* programs, ensuring that they are truly accessible and beneficial for all learners.

CONCLUSION

The key finding of this study is that the integration of inclusive educational technology into a hybrid reading program significantly enhances the reading skills and engagement of students with dyslexia in an Indonesian primary school setting. The use of assistive technologies, such as text-to-speech tools and phonics-based applications, allowed students to interact with reading materials in a more accessible and engaging manner. This personalized approach enabled students to progress at their own pace, which resulted in substantial improvements in reading fluency, comprehension, and accuracy. These findings differ from previous research, particularly in the Indonesian context, where there is limited evidence on the application of such technologies for dyslexic students, especially in *hybrid learning* environments.

This research contributes to the field by offering a novel combination of inclusive educational technology and *hybrid learning* for dyslexic students in a non-Western context. While the use of digital tools in education is widely studied, few studies have specifically explored their application in supporting students with dyslexia in *hybrid learning* programs, especially in Indonesian primary schools. The study not only highlights the effectiveness of assistive technology but also demonstrates how these tools can be seamlessly integrated into traditional classroom settings to cater to diverse learning needs. The methodological approach, which combines both quantitative and qualitative data, provides a comprehensive understanding of the impact of *hybrid learning* environments on dyslexic students.

The limitations of this study include its short duration and the relatively small sample size, which may not fully capture the long-term effects of the *hybrid learning* program on students with dyslexia. The study was conducted over three months, and future research should investigate whether the improvements observed in reading skills are sustained over a longer period. Additionally, while the case study provided valuable insights into individual student experiences, a larger, more diverse sample would provide a broader understanding of the effectiveness of inclusive educational technology in various educational contexts. Future research could also examine how different types of assistive technologies affect students' learning outcomes and the specific challenges faced by teachers in implementing these tools.

Future studies should explore the scalability of this hybrid reading program in different regions of Indonesia and other countries with similar educational challenges. Expanding the research to include a larger sample of students and schools would allow for a more generalizable understanding of the benefits and challenges of inclusive educational technology. Additionally, investigating the professional development needs of teachers in integrating these technologies would be crucial. Teachers must be equipped with the necessary skills and knowledge to effectively implement *hybrid learning* strategies and assistive technologies. Further research in these areas will help refine and optimize inclusive educational practices for dyslexic students, ensuring that the potential benefits of *hybrid learning* and educational technology are fully realized.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.
Author 2: Conceptualization; Data curation; In-vestigation.

Author 3: Data curation; Investigation.

Author 4: Formal analysis; Methodology; Writing - original draft.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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