

TECHNOLOGY-ASSISTED READING INTERVENTIONS FOR STUDENTS WITH DYSLEXIA: DESCRIPTIVE QUALITATIVE RESEARCH

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Abstract

This study explores the impact of technology-assisted reading interventions on students with dyslexia, focusing on their reading skills and learning experiences. Given the estimated 10-15% prevalence of dyslexia among school children globally, this research is particularly relevant for Indonesia, where approximately 5 million students are affected. The study employed a qualitative descriptive approach, collecting data through in-depth interviews with students and teachers at Diponegoro Junior High School Batu, East Java. Technology used in the interventions included educational smartphones, Calis (Baca-Tulis) modules displayed via LCDs or projectors, and reading applications in Indonesian and English installed on mobile devices. The findings reveal that with proper support from school and family environments, technology can significantly enhance the reading abilities and confidence of students with dyslexia. However, integrating technology into traditional curricula remains challenging, with concerns about potential gadget addiction and reliance on conventional teaching methods. The study underscores the importance of collaboration between teachers, students, and parents to optimize the benefits of technology in inclusive education. It recommends further research on the effectiveness of interactive multimedia tools and the development of adaptive, technology-based educational strategies to create a more inclusive learning environment for dyslexic students.

Key words: Dyslexia, Reading Intervention, Educational Technology

INTRODUCTION

Based on a report by the Dyslexia Association of Indonesia (DAI), revealed that the prevalence of dyslexia among school children throughout the world ranges from 10 to 15 percent. Taking into account the number of school children in Indonesia which reaches around 50 million, it can be concluded that around 5 million of them are estimated to have dyslexia. This research provide understanding of the impact of dyslexia in the educational context in Indonesia, and provide a strong basis to support the implementation of inclusive education strategies for children who face the challenges of dyslexia. This condition affects individuals regardless of age, both children and adults.

Dyslexia is a type of learning challenge, especially language, caused by neurological factors. Apart from difficulty in arranging or reading words in the correct order (called reverse reading), people with dyslexia can also arrange or read words from top to bottom, left to right. Additionally, they face challenges in retaining and retaining instructions in their memory. Unfortunately, this

often leads to the misunderstanding that dyslexic sufferers have difficulty concentrating, are easily distracted, and have difficulty maintaining focus.

Technology-assisted reading interventions represent a contemporary and potentially transformative approach to addressing the complexities associated with dyslexia. By utilizing digital tools, multimedia resources and interactive platforms, this intervention aims to create a more inclusive and engaging learning environment. However, the effectiveness and differences of these interventions have not yet been explored, requiring comprehensive investigation into their impact on the reading skills and experiences of students dealing with dyslexia.

The previous investigation centered on the creation and assessment of interactive multimedia specifically designed for young students with dyslexia at an inclusive elementary school in Malang. This study aim to evaluate the practicality and efficacy of interactive multimedia in improving pre-reading skills for students with dyslexia. The development model encompasses assessment/ analysis, design, development, perpetration, and evaluation. Results from media experts' confirmation and field trials indicate the multimedia's validity and felicity for enhancing pre-reading chops in dyslexia scholar. The study also highlights the need for further development to address the coming reading stage and consider the specific characteristics and conditions of scholars with special requirements (Sari et al., 2021).

In another study methodical mapping study system was employed to explore exploration trends and give an overview of educational interventions for primary academy scholars with dyslexia. The study aimed to identify the volume and type of exploration and results available within this area, assaying 57 studies published from 2015 to 2019. The exploration questions concentrated on the types of educational interventions proposed for scholars with dyslexia, the addition of ICT in interventions, and the end of the interventions. The study used a 10- step methodical mapping process, performed in the selection of 57 applicable papers. The bracket scheme included orders related to exploration design, educational interventions, addition of ICT in the intervention, and the end of the educational intervention. The analysis revealed an adding trend in the publication of papers in this area, with uneven representation among countries. Utmost interventions were structured language- grounded programs, with some use of ICT. The results also indicated a need for further substantiation for complex experimental designs as well as classroom tutoring interventions, along with interventions targeting pitch modulation for students with dyslexia (Skočić Mihić et al., 2022).

Other study surveyed 342 pre-service preceptors in an English department at a state university in Indonesia to understand their use of mobile bias for English language literacy. The maturity of replies was womanish (77.5) and possessed mobile bias (100). utmost scholars (64) had

been using mobile bias for more than 2 times for English literacy. The questionnaire used in the study was grounded on the UTAUT (Unified Theory of Acceptance and Use of Technology) model and former literature, and validity was assured through expert judgment and content validity assessment. The data was anatomized using SmartPLS3, and the results showed that the dimension model had acceptable trust-ability, coincident validity, and discriminant validity. The structural model supported all suppositions except for the relationship between gender and the primary constructs. Overall, the study handed perceptive into using mobile bias for English literacy among pre-service preceptors. The study set up that performance expectation, trouble expectation, social influence, and easing conditions are important factors affecting behavioral intention to use mobile technologies. Gender did not significantly moderate these influences. The study also set up that behavioral intention has a significant influence on the operation geste of mobile technologies in learning English. The study suggests that understanding these factors could ameliorate the quality of English literacy and encourage the integration of mobile- supported language literacy as an innovative approach in English language tutoring. The study acknowledges limitations and suggests unborn exploration to dissect the results and encourage pre-service preceptors' operation of mobile bias for learning English. (Arif et al., 2022)

Another study investigated the combined impact of Peer Assisted Instruction (PAI) and iPad Assisted Instruction (IAI) on the oral reading fluency of 5th grade students with learning disabilities. This study, using a multiple baseline design, focused on four participants identified as having learning disabilities to read. This intervention demonstrated an important and positive impact on students' oral reading fluency, as evidenced by statistically significant improvements. Various assessment methods, including visual analysis, effect size calculations, and measures of reliability, maintainability, inter-rater agreement, fidelity of implementation, and social validity, were used to evaluate the effectiveness of the intervention comprehensively notably, students expressed positive feedback regarding their experiences, particularly highlighting the efficacy of iPad-assisted teaching. Collective findings suggest that a combined PAI and IAI approach promises the significant improvements in oral reading fluency for students with learning disabilities. (Mize et al., 2019)

This research is motivated by exploration conducted by Sari et al (2021). They concluded that Interactive multimedia designed for the early reading stage in their study promises further development, especially considering ongoing technological advances. Based on the insights gained from this research and development process, there is potential to improve multimedia by including content for the next stage.

Based on the background of the study the researcher writes the research question as follow:

1. How do technology-assisted reading interventions impact the reading skills and experiences of students with dyslexia?
2. How do students with dyslexia express their preferences and perspectives regarding the design and usability of technology tools used in reading interventions?
3. How does this impact their overall experiences and outcomes?

METHOD

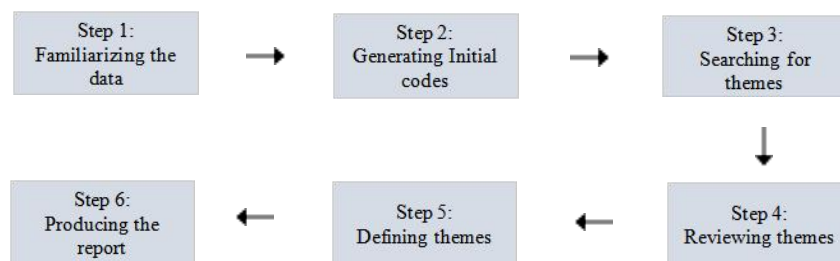
This chapter provides a detailed overview of the research methodology used in this study, including research design, participants, data collection, data analysis, and data reliability. This study uses a qualitative descriptive design as explained by Moleong (2010:6). This approach is ideal for exploring complex phenomena such as individual experiences, behaviors, perceptions, and motivations. Qualitative descriptive research seeks to offer a comprehensive and nuanced understanding of these aspects without relying on numerical data. In this context, this study aims to investigate how technology-assisted reading interventions impact students with dyslexia by examining their experiences and perspectives in detail. The focus is on how these technological tools can improve reading skills among students with dyslexia, particularly in the context of English language learning.

The study was conducted at Diponegoro Junior High School in Batu, East Java, an inclusive institution chosen for its strong support for students with diverse needs, including dyslexic people. The choice of location is crucial, as inclusive practices in schools provide a rich environment to test the effectiveness of assistive technologies. Participants in this study included dyslexic students and their teachers, allowing for a comprehensive exploration of how technology impacts the learning process from various perspectives. The aim is to assess the practical benefits and challenges associated with the use of assistive technology in an educational environment that supports a wide range of student needs.

Data collection was carried out by conducting in-depth interviews with students with dyslexia and their teachers. This interview is designed to capture a detailed explanation of their experiences and perspectives regarding the use of technology to support the development of reading. The qualitative descriptive method allows researchers to collect rich and contextual data that highlights the real-world application of technology in reading instruction. This approach allows for a thorough examination of how the technology can be used to support students with dyslexia and what obstacles may arise during its implementation.

Data analysis was carried out with a thematic analysis approach adapted from Braun & Clarke (2006). This analysis involves six main steps: familiarizing yourself with the data, generating the initial code, searching for themes, reviewing themes, defining and naming themes, and creating a final report. Each step is carefully executed to ensure comprehensive and systematic data analysis. This process provides insight into how assistive technology interventions can improve reading skills and identify the strengths and limitations of these tools. This study underscores the need for a different understanding of how technology tools are used in practice and highlights the importance of collaboration between educators, students, and families to optimize the benefits of assistive technology in inclusive education.

Figure 1. The flowchart of thematic analysis



The result of the six procedures of thematic analysis, the researcher finds four points of experience and perspective about students and teachers, the overall results as below:

Table 1. The report of thematic analysis

No	Open coding	Axial coding	Selective coding
1	Individual, Learning, Experience, Technology-assisted, Dyslexia students, Improving, Reading intervention	1. Individual learning experiences through technology for students with dyslexia. 2. Improving students reading skills through technology-assisted reading intervention.	Students Experience in Using Technology

2	Students, Involvement, Learning, Motivation	1. Students involvement in reading with technology-assisted . 2. Improved student learning motivation through the use of technology in reading intervention.	Teachers Experience in Using Technology
3.	Benefits, Individualized support	1. The Benefits of technology in reading for dyslexia students. 2. Individualized support in technology-based reading interventions.	Students Perspective in Using Technology
4..	Teachers role model, Supporting, Creation, Supportive learning environment	1. Teacher role model in supporting the use of technology in learning. 2. Creation of a supportive learning environment through technology.	Teachers Perspective in Using Technology

FINDINGS

1.1 Students Experience in Using Technology

The first findings began with students experience in using technology. Student 1 shared his very inspiring experience after using assistive technology to read. She felt a significant change in his reading ability and comprehension of the material. Previously, Student 1 often felt frustrated and lacked confidence everytime she faced a reading task. Each page of the book felt like a mountain to climb, and often he felt hopeless before reaching the top. However, with the help of technology, he began to feel a noticeable difference. This technology provides tools that allow him to crack difficult words, understand context, and enjoy the learning process without fear. She also emphasized the importance of support from the school environment and family in the learning process.

"With the help of technology, I can learn in a way that is more suitable for me. I no longer feel pressured, and this makes it easier for me to learn. Now, I can read more fluently and understand the material better. I feel more confident and ready to face other learning challenges. The support from my teachers and family is very meaningful. They are always there for me, giving me the encouragement and confidence I need".

Student 2 also explained her hope that more students can experience the benefits of this assistive technology. She feels that this technology has changed how she learns and gives him new hope. She also added that the support provided through guided exercises has greatly helped her overcome reading challenges. These exercises are designed to suit each student's level of ability and needs, allowing them to learn in the most effective way for them. A non-judgmental learning environment is also an important factor in the success of Student 2. She feels that this technology creates a safe and comfortable space for him to explore his reading skills without fear of mistakes or criticism.

"I hope that all students who are experiencing difficulties like me can have access to this technology. It has completely changed the way I learn and given me new hope for the future. The exercises in the app helped me understand difficult words and sentences. I can learn on my own without feeling rushed or pressured. In this app, I can learn from mistakes without feeling embarrassed or afraid. This makes me more confident to keep trying and developing".

1.2 Teachers Experience in Using Technology

The second findings is teachers experience in using technology. The accompanying teacher of dyslexic students explained that although technologies such as iPads and learning apps have been introduced, their use is still limited in daily practice. Time and schedule constraints are one of the main obstacles in the intensive use of technology. She also expressed concern about the potential for gadget addiction, which is the main reason for limiting the use of technology in the classroom.

"Usually I read the material to the students, because there is no special media used. If the child can understand when it is read, I read it. But if they can only copy and don't understand the meaning, I still use the traditional way. Its use is not effective continuously because of schedule constraints and time constraints. Sometimes if there is more time, the technology can be used, but it is not intensive. They like to use technology, but I don't get used to it, I'm afraid that if they get used to it, they will keep asking for it".

Teacher 2 has in-depth experience in using technology to support dyslexic students in reading. She explained started the process with initial motivation to build students' interest before introducing technology. Teacher 2 also utilizes visual-based technology, such as images, to support student learning. In addition, she balances the use of technology with traditional methods by arranging the right time allocation for each method, to ensure that students are not too dependent on technology and remain independent in learning. In terms of assessment, teacher 2 is aware of the challenges. Teacher 2 also gave simple rewards such as stamps to students who showed progress.

"I usually motivate them first before introducing technology, in the hope that they can read English better. I often show short stories that are tailored to the minimum competencies that must be achieved. After that, they observe and try to understand, then imitate and read. I do this over and over again. Because they are still in the early stages of knowing writing and have special barriers, I use visual media, especially images. These pictures caught their attention, which then motivated them to learn better. The progress of dyslexic students is indeed difficult to measure precisely, because it depends on their psychological condition. However, any improvement, even if it is small, I consider it a significant progress. Although it is simple, it motivates them a lot. They even often ask, 'Maam, I haven't got a stamp today,' which shows how important this recognition is to them".

1.3 Students Perspective in Using Technology

In the perspective of Student 1, assisted-technology for reading has brought about a very significant change. This technology allows Student 1 to learn at his own pace and learning style, providing much-needed individualized support to overcome reading challenges that previously interfered with his or her learning process. Student 1 felt a great improvement in his ability to read and understand the material, as well as overcome the frustration and lack of confidence that he had often experienced before. Student 1 also emphasized the importance of support from the school environment and family, revealing that her success is not only thanks to technology, but also because of the motivation and encouragement from her teachers and family. Student Experience 1 shows that technology not only helps in improving reading skills but also has a positive impact on students' emotional well-being. She feels more motivated and eager to learn, which has a positive impact on her academic performance. His story is a vivid example that technology can be an effective tool in supporting dyslexic students to reach their full potential.

"With the help of technology, I can learn in a way that works better for me. I no longer feel pressured, and this makes it easier for me to learn. Now, I can read more fluently and understand the material better. I feel more confident and ready to face other learning challenges. The support from my teachers and family is very meaningful. They are always there for me, giving me the encouragement and confidence I need".

Student 2 shared a positive perspective that was also very inspiring regarding the use of assistive technology for reading. She feels that the interactive elements in the learning application make the learning process more fun and less boring. This technology changed his outlook on learning, making it more lively and dynamic. Student 2 also noted that the guided exercises in the app helped him overcome his reading challenges in a way that was appropriate to his ability level. The non-judgmental learning environment in the app also plays an important role in boosting his confidence

"Games and interactions within the app make me more motivated to learn. It feels like playing, not learning. Every time I open the app, I feel like I'm entering a new world that makes me more excited to learn. The exercises in the app really helped me understand difficult words and sentences. I can learn on my own without feeling rushed or pressure. In this application, I can try and learn from mistakes without feeling embarrassed or afraid. This makes me more confident to keep trying and developing".

1.4 Teachers Perspectives in Using Technology

The accompanying teacher of dyslexic students at Diponegoro Junior High School have the view that although technology offers a lot of potential, traditional approaches are still more dominant in accompanying dyslexic students. This reflects the prudence of teachers in integrating technology, keeping in mind parents' concerns and the risk of gadget addiction among students. In addition, the accompanying teacher admitted that the technology used has not had a significant impact because its use has not been intensive. However, the teacher also recognizes the importance of innovations in educational technology that are more effective and user-friendly to support dyslexic students. The teacher also highlighted the need for stronger collaboration with parents and specialists to optimize student learning outcomes.

"They like to use technology, but I don't get used to it, I'm afraid that if they get used to it, they will keep asking for it. Because most of the time, I have to use the book, so I use the old way, not

technology. So yes, they do, sometimes maybe because the book is so boring, not to the point of being addicted to that. Actually, it's like a speed reading application is good, it's just that sometimes children of junior high school age are lazy. Collaboration with other teachers does exist, but for cooperation with specialists, it does not exist yet".

English teacher at Diponegoro Junior High School also has an in-depth view of the use of technology. From She's perspective, there are several important aspects related to the use of technology in reading interventions for dyslexic students. She realized that training related to technology-based reading interventions was still limited. The limitations of this training indicate the need for further development in this field to improve the effectiveness of technology in learning. She also sees the importance of balancing technology and traditional methods in teaching. This perspective demonstrates his understanding of the importance of avoiding over-reliance on technology and ensuring students remain self-reliant in self-study skills. Overall, She has a mindful view of the use of technology in supporting dyslexic students. She emphasized that recognition and reward for students' progress, while simple, have a major impact on their motivation. She approach and perspective demonstrate a commitment and creativity in using technology effectively for reading interventions.

"Training for technology-based reading interventions is still minimal, especially for my field of study. However, for children with special needs, continuous training is still very necessary. I set the time allocation for when they should use technological tools and when to use traditional methods. This is important so that they are not too dependent on technology and can still be independent in learning. Although it is simple, it motivates them a lot".

Overall, these findings underscore the transformative potential of technology in supporting dyslexic students, while also highlighting the importance of a supportive and collaborative educational environment.

DISCUSSION

This research highlights that technology-assisted reading interventions significantly enhance the learning experiences of these students, leading to improvements in their reading skills, motivation, and overall confidence. Through interviews with educators and students, it became evident that personalized and adaptive learning tools, such as text-to-speech software and

interactive reading applications, play a crucial role in addressing the unique challenges faced by dyslexic learners.

2.1 Students Experience in Using Technology

This study shows that students experience the use of technology in learning as a very positive experience. They realize that technology has opened up many resources and opportunities for them to explore and expand their knowledge beyond the traditional classroom environment. The use of technology in reading interventions for dyslexic students provides significant benefits. The results of interviews with teachers and accompanying teachers of students with special needs showed an improvement in students' reading skills, learning motivation, and confidence after implementing technology in learning. In line with the findings of Smith & Johnson (2018), visual-based and user-friendly technology can help dyslexic students understand texts and improve their reading skills. Interactive and multimedia technology features make learning more exiting and in-depth, sparking curiosity and creativity among students. In addition to improving academic performance, technology also enhances student engagement, motivation, collaboration, and overall learning experience. In addition, the results of the data analysis also show that technology-assisted reading interventions have been proven to be effective in improving the reading skills of dyslexic students, in line with the findings of Black & White (2019) which highlighted the improvement of reading skills of dyslexic students through the application of technology.

2.2 Teachers Experience in Using Technology

In this study, teachers experienced a positive impact from using technology in learning. In a reading intervention study for dyslexic students, teachers and accompanying teachers of students with special needs reported improvements in students' reading skills, learning motivation, and confidence after implementing technology in learning. Teachers realize that visual-based and user-friendly technology can help dyslexic students understand texts and improve their reading skills. The integration of technology in reading learning also provides teachers with effective tools to create a supportive and personalized learning environment for students. In another study examining teachers' experiences in using technology in regular classrooms, it was found that teachers experienced improvements in teaching efficiency and student engagement. Teachers use various technological tools, such as interactive whiteboards, learning apps, and mobile devices to enrich the subject matter. The results of the study show that technology helps simplify the teaching process, allows for instruction differentiation, and provides a variety of resources that can be accessed by students at any time (Smith et al., 2022). However, in reading intervention research for dyslexic

students, technology focuses on tools that help understand texts and reading skills, whereas in regular classrooms, technology is used more widely for various subjects (Johnson & Brown, 2023).

2.3 Students Perspective in Using Technology

From a student's point of view, the use of technology in learning creates a dynamic and interactive learning environment. They appreciate interactive elements such as multimedia resources and interactive exercises that make learning more fun and dynamic. Students feel that technology allow them to control their learning pace and style, so they can tailor the learning experience according to their individual needs and preferences. With technology, students feel empowered to overcome challenges and achieve academic success in learning. Students also appreciate the interactive elements that are integrated into the intervention, such as multimedia resources, gamification elements, and interactive exercises. These components not only make learning more fun and dynamic but also improve their understanding and retention of reading materials. The interactive nature of these tools encourages active participation and stimulates their cognitive engagement, which is an important factor in improving overall reading skills. Another study focusing on the use of technology in inclusive education found that technology plays a key role in creating inclusive and collaborative learning environments. Students with various special needs report that technology helps them feel more engaged and supported in learning. Adaptive technology tools allow them to learn in a way that suits their individual needs (Garcia & Martinez, 2020). Technology will enable them to access information quickly, interact with subject matter through various media, and get quick feedback from teachers and automated evaluation tools. Students feel more motivated and interested in lessons when technology is used effectively in the classroom (Clark, 2021).

2.4 Teachers Perspective in Using Technology

From a teacher's perspective, using technology in learning provides them with effective tools to create a collaborative, inclusive, and adaptive learning environment. Teachers realize that technology can significantly improve dyslexic students' reading skills, learning motivation, and student engagement. They also recognize that the collaborative aspect of technology enriches students' learning experience and enhances their communication and teamwork skills. With technology, teachers can provide a more adaptive and student-oriented approach to learning, creating a more effective, enjoyable, and inclusive learning experience for them. The use of technology in reading interventions for dyslexic students has been shown to provide significant benefits in improving reading skills, learning motivation, and student engagement. These findings

provide a strong basis for recommending the integration of technology in the learning of dyslexic students, thereby creating a more effective, enjoyable, and inclusive learning experience for them. This research makes an important contribution to strengthening the understanding of the benefits of technology in reading interventions for dyslexic students, as well as providing a foundation for developing more adaptive and student-oriented learning programs in the future. Another study focusing on the use of technology in inclusive education found that technology helps teachers create a more inclusive and supportive learning environment. Teachers report that technology allows them to provide better support to students with a variety of special needs, including dyslexia (Garcia & Martinez, 2020). In inclusive education, technology helps teachers provide better support to students with various disabilities, while in dyslexia interventions, technology is specifically designed to help students with reading difficulties, providing more targeted and personalized support (Harris, 2020).

Moreover, the findings emphasize the importance of aligning technology with the preferences and experiences of students to ensure its effectiveness. Students reported feeling more engaged and less anxious when using technology, as it provided a non-judgmental environment that encouraged them to learn from their mistakes without fear of embarrassment. However, the study also identified challenges in fully integrating technology into traditional educational practices, primarily due to a reliance on conventional methods and concerns from parents regarding gadget addiction. This underscores the necessity for a balanced approach that combines both traditional and technological methods to create a supportive learning atmosphere.

Overall, the discussion in this chapter reinforces the need for collaboration among educators, parents, and technology developers to foster an inclusive educational environment that effectively meets the diverse needs of dyslexic students. By addressing these challenges and leveraging the potential of technology, educators can significantly enhance the educational outcomes for students with dyslexia, paving the way for more equitable learning opportunities.

CONCLUSION AND IMPLICATION

The research has provided valuable insights into the transformative impact of technology on the educational experiences of dyslexic students. Through in-depth interviews with educators and students, it has been established that technology-assisted reading interventions can significantly enhance reading skills, motivation, and confidence among dyslexic learners. The findings indicate that personalized and adaptive learning methods facilitated by technology are crucial for addressing the unique challenges faced by these students.

The implications of this study are multifaceted. Firstly, it underscores the necessity for educators to integrate technology into their teaching practices to create a more inclusive learning environment. By utilizing tools such as text-to-speech software and interactive reading applications, teachers can better support dyslexic students in their reading development . Furthermore, the study highlights the importance of professional development for educators, ensuring they are equipped with the knowledge and skills to effectively implement these technologies in the classroom . Additionally, the research advocates for collaboration between educators, parents, and assistive technology developers to foster an environment that values and supports the learning needs of dyslexic students. This collaborative approach is essential for creating tailored interventions that can lead to improved educational outcomes .

In conclusion, this study contributes to the ongoing discourse on inclusive education and the effective use of technology in supporting diverse learning needs. It paves the way for future research aimed at further developing technology-based educational strategies for dyslexic students, ultimately striving for equity in educational opportunities for all learners .

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