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Assistive Technology for Dyslexia Students in Elementary School

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ABSTRAK

Kemajuan teknologi memerlukan adanya kolaborasi dalam praktik pembelajaran di kelas dengan memberikan aksesibilitas untuk mengoptimalkan pembelajaran siswa. Pembelajaran di kelas hendaknya dapat mengakomodasi semua kebutuhan belajar siswa, termasuk siswa yang mengalami disleksia. Tujuan dari penelitian ini adalah untuk menganalisis kebutuhan teknologi bantu untuk inovasi pembelajaran pada salah satu siswa yang mengalami hambatan disleksia di Sekolah Dasar. Penelitian ini merupakan penelitian kualitatif, dengan menggunakan metode studi kasus. Pengumpulan data dilakukan dengan menggunakan metode wawancara, observasi, dan dokumentasi. Instrumen yang digunakan dalam mengumpulkan data antara lain: pedoman wawancara, lembar observasi, dan pedoman dokumentasi. Analisis data dilakukan secara deskriptif kualitatif. Hasil penelitian menunjukkan bahwa salah satu siswa disleksia yang saat ini duduk di bangku kelas V SD mengalami defisit fonologis dan membutuhkan media pembelajaran untuk membantunya berlatih meningkatkan kesadaran fonologis. Oleh karena itu, diperlukan media pembelajaran berbasis teknologi bantu untuk meningkatkan kualitas pendidikan bagi siswa disleksia, terutama dalam proses pelatihan untuk meningkatkan kesadaran fonologis mereka.

ABSTRACT

Technological advances require collaboration in classroom learning practices by providing accessibility to optimize student learning. Classroom learning should be able to accommodate all student learning needs, including students with dyslexia. The purpose of this study was to analyze the need for assistive technology for learning innovation in one of the students who experienced dyslexia in elementary school. This research is qualitative research, using case study method. Data was collected by using interview, observation, and documentation methods. The instruments used in collecting data include: interview guidelines, observation sheets, and documentation guidelines. Data analysis was carried out in a qualitative descriptive manner. The results showed that one of the dyslexic students who is currently in fifth grade elementary school has a phonological deficit and needs learning media to help him practice increasing phonological awareness. Therefore, assistive technology-based learning media is needed to improve the quality of education for dyslexic students, especially in the training process to increase their phonological awareness.

1. INTRODUCTION

Dyslexia is classified as a specific learning disorder. Dyslexia is difficulty in reading accuracy or ability that is inconsistent with a person's chronological age, educational opportunities or intellectual abilities. Students with proven dyslexia have adequate general cognitive abilities but show considerable difficulty in learning to read through conventional instruction (Coskun & Mitrani, 2020; Critchley, 1970). Children with dyslexia also often experience difficulties in aspects of metacognitive learning (Reid, 2011; Tunmer & Chapman, 1996). They have a state of information processing that is different from normal children which is characterized by difficulty in reading (Shaywitz et al., 2008; Tamboer & Vorst, 2015). The difficulty factor for reading dyslexic students is that there is a deficit in the phonological component of language, resulting in problems in reading comprehension (International Dyslexia Association, 2018). The main difficulty of word recognition in dyslexic children is based on a phonological coding deficit which is

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the process of translating subvocal printed units into sound (Pennington et al., 1991; Vellutino et al., 2004). Phonological factors also provide an important substrate for the decomposition of words, and other aspects of spoken language such as vocabulary and listening comprehension, which are important for reading comprehension (Oakhill et al., 2003). These findings suggest that children's oral language skills, as well as their phonological skills influence reading development (Nation & Snowling, 2004).

From the problems of dyslexic students, some students managed to learn reading and spelling assignments earlier, especially with very good teaching, but then there were some conditions that resulted in the emergence of more complex problems in dyslexic students. Problems that are often faced by students with dyslexia tend to blame themselves for their difficulties in reading. So that dyslexic children are prone to become anxious and depressed because their academic achievement is low (De Santana et al., 2012; Willcutt & Bruce, 2000). In addition, the impact of dyslexia also causes the level of self-esteem in aspects of competence and power to be low (Kusumawardana R & Rosita, 2021). In addition, poor academic, social, emotional, and self-esteem outcomes in dyslexic children can be attributed to the lack of information provided to them at diagnosis (McNulty, 2003; Terras et al., 2009).

To minimize the complexity of the problems that occur in dyslexic students, several schools provide facilities for the existence of Special Guiding Teachers or GPK (Supena et al., 2018). The task of GPK is to bridge the difficulties of children with special needs and classroom teachers in the learning process and to carry out special tasks that are not carried out by teachers in general. However, in its implementation, some special supervisory teachers do not understand the concept of preparing the Individual Learning Program (PPI), this is due to the limited time and staff of the Special Guiding Teacher (GPK), and there is still a bias in understanding the concept of inclusive education, especially in designing and implementing special program (Rosita & Suherman, 2020). In addition to GPK, classroom teachers also feel incompetent and confident in teaching students with various types of special needs (de Boer et al., 2011). Thus, this causes dyslexic students in elementary schools to be less than optimal in learning. Therefore, schools need to improve the quality of learning by developing accessibility to help dyslexic students increase their phonological awareness so as to minimize difficulties in spelling, writing, and pronouncing words. One of the accessibility is the use of assistive technology.

Assistive technology seeks to promote the quality of learning in the classroom by providing flexibility and offering relevant individual education through various methods (Alshawabkeh et al., 2021; S. Liao et al., 2018; Y.-C. Liao et al., 2021). One of which is the use of technology in the individual learning process for students with dyslexia. Therefore effective integration of technology in education can help in overcoming the functional barriers experienced by students with disabilities, providing them with fair learning opportunities and leveled fields to properly demonstrate their differential abilities, through providing the necessary support and an equal learning environment. equally accessible to students (Rosita et al., 2020; Tetzlaff, 2017). Many researchers recommend guidelines for dyslexia-friendly websites including preferred options according to their needs and preferences (Berget et al., 2016; Evett & Brown, 2005; Rello, 2014). With the existence of a dyslexia-friendly web, it can be used as e-learning to practice reading for dyslexic students. E-learning is the use of various technological tools, both web-based (networks), distributed web, or network capabilities for educational purposes (Ariesta & Olifia, 2019; Garad et al., 2021; Virgiawan et al., 2018).

The development of assistive technology for the learning of dyslexic children by using the Orton-Gillingham approach (multi-sensory teaching variation) and ICT tools to teach such as spelling and recognize words using a mobile tablet (Purkayastha et al., 2012). In addition, the research designed a learning model for dyslexic children named LexiPal (Saputra, 2015). LexiPal uses a gamification approach and implements designs in software applications, and measures the effectiveness of the design on the desired psychological outcomes, namely motivating dyslexic children. Several other studies have also demonstrated the use of technology to overcome dyslexia problems and most use computer software to provide some form of assistive teaching. The research which focused on phonetic spelling and writing, using color animation and digital speech plus practices on phonological awareness, appropriate sounds and phonemic decoding (Torgesen et al., 2010).

From several web-based assistive technologies and using mobile tablets for dyslexic children in Indonesia, there has not been much development and even if there is, the learning media is not from school agencies that provide these services, thus requiring a fairly high additional cost in the process of improving the reading ability of dyslexic students. Based on this, researchers are interested in analyzing assistive technology for dyslexic students with phonological deficits at SD Al-Irhaam which is easy to run on various existing hardware and software (compatibility), easy to manage, and inexpensive in making assistive technology media so that this media can be used. by all school agencies without high costs in operation.

2. METHOD

The research method used is qualitative research which is a case study. The methods for collecting data are observation, interviews, and review of various relevant documents. The observations made were participatory observations in which the researcher tried to be directly involved in the life of the subject so that the research situation could take place naturally without any impression of intervention. Meanwhile, to obtain accurate data from the interview process, the research instrument was used, namely interview guidelines. The interview guide uses items derived from research variables. To obtain document data in this study, namely documents in the form of notebooks and the results of children's learning processes at school (report books). This document is used to complement the data obtained in interviews and observations and can be used as triangulation material to check the suitability of the data obtained both in interviews and observations.

3. RESULT AND DISCUSSION

Result

Based on the documentation data obtained from the Al-Irhaam Elementary School that one of the students experienced learning difficulties, on February 14 2018 an examination was carried out at PUSPPA (Center for Child Potential Development) Suryakanti. Based on the results of the examination by a psychologist, the student has an average level of intelligence (Wechsler scale), while the potential for intelligence is at a level above average (Wechsler scale). In addition, based on anamnesis history of growth and development and sensory motor examination by the doctor at PUSPPA Suryakanti that the student has a diagnosis of Developmental Coordination Disorder (DCD). Furthermore, the student was also examined by a doctor at the hospital. Santo Yusuf Bandung on August 6, 2018 and the results of the examination obtained data that the student was diagnosed with dyslexia. After obtaining the documentation data, an interview was conducted with one of the teachers at SD Al-Irhaam for a history of the documentation data above. The results of the interview obtained data that at the time of the initial examination by a psychologist at PUSPPA Suryakanti on February 14 2018, the student was in grade 2 semester 2. The condition of students often left the classroom during learning, so many assignments from the teacher were not done. Then from the notebook I also obtained data that many letters are inaccurate in writing. So the school made a recommendation to parents to check with PUSPPA Suryakanti. However, after the results of the examination from PUSPPA Suryakanti, in the 1st semester of 3rd grade elementary school, parents also independently conducted a re-examination at the hospital. Saint Yusuf Bandung on August 6, 2018.

From the data above, the researcher also conducted interviews with students with dyslexia at SD Al-Irhaam. The interview instrument used is to determine syllable awareness (awareness of syllables). This is because the indicators of dyslexia are related to organizing written and spoken language (International Dyslexia Association, 2018). So by knowing the extent to which understanding syllable awareness has a picture of dyslexic students related to their phonological awareness. The technical interview is by asking students to answer questions related to several tasks of repeating words orally and in writing from the tasks given by the researcher. The data obtained are presented in Table 1.

Table 1. Syllable Awareness Test Results

Number	Question	Verbal answer	Written answer
1	Tua	Right	tu-a (right)
2	Ajal	Right	a-jalal (false)
3	abjad	Right	ap-jat (false)
4	abdi	Right	ap-di (false)
5	abstrak	Right	ap-prax (false)
6	anggun	Right	anggun (right)
7	sebab	Right	se-bab (right)
8	sejak	Right	se-jak (right)
9	sabda	Right	sab-da (right)
10	fiktif	Right	fik-tif (right)
11	slogan	Right	sele-gan (false)
12	syahdu	Right	sah-du (false)
13	traktor	Right	terak-tor (false)
14	dahsyat	Right	das-sat (false)
15	modern	Right	mod-deren (false)
16	sanggup	Right	sang-gub (false)

Number	Question	Verbal answer	Written answer
17	struktur	Right	sed-teruktur (false)
18	intruksi	Right	intek-si (false)
19	kompleks	Right	kom-pex (false)
20	blangko	Right	belang-k (false)

Based on the table 1, to determine the syllable awareness of 5th grade Al-Irhaam Elementary School students who experience dyslexia, from twenty questions given; verbally all correct in repeating the given word, but in writing, of the 20 questions only 5 questions are correct and 15 questions are wrong because there are many letters in a word that are not accurate in their writing. From the observations, when students with dyslexia were asked questions related to syllable awareness, they were able to answer correctly orally by repeating the words given by the researcher. However, the student was not able to write accurately according to the questions given. This shows that at his current age of 5th grade, the student has not been able to accurately identify several letters in syllables. Whereas the development of reading in the process of children understanding the function of written language; alphabet and awareness of the phoneme aspect that enters the school age children in Kindergarten (McKenna & Stahl, 2009).

The process of fluency in spelling is also related to auditory temporal processing (ATP). Based on the ATP deficit theory for dyslexia, difficulty in processing appropriate fast stimuli interferes with the coding of sounds necessary for good phonological representation in reading (Stefanics et al., 2011). Thus, both working memory (WM) and ATP were significant predictors of reading performance and phonological awareness among participants with dyslexia. This is in accordance with research, the contribution of WM and ATP to various types of reading performance and phonological awareness in dyslexia, using a multidimensional approach (Fostick & Revah, 2018). The study subjects involved 78 adults with dyslexia and 23 adults who normally read WM and ATP tasks, as well as reading and phonological awareness tests. The results showed that readers with dyslexia performed worse on all tests.

Based on the data obtained from the syllable awareness test given to the fifth grade dyslexic students at Al-Irhaam Elementary School, there is agreement with the theory and previous research. The difficulty of phonological memory of students with dyslexia barriers is that phonological information stored in memory is not coded properly, so it is difficult to retrieve. These difficulties will lead to difficulties translating letters into sounds, breaking words into phonemes, and phonemic manipulation. The above conditions made him less confident when studying in class, because his friends had no problems in the process of reading and writing. This was conveyed during the question session related to the social and emotional conditions of students during the learning process. Even this student with dyslexia revealed that he was ashamed and felt that he was not competent in one of the lessons of learning to read the Qur'an because he was still at level 2 even though he was in 4th grade at that time. In fact, he was not enthusiastic about learning to read the Qur'an. From the results of interviews with students regarding their social and emotional development, the development of dyslexia can be the cause or correlation of social problems, including self-regulation and social interaction (De Beer et al., 2014). Over time academic self-esteem also deteriorates and leads to emotional instability (McNulty, 2003).

Based on the results of observations, interviews, and documentation that students with dyslexia at SD Al-Irhaam in intellectual capacity from the results of the psychological test at PUSPA Suryakanti, they have above average potential (Wechsler scale) but have difficulties in reading. Therefore, it is necessary to have a reading learning program using appropriate, intensive, and innovative instructions to help dyslexic students minimize their barriers to reading. Teaching reading, language, and writing effectively, especially to students with dyslexia, is a complex job, because it requires sufficient knowledge and skills. Knowledge and skills of basic language concepts such as phonology, phonics, and morphology have been identified as important for teachers teaching students to read early as well as students with reading difficulties (Brady & Moats, 1997). However, based on many studies show that teachers often lack knowledge about phonemic and phonetic awareness; the role of appropriate context cues in reading (eg, to determine the meaning of words, not to guess words in decoding); a common type of reading difficulty such as dyslexia; effective assessment methods; and intervention-based research (Brady et al., 2009; Moats & Foorman, 2003; Spear-Swerling & Cheesman, 2012; Washburn et al., 2011). Therefore, the competence and expertise of teachers in providing instructions and interventions in reading programs is the most important factor.

To obtain data on the study history of a dyslexic student at SD Al-Irhaam who is currently in fifth grade, interviews were conducted with fourth grade teachers. The data obtained are the students during the second to third grades, there is a special supervisor teacher (GPK) in the class to assist in the process of learning mentoring. However, the GPK lacks understanding in the tutoring process, so when there is an assignment from the class teacher, it is often the GPK who fills the assignment for dyslexic students, because students often complain that they cannot and are tired when doing assignments. This makes dyslexic

students less independent in learning. And since the fourth grade, students no longer use GPK, but students are also recommended to do therapy in minimizing their dyslexia barriers.

Based on the results of the interview, in accordance with the findings that Special Advisor Teachers (GPK) are still less competent in carrying out their duties in terms of task achievement (Indriawati, 2013). In addition, it could be due to a lack of knowledge, education, understanding, or the efforts of teachers to give assignments to students, which ultimately leads to poor learning quality. To be inclusive it is necessary to develop assistive technology to assist in the practice of educating children in the same class, so that they can learn the material in an easy-to-understand way, by removing the barriers that have prevented them from being on the same level as their peers (Smith et al., 1995). Effective integration of technology in education can assist in overcoming the functional barriers experienced by dyslexic students, providing them with fair and equal learning opportunities so as to be able to properly demonstrate their differential abilities, through providing the necessary support and a learning environment that is equally acceptable. accessed by students.

All students of SD Al-Irham have been introduced to be able to access computer technology. This is based on the results of interviews with teachers who teach computers at Al-Irhaam Elementary School, that students are given learning facilities using computers because there is also a special computer room for learning ICT (Information and Computer Technology). ICT learning includes hardware material, graphics processing software, text processing software and presentations. As for the material distribution, for class 1 material, namely hardware introduction, introduction to the world of basic ICT, and basic graphic software; class 2, namely text processing software; class 3, namely presentation processing software; Class 4 is intermediate graphics processing software; Class 5 is data text processing software; and class 6 which is advanced graphics processing software. So that all students are familiar with the use of technology through computers. However, phonological exercises for dyslexic students are not yet available. So that one of the dyslexic students at Al-Irhaam elementary school did not get additional learning sessions related to his reading difficulties. Therefore, school institutions need to plan arrangements in the implementation of training, support and guidance for dyslexic students in the use of assistive technology. If the computer room is optimized for the phonological exercise learning program for dyslexic students, at least. In addition, learning media are innovative and able to increase self-confidence in students to help practice increasing their phonological awareness.

Discussion

Based on the table 1, it can be said that the student is included in the phonological dyslexia group. Phonological dyslexia is dyslexia that has difficulty identifying the individual sounds that make up words. This is because dyslexic readers often exhibit poor short-term memory for words and have difficulty performing phonological manipulations that require maintaining phonological information while it is being transformed (Banai & Ahissar, 2004; Gathercole & Pickering, 2000; Verhagen & Leseman, 2016). The short-term memory contributed to its effect on reading skills especially for coding, fluency building, and spelling (Zeffiro & Eden, 2000). This suggests that the role of working memory is considered to include the system responsible for maintaining verbal and auditory information supporting long-term phonological representations of language (Schwarb et al., 2016). Several studies have shown the use of information technology to overcome the problem of dyslexia and most use computer software to provide some form of teaching with assistive technology (Anestis, 2015; Woodfine et al., 2008). Assistive technology is a general term that includes assistive, adaptive, and rehabilitation tools for individuals with disabilities and includes almost anything that might be used to compensate for the lack of certain abilities (Rosita et al., 2020). The use of assistive technology for learning dyslexic students is developed by using computer software and there is also using a mobile application using a mobile tablet. As for the learning content, it is necessary to analyze the needs of dyslexic students. This is because the problems that characterize people with dyslexia can be divided into six areas, namely reading, writing, speaking, memory, organization and general (McCarthy & Swierenga, 2010; Woodfine et al., 2008). This suggests that because of their individuality, there is no universal profile for people with dyslexia barriers (McCarthy & Swierenga, 2010). So that one way to improve accessibility for various profiles of students with dyslexia is according to the needs and preferences of individual users.

Several studies related to using computer software are the research, designed a learning model for dyslexic children called LexiPal (Saputra, 2015). LexiPal uses a gamification approach and implements designs in software applications, and measures the effectiveness of the design on the desired psychological outcomes, namely motivating dyslexic children. In addition, the Orton-Gillingham approach and ICT tools to teach spelling and word recognition to dyslexic students using mobile tablets (Purkayastha, et al., 2012). In Indonesia, not many have developed applications to help dyslexic students in phonological learning. Therefore, at Al-Irhaam Elementary School with computer room facilities, it can be used to develop assistive

technology devices for phonological learning for dyslexic students. As for facilitating the design of assistive technology for dyslexic children, it is necessary to measure several aspects including (1) the device must be compatible with user aspirations, emotional needs; and physically comfortable from the user's perspective, (2) the device must be easy and affordable to manufacture and maintain, thereby keeping the device functional and repairable using locally available materials, and (3) the device must be easy to understand by users with exposure limited in technology, portable and easy to operate without long training or complex skills. In addition to the above, many researchers recommend guidelines for dyslexia-friendly websites including preferred options according to their needs and preferences (Berget et al., 2016; Evett & Brown, 2005; Rello, 2014). People with dyslexia have different abilities and different preferences regarding color, type and font size (De Santana et al., 2012). A larger font size increases the readability of the text, which is the maximum for objective readability between 18 and 26 (Rello, 2014). In other literature, the Arial font is highly recommended for having the shortest reading time for people with, and also without dyslexia (British Dyslexia Association, 2007; Cooper et al., 2012; Davis Dyslexia Association International, 2005; Evett & Brown, 2005).

Based on the explanation above, there is an urgency of assistive technology for the phonological learning process in one of the dyslexic students at Al-Irhaam Elementary School. The form of assistive technology media can be in the form of a dyslexia-friendly web, by presenting reading learning content whose letters have been adapted to their conditions. This is done as a phonological improvement so that it has an impact on increasing reading skills and students can also be more confident because they can learn with web-based media (e-learning). The development of materials for phonological exercises requires collaboration with counselors or psychologists, and IT professionals who can make applications to create phonological learning programs for dyslexic children. Thus, the integration of technology in education needs to prioritize the need to understand the content of reading learning for dyslexic students in elementary schools. So we recommend for future research to develop assistive technology for phonological learning media for students with dyslexia, by understanding how content, pedagogy, and technology can work together to improve reading learning for dyslexic students. As for this study, researchers experienced limitations in implementation in the field due to the Covid-19 pandemic, so the time available to complete was relatively short, even though the need for research samples with dyslexic children who had phonological difficulties that should have been more than one child, to get a comprehensive picture. related to the need for assistive technology based on web learning.

4. CONCLUSION

From the data that has been obtained from students with dyslexia in grade 5 Al-Irhaam Elementary School, it can be concluded that dyslexic students need to optimize their learning assistance and psychosocial assistance. This is because dyslexic students generally have cognitive capacity that is able to participate in regular learning, only in the reading aspect they are hampered. So those with dyslexia often experience a lack of confidence because of these obstacles and have an impact on their low academic scores. Therefore, to help dyslexic students minimize reading barriers, there needs to be intensive training and using assistive technology based on web learning to increase their phonological awareness.

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