

Mobile Learning in Improving Reading Ability Dyslexia: A Systematic Literature Review

Meta Silfia Novembli
Yogyakarta State University
Yogyakarta, Indonesia
metasilfia.2017@student.uny.ac.id

Nur Azizah
Yogyakarta State University
Yogyakarta, Indonesia
nur_azizah@uny.ac.id

Abstract—Dyslexia is a specific learning disability in aspects of reading and spelling that originate from neurological and genetic. Reading is some sub-skills in the form of attention, letter or word recognition, organizing in the way of words and sentences, text transfer activities, and understanding the text. To develop reading skills, dyslexia requires a lot of structured practice and corrective feedback. Nevertheless, there are still many learning approaches or strategies that must be considered by the teacher, such as approaches that involve the use of Information, Communication, and Technology (ICT), one of which is Mobile Learning (M-Learning). The aim of this is to examine relevant empirical studies of studies related to M-learning to improve the ability to read dyslexia. The research method uses the Systematic Literature Review. The results showed that the overall use of M-learning was effective in enhancing the ability to read. The aspects that are developed are also in accordance with the learning needs of dyslexia.

Keywords—dyslexia, reading ability, mobile learning

I. INTRODUCTION

Dyslexia is known for specific learning difficulties in aspects of reading and spelling [1] of neurological origin [2], and genetic [3]. The character of Dyslexia is difficulties inaccurate and smooth word recognition and poor spelling and decomposition abilities [4]. Frith mentioned that dyslexia is neurocognitive damage [5].

Dyslexia is the most encountered of specific learning difficulties, and about 5 to 17.5% occur in school-age [1]. The prevalence of children with learning difficulties in Asia is at 15%, and 60% to 80% are dyslexic [6]. Dyslexia is almost incurable because it is caused by a neurological disorder experienced. However, by conducting early detection and effective learning approaches, dyslexia can improve itself to overcome the problem.

The problem that distinguishes dyslexia from other children is the way children process information. Information processing relates to the method information is retrieved, speed and processing style, as well as how to deliver it [3]. Information processing when reading refers to complex cognitive activities because in reading individuals will take the cognitive ability that may be used to support an understanding of the content of readings [7].

Reading is a process of thinking to understand the contents of the text that is read. Reading is a complex process that requires analysis, coordination, and interpretation from various sources of information and activities to understand meaningful sign or writing so that the message conveyed through the writing can be accepted by the reader. Reading is not just an act of seeing a collection of letters that form words or groups of words [8]. Reading activities consist of the

process of decoding, word recognition, understanding, and articulation [7]. Reading consists of some sub-skills such as attention, letter or word recognition, an important organization in the form of words and sentences, spontaneous text transfer activities, and understanding the text [9]. So that to be able to read students must master these sub-skills.

Dyslexia requires a lot of structured practice and corrective feedback in developing reading skills [4]. Teachers need to consider factors such as context, assessment, curriculum, students, learning styles, and information to develop appropriate learning approaches [3]. Learning approaches that are easily adapted to dyslexia or used in the curriculum framework are phonological awareness approaches, Phonic Code Crackers, and multisensory approaches [10]. But with the pace of the times, teachers must consider the progress of Information, Communication, and Technology (ICT) in the learning process.

The use of computational technology in learning has been used with various variations. Since the last few years, the technology progressed so fast that a new term has emerged, namely mobile

learning (M-learning). M-learning first appeared in the mid-1990s. In 2006 at the BT Government Innovation Center, the UK, Mike Sharples at the Becta 'Future Gazing for Policy Makers' seminar explained the three phases of M-learning, namely (1) focusing on devices such as PDAs, tablets, laptops, and cell phones, which can be used in context education and learning. This first phase utilizes the productivity of mobile devices and technologies such as e-books, class response systems, handheld computers in classrooms, data recording devices, and learning objects that can be reused [10] (2) Focus on learning outside the classroom in the form of field visits and visits to museums. (3) Focus on student mobility in the form of Reality Learning (student involvement with learning media), Context-Sensitive Learning (communicative skills and learning), and Ambient Learning (the role of technology in adding activities in designing innovative learning environments) [11].

M-learning is a new domain. M-learning has been regarded as the future of learning or as an integral part of the educational process in the future. M-learning is the use of cellular technology to assist learning and explore information in specific contexts [12]. M-learning is not just sending content to mobile devices, but rather a process for knowing and developing student knowledge in and throughout the context and new learning spaces [11].

The development of learning media based on M-learning has many advantages such as lower costs, supports multimedia content, and can be used in various places. Mobile

devices are also lighter than books and laptops. Ease and low prices are the main advantages of M-Learning.

The development of M-learning in learning helps the development of learning dyslexia. This is evidenced by research conducted [13] regarding the development of cell phone applications for children with dyslexia. This study aims to improve the ability to read and write dyslexia by showing the results that technology integration can create new learning processes very effectively. This result is also supported by research conducted [14] by developing a mobile learning application in the form of Writers Learning Algorithm (WLA). The results of his study show that the use of WLA is effective in improving the ability to write dyslexia.

There are many studies on the use of M-learning to help improve the ability to read dyslexia. However, there are not many literature studies explicitly discussing studies to help teachers implement Best Practice M-Learning to help dyslexia. This article aims to examine relevant empirical studies of studies related to M-Learning in helping dyslexia. The research question in this article is a) how effective is the use of M-Learning in improving the ability to read dyslexia ?; b) what is the target of reading skills in using M-Learning?

The rest of this paper is organized as follow: Section II describes the theoretical Background. Section III describes the proposed method. Section IV presents the obtained result and following by discussion. Finally, Section V concludes this work.

II. THEORETICAL BACKGROUND

This section presents the fundamemntal theory used.

A. Dyslexia

Dyslexia is a specific type of disorder that included in the Specific Learning Disability (SLD) category in the Individual with Disabilities Education Improvement Act (IDEA). The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) describes dyslexia as an alternative term for "Specific Learning Disorder with Impairment in Reading" [1]. The International Dyslexia Association defines dyslexia as a specific learning disability that has difficulty in poor spelling and decoding abilities, accurate and fluent word recognition and caused by a deficit of neurological language phonological components [4].

The main characteristic of dyslexia is a weakness in the sound symbol association (when starting to read) [1], basic reading skills (identification of phonetics and identifiers), still reading (level and accuracy), and spelling [2] as well as difficulties in processing information. Information processing relates to how to retrieve data, speed, and processing style, and how to deliver it [3]. The information processing cycle has three main components, namely input, cognition, and output [10]. Children with dyslexia can experience difficulties in all three cycles.

Input is related to sensory perception (visual, auditory, and sensory integration). Problems with visual perception can be in the form of ground-figures (seeing objects in the background), closures (resolution of images), and spatial issues. Auditory problems can be in the form of the problems with ground auditory (noise) and difficulties in voice discrimination and ballots. In addition to visual and auditory,

input also comes from Sensory Integration (IS). The IS is the ability to involve two or more senses simultaneously [15]. The problem with IS can be in the form of students' inability to hear and record during the learning process because these activities require auditory and tactile perceptual abilities.

Cognition is related to memory, understanding, and organization. Cognitive resources are affected by increased processing capacity and speed. Siegler said that three mechanisms work together in creating changes in cognitive skills namely encoding, automaticity, and strategy construction [16]. Problems in encoding can be in the form of a child's difficulty in entering information into memory so that the child quickly forgets the lesson. In dyslexia, this problem can be a child's inability to remember simple sequences and recognize words. Issues with automation can be in the form of difficulties in processing information received so that children experience problems in understanding instructions. In dyslexia, this problem can be in the form of children's difficulties in identifying or manipulating ballots in reading. Issues in the construction of strategies can be in the kind of the way children organize information received. In dyslexia, this problem can be difficulty in pronunciation of letters or words when reading.

Output relates to the ability to express ideas and thoughts both in oral and written form [15]. Difficulties in production can include the problem in speaking (word taking and fluency of speech), trouble in writing, and challenges in producing expressions according to feelings and emotions. In dyslexia, the problem of output can be difficulty in placing ideas in writing, difficulty in pronunciation or creating the right ballot (phonological awareness) and making many mistakes when spelling.

B. Reading

Reading is one of the language skills. Reading must be taught explicitly because reading is a process of absorbing input into language symbols in written form [17]. Reading activities consist of the process of decoding, word recognition, understanding, and articulation [7]. Reading can include some sub-skills such as attention, letter and word recognition, an essential organization in words and sentences, spontaneous text transfer activities, and understanding the text [9].

Cooter said that the skills, concepts, and abilities found to predict reading, writing, and achievement of student spelling include the following: (a) alphabet knowledge (knowledge of names and sounds associated with writing); (b) phonological awareness (the ability to detect, manipulate, and analyze auditory aspects (sounds) of spoken language, including words, syllables, and phonemes); (c) rapid automatic naming (RAN) of letters or digits (the ability to recognize and name quickly a series of letters or numbers); (d) rapid automatic naming (RAN) of objects or colors (the ability to identify items or colors in a set of object images); (e) phonological memory (the ability to remember and repeat oral information for a short time); (f) the concept of print conventions; (g) production and understanding of spoken language (ability to understand aspects of spoken word, including grammar and vocabulary); and (h) visual processing (the ability to match or distinguish symbols that are presented visually) [18].

The National Reading Panel states that there are five essential things in early reading learning, namely phonemic

awareness, alphabet, vocabulary, fluency, and understanding [18]. There are several interrelated theories to help teachers understand the way students read, namely behavior theory (oriented to texts such as letters, words, and sounds), cognitive learning theories (focusing on students' thinking processes), and social learning theories (students have self-control during learning) [19].

C. Mobile Learning

Information technology changes rapidly, so individuals with learning disabilities must be aware of this. The ICT is a term that covers and reaches out to all things. Devices included in ICT can be in the form of computers (desktops, laptops, and handhelds), playback and recording (video recorders, audio recorders, tape recorders, digital cameras, and VCD / CD players), communication equipment (cellular phones), monitoring tools (cameras and CCTV), and everyday equipment (washing machines, toasters, microwaves, etc.) [20]. An essential element in all devices is control over their use.

ICT includes the use of multimedia equipment. There are five roles of ICT in supporting dyslexia, namely (1) obtaining information; (2) analyze data; (3) storing information; (4) synthesizing information; and 5) presenting information [22]. ICT can be used functionally in word processing and check spelling as well as the opportunity to provide learning motivation to dyslexia [21]. ICT development for dyslexic children is divided into two parts, namely in the form of a) hardware (hardware) such as computers, laptops, and cell phones or mobile phones; b) Software (Software) in the form of Text-to-speech (TTS), Speech-to-text, Concept mapping, Spelling and grammar checking [22].

ICT is one source of learning for dyslexia. The use of ICT requires several core areas of knowledge and understanding of the difficulties faced by dyslexia regarding literacy, organization and understanding of various aspects of the syndrome experienced [21]. The use of ICT can improve the quality of input in dyslexia so that it can process information better [9], one of which is the use of M-Learning.

Mobile learning or M-Learning is a learning activity that occurs when students are not in a fixed location. M-Learning is experience and opportunity [23] which happens when students take advantage of learning opportunities [24] to obtain relevant knowledge and skills [11] through the use of technology that occurs anywhere and anytime, which results in changes in behavior. Winters [11] defines M-Learning as a concept that describes a conceptual perspective on technocentric, rational about e-learning, adds formal education, and is student-centered. Knowledge development by students encourages the movement from seeing M-Learning as a process of transmitting information based on a flexible and compatible access model to the idea of intervention in the process of building students' knowledge with M-Learning as a meditation tool.

M-Learning is not just online learning. Designing an M-Learning system or application must pay attention to the differences in M-Learning with other online learning. Peng said that the main difference between M-Learning and online learning lies in mobility [25]. M-Learning has its characteristics. M-Learning characteristics can provide meaning and involvement in handling the surrounding

environment to communicate which includes increased portability, functional, multimedia convergence, personal ownership, social interactivity, context sensitivity, location awareness, connectivity, and personalization [11].

M-Learning, when properly designed can improve communication skills and community formation, enhance identity creation, collaborative learning, and monitoring. The potential benefits of M-Learning for learning approaches are increasing retention, efficiency, cost-effective, time-saving, improving collaboration and community, and overall. [24]. The main benefits of M-Learning are flexible learning abilities, cost-effective, providing learning opportunities outside the classroom, improving high-level thinking skills, allowing learners to learn to develop, motivating students by providing high involvement and autonomy [23]. M-Learning delivers many benefits to reach students in various ways to improve and personalize the education they receive. M-Learning also has comprehensive benefits, namely (a) encouraging learning anywhere and anytime; (b) reaching underserved students because of relatively low costs and accessibility; (c) increase social interaction; (d) help overcome many of the challenges associated with higher technology and (e) enabling personalized learning experiences [11].

III. PROPOSED METHOD

This study uses the Systematic Literature Review (SLR). SLR is a means of evaluating, identifying, and interpreting all research relevant to particular research questions, topics, or new phenomena [26]. The SLR stages were carried out namely searching electronic databases in the IEEE database, ScienceDirect, SAGE, ProQuest, and the National Library of Indonesia e-Resources Service (PNRI) to find studies published between 2010 and 2017. Keywords or terms used in the search is "Mobile Learning for dyslexia" and "Mobile Learning AND Dyslexia." The term box is related to each database and search is used by the "research domain, type of document, language and year of publication." The initial search resulted in 460 articles. Furthermore, screening was carried out on the abstract of the study.

The selection of materials must be by the criteria in the form of (a) All participants included in the study must be 3 to 12 years old. (b) the subject is dyslexic or has symptoms of dyslexia. (c) the report must be in English. (d) using a Randomized Controlled Trial (RCT) design. (e) the steps used are pre-test-post-test and (f) intervention using M-Learning.

The literature search is carried out only by the primary author. In total, 435 abstracts were not identified that did not meet any of the criteria, therefore were not considered further. The remaining 25 studies were examined in depth to determine whether the study *met all* requirements. After checking there were 16 articles that did not meet the criteria, so there were nine articles left.

IV. RESULTS AND DISCUSSION

This section presents the results obtained and following by discussion.

A. Results

Nine (9) studies in table 1 show the effectiveness of using M-Learning and ICT in improving dyslexia reading skills.

McMurray in [27] evaluated the use of Lexia Reading designed to improve reading standards through a phonics-based approach to learning to read. 106 dyslexia aged 6 to 7 years in four schools in Northern Ireland were divided into intervention groups (53 people) using Lexia Reading and the control group (53 people) without using Lexia Reading. The intervention and control group conducted a series of standard tests in the first two weeks of the study (October 2009) to determine the ability or initial score. Implementation of software usage began early November 2009 to May 2010 (for 20 weeks). The study showed significantly different results between the intervention group and the control group ($P < 0.037$). The increase in the standard reading score of the intervention group averaged 6.78 points ($P < 0.0001$). However, the improvement in standard reading scores in the control group averaged only 1, 43 points. The author concludes that the use of Lexia Reading is effective in improving the ability to read (spelling and phonological) dyslexia.

Rello & Pielot in [28] evaluated Android-based games (DysEggxia and Word Search) designed to improve spelling ability in dyslexia through fun and targeted training. 48 dyslexics (29 women and 19 men) aged 6 to 11 years experimented using DysEggxia and Word Search. The procedure is to divide dyslexia into two groups: group A uses DysEggxia and group B uses Word Search for four (4) weeks which is carried out in 12 sessions for 20 minutes. The study showed significantly different results between dyslexia using DysEggxia and dyslexia using Word Search. DysEggxia significantly reduces the number of errors per word ($T = 629.5$, $p = 0.029$, and $r = 0.292$). This result shows that the DysEggxia game can improve spelling and writing dyslexia compared to Word Search.

In line with the research of Rello & Pielot in [28], Benmarrakchi, *et al.*, in [29], evaluated DysEggxia Android-based games that aimed to improve spelling skills in Arabic. This study involved 32 students (12 dyslexia and 20 non-dyslexic) aged 8 to 12 years. The study showed significantly different results in the spelling error score between dyslexia and nondyslexia ($P < 0.00001$). Dyslexia tends to have a higher spelling error score compared to non-dyslexia.

Skiada, *et al.*, in [30], develop and evaluate tablet-based game devices named Easylexia which aims to improve reading comprehension, orthographic coding, short-term memory, and mathematical problem-solving. As many as five dyslexics aged 7 to 12 years were involved in the evaluation of the device. The procedure is to divide dyslexia into two groups by classifying it according to gender and the severity of symptoms of dyslexia, and age. The study was carried out for 12 to 18 months. The results showed that the use of Easylexia significantly improved understanding showed high performance, and reduced the level of errors in implementation.

Saputra in [31] develops and evaluates games that are named "Lexipal" by using the Windows platform that aims to increase the motivation to learn dyslexia. Lexipal evaluation involves 40 dyslexia aged 5 to 8 years which is held one meeting with a duration of 45 minutes. Assessment is seen from the involvement shown through participation and interest in dyslexia. The results showed that all dyslexia felt happy and enjoyed playing the application.

He, *et al.*, in [32] evaluated the use of Home Literacy Environment (HLE) in dyslexia and non-dyslexia in improving literacy skills. The evaluation involved 5063 students (195 dyslexia and 4868 non-dyslexia). The study was conducted from 1 to 31 October 2011. The study showed significantly different results in the use of HLE in dyslexia and non-dyslexia. But there is a positive correlation between the use of HLE in reducing the risk of dyslexia and increasing the number of activities related to literacy.

Madeira *et al.*, in [33], evaluate the use of Android-based games that aim to improve syllabic skills, string words, and sound letters or words. This study involved eight (8) students (4 dyslexic and four non-dyslexic) aged 10 to 12 years. The study was conducted for seven days, and each meeting was done four times in 15 minutes. The results showed that the use of Android-based games could improve syllabic skills, stringing words, and the sound of letters or words in dyslexia. This assessment is seen from the ability of dyslexia which overall gets the same results sometimes even better than non-dyslexia in Table I.

Tariq & Latif [13] developed and evaluated the Writers Learning Algorithm designed to improve the ability to write dyslexia. A total of 20 dyslexic students aged 3 to 5 years were involved in assessing the Writers Learning Algorithm. The results explain that there is an increase in writing and phonological abilities of 87%. This study was seen from the comparison of the strength before and after dyslexia using the Writers Learning Algorithm.

Samsudin in [34], develops and evaluates learning applications called Dyslexia Aide. This development aims to improve academic functions (alphabet and spelling) and skills (memorization skills). Researchers did not explain the number of respondents involved, but evaluation of Dyslexia Aide devices was performed in dyslexia aged 3 to 5 years. Assessment is seen by comparing the abilities before and after the use of Dyslexia Aide. The study showed that there is the success in dyslexia in completing tasks according to the application. But the results do not describe the increase or difference in the ability of dyslexia before and after using Dyslexia Aide.

The study studied so far has shown the use of M-Learning in helping dyslexia, but not all studies show its effectiveness in improving the ability to read dyslexia. The purpose of M-Learning is beneficial in enhancing the ability to read dyslexia, this is evidenced by research conducted by Benmarrakchi, *et al.* [29], Madeira, *et al.*, in [33], McMurray [27], Rello & Pielot [28], Skiada, *et al.* in [30], [13]. However, research conducted Samsudin in [34] & Saputra in [31] does not illustrate the effectiveness of M-Learning in improving dyslexia reading skills, because the study more demonstrates the use and features of M-Learning devices.

The targeted aspect of developing reading skills in M-Learning development and evaluation is the alphabet [29], spelling [29],[27],[28], phonological McMurray [27] syllables, sounds of letters [33], reading comprehension [30] writing [28], [13] and literacy [32].

B. Discussion

This article aims to examine relevant empirical studies related to M-Learning in improving dyslexia reading skills. The research questions asked are: (a) is it effective to use M-Learning in improving dyslexia reading skills ?; (b) what is the target of reading skills in using M-Learning?

Association Dyslexia International explains that dyslexia is a specific learning disability characterized by poor spelling and decoding abilities and accurate / or fluent word recognition [4]. The main characteristic of dyslexia is a weakness in the sound symbol association (when starting to read) [1], basic reading skills (identification of phonetics and identifiers), still reading (level and accuracy), and spelling [2] as well as difficulties in processing information. The problem or inability requires a learning medium that can help dyslexia in improving the ability of word recognition, spelling ability, and decoding.

TABLE I: LIST OF ARTICLES PUBLISHED AND APPLIED FOR DYSLEXIA IN THE PERIOD 2010 TO 2017 DYSLEXIA PADA PERIOD 2010 TO 2017

Study	Number of participants	Age	Diagnosis	Specific skills targeted	Type of intervention	Method of delivery	Design	Total hours intervention	Measures and Blinding	Results	Effect Sizes
Mcmurray [27]	106 (53 intervention groups and 53 control groups)	6-7 year	Dyslexia	Spelling and phonology	Lexia Reading	Software	Experiment: 1 control group vs. 1 intervention group	October 2009 to May 2010	Regression analysis, and variance analysis	There were significant differences between the intervention group (using Lexia Reading) and the control group	The ability of the intervention group increased by an average of 6.78 points from the initial ability while the control group only rose 1.43 points.
Rello & Pielot [28]	48 (29 women and 19 men)	6-11 year	Dyslexia	Spelling and writing	“DysEggxia”	Android based game	Experiment: 1 control group vs. 1 intervention group	8 weeks	T Test and Wilcoxon-Signed-Rank Test	There were significant differences between the intervention groups (using DysEggxia) with the control group (Word Search)	Intervention group: error reduction rate of 20% Control Group: error reduction rate of 9.4%
He, <i>et al.</i> [32]	5063	9-12 year	195 Dyslexia & 4868 Non dyslexia	Literacy	<i>Home literacy environment (HSE) (computer and television) and electronic devices</i>	ICT	Qualitative (questionnaire)	1 October to 31 October 2011	T test Chi-Square Mann-Whitney U test	There are no significant differences between HLE users and electronic devices. There is a positive correlation between the use of electronic devices with dyslexia	Electronic devices can improve dyslexic literacy compared to HLE
Skiada, <i>et al.</i> [30]	5	7-12 year	Dyslexia	Orthography, reading comprehension, and solving mathematical problems	“EasyLexia”	Tablet-based game	Mixed methods (qualitative and quantitative)	12-18 months	Likert and Triangulation Scale	There was a significant increase before and after using EasyLexia	Not explained
Saputra [31]	40	5-8 year	Dyslexia	Motivation to learn	“Lexipal” Platform Windows	ICT	Mixed methods (qualitative and quantitative)	1 meeting for 45 minutes	Likert and Triangulation Scale	Dyslexia is willing to study material using an application.	Not explained

										Dyslexia is happy and enjoys the game in the application	
Madeira, <i>et al.</i> [33]	8	10-12 year	4 Dyslexia & 4 Non dyslexia	Syllables, words and sounds	Android	Android based game	Experiment: 1 control (non-dyslexia) vs 1 group	1 week 1 meeting 4 times with a duration of 15 minutes	Not specifically explained	Dyslexia has the same overall results and is even better than non-dyslexics	Average increase: Syllable: 47% Word series: 71%

Based on the results obtained in the literature study found that the use of technology (M-Learning) can generally help and be effective in improving the ability to read dyslexia. This result is consistent with the theory which states that the use of ICT can improve the quality of input in dyslexia so that it can process information better [9]. Technological development has become an exciting innovation in learning that requires teachers to create approaches that are appropriate to students' learning needs, especially dyslexia. Research conducted McMurray, S. in [27] which aims to develop Lexia Reading software to improve the ability of standard reading through Phonics-based approaches to learning dyslexia. The results obtained the state that Lexia Reading provides benefits and offers phonics intervention in a structured and systematic manner for dyslexia, to increase concentration, increase phonological awareness, support spelling schemes, develop independent learning, and improve self-confidence and motivation for dyslexic learning. So that supports the theory that the learning approach that is easily adapted to dyslexia or used in the curriculum framework is the phonological awareness approach, the Phonic Code Cracker, and the multisensory approach [10, p. 44–45]. Madeira et al in [33] research aim to develop a Mobile application prototype in helping dyslexia to analyze its learning performance. The results showed that the Mobile application was able to collect, analyze and synthesize and provide positive feedback on dyslexia learning performance. ICT includes the use of multimedia equipment that has five roles to support dyslexia in learning, namely (1) obtaining information; (2) analyze data; (3) storing information; (4) synthesizing information; and (5) presenting information [22].

M-Learning has comprehensive benefits, namely (a) encouraging learning anywhere and anytime; (b) reaching underserved students because of relatively low costs and accessibility; (c) increase social interaction; (d) help overcome many of the challenges associated with higher technology and (e) enabling personalized learning experiences [11]. The benefits of M-Learning are shown by research conducted Skiada, et al. in [30] whose research results show that applications help dyslexia concentrate and show progress, not only in word recognition and reading but also in phonological decodes. The main benefits of M-Learning are flexible learning abilities, cost-effective, providing learning opportunities outside the classroom, improving high-level thinking skills, allowing learners to learn to develop, motivating students by providing high involvement and autonomy [23]. The study conducted, Saputra in [31] is designing a learning model using the Gamification (Lexical) approach. The results obtained in the survey stated that dyslexia felt happy and enjoyed playing the application and they all wanted to participate in the evaluation. Dyslexia requires a lot of structured practice and corrective feedback in learning [4]. Three studies conducted by Madeira, et al in [33], McMurray in [28] & Skiada, et al [30] show the results that applications or mobile devices developed (Lexia Reading, EasyLexia, and Android-based games) are media or tools which is useful in helping improve the ability to read dyslexia. This application is evidenced by the increase in syllabic skills, spelling, phonology, and reading comprehension because dyslexia is a difficulty in accurate and fluent word recognition and poor spelling and decomposition abilities [4].

V. CONCLUSION

There are many studies on the development of M-learning to help improve the ability to read dyslexia. M-Learning is the experience and opportunities that occur when students take advantage of learning opportunities to obtain relevant knowledge and skills through the use of technology that happens anywhere and anytime, which results in changes in behavior. M-Learning development focuses on improving the ability to recognize alphabets, syllables, phonology, spelling, reading, and writing in dyslexia. The use of M-Learning (in the form of applications) is more effective in improving the ability to read dyslexia than conventional approaches. The purpose of M-Learning also offers structured and systematic activities in providing intervention to dissection in developing reading skills.

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