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Development of Android application-based digital literacy media to improve the reading ability of ADHD students

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ABSTRACT

This study aims to help kids with Attention Hyperactivity disorder (ADHD) in inclusive classrooms become better readers. The ADDIE model, which stands for Analysis, Design, Development, Implementation, and Evaluation, is used in this study's R&D (Research and Development) research. The study was conducted between 11 February and 12 April 2023. Eight kids with ADHD from 4 primary school classes at UNESA 2 Labschool participated in this study. Of these, two were in class 3, two were in fourth grade, two were in fifth grade, and two were in sixth grade. Ways for gathering data via a questionnaire. It is claimed that the outcomes of enhancing students' reading abilities with digital literacy media built on Android applications are reliable, applicable, and efficient. This study used a questionnaire as the data collection tool to assess its validity, usefulness, and efficacy. The Aiken's V validation result for digital literacy media was 0.89, deemed legitimate and highly acceptable for usage by material specialists. Experts in the media estimate Aiken's V average to be 0.93. The average percentage result for Android application-based digital literacy media is 89%, making it extremely practical. 91% of the time, it works. Media promoting digital literacy is therefore deemed effective. It is legitimate, practical, and efficient to use Android applications-based digital literacy media to help ADHD pupils with their reading abilities in inclusive schools.

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INTRODUCTION

A nation can face the problems of the times during the Industrial Revolution 4.0 and society in the 5.0 era; education is a fundamental need that all people in the world own. This condition requires a learning process that is adaptive to the current situation, including learning related to 21st-century education or learning that combines technological abilities, scientific abilities, and literacy skills. Advances in technology and information positively impact the progress of digital information (Kurnianingsih, Rosini, et al., 2017). Education is the main factor determining the success of the demographic bonus, which is one of the reasons why Indonesia is currently

transitioning to a new phase of the demographic bonus. This is because education is the main factor determining success in dealing with demographic bonuses (Parwodiwiyono & Witono, 2022). To answer the challenges of the times in the world of education in the current era of globalization, a basic need that must be mastered and developed is the ability to master digital technology.

Digital technology is continuously experiencing growth until it has penetrated family life at this time without being stopped (Fatmawati & Sholikin, 2019). The growth of digital technology as a support system, knowledge source, and communication channel has changed how individuals think about learning, gathering, and hiding information. Human resources (HR) and the growth of a nation can be increased through education (Hidayat & Syafe'i, 2018). The sophistication of education and technological advances present a big challenge for educators to continue to play an essential role in educating the country's young generation. The growth of information and communication technology (ICT) has sparked innovation in many industries, including education, which is marked by the emergence of electronic learning (E-learning). A new idea in education, electronic learning (often known as "E-learning") combines knowledge acquisition with rapidly evolving information and communication technologies. Based on survey results, information technology has a positive impact on child development and is helpful in learning activities (Rakimahwati & Roza, 2020). Digital learning is essential and must be mastered because digital-based information narratives are currently numerous and abundant due to advances in information technology and the internet (Kurnianingsih et al., 2017).

Learning using digital media continues to develop and advance, and students and teachers must continue improving their understanding of the subject matter to make it more inventive and collaborative (Indarta et al., 2022). Unique learning materials for students are packaged in software or applications and the Android operating system. This program is made by integrating and combining various elements, such as images, colors, audio, and animation, into content that is packaged in the form of reading or literacy learning according to the characteristics of students to arouse their interest in doing so. The existence of this innovation can contribute to students exploring knowledge and accessing information in the form of digital literacy. The benefits of digital literacy are felt not only by regular students but also by students with learning difficulties or children with special needs (ABK), which is very clear in obtaining information because reading is one of the essential components of learning (Akbar, 2017). Another benefit of literacy skills for students is that when they enter college, they can process information and effectively use library facilities on their campus (Kurnianingsih et al., 2017).

Children with special needs (ABK) often behave maladaptively, hurting them and their surroundings (Rapisa & Kusumastuti, 2022). Attention deficit hyperactivity disorder (ADHD) is a term used to describe students who exhibit an attention deficit condition and high impulsivity (excessive behavior). Hyperactive behavior states individual behavior that shows an attitude of being unable to be silent, not paying attention, and being impulsive (Akbar, 2017). Initially, ADHD was known as minimal brain damage (minimum brain dysfunction) or hyperkinesis (Purwandari, 2006). Generally, ordinary children can control their attitudes and social behavior when interacting with other people, while children with ADHD tend to be restless and very active (Wibowo, 2020). Children with ADHD are easier to identify when the sufferer has entered elementary school age, starting around 6 (Ng, N., Bangsa, P. G., & Christianna, A.., 2016). School-aged children with ADHD who have reading difficulties should receive reading interventions with evidence of support and interventions that address the symptoms and challenges associated with ADHD (Adhd et al., 2015).

Someone with ADHD shows brain dysfunction when they struggle to regulate their impulses, restrain their behavior, pay attention for a long time, or are easily distracted (Mariyah, et al., 2017). ADHD children are among children with special needs who need special services to meet their needs. ADHD children need it for formal education (Sari, 2022). Learning methods in the form of digital literacy media can be implemented by educators who can accommodate hyperactive children with special needs, especially in beginning reading material (Susanto & Nugraheni, 2020). Hyperactive children will very likely show developmental delays and delays, as well as the ability to learn how to focus attention, take care of themselves, and get along with their

friends (Akbar, 2017). Students with this disease will struggle academically, socially, and especially with reading and literacy skills. Every student, even with ADHD, needs strong reading skills to overcome difficulties (Putra, 2018). Delays in social interaction in children with ADHD make children rarely communicate and interact with their peers (Sari & Sukerti, 2020).

In the current era of globalization, Indonesian education is experiencing a literacy crisis; the literacy crisis that has occurred over the past three years has caused the condition of education in Indonesia to experience or decrease the ability to understand reading or literacy, according to data released from the results of the International Students Assessment Program study. (PISA) 2019, which was released on 03 December 2019 in France, and the latest PISA score will be released in 2023, which should have been released in 2022, was delayed because, at that time, the Covid-19 pandemic hit the whole world, Indonesia's position was shallow in literacy or literacy. As seen from the results of the 2018 PISA observations, Indonesian students are ranked 74th out of 79 countries with a total score of 371. These results show that literacy skills have not yet increased, and it is necessary to hold breakthroughs to overcome these problems, especially regarding literacy. In the Progress In International Literacy Study (PIRLS) 2019 ranking, Indonesia is at level 41 out of 45 PIRLS participants with a score of 405. PIRLS 2019 data collection, especially in the field of reading skills, shows that the competency level of students in Indonesia is relatively low. Reading ability is a multifaceted process that combines mastery of recognition and understanding of language (Gray & Climie, 2016). Language skills are needed because, through language, children can fulfill their needs by interacting with their environment, acquiring knowledge, and so on (Rakimahwati & Roza, 2020). The PISA and PIRLS 2019 results above, especially regarding reading or literacy skills, show the low ability of Indonesian students.

The existence of this android application is a medium to help students or children read and understand texts better (Amarulloh et al., 2019). Claims that by adopting digital learning, students gain knowledge about various current technological advances and information about emerging advances. Students will easily understand and absorb this application because it is made with different color displays, is equipped with illustrations that attract students' interest in reading, and is equipped with sound because the simplest way to read is to look at pictures (Widyastuti, 2017). ADHD children have a tendency to get bored quickly but can focus on something that interests them; it is necessary to design an interactive visual communication media strategy so that it can attract their interest in interacting (Ng et al., 2016). In general, children with ADHD have relatively high motor activity compared to children of their age, find it challenging to follow sequential instructions, and forget easily (Roshinah et al., 2014). Children with ADHD may exhibit centrality deficits when listening to glances due to the auditory nature of receiving fleeting information (Manuscript, 2014).

In this study, the researcher refers to previous studies related to the research being carried out, such as research conducted by children. Initial research was conducted by Amarulloh et al. (2020). Based on the findings of this study, it can be concluded that the use of an Android-based media application called Indonesian Digital Literacy (LDI) impacts the abilities and learning outcomes of students with ADHD. This is indicated by the increase in the pretest value of the experimental group after the post-test, which is greater than the increase in the pretest value of the control group. The second investigation was conducted by Umroh et al. (2019). In his research at the University of Maryland SLB Laboratory, he holds the title Multimedia Tutorial Growing Interest in Reading for Students with ADHD. The validity level of digital literacy tutorials as learning media is 95.5% for material experts, 82.1875% for media experts, and 92.5% for practitioner experts. When it comes to helping children with ADHD become interested in reading, multimedia resources are essential. This multimedia lesson has proven to be a very effective teaching tool for children with ADHD, as seen from the pre-test and post-test scores, which increased from 70 on the pre-test to 90 on the post-test. One similarity between the studies featured here and those presented previously is that both investigated the interest levels of children with ADHD in reading. In the third study conducted by Rizki (2019). With the title "Development of Android Application-Based Mobile Learning Media for Students with ADHD," Rizki (2019) looks at students with ADHD. The results of the evaluation of Android application-based mobile learning media obtained a very high-quality score of 87.8% from all reviewers and peer reviewers who took part in the assessment. The findings from the questionnaire

show that the mobile learning media has a satisfactory quality (79.71%). The data collection findings show that mobile learning media built on Android applications is feasible to use as a learning resource. These findings are based on research findings. Learning research conducted by Sambodo for children with ADHD is a form of development research and application-based learning media.

Based on initial observations made by SD Labschool UNESA 2 regarding online reading learning activities during the previous pandemic, it is known that 60% of students spend more time at home playing and hanging out with family. Children tend to use cell phones to watch YouTube and play games. Moreover, based on interviews with several SD Labschool UNESA 2 parents, around 45% of parents said "often" or "sometimes" let their children play on digital devices while doing assignments. Learning provided by the school is in the form of worksheets. While the use of other learning media still uses animated videos only. Nothing combines learning to read with exciting reading designs that interest children. Thus, digital literacy media is an exciting solution and can improve the intelligence and abilities of students. This research is necessary because reading is a language skill that students must improve to become proficient in languages. One of the learning methods that attracts children's attention in understanding the meaning of a word and the context of its use is to teach them to read through the use of Android application-based digital literacy media.

Hyperactive children look busy, but their activities seemingly have no purpose. The symptoms of children with ADHD are similar to those of autism but have much better communication and social interaction skills (Soegito, 2006). So that through digital literacy media, students can play while learning, and this can improve the reading skills of regular students and those with disabilities. In literacy in elementary schools in the current digital era. Stimulation or stimulation is given to help the process of physical and spiritual growth and development according to the stage of development of the child's age (Nurhazizah et al., 2019). This is important for research on developing Android application-based digital literacy media to improve the reading skills of students with ADHD in inclusive schools. This research is expected to provide valuable insights into how technology can be used as a learning support tool for students with ADHD and, overall, contribute significantly to the inclusive education community.

METHOD

The Learning Media Development Research Method, also known as the Research and Development (R&D) Method, was used in this study to improve the reading skills of children diagnosed with ADHD while they participate in classroom activities. According to Sugiyono (2016). The research technique known as research and development is what is done to create a particular item and evaluate how effective it is. The strategy used in this research is to make sure products. Developments resulting from this research are in the form of software and application programs. These programs are produced with the help of Figma design tools. They are supported by the Android Studio editing tools and the Flutter application framework, which can be used to execute applications on Android smartphones, laptops, and desktop computers. The ADDIE Model, which stands for Analysis, Design, Development, Implementation, and Evaluation, is the development (R&D) methodology used in this work.

In this study, the research procedure uses the ADDIE model. Done gradually starting from (Sugiyono, 2016). Analysis, Design, Development, Implementation, and Evaluation (ADDIE) steps are presented in Figure 1.

Researchers use the ADDIE development because it makes an innovation from the development of technology and learning of students in elementary schools to improve reading skills. The research lasted for about two months, from February to April 2023. This game was tried out at SD Labschool UNESA 2 in Classes 3, 4, 5, and grade 6, which consisted of class 3 having two students, class 4 having two students, class 5 there are two students, and in grade 6 there are two students the total becomes eight students with special needs (ADHD). The data collection method used in this study was to gather the necessary information to provide an overview of the validity, practicality, and effectiveness of digital media literacy based on Android applications.

Three validation instruments are used, namely validation from media experts, material experts, and learning feasibility tests.

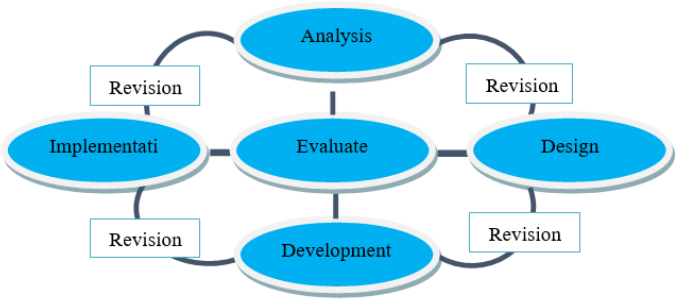

Figure 1. Stages of Development of the ADDIE Model

The researcher examines the data collected in this study by going through the following stages according to the method that will be used to evaluate the data.

Analysis of the Validity of Digital Literacy Media

Completed product validation sheets by instructors, media professionals, and content experts provide evidence of data reliability. Digital media literacy validation data is assessed according to the assessment criteria in Figure 2 below to assess digital media literacy's validity.

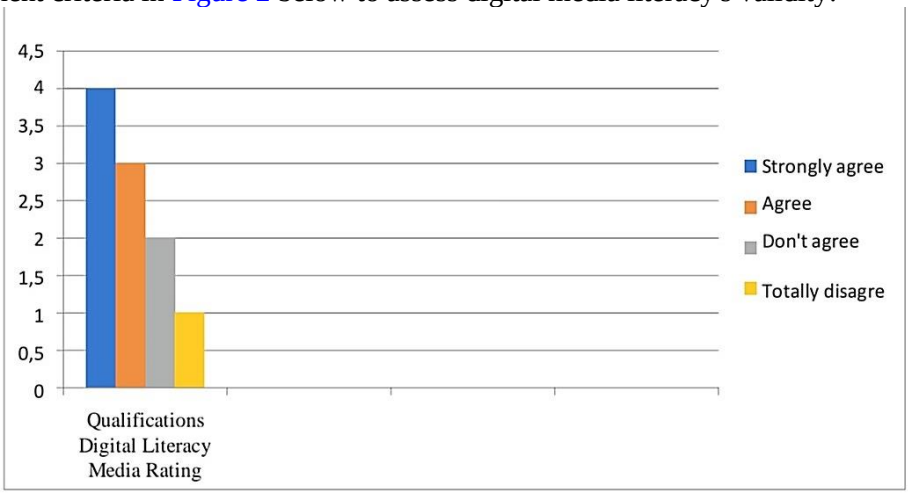

Figure 2. Assessment of the validity of digital literacy media

Furthermore, the collected data was analyzed with Aiken's V Validation using the formula 1.

$$V = \sum s / [n\,(c - 1)] \quad (1)$$

s is r – lo; n is number of appraisers; lo is lowest validity rating score (in this case = 1); c is the highest validity rating score (in this case = 4); and r is the number given by the validator.

The results of Aiken's V calculations range from 0 to 1. After the results of Aiken's V calculations, the media eligibility criteria are grouped into “Very worth it” (0.76 – 1), “Worthy” (0.51-0.75), “Not worth it” (0.26-0.50), and “Not feasible” (<0.25).

Practical Analysis of Digital Literacy Media

To find out the practicality of digital literacy media, some aspects must be met, namely practicality in theory. Practical analysis of theoretical aspects Practical analysis of educational digital literacy media against theoretical aspects contains four general assessment criteria with value codes. In addition, if the validator shows that digital media literacy can be used with at least some adjustments.

3. Effectiveness Test Analysis

Obtaining an efficiency analysis involves counting the number of students participating in the activities detailed on the observation sheets. The data is broken down and checked using Sugiyono's (2016) detailed proposal of proportions in Formula 2.

$$\text{Effectiveness Percentage} = \text{Ideal Score} / \text{Maximum Score} \times 100\ \% \quad (2)$$

To determine the effectiveness of digital literacy media, it can be adjusted to the criteria in the following figure 3. Based on the criteria above, digital literacy media is said to be effective if there is an increase in the ability to read and understand the contents of the reading for students and obtain a percentage of > 51%.

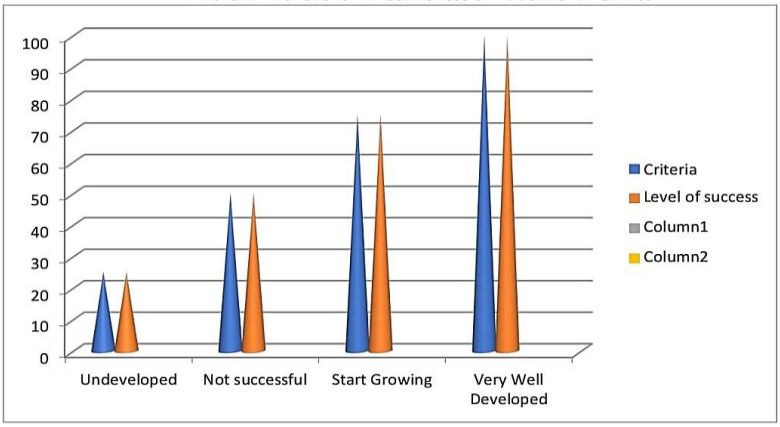

Figure 3. The level of effectiveness of digital literacy media

RESULTS AND DISCUSSION

Result

The information will be analyzed after completing tasks such as making observations, running experiments, and collecting and storing data. After the researcher processes the data using data analysis, a description of the research data is then given, and the data collected for this research will be studied using the following stages:

Analysis Stage

This stage analyzes the importance of developing digital literacy media products that researchers innovate. The development of this product begins with observations in the field where the high use of electronic media in the form of smartphones for students, as stated by the UNESA Labschool 2 elementary school principal, about 99% of students from grades 3, 4, 5 and grade 6 According to reports provided by the guardian instructor class, the average student already has an android smartphone. Most students exclusively use their smartphones to make phone calls, send and receive texts, play music and movies, and access various social media networks (including WhatsApp, Facebook, Twitter, and others). Students even spend more time playing online games such as PUBG and mobile legends. This causes a low interest in reading students, which results in a decrease in the ability of student learning outcomes. So, researchers create a media that can attract students' enthusiasm and provide innovative digital literacy media based on Android applications to help improve students' reading skills in elementary schools.

1. Curriculum Analysis

The curriculum analyzed refers to the 2013 Curriculum of the Minister of Education and Culture No. 146 of 2014 relating to language in the aspect of developing literacy, namely reading.

2. Student and Teacher Analysis

SD Labschool UNESA 2 has six teaching staff, including HR a class III teacher. AK is a class IV teacher, SA is a class V teacher, MP is a class VI teacher, and SR and NL are

accompanying teachers. Analysis of ADHD students attending SD Labschool UNESA 2 totaling eight students from grades 3, 4, 5, and 6. Researchers designed an Android application-based digital literacy media product for ADHD students at this stage. In this digital literacy media, researchers want to improve the reading skills of students with ADHD. According to the analysis of the elementary school education curriculum, this stage designs digital literacy media based on Android applications. At this stage, the first step is to make a lesson plan. The design of digital literacy media is by the curriculum and is supported by several theories. The following is a design according to the developmental stages of ADHD students. It is an Android application-based digital literacy media development design presented in Figure 4 until Figure 12.

Figure 4. Initial display of digital literacy applications based on Android applications

Figure 5. Display of menu options and books in digital literacy applications base on Android applications

Figure 6. Display of settings in digital literacy applications based on Android applications

Figure 7. Display of a selection of children's fairy tale books in digital literacy applications based on Android applications

Figure 8. Display of a selection of folklore books in digital literacy applications based on Android applications

Figure 9. Display of practice questions or evaluation of reading on digital literacy applications based on Android applications

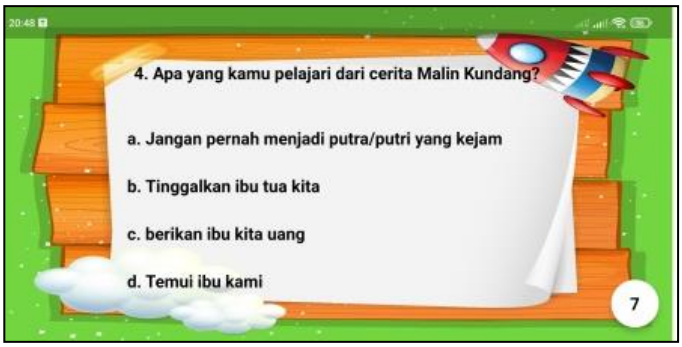

Figure 10. Display of sample questions in digital literacy applications based on Android applications

Figure 11. Display if the answer is **correct** in practice questions on the digital literacy application based on the Android application

Figure 12. Display if the answer is Wrong in practice questions on the digital literacy application based on the Android application

In validating digital literacy media, two experts are from universities. The validator was asked to assess the material and media that the researcher had made. The assessment of digital literacy media includes material/content and media/views. Namely Dr. MS M. Pd as a material expert and Dr. H. AM, S. Pd., M. Pd as media experts. Experts were asked to correct media and materials before researchers entered the field. After the expert stated that it was ready for use, the researcher proceeded to the implementation part. After the Android application-based digital literacy media has been created, the digital literacy media validation process is carried out by an expert, MS, as a material expert on February 8, 2023. The expert views and comments on the designs that have been made and revised according to expert advice to improve digital literacy media content android application based to improve the reading ability of students with ADHD. The V value for item 1 is obtained from V= 2/1(4-1) = 0.67 and V for items 5, 7, 10, 14, and item 2, we get V= 3/1(4-1) = 1, as well as items 3, 4, 6, 8, 9, 11, 12, 13, 15, 16. Aiken's coefficient values range from 0-1. Aiken 1 coefficient values are found in points 2, 3, 4, 6, 8, 9, 11, 12, 13, 15, 16. As for item values 1, 5, 7, 10, and 14, the Aiken coefficient value is 0.67. So that the average value of the Aiken V coefficient = 0.89 can be declared valid.

After the material expert, the media expert assesses that the V value for item 1 is obtained from V = 3/1(4-1) = 1, which is the same as items 3, 4, 5, 7, 8, 9, 11, 12, 13, 14, 15, 17, 18, 19, 20 and for V item 2 it is obtained V= 2/1(4-1) = 0.67 which is the same as item 6,10,16. Aiken's coefficient values range from 0 to 1. One Aiken's coefficient values are found in 1, 3, 4, 5, 7, 8, 9, 11, 12, 13, 14, 15, 17, 18, 19, 20, and the coefficient values are 0.67 in items 2, 6, 10, 16. So, the average value of Aiken's coefficient is V = 0.93; it can be stated that it has valid item validation and is declared suitable for use with revisions.

A limited trial was conducted at SD Labschool UNESA 2, held on February 11, 2023, in class III with two students. The total score obtained is 48, and the average percentage for each

assessment aspect is 85%, which is very practical so that with limited trial results, digital literacy media can proceed to the next stage, namely implementation.

Application

The implementation stage is carried out by developing digital literacy media for ADHD students based on Android applications, which experts have considered practical and tested on students. This application can be found in the Google Play store. The second step requires instructors to analyze digital media literacy to determine whether students successfully utilize media or not, as well as how students react after using digital media literacy. The implementation of Android application-based digital literacy media to improve the reading ability of ADHD students was carried out at SD Labschool UNESA 2 class III, consisting of 8 children. Furthermore, the teachers assessed the media in the FGD (Forum Group Discussion) activity on Wednesday, April 12, 2023.

The practicality questionnaire given to the teacher was filled in after the media had been applied to students. The teachers who assessed the questionnaire were Trisya Maritaria S.Pd from class III and Nita Dwi Rahmawati S.Pd (coaching teacher). The average practicality percentage of the two teachers is 95%. From the results of the practicality test, it was stated that digital literacy media based on Android applications to improve the reading skills of students with ADHD were practical. Furthermore, the assessment of the game media was also assessed by six teachers from Bakti Asih Surabaya SLB. Based on the assessment results in the FGD (Focus Group Discussion) activities at SLB Bakti Asih Surabaya, as many as six teachers with an average result of 85% were stated to be very practical.

Discussion

Development of Android Application-Based Digital Literacy Media to Improve Reading Ability in Attention Deficit Hyperactivity Disorder (ADHD) Students. The creation of educational media is a continuous innovation planned and implemented to enhance educational experiences and outcomes. To answer the demands of education that are developing along with advances in media and technology in the era of globalization, so far, digital literacy has only been known on social media, which can convey information related to things needed by citizens, but it is still not optimized to support the increasing quality in learning (Masitoh, 2018). Various types of media development continue to be carried out (Pakpahan et al., 2020). They claim that the media is a teaching instrument that should be able to improve student learning. Learning media must be created by educational needs to help distribute knowledge to students in a way that is easy to understand and understand. Learning becomes fun and not dull. Clarifying the teacher's message is one of the uses of media in education. Media can also be used for individual learning when placed in a way that fully meets students' needs. In this scenario, the media is used as a tool for educational activities, namely as a teaching resource (visual aid) for teachers (Arwani, 2011).

The development of digital literacy media based on Android applications is one of the renewable innovations that collaborates between technological advances and the demands of the times in the current digital era. The digital literacy skills in question consist of basic skills, including reading, writing, and understanding symbols to represent language and performing numerical calculations (Nurjanah et al., 2017). to improve the reading or literacy skills of attention deficit hyperactivity disorder (ADHD) students in inclusive schools. Given the importance of literacy skills for everyone, including those with special needs, Minister of National Education Regulation No. 70 of 2009 Article 3 Paragraph 1 states that all children, regardless of their needs or abilities, who have physical, emotional, mental, or social disabilities or who have the potential for intelligence or extraordinary skills, attend education, including in specific educational units. These students may have physical, emotional, mental, or social disabilities and have the potential for extraordinary intelligence or talent.

Smartphones are now a primary need for middle and upper-class people rather than just a secondary one. Smartphones come in many different styles and prices and are accessible to the general public. According to the needs of smartphone users, smartphones provide a variety of

exciting features. Learning outside the classroom is simpler by using your phone anytime, anywhere. Smartphones can be used as learning tools and infrastructure for their users, even though now they are only used to access social media and business. With the help of this research, Attention Deficit Hyperactivity Disorder (ADHD) children at school can improve their reading skills by building digital media literacy based on Android applications that can be accessed on smartphones.

Researchers have built a new Android-based media platform called digital literacy. This form of educational media is available to users as an Android application that can be used online and offline. This means that even if users do not have access to the internet, they can still use this form of educational media whenever they want and wherever they are. This makes learning more straightforward and efficient because educational materials can be carried anywhere and accessed whenever students want—individuals who own smartphones and have downloaded digital literacy apps. Android application-based digital literacy media is an alternative to improve the literacy or reading skills of ADHD students. The benefits of developing Android application-based digital literacy media are to improve the reading skills of attention deficit hyperactivity disorder (ADHD) students.

CONCLUSION

The findings of the analysis of hypothesis testing data and discussion of research on digital media literacy can be interpreted that digital media literacy based on Android applications to improve the reading skills of students with ADHD is claimed to be valid, practical, and successful. This conclusion can be reached based on hypothesis testing data analysis results. The reading ability of children, especially students with special needs, can be improved through the development of digital media literacy, a relatively innovation (ABK), one of which is Attention Hyperactivity Deficit Disorder (ADHD) students. This digital literacy media can be used on Android applications, smartphones or mobile phones, notebooks, and PCs. This digital literacy media is made in a way that is easy for students to understand and is expected to improve student's reading skills and can be used at school or when they are at home. Researchers carried out several stages of development, including analysis, design, development, implementation, and evaluation or assessment. Android application-based digital literacy media provides direct learning to students where students learn to read quickly and are accompanied by pictures that interest them when reading. It is hoped that this research will become a reference for further research to develop research in digital literacy based on Android applications.

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