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Developing Android-Based Learning Media to Enhance Early Reading Competence of Elementary School Students

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Abstract

Early reading skills at elementary school age have implications for reading performance at a later stage. The use of representative application-based learning media in the digital era has become a necessity. It was discovered that the learning practices implemented by the teachers did not stimulate students' motivation as the learning media tended to only use textbooks and were less interactive. Additionally, the parents' tended to spoil their children at home with gadgets (mobile devices). These factors allegedly hindered the learning process of early reading skills. This study explores the development of Android-based learning media to support early reading mastery for elementary school students. This development employed the 4D design, which included the stages of "define", "design", "develop", and "disseminate". Three groups of participants were involved (41 teachers and 108 students) at several elementary schools in the Sumedang Regency, West Java Province. As a solution, the Android-based learning media for early reading was produced and had a number of features that could help teachers and parents enhance elementary school children's early reading skills of. This study contributes to the development of learning media that can be utilized by teachers, parents, and students to enhance elementary school-aged children's early reading skills.

Keywords: Android, early reading, learning media, elementary school.

Introduction

The development of reading skills for students at the beginning of elementary school is crucial because reading skills at such time can predict reading performance in the following years (Cunningham & Stanovich, 1997; Kamil et al., 2016; Rayner et al., 2001; Schiefele et al., 2016). Children who start out as relatively good readers will continue to show higher reading growth than their classmates who start out as poor readers (Schiefele et al., 2016). The fact that Indonesia ranked 62 out of 70 countries in the world as country that has low literacy levels (Utami, 2021) is closely related to problems with early reading performance at the beginning of school. The problems include the inability to recognize letters, the inability to read syllables, words, diphthongs, clusters, diagraphs, consonants, and vowels, repetition, incorrect reading segmentation, and the inability to understand word meaning (Rahma & Dafit, 2021). These problems are often found in elementary school students in Indonesia (Afiyati & Iswara, 2020). Therefore, real steps are needed in tackling the problem of early reading skills at elementary school age.

Several recent studies on reading skills of elementary school students have been explored. For example, on learning motivation, Kanonire et al., (2022) discussed the relationship between reading motivation and reading skills in early school and reading performance in junior high school. They concluded that there is a correlation between intrinsic and extrinsic motivation in reading skills and they mentioned the importance of early reading skills for elementary school students in predicting reading performance for the following two years. Schiefele et al., (2016) measured reading motivation and reading comprehension performance of elementary school students at two different time points within one year. They suggested that intrinsic motivation in reading contributed to the development of early reading competence. Other studies discussed teacher expectations of elementary school students' reading achievement, such as in the study by Watson et al., (2019), which explored teacher expectations through a gender analysis approach on primary school teachers in New Zealand. They revealed that teacher gender affected his/her expectations about student achievement in reading. They further described that female teachers had higher expectations for their students than male teachers. Furthermore, a study related to reading learning methods was conducted by Prescott et al., (2018). They analyzed the implementation of a blended learning program for literacy learning in urban elementary schools. They found that a mixed learning approach to literacy learning, benefited diverse students especially in the early grades.

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However, these studies only showed the components that support the enhancement of early reading skills. An aspect that were not highlighted in these studies was the learning media in early reading learning practices. Learning media is a necessity in the learning process (Gillen et al., 2007; Kosasih et al., 2021; Peppler & Kafai, 2007; Supriyadi, Julia, & Iswara, 2019; Supriyadi et al., 2020; Willett, 2007) and they can stimulate students' performance, motivation, and skills in reading. Therefore, motivated by the aforementioned studies, this study seeks to focus on exploring the development of learning media to enhance early reading skills of elementary school students.

Theoretical Framework

Learning media aid teachers and students to achieve instructional goals (Antonietti, 2015; Arief & Isnan, 2020; Ramadhani et al., 2019; Sumarwati et al., 2020) and increasing student learning motivation siswa (Mindayula & Sutrisno, 2021; Puspitarini & Hanif, 2019; Sastradika et al., 2021). Nowadays, teachers can choose a variety of learning media including electronic-based media (Rouhi & Mohebbi, 2013). Learning media such as pictures, animations, and videos are believed to be able to help the visual perception problems experienced by students (Cantoni et al., 2004; Z. G. Ge, 2021; Turk, 2001). Using multimedia is expected to help students learn more from messages combining words and pictures than from those based on words alone (Grabe & Stoller, 2013; Mayer, 2002; Mayer & Moreno, 2002).

Researchers have classified learning media in two different categories with different perspectives, namely print-based and non-print-based learning media (Price, 2004; Sadler-Smith & Riding, 1999) and interactive and non-interactive learning (Z. Ge, 2014; Z. G. Ge, 2021; Hamidi et al., 2011; Ramadhani et al., 2019). Currently, smartphones are the most used learning media by almost all society levels (Lawrence & Choe, 2021; Lee & Al Khateeb, 2021; Ravikumar et al., 2022)especially among the higher education student community. Smartphones with the internet, in turn, provide access to social media platforms. Smartphones and social media (SM. Mobile devices are considered as convenient learning tools that provide access to all the different learning materials available (Saraubon, 2019).

Advances in mobile technology have encouraged an increasing number of studies on mobile learning at the elementary school level (Chu, 2014; Hsieh et al., 2016; Huang & Chiu, 2015). In the meta-analysis of mobile learning trends from 2003-2010, most of the studies focused on the effectiveness of the learning and the design of mobile learning systems. The research methods used were generally surveys and experiments (W.-H. Wu et al., 2012). Meanwhile, from studies related to mobile learning, 36 studies in 2000-2015 related to mathematics learning showed that elementary school settings and formal education contexts were the most common research contexts and that that mobile phones were the most frequently used mobile devices (Crompton & Burke, 2015).

Mobile-based learning media have also been widely developed by academics in language learning (Hashimoto et al., 2017; Smith & Wang, 2013; Wang, 2017) and the learning media have been generally developed for middle and high schools. However, studies on the development of mobile-based learning media in improving early reading skills for elementary school students are lacking. Therefore, this study is important because elementary school students learn differently from adults (García et al., 2016)or the correspondence between perceived performance and actual performance, is linked to students' metacognitive and self-regulatory skills. Making students more aware of the quality of their performance is important in elementary school settings, and more so when math problems are involved. However, many students seem to be poorly calibrated, with a tendency towards over-confidence. The present study analyzes the relationship between post-performance calibration accuracy and the metacognitive process shown by 524 fifth- and sixth-grade students while solving two math problems. After calculating a calibration index and establishing the stability of students' judgments and actual performance, differences in the metacognitive process exhibited by students with different calibration accuracy (Accurate vs. Inaccurate groups. In addition, for those who belong to the digital native group, namely the generation born after the 1980s who lived and grew up in a digital technology environment (M.Prensky, 2001), cellphones have integrated into their lives more than their parents (Bai, 2019; Sun et al., 2018)and relationships between mobile learning behaviors and personal characteristics in mobile learning environment. The current study designed and developed a game-based educational mobile environment and conducted an experimental research. Eighty-three elementary students participated in this study. The results revealed the features of elementary school students' mobile learning behavior including: 1. Thus, many countries have introduced mobile technology into the formal academic courses to keep up with the students' developmental characteristics and the digital era (T.-Y. Liu & Chu, 2010). Consequently, it is necessary to explore the development of mobile-based learning media in improving the early reading performance of elementary school students. The results of the investigation are expected to provide more empirical evidence for the optimization of multimedia learning in educational practice (Heuer & Hallowell, 2007; Hu et al., 2021; H.-K. Wu et al., 2015)it is unclear how the addition of pictures affects students' problem-solving performance. The multimedia effect in problem solving describes the phenomenon whereby an individual's problem-solving performance is enhanced when equivalent pictures are added to illustrate or replace part of the problem text. Using meta-analytic techniques, this study sought to determine the

overall size of the multimedia effect in problem solving and the possible boundary conditions (k = 51; N = 38,987; Range n = 10 – 31,842; Median n = 63.

Method

Research Design

The development stages of the multimedia-based learning media referred to the 4D model from Thiagarajan et al., (1974). The stages were "define" as the needs analysis phase, "design" as the phase in designing products based on the results of previous analysis, "develop" as a product development phase based on the results of trials, and "disseminate" as a product socialization phase. The wide use of 4D design in the pedagogical development context by academics in various disciplines was a consideration in choosing the design (see Aisyah et al., 2022; Muhtar et al., 2020; Supartini et al., 2020). A simple linear regression analysis was performed to compare the cases handled with the percentage of completeness.

Partisipant and Sites

This development study involved three group of participants. The first group were 41 elementary school teachers in Sumedang Regency, West Java Province. They taught in grades 1 to 3 and they belonged to the digital native group (M.Prensky, 2001). They were heavily involved in this study in the needs analysis and the development phases. The next were 108 elementary school students from grades 1 to 3 from various schools and 41 teachers in Sumedang Regency were also involved. Lastly, their parents gave consent for their involvement in the product trial. In the development of the product, 108 parents were also involved in the product testing activities.

This study focused on Sumedang Regency, West Java Province given that it will be a center for education development in West Java Province as indicated by the presence of several of the large universities in Indonesia. Visually, the location of Sumedang Regency is depicted in Figure 1.:

Fig. 1: Location map

Research Procedure

This study had 4 stages of activity that are "define", "design", "develop", and finally "disseminate". The four stages are described as follows.

Define

This stage is referred to as the analysis phase (Muhtar et al., 2020), which is to explore information and observe a number of phenomena related to the need for mobile-based early reading learning media. The curriculum and textbook used as learning resources for early reading were analyzed. Literature analysis was carried out by tracing a number of journal articles related to improving early reading skills. Field studies were also conducted to explore information from parents about their children's reading skills at school and the challenges of teachers in meeting the parents' expectations and curriculum demands. The findings in this stage became the basis for consideration in setting the learning objectives using the mobile-based early reading learning media.

Design

As a follow-up to the first stage, a conceptual design of the learning media was prepared. In this stage, the platform in designing the media was selected, the learning contents of early reading were compiled, and the guidelines for use and evaluation instruments were designed. This stage produced the initial product of mobile-based early reading learning media.

Develop

Three main activities were implemented: validity test, practicality test, and effectiveness test. In the validity test, three validators were asked to provide assessments and recommendations regarding the initial product. The practicality test was carried out by extracting information from the teachers and parents on the initial and final products of reading learning media, while the students took an efficacy test to see the enhancement of their early reading performance after completing a series of learning processes using the designed learning media.

Disseminate

As the final stage, product socialization was carried out through parenting seminars related to improving early reading skills in the community and publication of research results as a form of academic diplomacy to expand the meaning and usefulness of the research results.

Data Collection

At the "define" stage, surveys and interviews were used in data collection. The survey was taken using purposive sampling. It

contained 15 open-ended questions made using the Google Form application. The survey was distributed to the parents and teachers to explore their responses to the Android application they used in early reading learning. In conducting the survey, research ethics were considered. Before they filled out the survey, they received an explanation of the purpose of the survey and the extent of their involvement in this study. Guarantees of data confidentiality were explained and a consent form to be involved in this research was provided. Findings that required further investigation were followed up in in-depth interviews. At this stage, the data generated was qualitative data. In the "design" phase, the activities were focused on designing the product. Meanwhile, in the "develop" stage, the data were obtained from the expert validation assessment and student test results, hence the data were quantitative data.

Data Analysis

The qualitative data were obtained from interviews and quantitative data were in the form of numbers. In conducting qualitative data analysis, a combination of thematic inductive analysis and content analysis was used(Julia et al., 2020; Supriyadi, Julia, & Firdaus, 2019). Data coding and categorization were done to ensure that there was no overlapping of information. To facilitate coding and categorization, NVivo software was used. To analyze quantitative data, SPSS software was used.

Findings

Phase of Define

In analyzing the need for mobile-based early reading learning media. The participants were interviewed. From the interviews and questionnaires, 4 major themes were generated, namely curriculum demands, learning practices, motivations, and barriers. The four themes are illustrated in the concept as shown in Figure 2:

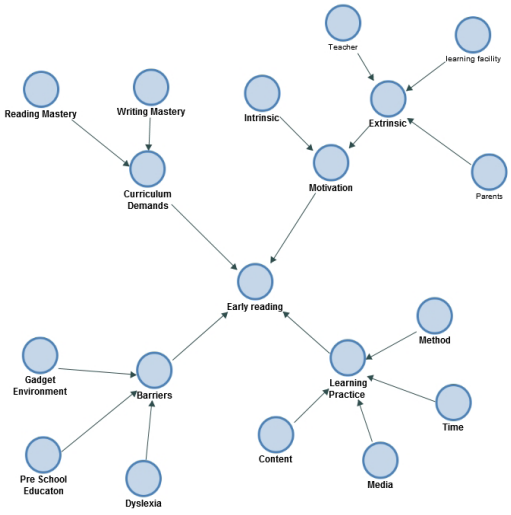

Fig. 2: Needs analysis of mobile learning media

Curriculum Demand

The curriculum is a set of subjects and educational programs provided by an educational institution that contains lesson plans given to students in a period of education level (Salim & Hanif, 2021; Işman, 2020; Xu et al., 2020). In the view of teachers and parents, the demands of the curriculum in elementary schools are not for the period of learning to read, as children must already be able to read and write when they start elementary school. This opinion was expressed by several participants (translated transcription):

> *Seeing the demands of the current curriculum, children starting elementary school should be considered to have the skills to read and write but in reality, this is not the case* (Teacher 3)
>
> *Currently, when students start elementary school, they must at least have the skills to read* (Teacher 8).
>
> *From the tasks given at school, children are considered to be able to read and write, therefore, before entering elementary school, children must be able to read* (Parent 56).

From these teachers' and parents' perceptions, a learning process that can achieve early reading skills at elementary school age quickly and accurately was needed as an effort to answer curriculum challenges.

Learning Practices

Four items were highlighted in the teachers' learning practices to achieve the early reading skills, namely time allocation, percentage of completeness, number of students handled, content, methods, and media used. In terms of time allocation, the teachers viewed that the availability of time in completing the early reading skills for elementary school students was very minimal so that additional time was needed outside of class hours. This opinion was expressed by several teachers (translated transcription).

> *To complete grade 1 elementary students' reading ability, it is necessary to provide special treatment and additional time outside of class hours* (Teacher 12).
>
> *Students who have minimal early reading skills need to take private or tutoring and the school need to facilitate this outside of additional lesson hours* (Teacher 43).

Given that some teachers felt that time allocation was lacking, it was suspected to be closely related to the methods adopted in the learning practices. The results of interviews showed that the methods used by teachers in completing early reading skills tended to be the classical method, in which the learning activities were carried out by all children in the same class at the same time (Bozkurt, 2022; Gjoreski et al., 2020). This was stated by several teachers (translated transcription):

> *Reading learning activities are carried out together at the same time, and using the method, there are still children who have not completed (the learning), then it is recommended that their parents take additional lessons provided by the school* (Teacher 14).

> *Given the limited time, learning is carried out classically* (Teacher 73).

In terms of the presented contents, the teachers provided six materials, namely recognizing letters, both vowels and consonants, reading syllables, reading several syllables, reading short and long sentences, and building reading habits. Meanwhile, contents such as diphthongs, clusters, diagraphs, repetitions, reading segmentation, and word meanings tended to remain untouched. This was as stated by several teachers (translated transcription):

> *The materials presented in early reading include recognizing letters, both vowels and consonants, recognizing syllables, reading words (Teacher 87).*

> *To achieve the initial reading ability, children need to master the materials on vowels, consonants, (and) syllables, and then get used to reading short and long sentences (Teacher 63).*

> *The materials needed to achieve early reading skills for elementary school students include the introduction of letters, consonants and vowels, letter sounds, syllables, and short sentences* (Teacher 66).

In terms of the learning media used, the teachers used printed text books provided by the schools or by publishers in collaboration with schools. This was stated by several teachers (translated transcription):

> *We use textbooks available at school as learning resources and media (Teacher 18)*

> *The textbooks that we use are the sources and learning media that we often use today (Te*acher 46)

Motivation

Motivation is the reason that underlies an action carried out by an individual (Kim et al., 2021; Yin et al., 2021). Conceptually, motivation consists intrinsic and extrinsic aspects (Good et al., 2022; Van den Broeck et al., 2021). Intrinsically, student motivation in this study was quite high as indicated by their desire to learn and curiosity. However, several extrinsic factors made the intrinsic motivation less explored, such as the lack of innovation at the teacher's end, parenting style that spoil children too much with gadgets or mobile devices, and the learning facilities that were lacking and disliked by children. This was stated by several participants (translated transcription):

> *Judging from the motivation in students, it is already high. Maybe the innovations raised by teachers in learning are less attractive to students. This may also be caused by the limited learning facilities (Teacher 92).*

> *To strengthen children's motivation, there needs to be a breakthrough in technology-based learning media that is favored by generation Z students (Teacher 79).*

> *My child is quite eager to learn, but because the sources and learning media that I use at home are only textbooks, the enthusiasm for learning is lacking (Parent 34).*

> *Given that today's children cannot be separated from smartphones, while the competency demands elementary school age children now have to be able to read, it is necessary to have a smartphone application that facilitates learning to read* (Parent 67)

The statements above indicated that teachers and parents had high expectations that mobile-based learning media that can strengthen students' learning motivation would exist. The increase in student motivation is expected to have an impact on students' reading performance.

Barriers

From the teachers' perspective, the lack of children's early reading skills to read early was caused by three factors. First, the gadgets or mobile devices children used tended to have more game applications that did not support the competence achievement needed at their age. Second, some students had dyslexia or reading difficulties. Third, the children did not have preschool education. This was stated by several teachers and parents.

> *There are several things that hinder students in having competence in early reading, including children being attached to their gadgets as a result of parenting, and children not attending pre-primary education (Teacher 77).*

> *One of the delays in achieving initial reading skills is dyslexia and not attending kindergarten education* (Teacher 64).

> *Preschool education is important in efforts to achieve students' early reading skills in elementary school. Besides that, learning media that makes children happy is an important fact that should not be ignored considering the current trend of children not being separated from smartphones* (Parent 62).

Based on these themes, there are several indicators that need to be considered in designing learning media. First, learning media is to be designed based on smartphone applications. Second, the material content supports the enhancement of reading competence quickly and accurately, as well as increase students' learning motivation and foster reading habits. In addition, the media is a solution in meeting the demands of the curriculum.

Phase of Design

As a follow-up to the previous stage, an Android-based early reading learning media was designed. The selection of the Android base was because teachers and parents in particular, also people in Indonesia in general, use Android-based smart phones (Ahmar & Rahman, 2017; Sari et al., 2019). It was expected that the use of Android can reach the wider community. The software used in making the Android application was Smart Application Creator 3 TC-V 3.3.5.

In the preparation of this learning media, learning objectives were set. The resulting learning media were expected to be used as a material guide in improving children's minimal skills to read Indonesian texts, namely recognizing letters, being able to read syllables, word by word, diphthongs, clusters, diagraphs, consonants, vowels, repetitions, and reading segmentation, and recognize the meaning of words. Therefore, the materials compiled referred to the achievement of these goals.

We compiled using the letter "d, n, t, p, m" and it was called "dia tampan method" (He is handsome method) to make it easier to remember. The dia tampan method used the words "*ada, ini, itu, apa, mana*" (respectively: there is, this, that, what, where) in the lesson (Iswara et al., 2020). Sentences formed by dia tampan method included "*ada dada, ini nana, itu tita, apa ini pipa, mana mama*" (there is a dada, this is nana, that is tita, is this a pipe, where is mama). Furthermore, the material was accompanied with pictures of letters and associations (similarities) of letters, text sounds, or readings. The application design in Figure 3 shows "*huruf d seperti daun*" (letter d looks like leaf) and lines of sentences that students should read "*ada, ada dada, ada didi, ada dudu, ada dede, ada dodo*" (there is a dada, there is didi, there is dudu, there is dede, there is dodo).

Fig. 3: Android-Based Early Reading Application Design

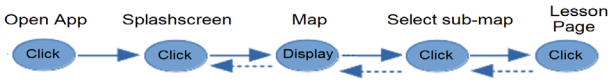

Fig. 4: Application Navigation Flow

Next, the interface or screen display for each page was designed. This Android application interface was designed to consist of three parts, namely (1) the splash screen, (2) the map (navigation) screen, and (3) the lesson screen. The splash screen consisted of the name of the application, the copyright label, and the start button. On the splashscreen, the application header section had the name of the application, namely "*belajar baca*" (learning to read) in lower case letters to make it easier for students to read. The map screen provided a choice of more detailed navigation or the lessons the students would to follow. The map screen was divided into four sections and below that was a Google Forms survey link button. Only the Google Forms page needed internet connection, the rest of the application features did not use an internet connection. The map screen consisted of 5 layouts (pages). The lesson screen had reading features that could produce sounds when tapped or clicked with 19 layouts (pages). The application flow is described in Figure 4.

Phase of Develop

This stage consisted of two steps. First, three experts reviewed the resulting product. After the product was reviewed, the second step was the test of validity and reliability of the product to non-sample students. The results of the expert assessment using the Likert scale are presented in the following Table 1.

The validation results in Table 1 show that the Android application obtained the lowest average score of 4.17 and the highest average score of 4.50. This means that the expert validation results were included in the fairly good criteria and the design of the application was suitable for use in the learning process. Furthermore, the validity and reliability of the instrument were tested in three steps 1) compiling 15 statement items; 2) conducting trial on non-sample classes 3) following up on the results of the validation. The details of the 14 statement items are in Table 2.

Table 1: Expert Team Validation Results

Assessed Components	*Expert 1*	*Expert 2*	*Expert 3*	*Average*
Perceived Usefulness (PU)	4.26	4.75	4.49	4.50
Perceived Ease of Use (PEOU)	4.13	4.13	4.25	4.17
Clarity (K1)	4.25	4.26	4.49	4.33
Appropriateness (K2)	4.18	4.48	4.32	4.33

Table 2: Questionnaire items (15 statement)

No	Statement	Quantity
1.	Self-efficacy	2 items, 5 point Likert scale
2.	Ease of use	2 items, 5 point Likert scale
3.	Usefulness	2 items, 5 point Likert scale
4.	Clarity	2 items, 5 point Likert scale
5.	Appropriateness with student/ curriculum/teacher needs	3 items, 5 point Likert scale
6	Joyfulness	2 items, 5 point Likert scale
7	Behavior intention	2 items, 5 point Likert scale

Table 3: Instrument Validation

Indicator	Sub Indicator	Score	Average	Criteria
Self-efficacy	Item no.1	0.5671	0.6107	High
	Item no.2	0.6542		
Ease of use	Item no.3	0.5214	0.4990	Medium
	Item no.4	0.4765		
Usefulness	Item no.5	0.7653	0.7593	High
	Item no.6	0.7532		
Clarity	Item no.7	0.6585	0.6469	High
	Item no.8	0.6353		
Appropriateness with student/ curriculum/ teacher needs	Item no.9	0.7859	0.6774	High
	Item no.10	0.6824		
	Item no.11	0.5639		
Joyfulness	Item no.12	0.5637	0.6500	High
	Item no.13	0.7362		
Behavior intention	Item no.14	0.7453	0.7409	High
	Item no.15	0.7364		

Table 4: Students' Attitudes Towards Android Media (SE, PU, PEOU, C, A, J, BI)

	N	*Min*	*Max*	*Mean*	*Std. Dev.*
Self-Efficacy (SE)					
Students can learn early reading using the Android application.	108	3	5	4.13	0.58
The Android application helps students learn early reading.	108	1	5	4.11	0.67
Perceived Ease of Use (PEOU)					
It is easy for me to use the Android application to learn early reading.	108	2	5	3.95	0.65
Learning early reading with an Android application is easy for me.	108	2	5	4.04	0.59
Perceived Usefulness (PU)					
The Android application is useful for learning early reading.	108	2	5	4.06	0.59
I find the Android application useful in learning early reading.	108	2	5	4.11	0.60
Clarity (C)					
The Android application lessons in early reading are clear and understandable.	108	2	5	3.88	0.64
The Android application for early reading is clear and understandable for me.	108	1	5	3.95	0.65
Appropriateness (A)					
The early reading lessons using the Android application is suitable for students.	108	3	5	3.88	0.58
The early reading lessons using the Android application is appropriate with the curriculum.	108	3	5	3.77	0.61
The early reading lessons using the Android application appropriate with the teacher's orientation.	108	3	5	3.93	0.54
Joyfulness (J)					
I enjoy learning early reading using the Android application	108	4	5	4.23	0.44
Learning early reading using the Android application is fun for me.	108	4	5	4.31	0.48
Behavior Intention (BI)					
I will be using the Android application for early reading in the future.	108	2	5	3.95	0.59
If offered, I will use early reading the Android application for early reading.	108	2	5	3.97	0.59

To measure completeness, an instrument was used to obtain information about the number of students handled, the percentage of completeness, the average score for completeness, the length of learning (weeks), the number of meetings per week (Table 3).

In the self-efficacy indicator, Table 3 shows that the average validity value is 0.6107 with high criteria. Overall, all instruments obtained a medium and high average validity. Therefore, the instrument was considered feasible to be implemented in the study. To determine the level of students' reading ability, a limited trial was conducted in the form of a questionnaire containing 15 statement items, which consisted of self-efficacy, ease of use, usefulness, clarity, appropriateness with student/curriculum/teacher needs, joyfulness, and desire to use (behavior intention). The questionnaire was given to students after students received the treatment. Reading proficiency test materials were taken from the Android application without the voice feature. The trial was conducted on 108 elementary students in grades I to III. Table 4 presents the results of the student questionnaire.

The effectiveness or success of using the Android application can be seen from the responses of 41 teachers for 108 students in the following table 6.

Table 6 shows that most teachers did the reading lessons 3-4 times a week (20 respondents, 48.78%). Each teacher handled 1-5 students and 6-10 students (respectively 12 and 9 respondents, 29.27% and 21.95%).

Based on the number of students handled and the completeness percentage, linear regression analysis was obtained with a correlation value of 0.5791 (medium). The correlation value of 0.5791 indicated a moderate correlation category, which means that the category is neither low nor strong. The adjusted R square shows values of 0.2911217949 or 29.11%. Which means the number of completeness can explain the number of cases by 29.11% the rest is influenced by other factors. The significance value of F is 0.01484070329 which is smaller than alpha 0.05 so it can be concluded that there is a significant effect between the number of cases and the number of completeness. The regression equation obtained was Y=-0.5240384615 + 0.8798076923.X. The results of the linear regression of the number of students handled and the completeness percentage are summarized in Table 7.

Phase of Disseminate

In the final stage of this study, the product application for developing early reading learning media was socialized to

Table 5: Students' Attitudes Towards Android Media (SE, PU, PEOU, C, A, J, BI)

	N	*Min*	*Max*	*Mean*	*Std. Dev.*
Self-Efficacy (SE)					
Students can learn early reading using the Android application.	108	3	5	4.13	0.58
The Android application helps students learn early reading.	108	1	5	4.11	0.67
Perceived Ease of Use (PEOU)					
It is easy for me to use the Android application to learn early reading.	108	2	5	3.95	0.65
Learning early reading with an Android application is easy for me.	108	2	5	4.04	0.59
Perceived Usefulness (PU)					
The Android application is useful for learning early reading.	108	2	5	4.06	0.59
I find the Android application useful in learning early reading.	108	2	5	4.11	0.60
Clarity (C)					
The Android application lessons in early reading are clear and understandable.	108	2	5	3.88	0.64
The Android application for early reading is clear and understandable for me.	108	1	5	3.95	0.65
Appropriateness (A)					
The early reading lessons using the Android application is suitable for students.	108	3	5	3.88	0.58
The early reading lessons using the Android application is appropriate with the curriculum.	108	3	5	3.77	0.61
The early reading lessons using the Android application appropriate with the teacher's orientation.	108	3	5	3.93	0.54
Joyfulness (J)					
I enjoy learning early reading using the Android application	108	4	5	4.23	0.44
Learning early reading using the Android application is fun for me.	108	4	5	4.31	0.48
Behavior Intention (BI)					
I will be using the Android application for early reading in the future.	108	2	5	3.95	0.59
If offered, I will use early reading the Android application for early reading.	108	2	5	3.97	0.59

Table 6: Teachers' Response about The Effectiveness of Android Application (N=41)

No	*Completeness Test*	*Criteria*	*Number*	*Percentage*
1.	Number of students handled	>20 students	4	9.76
		16–20 students	8	19.51
		11–15 students	8	19.51
		6–10 students	9	21.95
		1–5 students	12	29.27
2.	Completeness percentage	100%	4	9.76
		>75%	15	36.59
		>50%	11	26.83
		>25%	9	21.95
		<=25%	2	4.88
3.	Number of meetings per week	>8 times	1	2.44
		7–8 times	3	7.32
		5–6 times	9	21.95
		3–4 times	20	48.78
		1–2 times	8	19.51

Table 7: Summary Output

Regression Statistics	
Multiple R	0.5791603256
R Square	0.3354266827
Adjusted R Square	0.2911217949
Standard Error	1.118463919
Observations	17

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	9.470871041	9.470871041	7.570873084	0.01484070329
Residual	15	18.76442308	1.250961538		
Total	16	28.23529412			

	Coefficients	*Std Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95%*	*Upper 95%*
Intercept	-0.5240	1.14240	-0.45871	0.65301	-2.9590	1.9109	-2.95901	1.91094
Completeness percentage	0.8798	0.31975	2.75152	0.01484	0.19827	1.5613	0.19827	1.56134

teachers and parents in the Sumedang Regency through scientific forums of seminars. In addition, the dissemination of the research results was also carried out through international standard scientific publications as a form of academic diplomacy.

Discussion

From the reviewed literature, a number of studies compared instructional media, but the empirical results are often mixed or paradoxical. Audio, video, and text often compared. Some studies stated that the first two media were better than the latter (Ayres et al., 2009; Z.-G. Ge, 2021; Große et al., 2015; van der Meij & van der Meij, 2014), while others found otherwise (Delgado et al., 2022; Hardway et al., 2017). Several academics also stated that several media were better than one media, which was reflected in Multimedia Learning (Mayer, 2017). However, the actual results of the existing studies were not clear in terms of the kind of learning media combination that would be more useful than a single-media because the learning contexts can vary and can change over time. Therefore, further empirical studies need to be carried out, especially in relation to learning settings (Z.-G. Ge, 2021; S.-H. Liu et al., 2009). Therefore, the findings in this study are in line with these demands, and the experiments aimed at this study were oriented towards independent learning of e-learners considering that this is rarely done (Z.-G. Ge, 2022; Z. Ge, 2014).

The results of this study indicate that the designed learning media for early reading provided a feasible means to enhance reading performance for students in elementary schools. In other words, the results of this study prove that the type of media affects students' independent learning

performance. This finding actually contradicts Clark, (1983) conclusions in his meta-analysis. He stated that no learning benefit can be derived from using a particular medium to deliver instruction because the media are "only vehicles." However, the experimental results showed that the correct learning media can enhance learning. This statement is supported by Clark, (1983), who described the benefits of learning by using certain media. Parker et al., (2008) also refuted Clark's claim. However, the impact of these different types of media needs further investigation due to differences in learning content, learning context, and students. Good learning outcomes using one form of media in a particular learning context cannot guarantee success in other learning settings (Z. G. Ge, 2021).

Thus, for the completeness in early reading for elementary school students, learning media is an aspect that needs to be considered by teachers. This also implies that teachers in elementary schools need to continue to innovate learning by developing learning media that is not only focused on lesson content but also students' psychological aspects such as convenience, affordability, joyfulness, and so on (Zhang, 2010). The learning innovation in question is in an effort to develop a style of learning and teaching (Kosasih et al., 2021; Taja et al., 2021). This also requires teachers in primary schools including parents to have literacy skills, namely the 21st century literacy which includes 3 literacy types, namely data literacy, technological literacy, and humanity literacy (Suherman et al., 2020; Supriyadi et al., 2020). The three literacy points are important because they affect students' interest or motivation (Guthrie & Cox, 2001; Guthrie & Wigfield, 2017; Ho & Lau, 2018) and motivation has an impact on reading performance (Kanonire et al., 2022).

Conclusion

This study concludes that the Android-based learning media for early reading had a significant impact in the estimation of an increase in early reading mastery on the number of elementary school students based on liner regression calculations of 29.11%. The features available in the learning media were in line with the needs. The results of this study indicated that the application had a positive and significant impact on early reading learning. Additionally, the application was quite representative in meeting the demands of the elementary school curriculum for early reading material. Teachers and students showed positive attitudes regarding learning to read using the Android application.

Suggestion

This application contributes in completing the early reading skills of elementary school students effectively and efficiently. Therefore, this application can be used as a guide for elementary school teachers in the learning process.

Limitations

This study is limited to the locus of an area, which is only one regency, focuses on grade 1 elementary school students, and the use of one type of software or platform, namely Android. By these limitations, it is possible to expand the locus and focus as well as other platforms used in developing reading skills and performance.

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