Information Technology Innovation for Android-Based Letter and Number Recognition to Improve Learning Outcomes for Kindergarten Students

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Abstract. Children aged 4–6 years are referred to as preschool age, where children are being prepared to enter the learning process, namely school. This age is a sensitive period for children who are sensitive to receive and respond to various stimuli. Education at preschool age is best applied to children at that age because children begin to be sensitive in receiving and responding to stimuli received from their environment, as well as early for children to learn basic things to develop spiritual, emotional, intelligence, skills that will be useful later. The golden age of children is an important period and is observed in the growth and development of children's learning. The use of information technology as a learning medium is an innovation in the teaching and learning process that supports children's learning success. This research was conducted to know the effectiveness of information technology innovation as an educational medium for the ability to recognize letters and numbers of kindergarten students. The research method used is Research and Development with the SDLC (System Development Life Cycle) Software Engineering development procedure. The model used in this study is the Waterfall model which consists of 5 stages, namely Communication, Planning, Modeling, Construction, and Deployment. The data collection methods in this study were pretest and posttest. Data analysis used descriptive percentages. The results of the research test show an increase in learning outcomes for kindergarten students and the implementation of information technology can help teachers in the learning process. From these results, it is known that the innovation of information technology for recognizing letters and numbers based on Android is effective in teaching and learning activities.

Keywords: Innovation · Information Technology · Android · Letters and Numbers

1 Introduction

Technology can facilitate the learning process and get what you need from anywhere, anytime, and from anyone [1]. In the world of education, information technology is starting to be felt to have a positive impact because, with the development of information

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technology the world of education has begun to show significant changes, with development of information and communication technology, various conveniences can be felt, such as the ease of obtaining information via computers, cell phones, and the internet. The sophistication of computer technology innovation provides benefits for humans, especially in completing a performance [2]. In addition, computers are also useful in the fields of business, administration, and schools.

Learning is a system that has several interrelated components with the aim of creating conducive conditions for learning to achieve goals [3]. [4] argues that learning is not merely conveying material following the curriculum targets, regardless of the condition of students, but also related to human elements, materials, facilities, equipment, and procedures that influence each other to achieve learning objectives. The learning process plays a very important role in producing or creating quality education graduates. Therefore, the main thing that should get more serious attention from education stakeholders is to create quality learning [5].

Learning media is anything that can be used to convey messages or information in a teaching and learning process so that it can stimulate students' attention and interest in learning [6]. Along with the times, today's learning media should be able to be optimized using a variety of technologies that are already available. The innovation of using the right learning media has been proven to increase students' motivation to study harder [7].

The utilization of technology as a learning medium that is well designed and conceptualized in such a way will attract children's interest to use it [8]. According to [9] parents, especially those with high work mobility, tend to give their children gadgets that already contain various educational applications in the hope of facilitating the learning process for their children. The "Letter and Number Recognition Application" installed on the gadget allows students to learn alphanumerics anywhere and anytime. Students can also repeat and review alphanumeric learning at home or elsewhere regardless of place and time. This application is also interactive because there is a feature of imitating letters or numbers based on examples, so it is hoped that it will provide a separate experience for children who try it.

Today's gadgets continue to be developed into one of the communication facilities that are packaged in increasingly smaller sizes. So that it is easier to carry, lightweight, and does not take up much space. In the world of education, gadgets can be an asset for teachers in developing their creativity in teaching. The most appropriate teaching pattern for students in this digital era is to invite them to learn in their world, namely the digital world. For this reason, gadgets are easy to use in learning [10].

The educational game is an educational learning media, where the media can encourage students to think creatively and carry out activities with fellow students in playing games in learning activities [11].

Based on Law Number 20 of 2003 Article 1 Number 14 concerning the National Education System, education begins at an early age, namely from birth to the age of six years through the provision of educational stimuli to assist physical and spiritual growth and development so that children have the readiness to enter further education.. [12] Educational preparation for children is considered important, especially for children aged 4–6 years. In terminology, this age is referred to as preschool age, where children are

being prepared to enter the learning process, namely school. This age is a sensitive period for children who are sensitive to receiving and responding to various stimuli received from their environment. This period is a time to lay the first foundation in developing physical, cognitive, social, emotional, self-concept, language, discipline, independence, artistic, moral, and religious values abilities [13].

According to [14] Alphanumeric writing ability is one of the main provisions for children to understand the lessons given at school. This ability is based on the child's ability to recognize letters and numbers. So, children at preschool age are expected to be able to recognize letters and numbers, also start writing them by imitating what has been exemplified. These two things are useful as a provision for children to understand the lessons given at school.

However, in the application of preschool education turns out that there are still obstacles that result in a lack of understanding of children during teaching and learning activities. Based on the results of interviews conducted in January 2021 with Mei Maryati, S.Pd. Teacher at Hidayatul Athfal II Kindergarten Jepara obtained information that the problem found was that there were still 42% of students who had difficulty recognizing letters and numbers. 23% of students still have trouble imitating letters and numbers based on examples. Another problem is there are no facilities for students to review lessons at home because the textbooks provided must be returned when the learning time is over.

Based on these problems, it is necessary to innovate learning media so that it can help teachers and students in teaching and learning activities. The selected learning media is a mobile apps-based application that utilizes the development of information technology, namely gadgets. Good use of technology that is designed and conceptualized in such a way will attract children's interest to use it [15]. The application installed on the gadget allows students to review alphanumeric learning anywhere and anytime, so it is hoped that it will provide a separate experience for children who try it.

According to [16] argues that the framework of thinking is a conceptual model of how theory relates to various factors that have been identified as important so that the framework of thinking is an understanding that underlies other understandings, an understanding that is fundamental and becomes the foundation for any thought or a form of process. of all research conducted.

Many preschool students do not know what numbers and letters are. Another problem is that there are no facilities for students to review lessons at home because the textbooks provided must be returned when the learning time is over. Based on the problems above, it is necessary to have a tool to make it easier for students to learn alphanumeric and an alternative for teachers in delivering alphanumeric learning materials. The tool is the "Letter and Number Recognition Application", which is a mobile apps-based application that utilizes the development of information technology, namely gadgets (Fig. 1).

2 Method

The research method describes the method used to answer the problem in detail. This research uses a development study or Research and Development. The research and development method is a method used to create a product and then test the product to

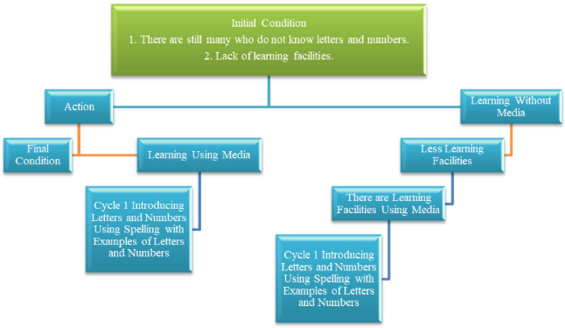

Fig. 1. Learning Process

determine the effectiveness of the product [13]. The development procedure used is the SDLC (System Development Life Cycle) Software Engineering method. The model used is the Waterfall model. This model was developed to design and create software. [17] There are 5 stages in the waterfall model, namely communication, planning, modelling, construction, deployment.

The trial was conducted to determine the feasibility and effectiveness of the application of learning media letters and numbers in the learning process [18]. In addition, trials are also a requirement in development research that must be carried out so that researchers can find out whether the products produced are really of good quality and effective. There are five parts in product testing, including trial design, test subjects, types of data, data collection instruments, and data analysis techniques.

The trial subjects selected in this study were carried out on 21 students, consisting of 9 male students and 12 female students. The type of data in this study is the type of primary data. Primary data is a data source that provides data directly to data collectors. Primary data collection in this study was obtained by testing the product feasibility of media experts and material experts. The quantitative data. Quantitative data in this study is data on the number of students and the results of the pretest and posttest.

The data collection instruments selected were observation, interviews, questionnaires, tests, and documentation. Scoring in this questionnaire uses a Likert scale. The Likert scale is used to measure attitudes, opinions, and a person or group of people which contains five levels of answers regarding the respondent's agreement with the statement or statement that precedes the answer options provided.

The data analysis technique for the feasibility test used descriptive analysis. The data obtained from the validation results of media experts and material experts are questionnaire data which is converted into scores with a Likert scale.

3 Results

Letters and Numbers Learning Media Application is an android application that contains material for recognizing letters and numbers that can make it easier for kindergarten students to learn letters and numbers. This application contains two main menus, namely

Table 1. Result of learning media application using android

Aspect	*Pretest*	*Posttest*
The highest score	85	100
Lowest value	25	45
Average value	58.57	77.38
Number of students completed	13	18
Percentage of students completed	61.90%	85.71%

the Letter Menu, Number Menu. The material in it is also diverse, ranging from letter recognition and letter pronunciation, to letter sounds and letter writing. Likewise with numbers starting from sound and reading numbers, writing numbers, and counting exercises.

The test of the letter and number recognition media application using Android for preschoolers has been completed for Hidayatul Athfal II Kindergarten students in Jepara, with a total of 21 students. The average score on student learning outcomes in product trials before using the letters and numbers learning media application using android was 58.57, while the average value for student learning outcomes after using the letters and numbers learning media application using android was 77.38. The details are shown in Table 1.

The results of the user test above can be seen that the average pretest and 90 posttest learning outcomes in the user trial have increased from 58.57 to 77.38. The number of students' learning completeness also increased by 23.81%. So, it can be concluded that there was an increase in student learning outcomes before and after using the letter and number learning media application using Android.

The revised learning media for letters and numbers is guided by criticism and suggestions from experts and then used for trial use. At this stage, data were collected through pretest and posttest. After getting the results of the pretest and posttest, tests were carried out which included the normality test to determine whether the data obtained were normal or not, the t-test to determine whether there was a change between the pretest and posttest results, and the n-gain test to determine the increase in the pretest and posttest scores. Posttest. The N-Gain test was conducted to determine the increase in the pretest and posttest scores. The formula to find out how to apply the N-Gain test is as follows:

$$\text{N Gain} = \frac{\textit{Posttest Score} - \textit{Pretest Score}}{\textit{Ideal Score} - \textit{Pretest Score}}$$

The results of the average increase test are presented in the following Table 2.

Based on the Table 1, it can be seen that the increase in the average (gain) of the pretest data and posttest scores of Hidayatul Athfal II Jepara Kindergarten students is 0.52 with an average difference of 18.81. The average increase indicates that the application of learning media letters and numbers using android is effectively used to improve learning outcomes.

Table 2. Results of the Average Increase Test

Student	Pre-Test Scores	Post Test Scores	N-Gain	Note
1	75	95	0.8	Tall
2	70	90	0.67	Currently
3	85	100	1	Tall
4	75	90	0.6	Currently
5	65	90	0.71	Tall
6	60	95	0.88	Tall
7	80	90	0.5	Currently
8	60	95	0.88	Tall
9	60	80	0.5	Currently
10	65	85	0.57	Currently
11	70	95	0.83	Tall
12	50	65	0.3	Currently
13	70	80	0.33	Currently
14	45	65	0.36	Currently
15	40	60	0.33	Currently
16	75	85	0.4	Currently
17	55	70	0.33	Currently
18	30	45	0.21	Low
19	35	50	0.23	Low
20	25	45	0.27	Low
21	40	55	0.25	Low
Average	58.57	77.38	0.52	Currently

3.1 Functionality Testing

Functionality testing in this study was carried out using a black-box test which was carried out independently. Aspects of testing include testing the function of buttons, menus, and views per page.

The results of the black-box test state that the letter and number recognition application on Android is following what is expected as indicated by the acquisition of each test case. In black-box testing, there are no bugs displayed from the display of the test results of each test case. So, it can be stated that the black-box testing of the Letter and Numbers learning media application using Android is valid.

3.2 Compatibility Testing

Compatibility Testing is done by testing applications on various mobile device platforms, which include android versions, RAM sizes, internal memory sizes, and different processor types. The test was carried out using various smartphone devices with an android version above Android 4.4 (kitkat).

4 Discussion

The development of learning media for letters and numbers using android was obtained from problem identification and the results of literature studies. The design of learning media letters and numbers using android includes making use of case diagrams, making initial sketches (storyboards), designing assets using Corel Draw X7. These assets include navigation buttons, background images, app logos, and titles, create an app project using Construct 2 (Table 3).

Validation of the feasibility of learning media Letters and Numbers is obtained from the assessment process carried out by media experts and material experts. Validation is carried out with the aim of knowing the feasibility of the Letters and Numbers learning media, knowing the shortcomings, advantages, suitability, and providing criticism and suggestions for improving the Letters and Numbers learning media. The instrument used in the assessment is a questionnaire or learning media validation questionnaire.

The results of the feasibility test by material expert validators and media expert validators are included in the very feasible criteria. Therefore, the media for learning letters and numbers using android is very suitable to be used as a learning medium.

Table 3. Result of Functionality Testing

No	Test	Expected result	Output result	
			In accordance	Not
1	Open the app	Display the main page automatically	V	
2	About button	Showing about the app information	V	
3	Voice button	Urn off or play background music	V	
4	Letter menu button	Enter the letter menu	V	
5	Number menu button	Enter number menu	V	
6	Sound menu button number	Make a sound letter	V	
7	Menu button writing letters	Enter the letter writing menu	V	
8	Sound menu button number	Make a number sound	V	
9	Number writing button	Display the menu for how to write numbers	V	
10	Count button	Showing questions number calculation	V	
11	Back button	Back to main menu	V	

The revised learning media for letters and numbers is guided by criticism and suggestions from experts and then used for trial use. At this stage, data were collected through pretest and posttest. After getting the results of the pretest and posttest, tests were carried out which included the normality test to determine whether the data obtained were normal or not, the t-test to determine whether there was a change between the pretest and posttest results, and the n-gain test to determine the increase in the pretest and posttest scores. Posttest. The effectiveness of the media for learning letters and numbers has been tested by pretest and posttest users. From data collection through tests, it was found that the average increase in learning outcomes was 18.81, which was included in the moderate criteria.

5 Conclusion

Based on the research and understanding related to the learning media application test that has been carried out, the conclusions obtained are as follows:

The development of letter and number learning media applications is an effort to help teachers and students in learning activities, help increase interest in learning and help students.

Based on the user test, the students' learning mastery increased by 23.81% and for the N-gain test, the difference between the pretest and posttest scores was 0.52 with an average difference of 18.81.

Applications for recognizing letters and numbers for preschool-age children using Android have proven to be effective in learning activities. There is an increase in student learning outcomes at TK Hidayatul II Athfal Jepara.

References

1. C. A. Putra, Pemanfaatan Teknologi Gadget Sebagai Media Pembelajran, Jurnal Pendidikan Teknologi Informasi Universitas Muhammadiyah Palangkaraya, vol. 2, 2017, pp. 1–10. DOI : https://doi.org/10.33084/bitnet.v2i2.752
2. D. Aditama, H. Rosyid and N. Fahriani, Aplikasi Pembelajaran Alfanumerik Untuk Anak Usia Pra-Sekolah Berbasis Android Menggunakan Metode Tesseract-Ocr, Journal of Computer Science and Informatics Engineering (J-Cosine), vol. 2, 2018, pp. 70–76. DOI: https://doi.org/10.29303/jcosine.v2i1.128
3. D. Fitriah and M. U Mirianda, Kesiapan guru dalam menghadapi tantangan pendidikan berbasis teknologi, In: Proceedings of the Seminar Nasional Program Pascasarjana Universitas Pgri Palembang, Garuda, 2019, pp. 148–153.
4. D. L. Fithri and D. A.Setiawan, Analisa dan Perancangan Game Edukasi sebagai Motivasi Belajar Untuk Anak Usia Dini, Simetris: Journal Teknik Mesin, Elektro dan Ilmu Komputer, vol. 8, 2017, pp. 225–230. DOI: https://doi.org/10.24176/simet.v8i1.959
5. D. Smith and G. Hardaker, E-Learning Innovation through the Implementation of an Internet Supported Learning, Journal of Educational Technology & Society, vol. 3, 2000, pp. 422–43.
6. M. Dasgupta, R. K. Gupta and A. Sahay, Linking Technological Innovation, Technology Strategy and Organizational Factors: Journal Sage Global Business Review, vol. 12, 2011, pp. 257–277. https://doi.org/10.1177/097215091101200206
7. N. Setiani, Aplikasi HANACARAKA Sebagai Media Pembelajaran Aksara Jawa Berbasis Android, Semarang: Universitas Negeri Semarang, 2017.

8. S. P. Roger and R. M. Bruce, Software Engineering A Practitioner's Approach, New York: McGraw-Hill Education, 2015.
9. S. R. Putra, Desain Belajar Mengajar Kreatif Berbasis Sains, Yogyakarta: DIVA Press, 2014.
10. Sugiyono, Metode Penelitian dan Pengembangan Research and Development, Bandung: Alfabeta, 2017.
11. Suwarno, Game Edukasi, Jakarta: Jurnal Binus University, 2017. Retrieved at: https://pgsd.binus.ac.id/2017/12/31/game-edukasi/
12. S. Z. Dewi and I. Hilman, Penggunaan TIK sebagai Sumber dan Media Pembelajaran Inovatif, Indonesian Journal of Primary Education, vol. 2, 2018, pp. 48–53. DOI: https://doi.org/10.17509/ijpe.v2i2.15100
13. T. Setiadi and T. A Putra, Perancangan Game Berhitung Untuk Anak Usia 4-6 Tahun Pada TK Muslimat NU 09 Penanggulan Kendal, SAINTEKBU: Journal Sains dan Teknologi, vol. 10, 2018, pp. 1–9. DOI: https://doi.org/10.32764/saintekbu.v10i1.157
14. U. Sekaran, Metode Penelitian dan Pengembangan (Research and Development), Bandung: Alfabeta, 2017.
15. Anonymous, Sistem Pendidikan Nasional, Jakarta: Lembar Negara Republik Indonesia Nomor 4301, 2003.
16. K. A'yun, Penerapan Pembelajaran Inovatif melalui Media Audio Visual untuk Meningktkan Pemahaman Konsep Gelombang Elektromagnetik, Jurnal Materi Dan Pembelajaran Fisika, vol. 1, 2015, pp. 54–62.