Development of Android-based Learning to Improve Computational Thinking Skills in Junior High School

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Development of Android-based Learning to Improve Computational Thinking Skills in Junior High School

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Abstract

In this modern era, it is important for teachers to use Android as a learning medium. This aims to facilitate the learning process. The purpose of this study was to test the validity, practicality, and effectiveness of Android-assisted learning media to improve junior high school students' thinking skills. This study used the ADDIE model with 30 students of Rengat 1 Public Middle School as research subjects. The instruments used are non-test instruments in the form of validation sheets and practicality sheets. For data collection techniques, namely by taking validation data, practicality data and effectiveness to students. The data analysis technique used is to conduct product validation tests on experts, practicality and effectiveness tests on students. From the research results, it was found that the media was already in very valid results with a percentage of 88.25%, and for practical results a percentage of 80.26% was obtained with a very practical category. The effectiveness results showed that the pretest results of students who achieved KKM were only 20%, and the posttest of students who achieved KKM increased by 80%. This makes the learning media ready to be used by the teacher to students in the classroom.

Keywords: Development, Android, Learning Media, Computational Thinking

Abstrak

Pada zaman modern ini, penting bagi guru untuk menggunakan Android sebagai media pembelajaran. Hal ini bertujuan untuk mempermudah proses pembelajaran. Tujuan Penelitian ini adalah menguji kevalidan, kepraktisan, dan efektivitas dari media pembelajaran berbantuan Android untuk meningkatkan kemampuan berpikir siswa SMP. Penelitian ini menggunakan model ADDIE dengan 30 siswa SMP Negeri 1 Rengat sebagai subjek penelitian. Instrumen yang digunakan yakni instrumen non tes berupa lembar validasi dan lembar kepraktisan. Untuk teknik pengumpulan data yakni dengan mengambil data validasi, data praktikalitas dan efektivitas kepada peserta didik. Teknik analisis data yang digunakan adalah dengan melakukan uji validasi produk kepada ahli, uji praktikalitas dan efektivitas kepada peserta didik. Dari hasil penelitian, diperoleh bahwa media sudah berada pada hasil yang sangat valid dengan persentase sebesar 88.25%, dan untuk hasil praktikalitas diperoleh persentase sebesar 80.26% dengan kategori sangat praktis. Hasil efektivitas menunjukkan bahwa hasil pretest peserta didik yang mencapai KKM hanya 20%, dan posttest peserta didik yang mencapai KKM naik sebesar 80%. Hal ini membuat media pembelajaran siap digunakan guru kepada peserta didik di dalam kelas.

Kata kunci: Pengembangan, Android, Media Pembelajaran, Berpikir Komputasi

INTRODUCTION

As times change, education is one of the important goals that must be owned by all Human Resources, with the aim of being able to survive and also to form a better person than before. As the times progress, education also develops by adapting according to the times. Education is experiencing a new round of development, because various technologies have been developed for educational purposes (Khairani et al., 2019). The most pressing issue after independence was education for the

younger generation (Mahmudovna, 2022; Shukhratovich, 2022). Education has become an urgent need in recent years. So that education is expected to be able to change the fate of lagging countries to become developed countries and make these countries better than before (Han, 2015a, 2015b; Kuusisto et al., 2023). So that education can really make a contribution that has a positive impact in a country. One branch of education that is important to learn is mathematics.

The development of time makes mathematics also experience rapid development (Vanetik et al., 2020). Studying mathematics is important, so the position of mathematics in the world of education is very beneficial (Zafrullah & Zetriulista, 2021). Mathematics learning is taught in schools with the aim that students can solve math problems that exist at school or outside of school (Rizqi & Surya, 2017). So that mathematics is also a very important subject and has experienced extraordinary scientific developments in recent years. Technological advances in the current era are experiencing rapid development, especially in the industrial era 4.0 (Zetriuslita et al., 2020). o that these advances have an effect on the world of education, one of which is learning mathematics. So that learning mathematics also develops according to the times. One of the developing learning is by using computational methods.

Computational thinking is a problem solving skill that uses or involves concepts from computer science in finding solutions (Wing, 2006). Computational thinking has a definition as logical thinking that solves problems using procedures or ways that are easier to understand (Csizmadia et al., 2015). Computational thinking can be seen from: (1) Outlining the problem; (2) Recognizing patterns; (3) Carry out the process of finding concepts that can be used in solving problems; (4) Develop solutions piecemeal (Bocconi et al., 2016). So that the ability to think computation must be improved because this ability can affect the learning outcomes of students (Sa'diyyah et al., 2020).

From the pre-research conducted at Junior High School 1 Rengat, Riau, it was shown that around 65% of students considered mathematics to be a difficult and very boring subject. From the pre-research that has been done it also shows that the school still uses the classical method in learning, namely by using the blackboard as a learning aid. One way to attract students' interest in learning is by using technology in learning (Novilanti & Suripah, 2021). So it is hoped that learning using technology can provide new variations in the teaching and learning process in the classroom. Previous research shows that the learning media that has been researched has shown valid and practical results, so that the media is very feasible to use (Anggraini et al., 2019). So in this research will use the media in the form of Adobe Flash CS6.
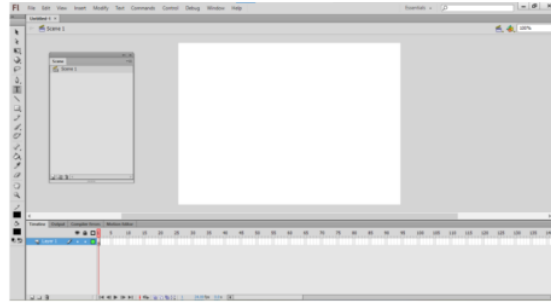
Figure 1. Initial Display of Adobe Flash CS6

Media created using Adobe Flash CS6 aims for students to be able to learn using Android. So that students can access anywhere and anytime. Learning by using media has its own advantages, namely with a new learning atmosphere (Aksa, 2017) . This media uses comparative material for seventh grade students at Junior High School 1 Rengat, Riau. With this media, the material will be made with a complete explanation, the existence of an evaluation question package consisting of 10 packages makes this media have its own advantages. With the explanation that has been explained in the previous paragraphs above, this research will be carried out by conducting validation tests and practical tests on media with computational capabilities with the help of Adobe Flash CS6.

METHOD

This research is research and development (R&D) using quantitative methods. Research development is research with the end that is testing the effectiveness (Alfianika, 2018; Sugiyono, 2017). This study uses the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation).

Figure 2. ADDIE Model Research Flow

The research subjects were 30 class VII students of Rengat 1 Public Middle School. The selection of this subject was carried out because suitable learning materials were given to class VII children at the school and all of them were already using Smartphones. The data collection instrument consisted of a learning media validation questionnaire, and a student response questionnaire. Data

analysis techniques that will be used are validity analysis, practicality, and effectiveness testing. The selection of validators was based on the experience of each expert, which was represented by two validators from lecturers as media and language experts, and one validator from teachers as material content experts. Two lecturers were chosen as media and language experts because they have educational background and experience in validating several other media. While the selection of teachers as linguists is due to teachers who are more experienced in learning materials at school.

After completing the validation sheet by the validator, then the data will be calculated to obtain descriptive validity data. The formula for calculating descriptive validity data uses the following formula:

After the validators had filled out the validation sheet, the data were modified to obtain descriptive validity data. The formula for obtaining the descriptive validity data (Akbar, 2013) is as follows:

$$Va_i = \frac{TSe}{TSh} \times 100\% \quad (1)$$

To determine the final result regarding the validity of the media from the validators, an average formula (mean) was used. The final validation formula is as follows:

$$V = \frac{Va_1 + Va_2 + Va_3 + \cdots + Va_n}{n} = \cdots\% \quad (2)$$

Note:

Va_1 = i-th validity

Va_n = n-tyh expert validity

n = Numbers of validators

TSe = Total empirical score (validation and validator results)

TSh = Maximum expected total score

V = Combined Validity

After obtaining the validity results from the validator, the next step was to match the percentage level with the validity criteria table (Table 1).

Table 1. Criteria for the validity of the learning media

Validity Criteria (%)	Validity Level
80.00 – 100.00	Very valid, or can be used without repair
60.01 – 80.00	Valid, or usable but needs a bit of improvement
40.01 – 60.00	Fairly valid, or usable but needs major revision
20,01 – 40,00	Invalid, it is recommended not to use it because it needs improvement
≤20.00	Not valid, or should not be used

Source: (Akbar, 2013)

After validating, the researcher then conducted a practicality test on students. Researchers analyzed questionnaire data from students, then calculated the average number of questionnaires that had been filled in with the practicality formula (Akbar, 2013) as follows.

$$P = \frac{TSe}{TSh} \times 100\% \quad (3)$$

Description:

P = Practical percentage

TSe = Total empirical score

TSh = Maximum expected total score

After obtaining the percentage practicality of the learning media, the criteria for the practicality of the mathematics and learning media were addressed, as is shown in Table 5.

Table 2. Practicality criteria for the learning media

Practical Criteria	Practicality Level
81%–100%	Very Practical
61%–80%	Practical
41%–60%	Practical Enough
21%–40%	Less Practical
0%–20%	Not Practical

Source: (Riduwan, 2013)

After completing the practicality test, the researcher then conducted an effectiveness test by conducting two tests, namely the pretest and posttest to see the results of the trial before using the media and after using the media. The calculation of pretest and posttest results uses the classical completeness formula (Nurkancana & Sumartana, 1986) which is as follows:

$$KB = \frac{P}{N} \times 100\% \qquad (4)$$

Description:

KB = Mastery learning
P = The number of students who get scores above the Minimum Completeness Criteria
N = The number of students who took the test

RESULTS AND DISCUSSION

Results

In this study, researchers used the ADDIE development model which consisted of five stages, namely the Analysis, Design, Development, Implementation, and Evaluation stages. In this study, researchers used the Adobe Flash CS6 application as the main medium in making learning media. Apart from using Adobe Flash CS6, the learning media is also assisted by several applications, such as Adobe Photoshop, Microsoft Office PowerPoint, Bandicam, and Voice Recorder which are then combined with the Adobe Flash CS6 application to make the media based on Android.

Analysis

At this stage aims to determine the needs required in research. At this stage, the researcher conducted curriculum analysis, student character analysis, technology analysis, and learning media analysis. The curriculum used is the Independent Curriculum. In this analysis, researchers took material, basic competencies, and core competencies according to the curriculum. In this media, the researcher made four meetings. Next, the researcher conducted an analysis of the students' character by paying

attention to the characters of class VII students at SMP Negeri 1 Rengat. The average student in the class is around 13-15 years old and all of them are able to use Smartphone technology. So it is easy for researchers to conduct research on these students.

Next, the researcher conducted a technology analysis and learning media analysis. The technology used is the Adobe Flash CS6 application. Adobe Flash is an application that is widely used by designers to produce work in the field of animation (Ampera, 2017). With this media, teachers can develop learning media and other interactive materials (Wati & Nugraha, 2020). One of the advantages of this application is that it can make media with a small size and can be converted in the form of Android.

Design

At this stage, the researcher designed storyboards and developed media, including collecting media and designing validation sheets and practical learning media sheets. In designing the Storyboard, the researcher designed the initial appearance of the media which consisted of the homepage, main menu, material menu and other menu. After doing the design, the researcher collects the materials needed to make the media. The researcher collected references and modified practice questions obtained in textbooks. Researchers also made other materials in the form of backgrounds and icons using the help of Adobe Photoshop. In addition, the researcher also made a learning video consisting of five videos with the help of PowerPoint and Bandicam so that students could be assisted in the teaching and learning process.

In addition to collecting media, researchers also made research instruments, namely learning media validation sheets and learning media practical sheets. Validity is the accuracy with what will be measured by what is measured by the test (Satria & Uno, 2012). The validation assessment is based on three indicators, namely media format, content, and language (Yamasari, 2010). While practicality is the level of users considering the intervention can be used under normal conditions (Rochmad, 2012). There are six criteria for assessing the practicality of media, namely ease of navigation, cognition content, information presentation, media integration, artistic and aesthetics, and overall function. (Munir, 2012). However, the researcher did not include aspects of cognition content, so that only five aspects were included in the practicality questionnaire. So that the design of the validity instrument is based on three aspects and the practicality instrument is based on six aspects, each of which has 15 statements for the validity instrument and the practicality instrument.

Development

After collecting materials, the next step is the process of developing learning media. In this process, the researcher installs and combines all the materials that have been made at the Design stage. In this media, the material is divided into five meetings, the first meeting is about understanding material and determining comparisons of two quantities, the second material is determining comparisons of two quantities with different units, the third material is about understanding and solving problems related to comparisons of worth, the fourth material is about solving the problem of comparison of values on maps

and models, and the fifth material regarding understanding and solving problems related to comparisons of inverse values.
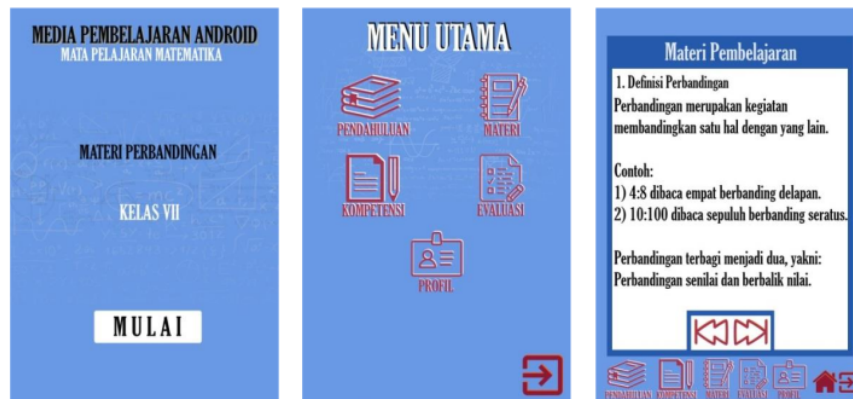

Figure 3. Display of Learning Media

Implementation

At this implementation stage, learning media was given to students with trials on 30 students with four meetings. The aim is to find out the practicality of the learning media that has been developed.

Evaluation

At this final stage, an evaluation is carried out to determine the final value of the learning media. Learning media developed using Adobe Flash CS6 has good quality because it has gone through the stages of development, namely the validity test and practicality test. The validity test was carried out by two mathematics teachers and two lecturers who are experts in media, material and language. The purpose of validating learning media is to find out whether the media/teaching tools meet the criteria or not (Anharuddin & Prastowo, 2023). The results of learning media validation based on the aspects investigated are shown in Figure 4.
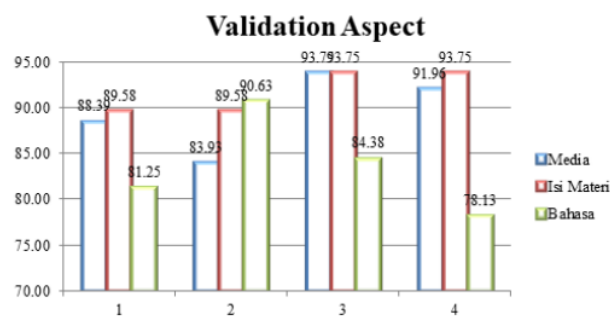

Figure 4. Aspect Based Validation Bar Chart

From the diagram above, the highest percentage is in the content aspect with an average of 91.67%. While the lowest aspect is in the language aspect with an average percentage reaching 83.59%. This is because the choice of language used by researchers is difficult for students to understand, so it

needs improvement in terms of language, and also there is a slight improvement in aspects of media format and aspects of material content. For the final result of the learning media validation test, a percentage result of 88.25% was obtained in the "Very Valid" category.

The next stage is the practicality test of learning media. Media is said to be practical if it can provide easy learning for students, reinforced by data and responses from users of the media. Researchers conducted a practicality test with a large-scale trial involving 30 students through a practicality questionnaire. The results of the practicality test can be seen in Figure 5.
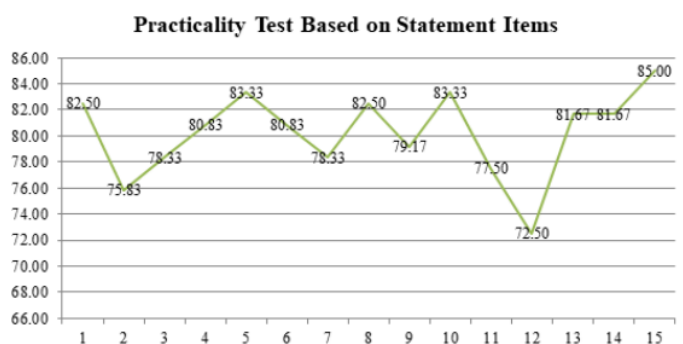

Figure 5. Practicality Results Based on Statement Points

From Figure 5, it can be seen that the highest percentage is found in statement number 15 with the sound "I am trying to answer the questions in interactive multimedia-based learning media with Adobe Flash Cs6 even though the answers are difficult" with a percentage reaching 85%. While the lowest percentage is at number 12 with the statement "Writing on interactive multimedia-based learning media with Adobe Flash Cs6 attracts my attention to be more serious about learning" with a percentage reaching 72.50%. As for the final percentage of the practicality test, it can be seen in Figure 6.
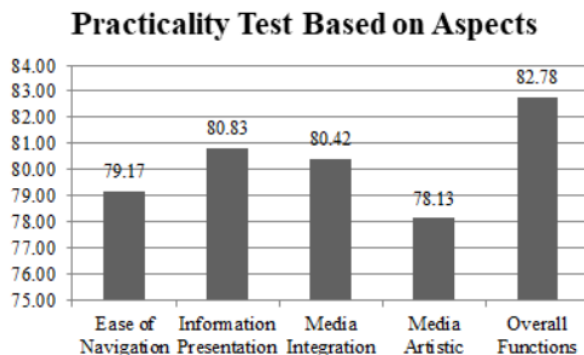

Figure 6. Practicality Test Diagram Based on Aspects

From the diagram that has been described above, it can be seen that the highest percentage is in the Overall Functions aspect with a value of 82.78%. While the lowest percentage is in the Media Artistic aspect with a figure of 78.13%. So it can be concluded that the results of the practicality test on

this learning media are 80.26% in the "Very Practical" category. After carrying out the practicality test, the researcher then conducted an effectiveness test using the pretest and posttest values. The pretest and posttest values can be seen in Figure 7 below.
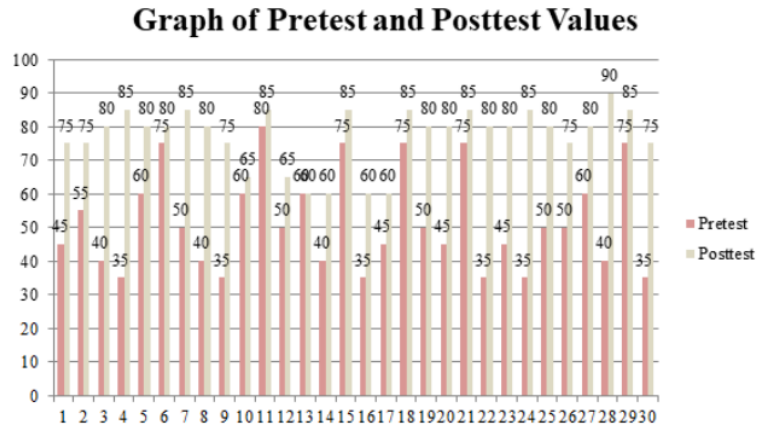
Graph of Pretest and Posttest Values

Figure 7. Pretest and Posttest Results of Learning Media Effectiveness

From the results of the graph above, it can be seen from the results of the pretest which shows that those who reach/pass the KKM score are 75, which is only 20%. After being given learning media and carrying out the posttest, students who reach/pass the KKM score are 80%. Which means there is an increase between before using the media and after using the learning media.

Discussion

From research that has been done before, learning media have met the desired criteria. Based on the results of data analysis, the learning media has fulfilled the valid category and the media has also achieved very practical results, so that it can be used in learning. The material is complete, and is included with the question package, which makes this media have its own advantages.

At the analysis stage, the researcher conducted a curriculum analysis using the Independent Curriculum with four meetings, with the target students being students aged 13-15 who were in seventh grade. This media is designed with Adobe Flash CS6 which can be displayed on Android, making it easier for students to study anywhere. By using the Adobe Flash CS6 application, researchers can use Android applications with a small size.

After the analysis phase was completed, the researcher carried out the design stage, namely by designing instructional media and designing validation and practicality questionnaires. Researchers design media consisting of the main menu to the profile menu. Apart from the media, the researcher also designed a validation and practicality questionnaire with 15 statements each. After that, the researchers combined the media designs that had been designed into Adobe Flash CS6 to be converted to Android. After the merger is complete, the media is given to the experts to test the validity. After carrying out the validation test, it is then given to students to carry out practicality tests and also enter

the implementation stage.

After carrying out the implementation stage, the last stage is the evaluation stage by attaching the final results of the valid test and practical test. After the researchers conducted data analysis, it can be concluded that the validity test is at 88.25% with a very valid category. While the practicality test showed a final result of 80.26% with a very valid category. Meanwhile, the effectiveness results showed that the pretest results of students who achieved KKM were only 20%, and the posttest of students who achieved KKM increased by 80%.

This media can be operated on Smartphones with a small size, and also has a question package, so that this media has its own advantages. However, this medium is difficult for beginners to master, so it takes some time to understand how to make it. This research is relevant to several previous studies, the media has been tested for its validity, practicality, and effectiveness (Adha & Efriyanti, 2022; Yanti et al., 2023).

CONCLUSION

From the results of the data analysis that has been done, it is found that the media is already in a very valid result with a percentage of 88.25%. Practicality results obtained a percentage of 80.26% with a very practical category. Meanwhile, the effectiveness results showed that the pretest results of students who achieved KKM were only 20%, and the posttest of students who achieved KKM increased by 80%. This makes the learning media ready to be used by the teacher to students in the classroom.

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