

Development of Android Based Mathematics Learning Media for Primary School Students

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Abstract

This research was conducted to develop an android-based mathematics learning media design for second-grade students at Xaverius 2 Primary School Palembang. This research adopted the research procedures outlined by Borg and Gall. The findings of this research are divided into two parts. The first part of the result research pertains to the needs analysis. Based on the need analysis, it is obvious that the development of learning media design to enhance students' independent learning at home is highly necessary. The second result research relates to the validation of the development of Android-based learning media design. The development of the android-based learning media design falls under the category of validity. Validation testing was conducted through a single assessment, The level of feasibility of Android-based Mathematics Learning Media for Elementary School Students by media experts obtained an overall average of 95.34% in the "Very Feasible" category, by material experts an overall average of 88.6% was obtained in the "Very Feasible" category, and Testing by students obtained an average of 82.47% in the "Very Appropriate" category, so it can be concluded that the Android-based learning media developed is very suitable for use.

Keywords: Learning Media, Android-Based Mathematics Learning

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INTRODUCTION

Education is possible to be obtained from everywhere, one of which is school. School is one of the institutions to provide educational services to students with the existence of levels of education (Devista, 2007). One of a kind is elementary school education which must be pursued within the level of education itself, before heading to the level of secondary education. Primary schools themselves have a structure of educators starting from the principal, teachers, staff, school employees and school committees who manage and develop education in primary schools. Elementary schools also have a significant role in providing learning to students themselves both directly and indirectly received by students. Therefore, learning in primary schools is the foundation for continuing learning to the next level by realizing the quality of new resources for the development and development of the Indonesian nation.

According to Law No. 20 of 2003 concerning the National Education System article 1 paragraph 20 states that learning is the process of interacting students with educators and learning resources in a learning environment (Ryfa, 2021). Therefore, we are able to

plan or design learning, then implement and evaluate it systematically to ensure that students can achieve learning objectives effectively and efficiently. By looking at the current situation after COVID 19 and learning is directed online at this time. On the other hand, online learning is implemented to provide meaningful learning experiences for students (Pengelola Web Kemendikbud, 2020), without being burdened by the demands of completing the entire curriculum achievements for grade advancement or graduation. There are numerous impacts on both teachers and students, starting from the impact on students and also the impact on teachers.

The impact on students is students are less prepared to participate in online learning, inadequate facilities such as the technology used and also the availability of internet connections and lack of supervision and assistance from participants' parents (Rahmanto et al., 2023). Furthermore, the impact on teachers is, not all teachers are proficient in using technology. Teachers must be able to carry out learning with online methods. Teachers experience boredom with the implementation of learning and the facilities used must be sufficient. From the impact caused, there are many obstacles experienced. Thus, it requires the right media to implement online learning. Online media is an alternative that really helps educators during the learning process. Currently, there are various online media available, including WhatsApp groups, Google Classroom, email, telegram, Google From, Meet, zoom (Ratnaningsih & Triayomi, 2021). Good media does not necessarily produce optimal output. The reason is the readiness of educators in using the media and the selection of the right online media are factors that determine the learning process to run optimally.

This also happened at Xaverius 2 Primary School Palembang, which is a school with a very good accreditation, so it made the researcher and even the entire school community feel very comfortable in the school. From the observations the researcher did during the internship at the school, the learning process carried out by the school is online or distance learning because of the appeal from the Mayor of the condition of Palembang city which is hazy. During online learning, this school has used learning media that enables students to learn from home. Therefore, it supports the online learning process. From the observations I made during my internship, the media used at Xaverius 2 Primary School Palembang include Google Meet, Google Form, Classroom, and WhatsApp Group which is very possible in this distance learning. Therefore, the cooperation between teachers and parents is essential in implementing this online learning, the teacher is a provider of learning materials while parents help teachers supervise and educate students who learn from home.

Munirwan Umar revealed about the role of parents in children's education including as caregivers and educators, mentors, motivators and facilitators (Umar, 2015) Education that only relies on learning at school is not necessarily guaranteed children's success in learning. On the other hand, parents always pay attention to their children, especially attention to their learning activities at home, will make children are more active and more enthusiastic in learning because they know that it is not themselves He alone wants to move forward, but his parents also have desires the same one. So that the learning outcomes or learning achievements achieved by students become better good (Cahyati & Kusumah, 2020)

From the online learning process carried out by schools, there are many obstacles faced by teachers both from students and from the parents of students themselves to carry out distance learning. One of them is that there are still many students who do not understand the material conveyed through online learning, so students need independent supporting media to study at home themselves . The problem is teachers face in online learning, namely teacher doubts in providing assessment of students where the questions given by the teacher were correctly done by the student independently or carried out by the student's parents (closest family). That. Then the teacher also experiences the affective

and psychomotor aspects of assessment obstacles in assessment due to not being able to directly observe the activities carried out by students (Dwitalia Sari, 2021).

One of them is in learning mathematics, which has an important role in students' lives. Mathematics is also one of the subjects that support the development of science and technology (Siagian, 2016). However, until now there are still many students who feel that math is a very terrible subject. Apart from being terrible, math is also considered a boring subject because it only discusses numbers, formulas, images, and counting operations. This should be a special concern for teachers to create a learning atmosphere that is fun and not boring. Therefore, there is a need for learning media to make students interested and enthusiastic about learning (Nurfadhillah et al., 2021). Especially in this era of globalization and information, the development of learning media is also increasingly advanced.

Advances in science and technology have a huge influence in various fields of human life. Education as one part of the human maturation process, on the other hand, has a great influence on the development of science and technology (Nurkholis, 2013). Learning media is a device that is used and functions for learning messages, learning media is one of the efforts to provide innovative and appropriate learning media. So in the end it is expected to improve the quality of education and interesting learning (Saifulloh et al., 2012). Therefore, it can be concluded that learning media is a physical means of conveying learning materials in printed or audible form including hard technology so that it encourages the learning process. One type of learning media that is considered to have a positive influence on education is media that uses technological devices (Rahmi & Samsudi, 2020). Technology-based learning media has several kinds, one of which is android-based learning media. Because the application that is very popular with everyone is android. Hence, this application is very suitable for supporting media for learning at home for students independently at home.

Based on the explanation above, researchers are interested in conducting research and development of android-based mathematics learning media as an effort to develop android-based learning media applications so that they can be used by teachers and students in learning. This product is produced through research activities with the aim of ensuring that the media produced meets the specified requirements. Therefore, this research is focused on developing android-based math learning media that will be used at Xaverius 2 Primary School Palembang. The material to be developed in the field of Mathematics studies by explaining flat and spatial shapes based on their characteristics. This research aims to develop spatial material for students by using android-based learning media for fifth-grade students of Xaverius 2 Primary School Palembang.

Theoretical Review

Media comes from Latin, namely *medius*, which means "middle", intermediary or "introduction". According to learning media is a tool used by educators in delivering learning material in class, so that it can attract students' interest in learning (Sapriyah, 2019). Meanwhile, Arsyad said that learning media are people, materials, or events that build conditions and can enable students to acquire knowledge, skills or attitudes and Media is a tool that can take any form alone can be used as a channel for messages to reach learning objectives (Bahri & Zain, 2002). According Fitriana (:, 2018), to learning media is a tool or supporting facility that can be used by a teacher to convey information so that it is well received. Based on several opinions above, it can be concluded that learning media is an intermediary tool used by teachers in the teaching and learning process in the classroom so that it can increase students' learning motivation and can acquire knowledge, skills or attitudes. Every lesson requires media to make it easier for educators to convey the material and make students more enthusiastic in the learning process.

Selection of media requires suitability to the material that educators will use in their teaching. According to Arsyad (2016: 74), there are six criteria for selecting learning

media, namely: a) The purpose of using the media. Teachers should pay more attention to the purpose of using media, such as the type of stimulus and related areas. developed in students, such as cognitive, emotional and psychomotor aspects. b) Purpose of using the media Once the purpose of using the media has been determined, the teacher should pay attention to the next steps, especially to whom the media will be used, taking into account class level, basics and quantity. from students at school. c) Characteristics of the media Before implementing the learning media chosen by the teacher, the teacher must first know the advantages and disadvantages of the media. This is done to facilitate the application of learning media in the classroom. d) Time Before applying these tools into practice, teachers must first know when to use these tools. Because, remember the distribution of time during the learning process. This method will be useless if its implementation takes a long time. Therefore, the transmission of knowledge by teachers will be hampered. e) Cost Before creating and identifying media, teachers also need to know the effectiveness of learning media by paying attention to cost factors that need to be considered first. Because using more expensive methods is not necessarily effective. f) Availability What the researcher means here is that the media that teachers will use is available in the school environment or available on the market (Arsyad, 2010). Sugeng Purwantoro, Heni Rahmawati and Achmad Tharmizi (2013) say "Android is a software used on mobile devices which includes an operating system, middleware and core applications (Sumiati et al., 2020). Android according to Satyaputra and Aritonang is an operating system for smartphones and tablets. The operating system can be illustrated as a bridge between the device and its use, so that users can interact with the device and run the applications available on the device (Satyaputra & Aritonang, 2014). Android is an operating system developed for Linux-based mobile devices. Initially this operating system was developed by Android Inc (Taufik, 2014). in 2003 which was then purchased by Google in 2005. Google initiated and led the OpenHandset Alliane (OHA) consortium, one of the main missions of which was the development of the Android platform (Mulyana, 2012).

According to Arif Akbarul Huda application components are an important part of Android (Hariyadi & Huda, 2015). Each component has a different function, and each component is interconnected. The following are the application components that you need to know, namely: 1) Activities. Activity is an interface page that can be used by users to interact with the application. Usually in one activity there are buttons, spinners, list views, edit text, and so on. One application on Android can consist of more than one activity. 2) Services. Services are application components that can run in the background, for example used to load data from a database server. Apart from that, music or radio player applications also use services so that the application can continue to run even if the user is carrying out activities with other applications. 3) Contact Provider. This component is used to manage data for an application, for example telephone contacts. Anyone can create an Android application and can access contacts stored on the Android system. Therefore, in order to access contacts, users need the contact provider component. 4) Broadcast Receiver. The function of this component is the same as the translation language, namely the recipient of the message. The case of a weak battery is a case that is often experienced by Android cellphones. The Android system is designed to deliver an "announcement" automatically if the battery runs out. If the application created is equipped with a broadcast receiver component, the user can take the action of saving and then closing the application or other actions.

Android application-based learning materials are something new in the world of education, these learning materials are usually in the form of educational applications or applications that contain teaching materials and learning materials. This application product can be downloaded on smartphones and devices with the Android operating system, usually available on Google Play or the Play Store. In essence, Android application-

based learning media is a learning media product in the form of an application that can be uploaded or downloaded to an Android smartphone. Android applications are one of the media that are classified as e-learning media because Android application products run on smartphones and devices with the Android operating system. Smartphones and gadgets are a form of communication technology. Based on this, learning materials based on Android applications are called electronic media.

METHOD

This research employs the Research and Development (R&D) methodology, which is a research method used to produce specific products and test their effectiveness. The procedure used in this research and development follows the steps outlined by Borg and Gall, specifically utilizing four out of the ten stages, namely: potential and problems, data collection, product design, and design validation (Sugiono, 2014). Research is able to be initiated based on either potential or problems. Potential refers to something that, when harnessed, adds value. Problems represent differences between what is expected and what actually occurs. Therefore, the potential serving as the foundation for this research is the educators, specifically teachers, who still lack expertise in the field of information technology and computers.

Numerous components of information that can be used as materials for product planning are gathered, with the purpose of addressing issues. The acquired information is initially analyzed to ensure that the resulting product is of high quality and achieves its objectives. To design this android-based learning media product, the following steps are undertaken: formulating fundamental competencies, determining assessment tools, arranging materials, creating the instructional media design, and paying attention to the structure of android-based learning media. Furthermore, designing validation is the process of evaluating whether the product's design, in this case, a new working system, will be more effective rationally compared to the old one or not. It is referred to as rational because validation at this stage is still based on rational thinking rather than field facts. Product validation is capable of being conducted by involving several experts or experienced professionals to assess the newly designed product. Each expert was asked to assess the design, accordingly revealing its strengths and weaknesses. Afterward, it is revised in accordance with the input and recommendations from the experts and followed by product testing.

The data analysis process is used according to the Miles and Huberman Model and is divided into several stages. It involves data reduction which means summarizing, selecting essential elements, focusing on important aspects, identifying themes and patterns, and discarding unnecessary information. Data presentation is carried out in the form of concise descriptions, charts, relationships between categories, flowcharts, and similar formats. Data verification implies that initial conclusions are provisional and subject to change if strong supporting evidence is not found in the subsequent data collection stages. However, if the conclusions presented in the initial stages are supported by valid and consistent evidence when the researcher returns to the field to collect data, then the conclusions put forth are considered credible. The media validation carried out in this research was carried out by 3 validators in the fields of technology, information and communication. Media validation is carried out once. This media design validation sheet is adapted from previous research, namely Triayomi, in 2015. This media design validation sheet is divided into 4 indicators, namely written appearance, image appearance, visual appearance and learning media function. The following are the results of the first media validation (Triayomi & Widyastuti, 2020).

RESULT AND DISCUSSION

This research aims to solve the problem formulation within the study which is, how is the design of android based mathematics learning at Xaverius 2 Primary School Palembang? The data collected in this research consists of the respondent's answers (educators & students) by filling out the questionnaires for needs analysis. This research put a strong focus on android-based mathematics learning, which will be used by schools for students independent learning at home. Through this android based mathematics learning media, students are expected to be able to use this media as an independent learning platform at home, and students also are able to access this learning material anywhere and anytime. Before the needs analysis is carried out, the questionnaire validation was conducted.

The validation conducted in this study involved three validators who helped the researcher check the questionnaire sheets for needs analysis that will be used in the research. There are 5 indicators used in the needs analysis for educators. The first indicator is about the learning conditions, facilities, and infrastructure, as well as the social and economic aspects. The second indicator focuses on the difficulties and obstacles faced by teachers during the classroom teaching process. The third indicator is the willingness and interest to try developing android-based learning materials. The fourth indicator explores the challenges faced by teachers in creating teaching materials. The fifth indicator delves into how you, as educators, approach development in packaging learning materials during online teaching.

Tabel 1 Educator Questionnaire Results

No	Statement	Yes	No
1.	Space construction material (KD 3.10 Class II semester 2) is learning material with a wide range of material	2	2
2.	Space construction material (KD 3.10 Class II semester 2) can be given in detail in a short time	0	4
3.	The available learning time allows for in-depth practice in spatial construction material (KD 3.10 Class II semester 2).	3	1
4.	The available learning time allows for enrichment in spatial construction material (KD 3.10 Class II semester 2). 3 1	3	1

Based on this table, it is known that the four teachers considered that the spatial construction material was learning material that was not too broad. However, this material cannot be provided in a short time. Because students must also be able to understand the material well. The available learning time can also allow for in-depth practice and enrichment according to the material.

Tabel 2. Facilities and Infrastructure Questionnaire Results

No	Statement	Yes	No
1.	The school has an adequate internet network.	4	0
2.	The school has an internet network that is easily accessible to students and teachers.	4	0
3.	Schools have adequate facilities to carry out online learning.	4	0

Based on the table above, it can be seen that we have an adequate internet network to be accessed by students and teachers. The school also has adequate facilities for implementing online learning.

Tabel 3. Student Questionnaire Results

No	Statement	Yes	No
1.	Students have gadgets (smartphones, iPads, etc.) that support	4	0

Based on the validation results, it can be concluded that the learning media created by the researcher already covers the characteristics of educational media. According to Gerlach and Erly. They outlined three characteristics of media in education, namely, fixative, manipulative, and distributive.

Tabel 4. Analysis of Media Expert Assessment Data

No.	Aspects of Earnings Assessment	Score Acquisition	Skor Maximum	Percentage Appropriateness
1.	Ease of use and navigation	48	50	96%
2.	Aesthetic or beauty	38	40	95%
3.	Media Integration	39	40	97.5%
Final average				95.34%

Based on the data, the final score obtained was 95.34%, so the media Android-based learning in the "Very Appropriate" category is used.

Tabel 5. Analysis of Material Expert Assessment Data

No.	Aspects of Earnings Assessment	Score Acquisition	Skor Maximum	Percentage Appropriateness
1.	Suitability	18	20	90%
2.	Quality of Content and Purpose	42	45	93,3%
3.	Instructional quality	33	40	82,5%
Final average				88,6%

Based on the results data, the total percentage is 88.6%, which means that the material in the learning media is categorized as "Very Appropriate" for use.

Tabel 6. Analysis of Testing Data on Students

No.	Aspects of Earnings Assessment	Score Acquisition	Skor Maximum	Percentage Appropriateness
1.	Ease of use and navigation	427	500	85,4%
2.	Clarity of presentation	740	900	82,2%
3.	Aesthetic or beauty	336	400	84%
4.	Media Integration	313	400	78,25%
Final average				82,47%

The overall average obtained was 82.47%, thus Android-based learning media was categorized as "Very Appropriate" for use. The media created by the researcher has several strengths, first, the created learning media already has the elements of 5M steps in the teaching process which are, observing, questioning, gathering information, associating, and communicating (2013 curriculum). Second, material can be uploaded in various formats including videos, PowerPoint (PPT), word documents, and images. Third, the students management in participating in the learning activities can be controlled by the educators through the learning media to which they have access to control. Fourth, it already uses a username and password to access the learning media. Fifth, for the

students' learning materials can be accessed through mobile phones and laptops. Next, the weakness of this learning media is the unstable internet connection, therefore it is a bit difficult to access the learning media. Moreover, the learning media for educators can only be opened from the laptop. Learning media is developed with a database system so that the material and practice questions are more dynamic. The development of learning media provides more means of interaction between user.

Another research found by Hamdan Hussein Batubala in 2017. Development research methods. The results of this research are (1) creating flat material Android-based mathematics learning media for grade IV SD/MI students, and (2) product assessment by experts, reviewers and elementary school teachers. Evaluation has been carried out. His score of 434 and percentage of 86.67% is very good. (3) The response of fourth grade SD/MI students to Android-based mathematics learning media reached a score of 439 and a percentage of 87.8%. The difference between this research and current research is the use of needs analysis. Even though this research uses a 4D model, the research that will be carried out uses Brog and Gall's needs analysis (Batubara, 2018). Research conducted by Sigit Prasetyo, 2017. This research method is development research. As a result of this research, (1) an Android-based science learning media product with bioregenerative materials has been developed for Class VI SD/MI students; (2) Android-based science learning media for class VI SD/MI students on material on the reproduction of living things with appropriateness according to the assessment results of reviewers, peer reviewers and SD/MI teachers, namely the Very Good (SB) category with a score of 631 and a percentage of 86, 85%, (3) the answers of elementary/MI students in the Android-based VI learning media science class were in the interval category between "agree" and "strongly agree" with a score of 635 and an assessment level of 88.23%. The similarities lie in developing Android-based mathematics learning media and in the use of research methods. The difference is that this research is a subject related to science, while this research is a subject related to mathematics (Prasetyo, 2017).

The research conducted by Zakiy et al, 2018. The method of this research is development. The results of this research are Android-based mathematics learning media. This media was declared suitable and valid to be used as a mathematics learning medium by 3 material experts with an average score of 3.67 (good) and 2 media experts with a suitability score of 4. Android-based mathematics learning media was proven to be effective and suitable for use as a medium. mathematics learning. The similarities between implementation lie in developing Android-based mathematics learning media and research methods. The difference lies in the needs analysis that will be used, namely this research uses 7 stages out of the 10 stages of Brog and Gall (Zakiy et al., 2018).

CONCLUSION

A valid android-based mathematics learning media has been developed for primary school students. The material to be further elaborated focuses on the field of mathematics explaining two-dimensional and three-dimensional based on their characteristics. Suggestions for further research: Android-based learning media can be developed to include basic competencies and broader material.

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