Development of Android-Based Matematika Pintar Application to Mathematics Learning

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Abstract

There needs to be a mathematics learning media that is in accordance with the times, so that it can motivate students to learn. This study aims to determine the development and feasibility of the Matematika Pintar application to mathematics learning for class VII. The application was created with the help of Adobe Flash CS6 software. The research method used is Research and Development (R&D) with the ADDIE model. The results of this study are: (1) Matematika Pintar contains all class VII material and has received suggestions from material experts, media experts, and users, (2) the feasibility results are based on the feasibility test of 2 material experts with a questionnaire instrument related to the aspects of completeness and accuracy of material who get an average score of 91.5, 2 media experts with a questionnaire instrument related to aspects of the view and presentation of the application get an average score of 74, users on a small-scale test as many as 6 people with a questionnaire instrument related to aspects of motivation, facilities, attraction, and benefits who get an average score of 83.667, and users in the main product field test as many as 30 people with a questionnaire instrument related to aspects of motivation, facilities, attraction, and benefits who get an average score of 81.8. The indicator used is if the average score>83.994 belongs to the very feasible category and 67.998 < average score ≤ 83.994 belongs to the feasible category.

Keywords: ADDIE; Adobe Flash CS6; Android; Matematika Pintar; Mathematics Learning

Abstrak

Perlu adanya media pembelajaran matematika yang sesuai dengan perkembangan zaman, sehingga dapat memotivasi siswa untuk belajar. Penelitian ini bertujuan untuk mengetahui pengembangan dan kelayakan aplikasi Matematika Pintar berbasis android untuk pembelajaran matematika kelas VII. Aplikasi dibuat dengan bantuan software Adobe Flash CS6. Metode penelitian yang digunakan adalah Research and Development (R&D) dengan model ADDIE. Hasil dari penelitian ini adalah: (1) aplikasi Matematika Pintar memuat semua materi kelas VII dan telah mendapatkan saran dan masukan dari ahli materi, ahli media, dan pengguna; (2)

hasil kelayakan didasarkan pada uji kelayakan dari 2 orang ahli materi dengan instrumen angket terkait aspek kelengkapan dan keakuratan materi yang mendapatkan skor rerata sebesar 91,5, 2 orang ahli media dengan instrumen angket terkait aspek tampilan dan penyajian aplikasi yang mendapatkan skor rerata sebesar 74, pengguna pada uji skala kecil sebanyak 6 orang dengan instrumen angket terkait aspek motivasi, kemudahan, kemenarikan, dan kemanfaatan yang mendapatkan skor rerata sebesar 83,667, dan pengguna pada uji lapangan produk utama sebanyak 30 orang dengan instrumen angket terkait aspek motivasi, kemudahan, kemenarikan, dan kemanfaatan yang mendapatkan skor rerata sebesar 81,8. Indikator yang digunakan adalah jika rentang skor rerata > 83,994 termasuk kategori sangat layak dan 67,998 < skor rerata ≤ 83,994 termasuk kategori layak.

Kata Kunci: ADDIE; Adobe Flash CS6; Android; Matematika Pintar; Pembelajaran Matematika

Introduction

Education has an important role in everyday life, especially education in the field of mathematics, which is one of the compulsory educations that exists in formal education. For some students, mathematics is considered difficult because the material is abstract and rigid. Abstract math materials can be learned easily using learning media (Auliya, 2018, pp. 52-63). Learning media can help teachers bring everyday life into learning, so that abstract and unfamiliar ideas become concrete and easy for students to understand. If the learning media can be functioned appropriately then the learning process is effective (Wibawanto, 2017, pp. 3). A learning device is said to be valid if there is a consistent linkage of each component of the learning device developed with the characteristics of the applied learning model, it is said to be practical if the device is easy and implementable, and it is said to be effective if learning goals can be achieved through the use of developed learning devices (Fatmawati, 2016, pp. 95).

On the other hand, the increasingly advanced field of technology, teachers are required to develop a variety of multimedia technology (i.e. learning media) including media based on computer technology and smartphones. The development of computer technology can be used to assist in the creation of learning media while smartphones can be used to help the application of these learning media.

According to Oetomo (2002, pp. 109), multimedia is defined as a combination of text, images, graphic art, animation, sound, and video. These various media are combined into a unit of work that will produce information that has a very high communication value. That is, information can not only be seen as a printout, but also can be heard, forming simulations and animations that can arouse interest and have high graphic art in its presentation. Then, the multimedia technology as the digital integration of text (written), graphics, animation, audio (dialogue, stories,

sound effects), still images (images) and visual stimuli, and motion video. Through the integration of these media, the learning experience becomes an interactive experience that reflects an everyday experience (Vaughan, 2005). Based on the experts, it can be concluded that learning multimedia which is part of multimedia technology, is everything that uses a combination of sound, images, graphic art, animation, video, and text that is interactive, to convey a message and encourage the learning process of students so as to make the learning experience as in real life around it. Multimedia learning also provides its own view that knowledge is not only acquired through book texts but more broadly than that. The growth of awareness of the importance of learning multimedia development must be realized by teachers, especially the availability of support from the technology side.

The use of multimedia can stimulate and increase students' motivation in learning. The inclusion of learning multimedia can create a pleasant atmosphere in learning because multimedia combines several elements of media so that the learning process with multimedia is more interesting (Kuswanto and Walusfa, 2017, pp. 59). Beauty, attractiveness, and interactivity in a learning media is a means so that students are not bored in following lessons, make it easier to receive subject matter, as well as enhance the active role, and the level of student self-learning.

Then, one of the learning media makers that use technology is Adobe Flash CS6 software. Adobe Flash is a computer software that can function to create simple and dynamic web, mobile animations, or interactive applications designed specifically by Adobe. Adobe Flash is in great demand by people because of its lightweight and reliable ability to create two-dimensional interactive applications. The features contained in this application are very complete and can be used to provide animation effects on websites, movies, games, cartoons, interactive animations, and others (Wibawanto, 2017, pp.3). Since 2012 Adobe added features to Adobe Flash and improved it with Actionscript 3.0 facilities so that it can create three-dimensional animations through a basic programming language called AGAL (Wibawanto, 2017, pp. 29). Adobe Flash CS6 is the latest version of Adobe Flash, which was previously Creative Suite 5.

Some of the advantages of Adobe Flash CS6 application are: (1) can create interactive button: *button, movieclip*, and *timeline*; (2) may make changes in color transparency in the movie; (3) make changes to animation from one form to another; (4) create 3D transformation animations and decoration animations that are one of the latest features; (5) can make animated moves by following a predefined flow; (6) can process and create animations from bitmap objects; (7) can create vector-based animations that have flexibility in the creation of vector objects; (8) integrated with Adobe Photoshop and Illustrator; (9) has online color theme

facilities collected in the kurel community. Thus, there are many features provided by Adobe Flash CS6 that can be utilized in the creation of an application.

Based on the advantages of Adobe Flash CS6, so this software is able to combine learning concepts with audio visual technology that is able to produce new features that can be utilized in learning. The features in Adobe Flash CS6 are able to design animations that are more interesting, not monotonous, and facilitate the delivery of materials (Marianda, et.al, 2014, pp. 113). The animation can be used as a mathematical learning media packaged in the form of multimedia percentage. In its application, Adobe Flash CS6 can be used to make interactive learning media effectively, efficiently, and easily accessible to students, because the world of education is required to always develop quickly following the development of science and technology (Vevi, et.al, 2018).

In addition, android is one of the mobile-based technologies that can be used on various mobile devices (Satria, Tresnawati, and Roji, 2015, pp. 2). Andorid is a Linux-based operating system that belongs to an *open-source* operating system designed for touch screen mobile devices such as mobile phones and tablets. An *open-source* operating system is an open-source operating system that allows users to develop it openly. This provides a great opportunity for app developers and app makers. Android is very supportive of learning with various features that have been provided. All available features are very useful to help students understand the learning material, so that teachers do not need to explain repeatedly because students can more easily play the material through an application that can be opened anytime and anywhere. Agree with Darusalam's opinion, the use of android-based learning media can reduce a static atmosphere and can create an effective, interesting, interactive learning process, and can arouse students' learning motivation (Darusalam, 2015).

Therefore, researchers are interested in improving the quality of class VII mathematics learning with the development of android-based Matematika Pintar application which in its manufacture uses the help of Adobe Flash CS6 software. The purpose of this study is to describe the creation and test the feasibility of Matematika Pintar applications to mathematics learning for class VII.

Method

This research was conducted by the research and development (R&D) method. According to Sugiyono (2010, pp. 407), development research is a research method used to produce and test the effectiveness of the product. To produce a product, innovative and creative research and development are needed. In addition,

it also requires testing to find out whether the product is valid and feasible to use or not. In the field of education, products produced from an R&D study are expected to improve progress and increase the quality of education. Next, the products produced from this research are in the form of learning media that use the ADDIE model.

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Analysis ⟹ Design ⟹ Development
                                    ⟱
Evaluation ⟸ Implementation
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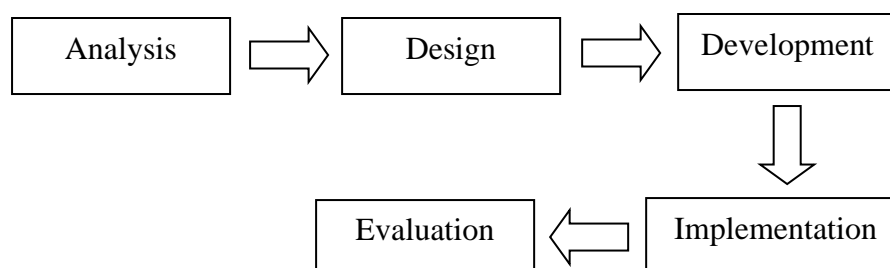
Figure 1: The Step of ADDIE Model

In product trials, before being piloted, Adobe Flash CS6's interactive learning media products were validated first by material experts and media experts and then revised. The revised product is then tested by the user. The data in the study is an assessment of the validation of experts and questionnaires from the trial subjects. The types of data obtained are qualitative data and quantitative data. Quantitative data in the form of expert validation results and test results in the form of assessments in the form of ticking. Qualitative data in the form of inputs and suggestions related to the application. The data obtained serves to provide input in revising the quality of android-based applications developed.

Data collection techniques in this study are carried out by spreading questionnaires. The deployment of assessment questionnaires is aimed at media experts, materials experts, and students during small-scale trials and main fields. Furthermore, the assessment indicator for media experts is in the form of the view and presentation of the application. Assessment indicators for material experts related to the aspects of completeness and accuracy of the material. While the assessment indicator for students about the motivation, facilities, attraction, and benefits of the application.

The data analysis techniques in this study use quality descriptive data analysis that displays the results of Matematika Pintar development. The data obtained in this study will be analyzed through the following stages: (1) Validate the application, if there is a suggestion, thus revisions will be carried out; (2) Data obtained through expert questionnaires and student questionnaires in the form of letters is converted into grades with excellent conditions = 5, good = 4, enough = 3, less = 2, and very less = 1; (3) Find the average value of eligibility from various

parties; (4) Create ideal assessment criteria; (5) Categorize eligibility averages by comparing tables of ideal assessment criteria.

Results

This research has successfully developed a Matematika Pintar learning application using Adobe Flash CS6 *software* for students of class VII MTs / junior high school. The Matematika Pintar Application has several learning features, namely in the form of materials in the form of e-books, problem exercises with discussions, daily repetitions, and semester exams. Matematika Pintar applications can be used or installed on various types of android devices. The application has also been validated to materials experts and media experts as well as small-scale trials and main fields.

Product Development

This development research aims to develop android-based Matematika Pintar applications to mathematics learning for class VII. The procedural steps of this study are as follows:

Analysis

Researchers conducted a literature study to collect class VII material consisting of 9 chapters, including paying attention to KI and KD as guidelines for compiling materials and questions. In addition, researchers also looked at several application models that would be suitable for the junior high school student characteristics.

Design

In this step, the researcher begins to create an initial picture or concept of what will be displayed in Matematika Pintar application. The first view that will appear is the login page, where the user is asked to fill in the username and madrasah/school name. The next page is the front page in which there are buttons "Material", "Ulangan Harian" of each chapter, and "Ujian Semester". On the material page of each chapter there will be a selection of e-books and practice questions. Ulangan Harian is presented based on each chapter. On the Ujian Semester page there is a choice of semester I and semester II. Here is a *flowchart* that gives a brief overview of the flow of the *scene*:
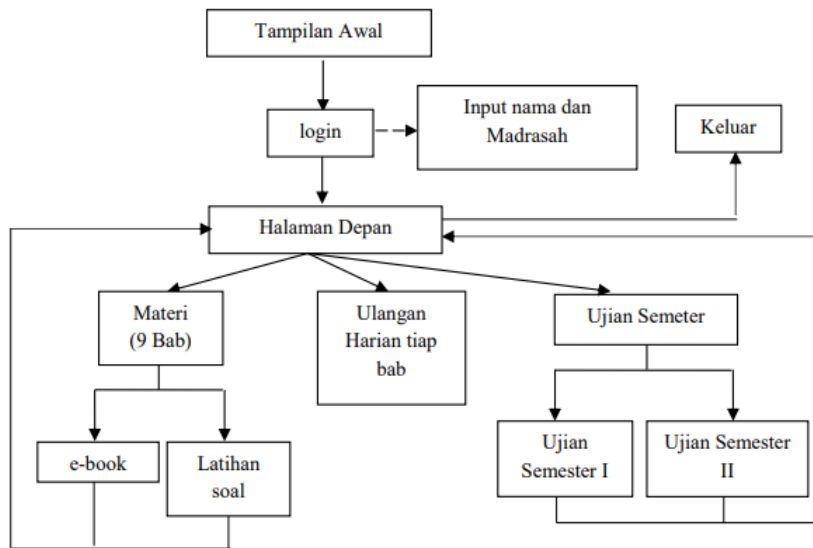
Figure 2: Matematika Pintar Application *Flowchart*

After creating a flowchart, researchers create a *storyboard* that is a brief depiction of the storyline in the learning media. Here is the login view *storyboard*.
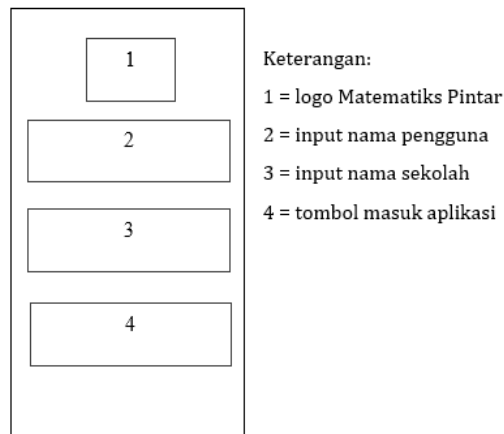

Figure 3: Login View *Storyboard*

Figure 3 above is a login view *storyboard* that contains two input boxes in the form of usernames and school names. Both of these input boxes must be filled in before the user presses the sign-in button. If the user does not fill in both or one of the input boxes there will be an alert to fill all the input boxes before proceeding to the front page of the application.
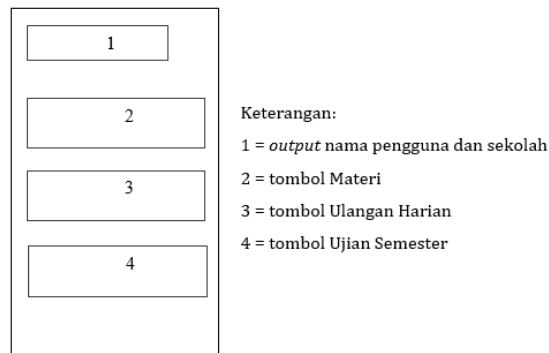
Figure 4: Front Page *Storyboard*

Figure 4 is a front page storyboard. On the front page there will be username and school text that has previously been filled in on the login page. In addition, there are also three other buttons, namely the materi, ulangan harian, and ujian semester buttons.
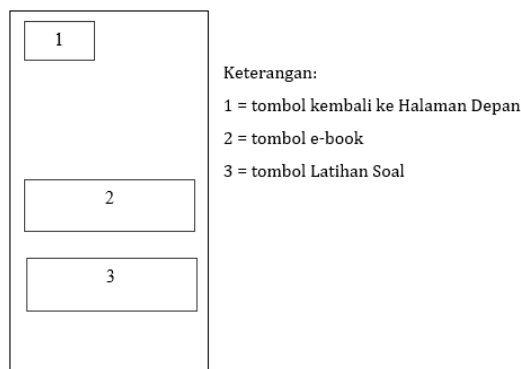

Figure 5: *Storyboard* Material Page of each Chapter

Figure 5 this is the material display of each chapter. Here, there will be three buttons, namely the back button, the E-Book button (material), and the Latihan Soal button.
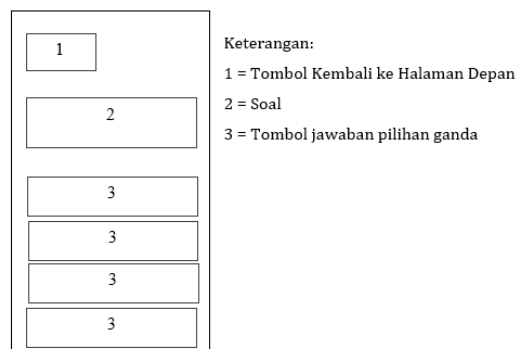

Figure 6: Daily Reply Storyboard

Figure 6 is a storyboard that repeats every day. On the daily replay there will be a back button, a question, and several answer options buttons. All the material on the daily repetition there are 3 packets of questions, in which each question package has 10 questions. These three problem packs are displayed randomly so that users do not feel bored in using this application.
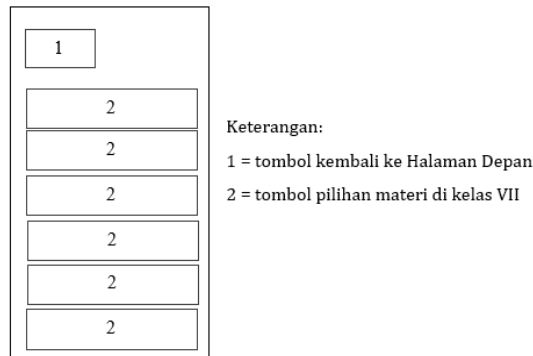

Figure 7: Material Choice *Storyboard*

Figure 7 describes the material selection page that contains e-books and Ulangan Harian. This material consists of 9 chapters in class VII, including: the numbers, the sets, the algebraic forms, the linear equations and the inequalities of one variable, the comparison, social arithmetic, lines and angles, triangles and quadrilaterals, and the presentation of data.
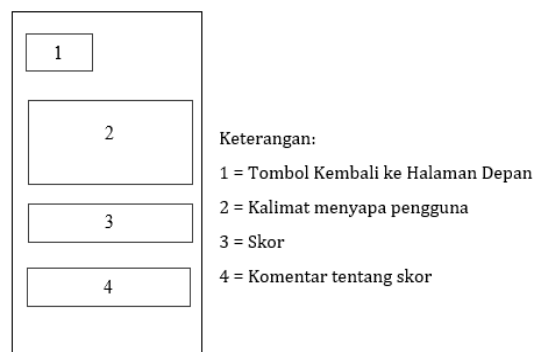

Figure 8: Score View *Storyboard*

While Figure 8 describes the appearance of the score page that appears when students have done Ulangan Harian or Ujian Semester. On this score page there is a back button, user-tapping sentences such as "Hello you get a score", then there is a score obtained and there is a comment about the score obtained.

Development

The development stage is the core activity of development research. Based on the storyboard, researchers created animations, buttons, and some interactive displays using Adobe Flash CS6 software. Some views can be viewed as follows:

1) Create a logo as the initial display of the application when installed on an android-based phone. Matematika Pintar app logo can be seen in Figure 9.

Figure 9: Matematika Pintar App Logo

If the Matematika Pintar application APK which has a size of 71.6kb is installed hp based on android then the display can be seen in Figure 10. The icon displayed is in the form of the Matematika Pintar application logo which is given a dark blue background.

Figure 10: Matematika Pintar App Icon View on Android Phones

2) Create a login view as an app opener and create a learning media title, as in Figure 11. The username and school name must be filled in before the user presses the login button. If the user has not filled in the name only, a warning sign will appear such as "Sorry, please enter the name first." Likewise, when the user has not filled in the school's name on the login page, there will be a warning sign "Sorry, please enter the school's name first". In this view we do not provide

login using a google or facebook account because this application is designed so that in using it does not use data / internet packages.

Figure 11: Login View

3) Creating a front page in the Matematika Pintar application is as simple as in Figure 12. This page brings up the Matematika Pintar logo in the upper right corner and the username and school correspond to what has been entered when logging in. Displaying the name and school on this page wants to give an interactive impression with a greeting. On this page there are also four buttons, namely the Information button, the Materi button, the Ulangan Harian button, and the Ujian Semester button.

Figure 12: Matematika Pintar App Front Page

4) Create learning materials as in Figure 13. This page appears when the user presses the material button on the front page of the application. On this page displays a picture of two children who are learning accompanied by motivational sentences and on the right there is the Matematika Pintar logo. There are ten buttons on this page, namely the back button and 9 other buttons that show each chapter of class VII mathematics material.

Figure 13: Material Selection View

5) Create a page of Ulangan Harian and Ujian Semester that look like Figure 14. This page appears when users want to do daily replays and semester exams. The difference in daily replay page views and semester exams is that it is in time. On this page there is an exam or replay title according to the material, time that runs backwards and when time runs out it will switch to the score page, as well as questions and four answer selection buttons.

Figure 14: Question View

6) Create an exam score page as in Figure 15. This score page appears every user finish working on daily replays on the material or exam each semester. On this score page there is a back button, the Matematika Pintar application logo, the text "Ulangan Harian" or "Ujian Semester", the score obtained by the user, as well as comments and motivation for the scores obtained. On this page it is also given the phrase "Hai, Kamu mendapatkan skor Ulangan Harian!" to make the app more interactive.

Figure 15: Exam Score View

Implementation

At this step, researchers validate material experts and media experts. Once validated and improved, the application is assessed by a small-scale user before a main field product test is performed.

Material Experts

Validation of materials was carried out by 2 material experts who worked as junior high school mathematics teachers in East Java. The results of material validation by material expert I show the number of scores of 90 and the validation of material II shows the number of scores of 93 with some inputs as in Table 1.

Table 1: Material Expert Review and Input

No.	Menu	Reviews and Feedback
1.	Question page	It would be nice if the matter was made randomly
2.	Question page	It would be nice to be shown about what is wrong and which is right so that users can evaluate themselves more

Input from material experts is then followed up with revisions to the Matematika Pintar application. The follow-up is as follows:

a) Input number 1 is followed up by improving the question package and creating it randomly. Hopefully, if the user will do the problem, the problem obtained or done is not the same problem.

b) Input number 2 is followed up by adding a view (after the score page) of the wrong and correct questions.

Media Experts

Media validation was carried out by 2 media experts, namely the owner of the digital field CV in the Yogyakarta area and the data scientist of PT Astra Honda. The validation results on the Matematika Pintar application by media expert I show the number of scores 82 and media experts II show the number of scores 66 with some inputs as in Table 2.

Table 2: Media Expert Review and Input

No.	Menu	Reviews and Feedback
1.	Loading Page	The exact of the application is opened, on the header and footer against the white column. It would be better if there was none.
2.	Login page	It would be nice to write a description of the Name and School in the click or will be filled in, the caption is missing. This universe of Name and School writings still exists so this interferes when writing Names and Schools.
3.	Front Page	The triple point above replaces it with a more suitable icon

Input from media experts is then followed up and revised on the Smart Mathematics application. The follow-up is as follows:

a) Input number 1 is followed up by providing a *full screen* on the loading page.

b) Input number 2 is followed up by removing the name and school writing when clicked the input box.

c) Input number 3 is followed up by replacing the triple point above the corner of the front page with the about icon (letter i).

Small Scale Trials

After the product was validated by material and media experts and made improvements to expert experts, this study was also tested on a small-scale student, namely users (6 students) of class VII of MTs Manba'ul Huda Grobogan on October 9, 2021. This small-scale trial aims to get a feasibility and information assessment, so that Matematika Pintar applications can be developed for the better. The results of small-scale trials conducted as many as one time obtained an average score of 83,667.

Evaluation

This stage is the stage after all input from the validator is revised and the assessment of the user is small-scale. At this stage, the application was piloted in mathematics learning activities in class VII B MTs Manba'ul Huda Grobogan consisting of 30 students. The main field trial was held on October 11, 2021. After that, students are asked to fill out questionnaires related to Matematika Pintar app.

Product Eligibility

This due diligence process is a process of validation and user assessment. The eligibility indicator is outlined in 20 questions with an ideal maximum score of 100 and an ideal minimum score of 20. Here is a table of ideal assessment criteria in this study.

Table 3: Ideal Assessment Criteria in Research

Average Score Range	Category
$\bar{X} > 83,994$	Very Feasible
$67,998 < \bar{X} \leq 83,994$	Feasible
$52,002 < \bar{X} \leq 67,998$	Enough
$36,006 < \bar{X} \leq 52,002$	Less Feasible
$\bar{X} \leq 36,006$	Very Less Feasible

Material Experts Validation

Validation of the two material experts is done once. Based on the data, it can be known that the number of both scores from validators is 183 with an average score of 91.5. So based on Table 3, Matematika Pintar applications fall into the category of "Very Feasible". Assessment details are included in the following Table 4.

Table 4: Material Validation Results by Both Validators

| Materialist | Aspects | | Score |
	Completeness	Accuracy of Materials	
Validator 1	45	45	90
Validator 2	47	46	93
		Sum	183
		Average	91,5
		Score Range	$\bar{X} > 83,994$
		Category	Very Feasible

Media Experts Validation

Based on data on the validation of media experts, it can be known that the number of both scores from validators is 148 with an average score of 74. So based on Table 3, the android-based Matematika Pintar application for grade VII students falls into the category of Feasible. Details of the assessment can be observed in Table 5.

Table 5: Media Validation Results by Both Validators

| Media Experts | Aspects | | Score |
	App View	App Presentation	
Validator 1	42	40	82
Validator 2	34	32	66
		Sum	148
		Average	74
		Score Range	$67,998 < \bar{X} \leq 83,994$
		Category	Feasible

User Rating

The results of the initial trial of the Matematika Pintar application by users with a small scale as many as 6 students of class VII MTs Manba'ul Huda Grobogan once. Based on the data, it can be known that the number of scores from users is 502 with an average score of 83,667. Based on Table 3, the Matematika Pintar application falls into the category "Feasible." Data and details of numeracy can be observed in the following Tabel 6.

Table 6: Small Scale User Assessment Results

User	Aspects				Score
	Motivation	Facilities	Attraction	Benefits	
User 1	12	18	19	32	81
User 2	13	19	15	33	80
User 3	12	21	18	34	85
User 4	12	20	18	35	85
User 5	14	23	17	32	86
User 6	12	21	16	36	85
				Sum	502
				Average	83,667
Score Range: $67,998 < \bar{X} \leq 83,994$					
				Category	Feasible

After all validators and preliminary trial results stated that the Matematika Pintar application was feasible to use, the main field trial was continued by 30-person class of one student at MTs Manba'ul Huda Grobogan. The results of the main field trial resulted in a score of 2454 with an average score of 81.8. Based on Table 3, the application is "Feasible" using.

Table 7: Field Trial Assessment Results of 30 Students

	Aspects				
	Motivation	Facilities	Attraction	Benefits	
Total	374	617	482	981	2454
Average	12,467	20,567	16,067	32,700	81,8
Score Range: $67,998 < \bar{X} \leq 83,994$					
				Category	Feasible

Based on the results of the study, the android-based "Matematika Pintar" application for class VII students is already suitable for use in learning activities.

Discussion

The findings of the research which state that the "Matematika Pintar" learning media is suitable to be used as a medium for learning mathematics for grade 7 junior high schools is supported by the results of other studies that have both developed mathematics learning media. Among them is research conducted by Suddin and Deda (2020), Qohar, Nasution, and Wahyuningsih (2021), Ilmi, Arnawa, and Bakar (2021), Yaniawati, Supianti, and Fisher (2022), Sinambela, Simanjorang, Manurung, and Simanullang (2022), Aminatun, Subali, Dwiyani, Prihartina, and Meliana (2022).

Conclusion

Based on the research conducted, it was concluded that the first, resulting learning media in the form of Matematika Pintar applications for students of class VII junior high school. This application contains all class VII materials and is made with the help of Adobe Flash CS6 software and published in android application files, the second, Matematika Pintar Application has obtained input from validation of media experts and material experts then tested to students before the product is issued. Assessment indicators for material experts in the form of completeness and accuracy of the material. Assessment indicators for media experts in the form of application views and presentations. Assessment indicators for students in the form of learning motivation, facilities, attraction, benefits, the third, this android-based Matematika Pintar application for students of grade VII junior high school is already worth using in learning. This eligibility is based on the feasibility test of material experts who get an average score of 91.5, media experts of 74, users on small-scale tests of 83,667, and users on main product field tests of 81.8. The indicator used is if the average score range > 83,994 belongs to the category of very feasible and 67,998 < s average score ≤ 83,994 belongs to the category feasible.

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