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Development of Android-Based Mathematics E-Module on Probability Using Andromo Platform at SMA Negeri 1 Gondang

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Abstract: Education is a basic need for every individual to improve their quality of life. To enhance educational quality, innovations are required in curriculum, teaching methods, and learning media. This study aims to develop an Android-based mathematics learning media on probability material for grade 10 students using the Andromo platform, and to test its feasibility for classroom use. The research employed a Research and Development (R&D) approach using the Hannafin and Peck model, which includes three stages: needs analysis, design, and development-implementation. Data were collected qualitatively from direct observation and quantitatively from feasibility questionnaires. The subjects consisted of one material expert, one media expert, and 37 students divided into small and large groups. The feasibility results showed: (1) material expert validation 100% (very feasible), (2) media expert validation 100% (very feasible), (3) small group trial 97.9% (very feasible), and (4) large group trial 96.7% (very feasible). The study concludes that the Android-based mathematics e-module developed through the Andromo platform is highly feasible and can effectively support independent and classroom learning activities.

INTRODUCTION

Education is a basic need for every individual to improve their quality. Education has an important role in creating quality people (Sholikhah, Kartana, & Utami, 2018). As one of the efforts to improve quality in the world of education, new innova- tions are needed, such as curriculum development, learning method development, teaching material devel- opment, and learning media development (Mawarni & Hendriyani, 2021). Lack of use of learning media can be one of the factors in students' low understanding of mathematics subjects (Awalia, Pamungkas, & Alamsyah, 2019).

However, not all teachers are maximal in using learning media that utilize

technology during teaching and learn- ing activities. For example, at State High School 1 Gondang. At SMA Negeri 1 Gondang for mathematics subjects, there is no learning media used during ongoing teaching and learning activities. The teaching materials used at SMAN 1 Gondang for mathematics subjects are textbooks. Teachers had used *power points* to deliver material but this was considered unhelpful. In addition, teachers also provide simple games, but this is less effective if without teacher assistance. As for the delivery of material, teachers use lecture methods that are still ineffective. Based on observations, mathematics subjects in class X get quite low grades compared to other subjects. This is due to the negligence of students who use smartphones only for entertainment. In SMA Negeri 1 Gondang itself, the percent- age of students who have Android-based smartphones is 98%. Therefore, researchers want to develop mathematics learning media for android-based opportunity materials at SMA Negeri 1 Gondang.

A. Modul

1) Understanding Modules

Modules are a type of learning material that is packaged completely and systematically, Gather a set of planned learning experiences that are created or designed to help learners master certain learning objectives (Mahadiraja & Syamsuarnis, 2020).

2) Module Components

The components of the module contain learning objectives, learning materials, learning methods,learning tools and resources, and evaluation systems. One type of module that is currently developing is the E-module (Kuddus, 2019).

3) Difference between Module and E-Module

The differences between modules and e-modules according to Najuah et al. (2020) are in table 1.

Table 1. Differences Between E-Modules and Modules

No	E-Module	Module
1	Displayed via monitor	Printed, bound and covered
2	It is more practical to carry anywhere even though it contains a lot of material content.	The more contents, the thicker and heavier.
3	Use a CD, *flash disk* or memory to store.	Do not use CDs, *flash disks* or memory to

		store.
4	Production costs are cheap and the spread can be through social media.	Production costs are expensive especially if the module has a thick page, contains many colors, and also the cost for its deployment.
5	Requires a power source or other *hardware* to be able to use it.	Quite practical because it does not use other re- sources to use it
6	Durable and timeless.	The durability of paper is limited by time.
7	The script can be arranged linearly and non-line- arly.	The script can only be arranged linearly.
8	Can be equipped with audio and video.	Cannot be equipped with audio and video.

B. Learning Media

1) Understanding Learning Media

Media are all physical devices that can convey messages and encourage students to learn. In the context of Communication, media is one part of a learning strategy that becomes a container or distributor aimed at the recipient of the message and the delivery of the material to be delivered (Hasan, 2021).

2) Learning Media Functions

Themain function of learning media is as a tool in teaching and learning activities that affect the learning conditions created by teachers. More specifically, learning media has a function as the delivery of material from teachers to students in order to achieve learning objectives, the learning process will become more inter- esting, and the last is the learning process becomes more interactive (Faculty of Science, State University of North Sumatera, 2020).

3) Characteristics of Learning Media

According to Arsyad 2002 in Faculty of Science, State University of North Sumatera (2020), each media has its own characteristics, both in terms of its capabilities, how to make it, and how to use it. Understanding the characteristics of various teaching media is a basic ability that teachers must have in relation to teaching media selection skills.

C. Mathematics

1) Understanding Mathematics

Mathematics is a language. It is clear that mathematics as a language is indispensable for oral and written communication, in order for the information conveyed to be known and understood by others (Aminah, Wijaya, & Yuspriyati,

2018). One of the materials contained in mathematics is chance.

2) Opportunity Material

The opportunity chapter learning material includes the odds of an event and the chances of multiple events.

D. Android

1) Understanding Android

Android is a Linux-based operating system created for touchscreen devices such as smartphones and tablets. The rapid growth of Android Indonesia is due to Android is a fast platform both from its operating system, development tools, application market, and getting high support from *Open Source* in the world, this has resulted in *Android* continuing to grow rapidly both in terms of technology and in terms of *devices* (Siyamto & Saputra, 2020). Android Advantages

Android applications are often found on *smartphones* that use the Android operating system. The advantage of *Android* applications is their ease of use. In addition, *Android* applications processing data and information generated can be faster and *real time* (Nugraha, Maurits, & Al Anshori, 2023).

E. Andromo

1) Understanding Andromo

Andromo is *an* Android app development platform with no mastery of user code. Andromo allows us to create applications in minutes without programming knowledge.

2) Menu on Andromo

a) Components include popular, layout, media, monetization, buttons, extensions and firebase activities.
b) Styles include color, card display, activity, app bar and drawer man.
c) Settings there is 1 menu, which is basic divided into 4 types, namely application name, application version name , application code version and package name.
d) There is 1 menu which is divided into 3 types, namely analytics, firebase auth, and satusignal.

e) Electronic Commerce there is 1 menu which is divided into 2 types, namely Shopify settings and Woo- comme settings.

f) Image is a menu contained in Andromo that functions as an image finder.

RESEARCH METHODS

A. Research Model

In this e-module development research, the type of this research is Research and *Development* or R & D. According to Mulyatiningsih (2012: 161), Research and development aims to produce a new product through a development process. The model used in the research development of this mathematical e-module uses the Hanafin *and* Peck model. The stages of development of the Hanafin *and* Peck model are shown in figure 1 below.

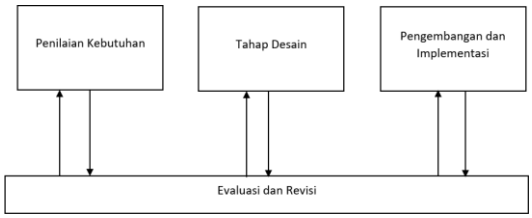

Figure 1. Stages Of Hannafin and Peck (Sudarmika & Parmiti, 2018).

B. Research Procedure

In this study, there are a number of procedures that are adjusted to several stages in the Hanafin *and* Peck model in developing research products. A number of procedures consist of 3 stages of development, which are explained as follows:

1) Needs Assessment

The first stage in Hanafin *and* Peck's development model is needs assessment. At this stage, researchers conduct observations and interviews with teachers who aim to find out the problems experienced by students and find product descriptions that are in accordance with the problems experienced. After this stage is complete, an evalua- tion is carried out.

2) Stages Desain

The results obtained from the needs analysis will be used as a basis for creating media that you want to use for student learning. At this stage, the activities carried out are designing media that are tailored to the needs. The result of this stage is in the form of a prototype. After this stage is complete, the researcher will conduct an evalu- ation.

3) Development and Implementation

In stage 3, there are 2 activities, namely the development stage and the implementation stage. The breakdown of both stages is as follows:

a. Media Development

The existing prototype will be developed using the Andromo platform to become a product that is ready to be tested by material experts and media experts. The material expert of this product is Mrs. Nining Dwi Rohmawati, M.Pdi and the media expert is Mr. Okta Purnawirawan, M.Pd.

b. Implementation

The finished product is implemented to grade X students of SMA Negeri 1 Gondang. This Tahp aims to find out whether the E-module is suitable for use in the learning process, if it is not feasible it will be evaluated and updated until the E-module is suitable for use.

C. Product Trials

Here is a summary of the trials conducted by researchers:

1) Test Drive Design

There are 3 stages of e-module product trials, namely individual trials, small group trials, and large group trials. The initial stage will involve individuals, such as material experts and media experts.

2) Test Subjects

The subjects involved in this mathematics e-module trial consisted of individual tests conducted by material experts who were grade X mathematics teachers of SMA Negeri 1 Gondang and media experts who were lecturers from Bhinneka PGRI University. The Small Group Trial involved 5 grade X learners as representa- tives of the study population. And the Large Group Trial was carried out in class X-2 SMA Negeri 1 Gondang with a total of 3.7 students.

3) Data Collection Techniques

The techniques used by researchers to collect data in this study are as follows: a) Observation: observations were made on grade X students at SMA Negeri 1 Gondang to look for problems experienced by students in KBM. b) An interview was conducted with one of the teachers to obtain the required information. c) Ques- tionnaires are used to Data collection by providing written questions to respondents.

4) Data Analysis Techniques

The results of this data analysis will be used as a basis for modifying the product under development. Table 2 will show the feasibility category for products sourced from Suharsismi Arikunto (2006, in Fajar, 2022).

Table 2. Categories of Product Eligibility

Percentage Score	Interpretation
70% - 100%	Very decent
60% - 79%	Proper
40% - 59%	Pretty decent
0% - 39%	Less viable

The following is for the formula used qualitative data analysis techniques based on sources from (Akbar, 2013 in Ekky 2019):

$$Hasil\,Validasi\,(V) = \frac{skor\ total\ (ST)}{skor\ semua\ (SS)} \times 100\%$$

RESULTS AND DISCUSSION

A. Data Presentation, Results of Problem and Needs Analysis

1) Analysis

Analysis data was obtained from observations and interviews at SMA Negeri 1 Gondang. The result is that there is no learning media used and manystudents who neglect time when playing *smartphones*. They use *smartphones* to play games, watch TikTok videos and play social media.

B. Presentation of Data and Results of Product Development Analysis

a. Design

At the design stage, it starts with creating the contents of the e-module using Canva and will be built into an application using Andromo. Figure 4.1 shows the product display design in Canva.

Figure 2. Screen View on Canva

b. Expert test results materi

The material expert validation test was conducted by Mrs. Nining Dwi Rohmawati, M.Pdi as a mathemat- ics teacher at SMA Negeri 1 Gondang. The results obtained from the material expert questionnaire are shown in table 3.

Table 3. Material Expert Test Results

No	Aspects	Indicator	Shoes	Maximum score
1	Material	The material inside the application is ATP compliant	5	5
		There are sample room materials and sample points	5	5
		There is a material opportunity for events	5	5
		There is a material opportunity for two events to be separated from each other	5	5
		There is a material chance that two events cannot be separated from each other	5	5
		There is a material opportunity for mu- tually free events	5	5
		Suitability of the image to the material	5	5
		Clarity of sample questions	5	5
2	Facilities	Ease of use of the e-module	5	5
		Kelayakan e-module	5	5
3	Evaluation	There are quizzes	5	5
		The quizzes presented can be read clearly	5	5
	Sum	**Overall score**	60	60

$$Hasil\ validasi\ (v) = \frac{skor\ total(ST)}{skor\ semua\ (SS)} \times 100\%$$

$$= \frac{60}{60} \times 100\%$$

$$= 100\%$$

Based on the percentage calculation above, it is obtained by 100% with the criteria of "Very Feasible" as a learning medium for students.

c. Media expert test results

Product material expertise was carried out by Mr. Okta Purnawirawa, M.Pd as a lecturer in Technology and Information Education at Bhinneka PGRI University. The results obtained from the material test are shown in table 4.

Table 4. Ahlu Media Test Results

No	Aspects	Indicator	Shoes	Max Score
1	Clarity of Media Content	Clarity of writing/text	5	5
		Suitability of the image to the material	5	5
		The videos contained in the application can be seen clearly	5	5
		Language is easy to understand	5	5
2	Facilities	Ease of use of media	5	5
		The application can *be installed* properly	5	5
		Application does not experience errors	5	5
3	Aesthetic	Interesting media display	5	5
		The colors used are interesting	5	5
4	User Needs	According to user needs for media	5	5
		Media Eligibility to Users	5	5
5	Distribution	Application format in the form of apk	5	5
	Sum	**Overall score**	60	60

$$Hasil\ validasi\ (v) = \frac{skor\ total(ST)}{skor\ semua\ (SS)} \times 100\%$$

$$= \frac{60}{60} \times 100\%$$

$$= 100\%$$

Based on the percentage calculation above, it is obtained by 100% with the criteria of "Very Feasible" as a learn- ing medium for students.

d. Data Presentation and Product Trial Analysis

1) Implementation

a. Small group test results

In one class X-2, trials were carried out on 5 students before being tested on large groups. The results of the small group trial are presented in table 5.

Table 5. Results of Small Group Trials

No	Aspects	Indicator	Shoes	Max Score
1	Material	Materials according to ATP	25	25
		There are sample room materials and sample points	25	25
		There is a material opportunity for events	25	25
		There is a material opportunity for two events to be separated from each other	25	25
		There is a material chance that two events cannot be separated from each other	25	25
		There is a material opportunity for mutually free events	25	25
		Suitability of the image to the material	24	25
		Clarity of sample questions	23	25
2	Clarity of media con- tent	Clarity of writing/text	25	25
		The videos contained in the application can be seen clearly	25	25
		Language is easy to understand	24	25
3	Facilities	Ease of use of media	22	25
		The application can *be installed* properly	25	25
		Application does not experience errors	25	25
4	Aesthetic	Interesting media display	23	25
		The colors used are interesting	24	25
5	User needs	According to user needs for media	24	25
		Easy-to-read text	25	25
6	Distribution	Application format in the form of apk	25	25
7	Evaluation	There are quizzes	25	25
		The quizzes presented can be read clearly	25	25
	Sum	Overall score	514	525

$$Hasil\ validasi\ (v) = \frac{skor\ total(ST)}{skor\ semua\ (SS)} \times 100\%$$

$$= \frac{514}{525} \times 100\%$$

$$= 97{,}9\%$$

Based on the calculation of the small group trial questionnaire, the feasibility percentage results were obtained at 9 7.9 %. With these results, the product is "Very Decent"

b. Large group test results

Large group trials were conducted to all students in class X-2 with a total of 37 students. The following are the test results from the group shown in table 6.

Table 6. Results of Large Group Trials

No	Aspects	Indicator	Shoes	Max Score
1	Material	Materials according to ATP	170	185
		There are sample room materials and sample points	183	185
		There is a material opportunity for events	182	185
		There is a material opportunity for two events to be separated from each other	181	185
		There is a material chance that two events cannot be separated from each other	180	185
		There is a material opportunity for mutually free events	182	185
		Suitability of the image to the material	180	185
		Clarity of sample questions	176	185
2	Clarity of media con- tent	Clarity of writing/text	180	185
		The videos contained in the application can be seen clearly	180	185
		Language is easy to understand	178	185
3	Facilities	Ease of use of media	168	185
		The application can *be installed* properly	171	185
		Application does not experience errors	182	185
4	Aesthetic	Interesting media display	178	185
		The colors used are interesting	175	185
5	User needs	According to user needs for media	182	185
		Easy-to-read text	183	185
6	Distribution	Application format in the form of apk	185	185
7	Evaluation	There are quizzes	181	185
		The quizzes presented can be read clearly	179	185
	Sum	Overall score	3760	3885

$$Hasil\ validasi\ (v) = \frac{skor\ total(ST)}{skor\ semua\ (SS)} \times 100\%$$

$$= \frac{3760}{3885} \times 100\%$$

$$= 96{,}7\%$$

Based on the calculation of the small group trial questionnaire, the feasibility percentage results were obtained at 96.7 %. With these results, the product is "Very Decent"

CONCLUSIONS AND RECOMMENDATIONS

A. Conclusion

Based on the results of research that has been done, researchers concluded that the development of math- ematical e-modules of this opportunity material can be done using the *Andromo platform* using *the Han- nafin and Peck* development model.*The Hannafin and Peck* development model has 3 stages, namely needs analysis, design, and development and implementation and is completed with evaluation at each stage.

The product results from the development of this learning media are very feasible to be used as learning media for grade X students at SMA Negeri 1 Gondang. Because this e-module product obtains a percentage of material experts of 100% with a very decent category. Furthermore, get a percentage of media experts of 100% with a very decent category. In addition, after conducting the trial results, the percentage of the small group was 97.9% with the very decent category and the percentage of the large group was 96.7% with the very decent category.

B. Suggestion

Suggestions from researchers and development are addressed to future researchers, namely:

1. The material must be in accordance with the flow of existing learning objectives.
2. The material described must be clear to make it easier for students to understand.
3. The design of the e-module can be further improved in terms of attractiveness.

4. In the product-module can be given with instructions for use.
5. Videos contained in the e-module can be accessed *offline*.
6. The size of the e-module can be reduced again.
7. E-modules are expected to be accessed via Android and *iOS mobile phones*.
8. You can choose another *platform* that has more complete tools because on *Andromo* there are still no *tools* to add *backsound.*

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