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Smartphone-Based Interactive Multimedia Development Using Smart Apps Creator for High School Mathematics Learning

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Abstract: This study aims to develop smartphone-based interactive multimedia products using smart apps creator (SAC) which was developed through the development of the ADDIE model (Analyze, Design, Development, Implementation, Evaluation). The product developed was tested based on the criteria of validity, practicality, and effectiveness of its use for learning mathematics. The research subjects were teachers and students of class X IPA 1 Public senior high school 4 Gorontalo as many as 28 students. The product is considered suitable for use based on the validity criteria from the assessment of the material expert, an average score of 3.45 is obtained in the very appropriate category, the media expert assessment is obtained by an average score of 3.78 in the very appropriate category, and the assessment of the learning design expert obtains an average score of 3.76 in the very category. worthy. Based on the practicality of the product, it is considered feasible to use with an average percentage of student responses of 84.29% in the practical category, and the average teacher response of 95.8% in the very practical category. The product is also considered effective as seen from the pretest and posttest scores obtained a gain score of 0.62 in the medium category.

Keywords: Interactive Multimedia, Smartphone, Smart Apps Creator, Learning, Mathematics

Introduction

The COVID-19 pandemic has been going on for approximately two years in Indonesia. So that the use of technology in supporting distance learning is something that cannot be separated. Without utilizing technology, it is impossible for online learning to be carried out. Along with the development of the industrial revolution 4.0 where technology plays a very important role in all aspects of life, especially in the world of education (H. P.S. Muttaqin et al., 2021).

The Gorontalo Provincial Government at the beginning of the even semester of the 2021/2022 academic year through the Dikbudpora Office issued a circular on limited face-to-face learning by allowing SMA/SMK/SLB Education Units that met the requirements to gradually implement it. According to the circular, the maximum number of students attending the class is 50% and the maximum length of study is 4 hours at school (Gorontalo, 2022). This, of course, has implications for the arrangement of the arrival schedule of students who are no more than three days at school, and alternately every day according to the group that comes. Thus, Distance Learning (PJJ) and Limited Face-to-face Learning (PTMT) must be combined to accommodate the learning needs of students who at the same time 50% study at school and the other 50% learn from home (BDR).

The results of observations in several high schools / vocational schools in Gorontalo Province, especially in Public senior high school 4 Gorontalo in implementing limited face-to-face learning and distance learning teachers use the Blended Learning model (Mufidah & Surjanti, 2021), where students who study at school and students those who study from home are given different treatment. When students learn from home (asynchronous), the teacher provides teaching materials, powerpoint media, teaching materials in the form of video tutorial shows from YouTube by utilizing Google Classroom as an LMS (Learning Management System). Some other teachers use whatsapp groups in online learning. It is hoped that the material provided at asynchronous time is completely understood beforehand and students are motivated to learn, so that when face-to-face learning is

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limited (synchronous) carried out in schools, with limited learning time, teachers are able to take advantage of the available time to discuss or check things. -Things that have not been understood by students when learning from home (asynchronous).

However, in reality, when face-to-face learning is limited (synchronous) it is found that learning loss occurs, where most students do not really understand the material that has been given by the teacher online. Learning loss is a situation where students lose knowledge and skills, either in general or in particular, or there is an academic setback due to certain conditions (Hanafiah et al., 2022). Therefore, the learning activities expected by the teacher at PTMT cannot be carried out optimally because the teacher must repeat the lessons that have been given during distance learning.

Learning is an activity to gain knowledge, hone skills and instill positive things through various learning resources (Rudi Susilana & Cepi Riyana, 2016). Therefore, appropriate learning media are needed to answer the challenges of learning in the midst of the COVID-19 pandemic that are able to accommodate limited face-to-face learning and Distance Learning (PJJ) which is carried out simultaneously. The results of an interview with one of the class X mathematics teachers of Public senior high school 4 Gorontalo obtained information that in the trigonometric comparison material for right triangles. The teacher feels that students are less able to master the concept of trigonometric comparisons in right triangles, students often make mistakes in solving problems of applying trigonometry to contextual problems. In learning in the normal era, teachers give projects related to the application of trigonometry to everyday problems, but with limitations during the covid-19 pandemic, it is felt that there is a need for learning media for mathematics in Trigonometry material that can also support students' independent learning activities at home. With the characteristics of abstract mathematical material, the use of correct and appropriate learning media can be a solution in learning mathematics because it can help and foster students' motivation and interest in learning, and also provide students with experience with events in their environment (Yanti et al., 2019).

One solution to answer these challenges is to utilize smartphone-based interactive multimedia using Smart Apps Creator (SAC). Smart Apps Creator (SAC) is a desktop application that is used to create interactive media that can produce output in the form of APK files (Latif et al., 2021). The output of the application in the form of an APK file can be used for smartphones. In addition, the SAC output file type can also be presented in the form of html5 which can be accessed through the website and also the .exe type which is usually run on a laptop or PC. Thus, interactive multimedia can be used by students in learning both online and offline. In addition, one of the advantages of Smart Apps Creator is that this application can be easily learned by teachers because it can create android mobile applications without programming (Syahputra & Prismana, n.d.).

Several studies related to the application of smartphone-based media with the help of smart apps creators have proven to be able to improve student learning outcomes during the COVID-19 pandemic (Khoirudin et al., 2021). This is in line with the results of research that has been carried out at Vocational high School NU 2 Kedungpring, where researchers use android-based applications in their learning. In his research it was found that students feel motivated in learning so they can use their free time to discuss with friends or teachers (Fajriani & Hidayat, 2021). In addition, other research with research subjects are students in the economics mathematics course, also developing learning media based on android smartphones, in their research it was found that in improving students' mathematical problem solving abilities, researchers used android-based learning media assisted by Smart Apps Creator (SAC). The combination of media elements, both video, audio and images, makes learning more relaxed and relaxed so that students' interest and attention to the material presented increases both in terms of experience and understanding of students (Mahuda et al., 2021).

Method

This research is a type of research and development (research and development) to produce smartphone-based interactive multimedia products using smart apps creator (SAC) which is a desktop application to create smartphone mobile applications. Product development uses the ADDIE model development stages, namely analysis, design, development, implementation, and

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evaluation (Mulyatiningsih, 2013). With a product trial design with three stages, namely product feasibility trials, small-scale trials, and large-scale trials.

The research was carried out in the even semester of the 2021-2022 academic year at Public senior high school 4 Gorontalo, with the research subjects being teachers and students of class X Senior High School, totaling 28 students. The instruments used in this research are:

1. interviews and observations to obtain initial information before designing multimedia products, namely information related to media analysis, materials, and learning environments.
2. Questionnaire for assessing the feasibility of multimedia products that are assessed based on media aspects, material aspects, and learning design aspects. The data analysis technique on the feasibility of interactive multimedia was adopted from the feasibility of the media (Mardapi, 2018) where the assessment stage was carried out with quantitative data then the score obtained from the validator was then converted to qualitative data.

Table 1. Questionnaire Rating Scale Guidelines

Category	Score
Very good	4
Well	3
Not enough	2
Very less	1

From the results of the quality assessment in terms of assessment of learning design, media, and material in multimedia, then the average score is processed by the following formula:

$$M = \frac{\Sigma X}{N}$$

Information:

M = Average score

$\sum X$ = Total score

N = Number of Appraisers

The average score of each validation instrument is then converted to qualitative data as shown in table 2.

Table 2. Media Eligibility Criteria

Score	Score Range	Category
4	X ≥ 3,0	Very Worthy
3	3,0 > X ≥ 2,5	Worthy
2	2,5 > X ≥ 2,0	less worthy)
1	X < 2,0	Not feasible

3. The practicality questionnaire of the use of interactive multimedia is intended to obtain information related to the practicality of using multimedia products obtained through the responses of students and teachers. The following is a table of practicality percentage categories from the responses of students and teachers (Riduwan, 2009).

Table 3. Questionnaire Rating Scale Guidelines

Percentage of Student Responses (R)	Category
85 % ≤ R	Very Practical

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$70\% \leq R < 85\%$	Practical
$50\% \leq R < 70\%$	Less Practical
$0\% \leq R < 50\%$	Not Practical

4. Learning Outcomes Tests from students were then analyzed using pre-test and post-test designs. The learning outcomes of the two tests were compared to see the effectiveness of the use of smartphone-based interactive multimedia both before and after use. The comparison of pretest and posttest results was obtained by comparing the mean scores of pretest and posttest using the N-gain formula (Hake, 1998) as follows:

$$g = \frac{S\ post - S\ pre}{S\ maks - S\ pre}$$

Information:

S post : Average score *Post-test*

S pre : Average score *Pre-test*

S maks : Maximum score

Furthermore, the comparison of gain values (Hake, 1998) is classified with qualitative data as shown in the table below.

Table 4. Questionnaire Rating Scale Guidelines

Score (g)	Classification
(N-gain) ≥ 0,7	Tall
0,7 > (N-gain) ≥ 0,3	Currently
(N-gain) < 0,3	Low

Results And Discussion

A. Development Results

The development process of smartphone-based interactive multimedia products presented through this mathematics learning application was developed using the ADDIE model development stages.

1. Stage of Analysis (analyze)

At the analysis stage, it was carried out before the researchers designed and designed interactive multimedia products for learning mathematics at SMA Negeri 4 Gorontalo. The things that are analyzed are related to the needs of learning media, learning environments, as well as material analysis that needs to be described in multimedia products. The data from the analysis were obtained through an interview process with mathematics subject teachers and also obtained through direct observation by researchers of the learning environment of SMA Negeri 4 Gorontalo. The results of the analysis, among others, are that teachers feel the need for media that can facilitate and can be used during face-to-face learning in class and distance learning so that mathematics learning in the limited face-to-face learning period can be carried out properly. In terms of the learning environment for students, access to certain media is needed that supports all types of devices owned by students to support the learning process of students during independent learning at home. In terms of material, the researcher chose trigonometric comparison material in right triangles which would be contained in smartphone-based interactive multimedia content that the researchers would develop based on the results of interviews with mathematics teachers at State High School 4 Gorontalo class X, that students were less able to master the concept of trigonometric comparisons in triangles. elbow.

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2. Design stage

In this design stage, the researcher carried out planning steps before developing interactive multimedia. Namely making a multimedia development planning schedule, preparing applications in making multimedia, determining trigonometry material reference books, making Flowcharts and multimedia storyboards to be developed, determining image, animation, and audio assets as well as making multimedia assessment validation instruments and conducting construct validation of the instrument. which is made.

3. Stage of development (development)

This stage is carried out in several stages, namely, making a prototype product from interactive multimedia, validation from experts in terms of material, content, and learning design. The results of the assessments from the validators were then analyzed and the product revised based on the input and suggestions given by the validators.

The following are the results of the assessment of the quality of the feasibility of multimedia products from every aspect from the validators of material, media, and learning design experts:

a. The results of the multimedia quality assessment from the validation of the material assessed by two material validators were obtained with an average score of 3.45 with a very decent category. With details for the preliminary aspect of 3.5 the very feasible category, the content aspect of 3.8 with the very feasible category, the learning aspect of 3.42 with the very feasible category, and the training aspect of 3.5 with the very feasible category.
b. The results of the multimedia quality assessment from media validation assessed by two media validators were obtained with an average score of 3.78 with a very decent category. With details for the display aspect of 3.75 the very feasible category, the use aspect of 3.6 with the very feasible category, and the utilization aspect with the highest score of 4 with the very feasible category.
c. The results of the multimedia quality assessment from the validation of learning designs assessed by two learning design validators were obtained with an average score of 3.76 with a very decent category. With details for the competence aspect of 3.67 the very feasible category, the learning aspect of 3.63 with the very feasible category, and the evaluation aspect with the highest score of 4 with the very feasible category.

The following is a recap of the multimedia quality assessment of each aspect of the expert Validator's assessment.

Table 5. Multimedia Quality Assessment Results

Aspect of Validation	Final Score Average	Category
Media	3,78	Very Worthy
Theory	3,45	Very Worthy
Learning Design	3,76	Very Worthy

4. Implementation phase (Implementation)

At the implementation stage of this interactive multimedia, researchers carried out field trials by looking at the practicality obtained from the responses of students and teachers after using the product. And the effectiveness of using multimedia products obtained through student learning outcomes tests. The multimedia product is presented in the "Trigoma" application with the existence of an apk, and is also presented in the form of an html5 and exe existence for PC computers. The following are the practical results of the responses of students and teachers after using the product.

Table 6. Percentage of Student Responses

Rating Points	Average Percentage of Response	Category
Use	81,09 %	Practical

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Utilization	86,06 %	Very Practical
Appearance	85,74 %	Very Practical
Average Percentage	**84,29 %**	**Practical**

Table 7. Percentage of Teacher Responses

Rating Points	Average Percentage of Response	Category
Use	97,9 %	Very Practical
Utilization	89,6 %	Very Practical
Appearance	100 %	Very Practical
Average Percentage	**95,83 %**	**Very Practical**

The interactive multimedia product that was developed was considered effective for learning mathematics as seen from the learning outcomes of students showing an increase in learning outcomes based on pretest and posttest scores. The following table summarizes student learning outcomes.

Table 8. Recap of pretest and posttest results

Test stages	Average score
Pre-test	52,06 %
Post-test	81,77 %
Score Gain	0,62
Category	**Currently**

5. Evaluation stage

At this stage the researchers conducted several analyzes based on suggestions and input from students and teachers after using interactive multimedia applications on large-scale trials. Suggestions and inputs from students and teachers are used as evaluation materials for further refinement and development of interactive multimedia.

Discussion

The product resulting from the development of smartphone-based interactive multimedia specifically for learning mathematics in class X students at Public High School 4 Gorontalo, was developed with the ADDIE model to produce multimedia products presented in the "Trigoma" application with the existence of apk, html5, and exe products. Products can be accessed online and offline. APK products can be installed and run offline, for html5 products and can be run online on a web-based basis, while products with an exe existence can be run through a PC computer. All forms of this multimedia product can be accommodated in accordance with the availability and needs of students' learning media. Smartphone-based interactive multimedia products are considered feasible to be used as one of the learning media for students, after going through the process of product development, revision, and testing. This is based on an assessment of the quality of

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multimedia in terms of feasibility, practicality, and effectiveness. The interactive multimedia product that was developed was considered effective for learning mathematics, seen from the learning outcomes of students showing the percentage of classical completeness of 89.29% getting a score above the KKM. In addition, based on the results of the pretest and posttest, a gain score of 0.62 was obtained in the medium category.

Conlusion

It can be seen from the results of the study that smartphone-based interactive multimedia products are considered suitable for use and their use is effective as one of the learning media for students, after going through the process of developing, revising, and testing the product. This is based on an assessment of the quality of multimedia in terms of feasibility, practicality, and effectiveness

The suggestions from researchers for smartphone-based interactive multimedia products can be implemented in other schools, even for all levels of elementary, junior high, and high school / vocational education by paying attention to the development of students. For other research and development, it is expected to develop smartphone-based interactive multimedia products for mathematics learning with a different focus on material, or for learning other than mathematics. And for Developers of Smart Apps Creator to be able to further develop multimedia editing products that can accommodate the needs of learning media for both teachers and students in the era of technological development 4.0.

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