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Development of Mobile Learning Media Android-based using the STAD Model for Improving Learning Outcomes of Modeling Subjects Software at SMKN 8 Malang

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ABSTRACT

Software Modeling is a discipline that studies procedures in developing software using various development models. This study aims to produce mobile learning media products using the STAD model to improve student learning outcomes in software modeling subjects. The development of this learning media uses the ADDIE development model. The test subjects in this study were students of class XI RPL SMKN 8 Malang who were divided into 3 trial subjects who were randomly selected, namely: (1) 2 individual trial subjects, (2) 10 small group trial subjects, and (3) large group trial subjects totaling 30 people. The results of media expert validation show that 95.2% of learning media is very valid and based on material experts 88% of the material in learning media is very feasible to use in the learning process. In the individual trial process, a percentage of 80.9% was obtained with very valid criteria, through small group trials, a percentage of 83.2% was obtained with very valid criteria, and large group trials showed that the media was very valid with a percentage of 85.9%. The results of increasing learning outcomes can be seen from the comparison before and after using the media by comparing the average grades and classical completeness scores of students. Before using the media, an average score of 67 was obtained with 63.3% classical completeness and after using the media, an average score of 88 was obtained with 96.6% classical completeness. Based on these results it is concluded that learning media is appropriate for use in the learning process.

I. INTRODUCTION

Graduate Competency Standards and content standards in the 2013 curriculum contain one of the learning principles that need to be considered, namely increasing the efficiency and effectiveness of learning by utilizing information and communication technology [1]. Based on these principles it can be said that the learning process in the 2013 curriculum will not be separated from the use of information and communication technology. In creating higher quality learning, it is necessary to use media in the learning process. At this time the learning media used varies widely, not only in *the* form of blackboards, books and *power point media,* but many learning media have developed that are more interesting and interactive daily [2]. Smartphones have various operating systems and one ofthem is Android. At this time almost all people have *a smartphone*. The ease of getting *a smartphone* is also the reason for the rapid development of smartphones today. There are several operating systems that exist on Smartphones and for now the most widely used is Android. The development of smartphones has been widely used in many fields, one of which is in the world of education. The learning process at this time will not be separated from smartphones and the internet. The use of smartphones themselves in the learning process is commonly referred to as mobile learning.

The definition of mobile learning itself is quite diverse. But in general, mobile learning is mobile learning that utilizes technology in the learning process so that students can learn anywhere without time and place restrictions and accommodate the limitations of multimedia delivery, especially in the form of

sound, images, text and animation. The use of mobile learning media in the learning process will be indispensable for the purpose of creating interactive learning media [3], [4]. Especially during a pandemic like what happened this year, all learning activities are carried out online by utilizing Google Classroom. The selection of learning media will be very important when viewed from the current situation. The use of learning media based on mobile learning will be very much needed with its various advantages that can be used remotely and is very flexible.

From the results of observations and experiences of the author teaching KPL at SMKN 8 Malang on. Learning that is currently applied to software modeling subjects at SMKN 8 Malang uses learning media in the form of power points as a means to assist teachers in delivering material conventionally. For the learning model currently used, namely Discovery Learning, this model has the characteristics of learning that requires students to actively analyze and discover the concepts they are learning for themselves. Learning activities begin with the delivery of material from the teacher through power point media. In this case, the material presented by the teacher is limited to concepts ssand start asking questions to students. The next activity is that students identify questions by gathering as much information as possible from various sources with the aim of answering questions. With a pandemic like today, learning activities are carried out online by using Google Classroom and Google Meet. The teacher explains the material using power point media through Google Meet and the teacher distributes assignments through Google Classroom.

Learning activities that use the discovery learning model and use power point media are not optimal because they have problems when used remotely, especially during a pandemic like this. The material presented by the teacher using power point is limited to basic concepts without any practice questions which causes learning activities to become one-way. This is also supported by the opinion of research that learning that uses the discovery learning model and utilizes power point media has drawbacks if the class being taught is too large [5]. At SMKN 8 Malang, each class has an average number of students of 35. With so many students being taught, the discovery learning model has one syntax, namely problem identification. At this stage the teacher gives students the opportunity to identify and analyze the problems they face individually. Individual problem identification activities as above are considered less than optimal because the abilities of each student are very diverse and this will affect the learning outcomes that will be obtained by students. Solving individual problems like this can lead to differences in understanding of the material for students. The lack of interaction between students in problem solving is considered to be influential, especially if the number of students in the class is quite a lot. This can be seen from the results of the daily tests obtained by students with the KKM value used, namely 65 and with a total of 36 students. There were 20 students who still could not reach the KKM score, which means that as many as 55.5% of students did not really understand the material being taught. This can be seen during questions and answers and presentations, there are still many students who do not seem to understand the material they are studying. This research is different from previous research, the researcher wants to develop an Android- based learning media that will be applied in classroom learning using the Student Teams-Achievment Division (STAD) cooperative learning model [6]. This model was chosen by the author because it was deemed appropriate in an effort to improve student learning outcomes in software modeling subjects.

II. METHOD

A. *Research and Development Procedures*

This research was conducted by applying the steps in the method research and development with the model from ADDIE as follows:

1) *Needs Analysis*

Based on the experience of researchers during Field Studies and Practices (KPL) at SMKN 8 Malang, especially in PPL class XI RPL subjects. The needs analysis here looks at the characteristics of students, almost all of whom have *smartphones* with a minimum specification of 1GB RAM with Android 5.1 *(Lollipop) operating system.* At SMKN 8 Malang, especially in PPL subjects, they use the Discovery Learning learning model. The characteristic of this model is that it is oriented towards each student's individual abilities. STAD type cooperative learning will be chosen by the researcher when viewed from the characteristics of students during the learning process. The advantage of this model is that it makes students active in group activities in understanding the material together. This type of STAD cooperative model will be chosen in making an Android-based mobile learning application.

2) *Material Analysis*

Based on the results of observations and experiences of researchers during KPL at SMKN 8 Malang, there was some material that was difficult for students to understand, especially for KD which required students to be able to analyze a case study and had to apply a development model to that case study. As in KD 3.1 D and KD 3.2 which explain various concepts in software modeling,for example SDLC and OOAD materials.

3) *Analysis of Floating Objectives*

The purpose of this research and development is to create mobile learning learning media using the STAD learning model in software modeling subjects at SMKN 8 Malang. This development is intended so that the learning process can be carried out by way of group activitiesand each member in it can help each other in understanding the material. Learning media that have been developed will be tested on students who are taking or have taken software modeling courses with the aim of knowing the feasibility of the learning media.

a) *Design Stage*

The design stage is used to design learning media according to a predetermined needs analysis. This stage is divided into 4 parts, namely: (1) Material Design; (2) Interface Design; (3)Design of Product Testing Instruments; (4) Evaluation of the Design Stage.

b) *Development Stage*

The development stage is the stage of making media based on the preparation that has been done in the previous stage. The development stage has two parts, namely: the DevelopmentStage and the Evaluation Development Stage.

c) *Implementation Stage*

In the implementation phase, the media that has been developed will be used during the learning process. At the implementation stage the researcher will distribute the media that has been developed to students and distribute questionnaires to obtain data from respondents.

d) *Evaluation Stage*

At the evaluation stage it is used to test the final results of development research activities whose results are the level of feasibility of using the development results. To measure this feasibility, researchers need to distribute open questionnaires that have questions with answers that have been prepared with a certain answer scale. Researchers used the Likert Scale as a guide in giving the answer scale. Assessment based on the Likert Scale measurement scale by (Sugiyono, 2016: 93). Such an assessment aims to anticipate a neutral or doubtful assessment. The following is an explanation of the level of assessment shown in Table 1.

B. *Product Validity Test*

Product validity testing is carried out by material experts and media experts. Material validation is carried out by evaluating and validating the contents of the material that has been made by experts who have mastered Software Modeling material in the product being developed. Media validation is carried out by evaluating and validating the product in terms of eligibility by experts who have mastered Information and Communication Technology (ICT).

C. *Product Trials*

Product trials are a process for collecting data that is used as a guide for making improvements and perfecting teaching materials developed with the aim that in the learning process it can increase students' understanding.

TABLE I. RATING LEVEL OF THE LINKERT SCALE

Scor	Description
Score 4	Very good/very good
Score 3	Good/worth
Score 2	Good enough/decent
Score 1	Not good/not worth

[a] Source: [7]

1) *Trial Subjects*

Individual Trial Individual trial subjects were carried out by 2 students of class XI Software Engineering.

2) *Small Group Trial*

The subject of the small group trial was carried out by 10 students of class XI Software Engineering.

3) *Large Group Trial*

Field trial subjects were carried out by 25 students of class XI Software Engineering.

D. *Types of Data*

Quantitative data is data obtained from the results of a questionnaire which is distributed to trial subjects including material experts, media experts, and students. The data obtained is then collected into the final result to find out which learning media has been made feasible.

Qualitative data is data obtained from interviews, needs analysis, suggestions evaluation and criticism of the results of product validation.

1) *Data Collection Instruments*

The instrument used for data collection in this study was a questionnaire that had been developed for trial subjects. There are two types of questions: open questions and closed questions. Open questions are questions that contain a rating scale while closed questions are questions that contain strengths/strengths, comments, and suggestions obtained from material experts and media experts.

2) *Data Analysis Techniques*

Teaching materials that have been developed will be validated by experts. The validation carried out has the aim of measuring the feasibility of teaching materials before being tested using instruments in the form of questionnaires for trials and observations for product trials. Guidelines for determining the validity and feasibility of teaching materials, researchers use the percentage of product validation criteria, for expert validation and validation in product trials shown in Table 2. Teaching materials can be said to be very feasible if the criteria are very valid and the validity criteria are 85.01% -100% already reached.

TABLE II. VALIDITY CRITERIA

No.	Score	Information
1	Score 4	Very Good/Very Decent
2	Score 3	Good/Decent
3	Score 2	Good Enough/Decent Enough
4	Score 1	Less Good / Less Decent

[b] Source: [7]

a) *Discussion of Improved Learning Outcomes*

Measurement of student learning outcomes is done by looking at the increasethe average score of the pretest and posttest results. The formula used to calculate the average test score is:

$$\bar{x} = \frac{\sum x}{n} \quad (1)$$

Information:
$\bar{x}$ = average value
$\sum x$ = Total score obtainedevery student
N = The number of students
Individual learning mastery can be achieved if student learning outcomes >= 65

from a maximum score of 100. Comparisons were also made on the percentage of students' classical completeness results in one class. The formula used to calculate classical completeness is as follows:

$$KK\ (\%) = \sum ST / N \quad (2)$$

Information:
KK (%) = classical completeness
$\sum ST$ = Number of students who have completed
N = Total of all students

Improved learning outcomes can be seen from the increase in the average score and student learning completeness from the results of student pretest and posttest trials. The criteria for completeness of learning outcomes are categorized as in Table 3.

III. RESULT

A. *Development Results*

This research and development produces learning media for mobile-based software modeling subjects with an application capacity of 25 MB. The material that will be displayed in this learning media is software development models and activity diagrams. Software Modeling learning media is equipped with several features, namely: multiple choice quizzes, materials, groups and leaderboards. The development of this product uses the ADDIE development model. Software modeling learning media was developed using the Java language and Android Studio software. Software Modeling learning media is tested through three stages of testing, namely (1) media expert validation test; (2) material expert validation test; And (3) the trial phase consisting of individual, small group, and large group tests carried out by class XI students of the software engineering expertise program at SMKN 8 Malang. The results of this product development will be explained as follows:

1) *Login View*

The login page is equipped with a register button that leads to a list page if the user does not have an account. The login display is shown in Figure 1.

2) *Main Menu Page Display*

Main page oflearning media for Software Modeling displays a learning menu consisting of (a) Test; (b) Material; (c) Groups; (d) Leaderboards; (e) Results; (f) Profile settings; (g) Reset passwords; (h) About. On the main page there are also buttons to display Basic Competencies, Learning Objectives, Competency Achievement Indicators, Instructions for Use. And if you log in as admin, a button will appear to add new questions to the application and a button to download student test results. The display of the main page is shown in Figure 2.

3) *Quiz View*

The test page displaysquestions that can be done by students. In the Software Modeling learning media there are 2 packages of questions that can be done with a predetermined time. The test display can be seen in Figure 3.

TABLE III. LEARNING OUTCOME CRITERIA

No.	Precentage	Description
1	90-100	Very good
2	80-89	Good
3	70-79	Enough
4	>50	Not Enough

[c,]Source: [8]

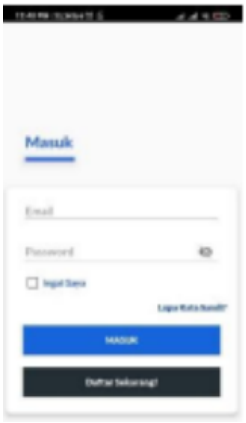

Fig. 1. Login View

Fig. 2. Main Menu Display

Fig. 3. Quiz View

4) *Material display*

The materials page contains a list of materials that students can learn. There are 7 submaterials consisting of various software development models, software development system requirements and activity diagrams. The appearance of the material is shown in Figure 4.

5) *Group view*

The group page displays a list of groups that have been registered and there are buttons to join groups and to create new groups by writing the group name and description of the group. If you already have a group, it will display a discussion page with other members. The group page view is shown in Figure 5.

6) *Leaderboard view*

The leaderboard page displays the rankings of all registered groups. The value of each group is obtained from the sum of all scores from the test results of all members. The leaderboard page display is shown in Figure 6.

Fig. 4. Material Display

Fig. 5. Group View

Fig. 6. Leaderboard view

7) *Analysis Results*

Material validation is carried out by an expert who is competent in the subject matter Software Modeling Material validation is carried out using the attached material expert assessment instrument questionnaire. The data obtained is in the form of quantitative data on aspects of content, language, and presentation with a total of 20 questions that have been adjusted to the eligibility criteria of teaching materials [9]. Data from material expert validation results are presented in Table 4.

Media validation is carried out by an expert who is competent in the field of Information and Communication Technology (ICT). The data obtained is in the form of quantitative data on aspects of software engineering, learning design, and visual communication with a total of 21 questions that have been adjusted to the eligibility criteria of teaching materials [9]. Data from media expert validation results are presented in Table 5.

TABLE IV. MATERIAL EXPERT VALIDATION RESULTS

No	Assestment Aspect / No Questions	Evaluation			
		tse	tsh	V(%)	Criteria
1	Material Aspect/ 1-9	32	36	88.8	Very valid
2	Question Aspects/ 10-15	22	24	91.6	Very valid
3	Language Aspect / 16-17	7	8	87.5	Very valid
4	Aspects of Implementation/ 18-20	10	12	83.3	Valid enough

TABLE V. MEDIA VALIDATION RESULTS DATA BY EXPERTS

No	Assestment Aspect / No Questions	Evaluation			
		tse	tsh	V(%)	Criteria
1	Software Engineering/ 1-12	48	100	100	Very valid
2	Visual Communication/ 13-21	32	36	88.8	Very valid

Individual trials (one to one) were carried out by two students who were taken based on class representatives. These students are students who have taken Software Modeling subjects. Individual trials were carried out using a respondent trial questionnaire. Data from individual trials are presented in Table 6.

Small group trials (small group evaluation) were carried out by 10 students who were taken based on class representatives. These students are students who have taken Software Modeling subjects. The small group trial was carried out using the attached respondent trial questionnaire. Data from the small group trial results are presented in Table 7.

The field trial (field evaluation) was carried out by 30 students who were taken based on class representatives. These students are students who have taken Software Modeling subjects. The field trial was carried out using the attached respondent trial questionnaire. Data from field trials are presented in Table 8.

TABLE VI. INDIVIDUAL TRIAL RESULT DATA (ONE TO ONE)

No	Assestment Aspect / No Questions	Evaluation			
		tse	tsh	V(%)	Criteria
1	Software Engineerings	33	40	82.5	Very worthit
2	Learning Design	45	56	80.3	Very worthit
3	Visual communication	58	72	80.5	Very worthit

TABLE VII. DATA RESULTS OF SMALL GROUP TRIAL (SMALL GROUP EVALUATION)

No	Assestment Aspect / No Questions	Evaluation			
		tse	tsh	V(%)	Criteria
1	Software Engineerings	169	200	84.5	Very worthit
2	Learning Design	230	280	82.1	Very worthit
3	Visual communication	300	360	83.3	Very worthit

TABLE VIII. DATA FROM FIELD TRIAL RESULTS (FIELD EVALUATION)

No	Assestment Aspect / No Questions	Evaluation			
		tse	tsh	V(%)	Criteria
1	Software Engineerings	523	600	87.1	Very worthit
2	Learning Design	712	840	84.7	Very worthit
3	Visual communication	932	1080	86.2	Very worthit

Trials to find out the increase in learning outcomes were carried out by 30 students. The test is carried out by giving pretest questions to students before using Software Modeling learning media. Calculation of the increase in learning outcomes is done by using n-gain analysis by comparing pretest and posttest scores after students use learning media. The results of the cognitive domain pretest conducted by 30 students obtained an average score of 67.6 in the less criterion and classical completeness of 63.3% which was calculated using the formula as described in chapter III. Of the 30 students based on the results of this pretest test, there were 11 students who had not obtained a score above the KKM that had been determined, namely 65. The results of the posttest carried out obtained an average of 88, 3 which entered the good criteria and experienced an increase of 20.7 from the pretest results. With classical completeness, a percentage of 96.6% is obtained, which means that out of 30 students there is only 1 student who has not completed and has increased by 33.3% from the pretest results. The results of increasing the achievement of knowledge competence can also be seen by the results of the n-gain analysis which has been presented in table 4.8. From the table it can be seen that the average n-gain is 0.72 in the high category. Data from increased learning outcomes can be seen in table 9. The results of increasing the achievement of knowledge competence can also be seen by the results of the n-gain analysis which has been presented in table 4.8. From the table it can be seen that the average n-gain is 0.72 in the high category. Data from increased learning outcomes can be seen in table 9. The results of increasing the achievement of knowledge competence can also be seen by the results of the n-gain analysis which has been presented in table 4.8. From the table it can be seen that the average n-gain is 0.72 in the high category. Data from increased learning outcomes can be seen in table 9.

Based on Table 9, this research is said to be successful because there is an increase in the average grades and classical completeness which can be seen from the increase in pretest and posttest results from 67.6% to 83.3% for the average score and for classical completeness from 63.6 % to 96.6%. This proves that research and development of mobile learning products that use the STAD model have had a positive effect on student learning outcomes. Students also find it easier to access material flexibly. This is in accordance with research findings that the design of appropriate learning systems and supports scientific learning can improve creative thinking and student learning outcomes in SMK [10], [11].

TABLE IX. ANALYSIS OF LEARNING OUTCOMES

No	Assessment Aspects	Clasical Mastery	Average Value
1	Pretest	63.3%	67,6
2	Postest	96.6%	88.3

IV. CONCLUSION

Based on the results of the development of modeling learning mediaSoftware that has gone through material, media validation tests and repairs, then the following product review is discussed regarding the objectives that have been prepared in the formulation of development research objectives section. The details of the development research objectives that have been fulfilled are as follows: (1) The resulting design is in the form of mobile learning media with Software Modeling for class XI students with the ADDIE development model; (2) Android-based learning media was successfully developed in accordance with KI and KDwhich is used in software modeling subjects for class XI RPL at SMKN 8 Malang; (3) Android-based learning media has gone through the feasibility testing process by media experts, materials and field trials and it is concluded that the product is said to be very feasible; (4) This research and development improves student learning outcomes seen from the increase in the percentage of average grades and students' classical completeness from the pretest and posttest:

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