Development of Animation Video Media based on Inquiry Strategy for Mathematics Learning

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Abstract: _This research is motivated by the low understanding of students in learning mathematics, especially in abstract material. This affects student learning outcomes which are still relatively low and have not reached the specified minimum completeness criteria (KKM). This study aims to produce instructional media in the form of inquiry strategy-based animated videos for mathematics learning in Senior High Schools (SMA) that are valid, practical, and effective so that they can assist teachers/educators in conveying material so that it is easier for students to understand. This research includes research and development (Research and Development). This study used the ADDIE development model with 5 stages, namely analysis, design, development, implementation, and evaluation. The instrument in this study used a questionnaire to test validity and practicality, and student learning outcomes of testing the effectiveness of the animated video media developed. The results of this research and development indicate that the validity test based on the media expert questionnaire validation for the first stage obtained an average value of 2.84 with good/quite valid criteria and the second stage obtained an average value of 3.92 with very good/valid criteria. While the validation of material experts for the first stage obtained an average value of 2.725 with good/quite valid criteria and the second stage obtained an average value of 3.78 with very good/valid criteria. The results of the practicality test based on the analysis of the mathematics teacher's response questionnaire for the first validator obtained an average value of 4.138 with good/practical enough criteria, while for the second validator an average value of 4.19 was obtained with good/quite valid criteria. The results of the practicality test based on the analysis of the response questionnaire from students of class XI MIA-1 SMA 1 Barumun Tengah obtained an average value of 4.48 with very good/practical criteria. In contrast, the questionnaire analysis of students' responses to class XI MIA-3 MAN 2 Padang Lawas obtained an average value -average 4.26 with very good/practical criteria. Whereas the results of the effectiveness test based on the percentage of classical learning completeness of students in class XI MIA-1 SMA 1 Barumun Tengah obtained an average value of 86% in the very good category, while the percentage of classical learning completeness of students in class XI MIA-3 MAN 2 Padang Lawas was obtained an average value of 88% with very good category._

Keywords: _Development, Animation Video Media, Inquiry Strategy, SMA._

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INTRODUCTION

Education is one of the determining factors in improving the quality and human resources in a country. In the world of education in various countries, improving the quality and human resources are still being discussed. In general, education aims to develop the potential of students to become more mature human beings who have faith and piety to God Almighty. That is, education guides students so that they can stand alone in their lives amid the community, nation, and state and have faith in God Almighty.

As an educator, in learning mathematics conveying subject matter so that it can be well received and understood by students is the main thing that must be achieved. One way that educators can use in realizing good mathematics learning is by using the right media and strategies. The fact that is often found in mathematics learning to date is the lack of use of appropriate instructional media and strategies by teachers/educators. This is the reason why students think that mathematics is a difficult and boring subject.

Based on the results of interviews conducted with students and mathematics teachers in the observation activities, it can be concluded that the media used in learning mathematics still uses conventional media such as PowerPoint (ppt), books, or others. Until now, learning mathematics has never used learning media in the form of animated video media. Meanwhile, learning strategies that can improve students' ability to think critically are still rarely used by educators. Educators only use learning models or methods such as lecture methods, discussions, and assignments.

In addition, another fact that is seen is the low student learning outcomes in mathematics learning because students do not understand the material taught by educators. Student learning outcomes in mathematics learning with an average score of 60 are still below the KKM that has been determined by the school, namely 65. The same problem can be seen from research referred to in the journal by (Khasanuddin et al., 2020) with the title "Development Animation-Based Media in Mathematical Learning in Building Materials". In this study, the problems found in the field were also the lack of proper use of media and methods in learning mathematics. This results in students having difficulty understanding the material taught by educators because educators have not been able to improve their ideas in learning.

The use of animated video media and inappropriate strategies in learning mathematics causes low learning outcomes and students' interest in participating in lessons. In addition to students considering mathematics as a difficult and boring subject, it also hurts their results and interest in learning. The facts found in the field also show that students have not been able to develop their ideas in solving various problems or questions given by the teacher. This is because educators have not been able to choose strategies that can help students develop their thinking potential. One of the animated video media that can be used in learning mathematics is animated video media with the help of Powtoon.

Powtoon is an animation software that allows users to quickly and easily create animated presentations by manipulating objects and inserting images. The use of animation media in the form of video, audio-visual, and other forms will be perfect to be used in the mathematics learning process if it is accompanied by the right model or strategy. One of the learning strategies that are appropriate to the use of Powtoon animation is the inquiry strategy. Inquiry learning strategy is a strategy that requires students to master the material while the teacher is the conveyer of information.

Research on inquiry strategy-based animated video media in mathematics learning has also been studied before. Based on data obtained from previous research, it can be seen that the media users based on inquiry strategy in learning mathematics can improve student learning outcomes with an effectiveness test score of 85.00% in the very good category. This means that the media users based on an inquiry strategy in learning mathematics can improve student learning outcomes.

Based on the results of previous research, the use of animated video media has had many positive impacts on learning. One of them is increasing students' ability to develop their findings and learning outcomes. In this study, the authors will develop an animated video media using existing software, namely Powtoon based on an inquiry strategy and it is expected to be able to improve student learning outcomes, especially in learning mathematics.

METHODS

This type of research is Research and Development (R&D) development research. R&B is one of the research methods applied to produce a product while simultaneously testing the validity, practicality, and effectiveness of the resulting product so that it is suitable for use (Rangkuti, 2016).

The development model used in this research and development is the ADDIE model developed by Raiser and Mollenda. The ADDIE model is one of the models used in research and development which consists of five phases or steps, namely analysis, design, development, implementation, and evaluation (Sugiyono, 2018). According to Rizma & Indrati (2020), one of the functions of the ADDIE model is to serve as a guide in building a set of effective research programs, and dynamic and support the performance of the research itself.

The subjects in this research and development were 33 students of class XI MIA-3 MAN 2 Padang Lawas and 21 students of class XI MIA-1 SMA 1 Barumun Tengah. The total number of subjects in this study was 54 students. The reason for choosing the subject of this study was because students in class XI MIA-3 MAN 2 Padang Lawas and students in class XI MIA-1 SMA 1 Barumun Tengah still had difficulty understanding the material conveyed by the teacher in learning mathematics.

The instruments used in this research and development are in the form of media and material assessment sheets by validators who are experts in their field to test the validity of animated video media, teacher response questionnaires, and student responses to test the practicality of animated video media and student ability test results to test effectiveness. The media expert validation questionnaire sheet is given to 1 validator who is an expert in their field based on the preparation of the display aspect and the number of specified statement items. Material expert validation questionnaire sheets are given to 1 validator who is an expert in their field based on the preparation of aspects of the presentation of material/content and aspects of using audio/sound and the number of specified statement items. Mathematics teacher response questionnaires were given to 2 mathematics teachers based on the appearance aspect, presentation of material/content, use of strategy, use of animated media and use of audio/sound, and the number of specified statement items. Student response questionnaire sheets were given to all students who were the subject of the study, totaling 54 students based on aspects of appearance attractiveness, presentation of material/content, use of strategy, use of animated media and use of audio/sound, and the number of specified statement items.

RESULTS

3.1 Analysis Phase

The analysis phase is the earliest stage in the ADDIE development model. The results of the analysis that have been obtained are used as a consideration in making animated video media based on the inquiry strategy (Sugiyono, 2018).

A. **Competency Analysis:** This competency analysis aims to see the level of students' ability to learn mathematics, especially in matrix material. This competency analysis is based on the results of interviews with mathematics teachers and students. The results obtained are: a) The low interest of students in participating in mathematics learning. b) There are still some students who have not been able to develop their own ideas in solving existing problems. c) Low student learning outcomes in learning mathematics.

B. **Analysis of Student Characteristics:** This stage of analyzing student characteristics aims to look at the characteristics of students. Analysis of the characteristics of the students was carried out by asking the age of the students and the difficulties faced by students in learning mathematics. Based on the results of research conducted at SMA 1 Barumun Tengah and MAN 2 Padang Lawas, the age level of the students who were the subjects of the research was 16-17 years. The difficulties that are often faced by students are that students still find it difficult to understand material that is abstract in learning mathematics.

C. **Material/Content Analysis:** The material/content analysis carried out aims to see the suitability of the material/content with the provisions of KI and KD. Based on the results of research conducted at SMA 1 Barumun Tengah and MAN 2 Padang Lawas, the material/content presented by teachers/educators in learning mathematics is in accordance with the provisions of KI and KD.

D. **Content/Learning Analysis**: Content/learning analysis is the activity of analyzing learning carried out by teachers/educators in learning mathematics. Based on research conducted at SMA 1 Barumun Tengah and MAN 2 Padang Lawas, the results obtained were: a) Teachers/educators rarely use media in learning. b) Teachers are still based on the available textbooks and LKS and have not developed learning media including learning media in the form of animated videos. c) Teachers/educators rarely use models, methods or strategies in learning mathematics.

3.2 Design Stage

The second stage in the ADDIE model development model is the design or design stage of the media to be developed. At this design or design stage the researcher begins to design or design the media to be made with three stages, namely:

A. **Learning Media Design:** The learning media to be developed is in the form of inquiry strategy-based animated video media. In the animated video media that will be developed, it is designed or designed as best as possible according to the steps of implementing the inquiry strategy, namely orientation, problem formulation, formulating hypotheses, collecting data, testing hypotheses and drawing conclusions. At this stage of learning media design, the researcher begins to design the shape or end result of the video that will be developed. The steps taken start from designing the opening of the video, presenting the material in the video, layout of the animations, choosing the appropriate background color, to closing the video.

B. **Animation Design:** The choice of animation to be used in this video is not arbitrary, but the animation used has been selected as well and as attractive as possible. The selection of this animation must also provide a separate message for students. In addition, the most important thing in designing the animation that will be used is the layout of the animation. This means that the placement of the animations is not just made on each slide, but the layout and suitability must also be designed. All slides in this video media are presented with interesting animations.

C. **Instrument Design:** The development of an inquiry strategy-based video animation media is also equipped with interesting instruments. The instruments used in this video are musical instruments and the use of the researcher's voice. Musical instruments are used at the beginning of the opening of the video. While the researcher's voice is used to explain all the material in the video. It is intended that the animated video media is made more lively with a combination of musical instruments and the researcher's voice.

3.3 Development Stage

In this development stage, the activities carried out are the creation of animated video media. Making this animated video media is done by combining all the slides that have been designed with the selected musical instruments into a complete video. The stage of making this animated video media is carried out in two stages, namely the pre-production stage and the production stage.

A. **Pre Production Stage:** In the pre-production stage, the author starts preparing all the software and hardware needed when making video media. Hardware needed such as laptops and mice, while the required software such as Powtoon.

B. **Production Stage:** The production stage is divided into three parts: opening, content/presentation of material and closing. The production stage for the development of animated video media begins with the division of the sub-materials to be discussed and the learning objectives to be achieved. After distributing the material and determining the learning objectives that have been achieved, the next step is the selection of interesting animations and backgrounds. After all the material has been made in the slides along with the animation and background, the next step is to add the instruments that have been made and combine all the slides into a complete video. The following is the cover in the animated video media that was made:

Figure 1. Animated Video Media Cover

3.4 Implementation Stage

This implementation phase is accompanied by several steps, namely as follows:

A. **Validity Test:** This validity test is carried out to see whether the media and material to be developed are valid or not. media and material expert validation is given to one validator each who is an expert in their field. The results of the media and material expert validation analysis can be seen in the following Table 1 below.

Table 1. Media expert validity test results

No	Aspect	Analysis	Score				
			SS	S	KS	TS	STS
1	Appearance	Score	1	10	2	0	0
		$\sum xi$	5	40	6	6	0
$\bar{x}$			3,92				
Criteria			**Very Good/Valid**				

The results of the media expert validation analysis show that the media created has very good/valid criteria based on the appearance aspect.

Table 2. Material expert validity test results

No	Aspect	Average	Criteria
1	Presentation of Material/Content	3,89	Very Good/Valid
2	Audio/Sound Selection	3,67	Very Good/Valid
$\bar{x}$		3,78	Very Good/Valid

The results of the material expert validation analysis show that the material presented in the animated video media is very good/valid based on the aspect of presenting the material/content and the aspect of audio/sound selection.

B. **Practicality Test:** The practicality test of this animated video media was obtained based on the results of the analysis of the response questionnaire from mathematics teachers and students. The mathematics teacher's response questionnaire was given to two teachers and 54 students from two different schools. The results of the analysis of the mathematics teacher's response questionnaire can be seen in the following Table 3 below.

Table 3. Analysis of mathematics teacher response questionnaire (first validator)

Validator Name	Aspect	Average	Criteria
Marwan Efendi Lubis, M.Pd	Appearance Display	4	Good/Fairly Practical
	Presentation of Material/Content	3,83	Good/Fairly Practical
	Use of Strategy	5	Very Good/ Practical
	Use of Animation Media	4,11	Good/Fairly Practical
	Use of Audio/Sound	3,75	Good/Fairly Practical
$\bar{x}$		**4,138**	**Good/Fairly Practical**

Table 4. Analysis of mathematics teacher response questionnaire (second validator)

Validator Name	Aspect	Average	Criteria
Maruli Simbolon, M.Pd	Appearance Display	4,2	Good/Fairly Practical
	Presentation of Material/Content	4,17	Good/Fairly Practical
	Use of Strategy	4	Good/Fairly Practical
	Use of Animation Media	4,33	Very Good/ Practical
	Use of Audio/Sound	4,25	Very Good/ Practical
$\bar{x}$		**4,19**	Good/Fairly Practical

The results of the analysis of the mathematics teacher's response questionnaire for the two validators show that this animated video media is quite practical to use in learning mathematics matrix material. While the results of the student response questionnaire analysis can be seen in the following Table 5 below.

Table 5. Analysis of student response questionnaire

No	Aspect	Average
1	Appearance Display	94,6
2	Presentation of Material/Content	95,4
3	Use of Strategy	94,33
4	Use of Animation Media	92,625
5	Use of Audio/Sound	93,75
$\bar{x}$		4,48
Kriteria		**Very Good/ Practical**

Questionnaire response from class XI MIA-1 SMA 1 Barumun Tengah

Table 6. Analysis of student response questionnaire

No	Aspect	Average
1	Appearance Display	136,8
2	Presentation of Material/Content	138
3	Use of Strategy	142
4	Use of Animation Media	141,125
5	Use of Audio/Sound	145
$\bar{x}$		4,26
Kriteria		**Very Good/ Practical**

Questionnaire response from class XI MIA-3 MAN 2 Padang Lawas

The results of the analysis of student response questionnaires from two different schools showed that students liked this animated video media and it was practically used in learning mathematics matrix material.

C. **Effectiveness Test:** This effectiveness test is based on the results of the scores obtained by students during the posttest. Before the instrument questions are distributed, a validity test, a reliability test and a question difficulty level test are first carried out. The results of the validity, reliability and difficulty level test questions can be seen in the following Table 7 below.

Table 7. Results of testing the validity and reliability of the problem instruments

No	Question	r_{xy}	r_{tabel}	validity	Criteria
1	Item 1	0,4344	0,3440	Valid	Currently
2	Item 2	0,4130	0,3440	Valid	Currently
3	Item 3	0,3675	0,3440	Valid	Low
4	Item 4	0,3912	0,3440	Valid	Low
5	Item 5	0,8244	0,3440	Valid	Very High
r_{11}		**0,618**			**Reliabel**

Based on the Table 7 above, it can be seen that the five items used are declared valid, because the value of rcount > rtable (0.3440) is at a significance level of 5% or 0.05. The reliability test results obtained also showed that the questions were declared reliable.

Table 8. Results of the problem level of difficulty test

No	Question	P	Criteria
1	Item 1	0,757	Easy
2	Item 2	0,412	Currently
3	Item 3	0,787	Easy
4	Item 4	0,393	Currently
5	Item 5	0,824	Easy

Table 9. Results of analysis of students' classical learning completeness

No	Calculation	Total Students	(P) %	Criteria
1	Complete Student	18	86%	Very Good
2	Incomplete Student	3	14%	Very Less

Class XI MIA-1 SMA 1 Barumun Tengah

Based on Table 8 above, it is known that the number of students who passed during the post-test was 18 students with a percentage of 86% very good criteria. While students who did not complete as many as 3 students with a percentage of 14% were very lacking criteria.

Table 10. Results of Analysis of Students' Classical Learning Completeness

No	Calculation	Total Students	(P) %	Criteria
1	Complete Student	29	88%	Very Good
2	Incomplete Student	4	12%	Very Less

Class XI MIA-3 MAN 2 Padang Lawas

Based on Table 10 above, it is known that the number of students who passed during the post-test were 29 students with a percentage of 88%, very good criteria. While students who did not complete as many as 4 students with a percentage of 12% very less criteria. So it can be concluded that the animated video media developed is stated to be effectively used in learning mathematics matrix material.

D. **Evaluation stage:** The evaluation stage is the final stage in the ADDIE model. This stage aims to see the final result of the video media which was developed based on the results of the research and the suggestions given. Based on the research results obtained, it can be concluded that the animated video media inquiry strategy-based video animation media for mathematics learning in senior high schools is stated to be valid, practical and effective.

CONCLUSIONS

This study uses the ADDIE model development model with 5 stages, namely: first, analysis (analysis). Second, design (design). Third, development (development). Fourth, implementation (implementation). The fifth is evaluation (evaluation). The results of the validity test based on the validation analysis of the media expert questionnaire in the first stage obtained an average value of 2.84 with good/valid enough criteria, while the second stage of validation obtained an average value of 3.92 with very good/valid criteria. Analysis of the material expert questionnaire validation given to one validator for the first stage obtained an average value of 2.725 with good/valid enough criteria, while the second stage of validation obtained an average value of 3.78 with very good/valid criteria. The results of the practicality test based on the analysis of the mathematics teacher's response questionnaire for the first validator obtained an average value of 4.138 with good/practical enough criteria, for the second validator obtained an average value of 4.19 with good/practical enough criteria. Questionnaire analysis of student responses in class XI MIA-1 SMA 1 Barumun Tengah obtained an average value of 4.48 with very good/practical criteria, while the questionnaire analysis of student responses in class XI MIA-3 MAN 2 Padang Lawas obtained an average value of 4, 26 with very good/practical criteria. The results of the analysis of the classical learning completeness of class XI MIA-1 SMA 1 Barumun Tengah obtained an average score of 86% with very good criteria, while the analysis of the classical learning completeness of students of class XI MIA-3 MAN 2 Padang Lawas obtained an average score of 88% with very good criteria. So it can be concluded that the inquiry strategy-based animated video media for learning mathematics in senior high schools is stated to be valid, practical, and effective.

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