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Development of learning media lathe machining based on animation video

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Abstracts. The objectives of this study are to develop a job sheet for the practice of animation video-based lathe machining for the learning media and test the level of feasibility of the results produced. This research method is Research and Development (R&D) with a 4-D model consisting of four stages, namely define, design, develop, and disseminate. The subject of the study consisted of material experts, media experts, and students of class XI machining techniques at Muhammadiyah Vocational School Prambanan. The object of the study is the flat lathe machining technique of class XI machining techniques. The instrument used was a questionnaire. While the data analysis technique uses quantitative descriptive analysis. The applications used in developing this job sheet include SSCNC (Swansoft CNC Simulator), bandicam, and wondershare filmora. The results of this study include: (1) the research produced an animation video-based learning media consisting of 6 subjects; and (2) the level of feasibility of animated videos is very feasible, it is known from the results of material expert validation reaching an average value of 71.50 with a percentage of 89.50% in the very feasible category. The results of media expert validation reached a value of 73 with a percentage of 91% in the very feasible category. The results of the small class test obtained an average score of 62.31 with a percentage of 86% in the very feasible category and the results of the large class test obtained an average score of 59.55 with a percentage of 83% in the very feasible category.

Keywords: job sheet, media, animation video

Introduction

Job sheet serves as a guideline and evaluation tool for implementing practical learning activities in working on a workpiece. The results of observations at the Muhammadiyah Prambanan Vocational School in September-November 2018 during the practical learning of lathe machining techniques were obtained that the job sheet used for practice was not yet by the standard. This is evidenced by the results of the evaluation, including a) not including the learning objectives; b) there are no work steps; c) symbols, images and orders are not accompanied by an explanation; d) number size is not accompanied by unit information; e) does not include occupational safety and health / K3, and f) does not include the evaluation of student learning outcomes. So that it has an impact on the lack of students' understanding of the correct work steps in working workpieces, while the criteria for job sheets that are in accordance with the standard are: a) title; b) basic competencies that must be achieved; c) completion time; d) equipment/materials needed to complete the task; e) brief information about K3; f) work steps; g) tasks that must be done; and h) reports carried out [1].

Based on the above problems, learning media is needed to support the practical learning of lathe machining techniques to support the learning process and facilitate students in understanding the content of learning materials. Learning media is a medium that is used to carry messages or information aimed at instructional or containing the purposes of teaching [2]. In line with that is, learning media is everything that can be used to channel messages from senders to recipients to stimulate students' thoughts, feelings, concerns, and interests and abilities so that the learning process takes place in achieving learning objectives effectively [3]. It was concluded that learning media is everything that can be used to stimulate thoughts, feelings, attention, and abilities or skills of students so that it can encourage the learning process in students.

The use of instructional media will provide an easier understanding of the topics studied by students [4]. In addition to arousing student motivation and interest, learning media can also present interesting and reliable data, facilitate data interpretation, and compact information [5]. The right media to apply is an animated video that contains theoretical and practical material in the form of workpiece steps from the beginning to the end of the turning process. Animated video was chosen because it is more interesting when compared to existing print sheet print media.

Animation comes from the Latin "anima" which means "soul" or animare which means "breath of life." Video animation is known as motion picture which has the meaning of "moving images," because in the manufacturing process sequential and manipulated images are used in such a way that it appears as if the image can move [6]. In line with this, video animation is a series of images and text that form a movement [7]. It was concluded that video animation is a video resulting from processing images of objects or text using the help of a computer or application so that it becomes an attractive and vivid moving image.

Through animated video-based learning media, it will be easier for teachers to deliver learning material so that students' understanding can be formed. Students will easily see and relearn learning materials that have been given without being explained by the teacher. Besides, the tendency of students to prefer to find information using a smartphone coupled with the existence of a school program will facilitate students with smartphones and it can be used as an intermediary in using the animation video-based learning media.

The Lathe Machining Technique is a productive subject in Machining Engineering Competence. In the subject of the lathe machining technique, there is a lathe process that is carried out to work the workpiece. The lathe process is the machining process to produce cylindrical shaped parts which are worked using a lathe [8]. The basic competency of lathe machining techniques is an expertise in doing work in terms of knowledge, skills, and attitudes that must be possessed by students so that effective learning can be achieved.

Research Methods

Research on the development of job sheet video animation based lathe machining techniques as a learning medium is included in Research and Development (R & D) research. Research and Development (R & D) is research to produce a specific product design and development to validate the design that has been made so that it becomes a product that is tested and can be utilized by the wider community [9]. In line with that, research and development is an industry-based development model where research findings are used to design products, then systematically tested and refined to meet quality standards [10]. This study aims to develop a job sheet for video animation based lathe machining techniques as a learning media for machining class XI engineering and test its feasibility.

The procedure used in the research and development of this animated video-based job sheet uses a 4-D development model. The flow of the 4-D development model in this study is explained as follows:

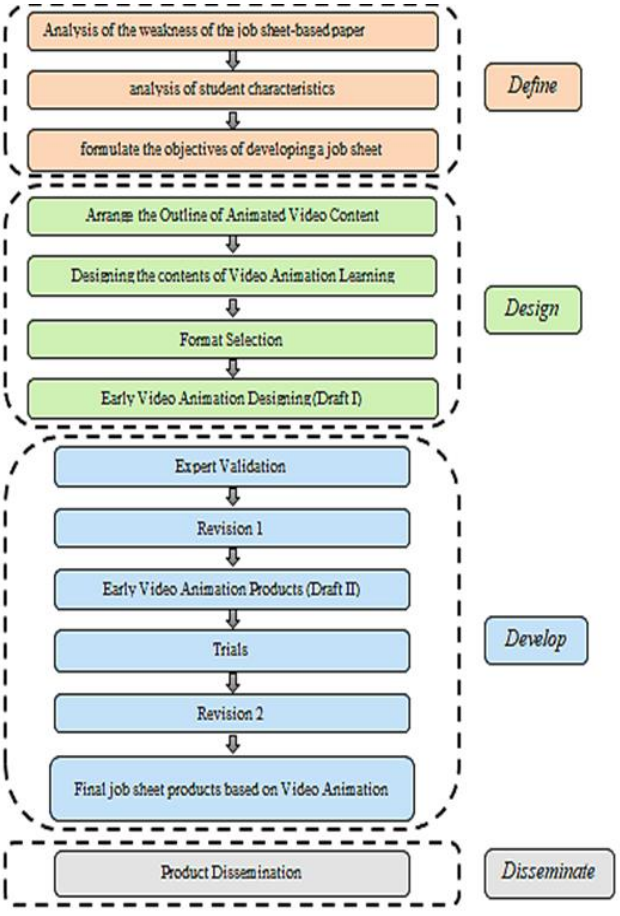

Figure 1. Development Procedure for Job Sheet 4-D Models [11]

The subjects of this study were material experts, media experts, and students as respondents. Material experts consist of lecturers and teachers who teach subjects or who have skills in lathe machining engineering. Media experts are lecturers who have skills in learning media. Respondents in this study were students of class XI Mechanical Engineering consisting of three classes. One class for small group trials and two classes for large group trials. The object of the study was the flat turning competency used in practical learning of machining techniques for class XI machining.

Data collection techniques using questionnaires/questionnaires addressed to material experts, media experts, and students. Questionnaires are often referred to as questionnaires wherein the questionnaire there are several kinds of questions that are closely related to the research problems that are to be solved, compiled, and distributed to respondents to obtain information in the field [12]. The method used to declare statement items and how to respond to them using a checklist form. The checklist is a series of statements where the respondent evaluated only needs to put a checklist (√) in the space provided [13].

Research Instrument

The research instruments were measuring instruments such as tests, questionnaires, interview guidelines, and observation guidelines that were used by researchers to collect data in a study [14]. The instrument in this study was to determine the quality of the job sheet product engineering video-based lathe machining developed. In this case, the researcher made a questionnaire for the feasibility test of the material expert, the feasibility test of the media expert, and the questionnaire for the class XI student of Mechanical Engineering.

Data analysis

The data analysis technique used is descriptive quantitative. Quantitative descriptive statistics are used to analyze data by describing or describing collected data [14]. Determination of the feasibility of learning media categories using a Likert scale made with intervals 1-4 with the criteria:

Table 1. Categories of Product Feasibility

Category	Score
Very feasible	4
feasible	3
Not feasible	2
Very unworthy	1

From the data collected, the average is calculated using the formula:

$$\bar{X} = (\sum X) / N$$

Information:
$\bar{X}$ = average score for each aspect
ΣX = number of scores for each aspect
N = number of values

Furthermore, the data obtained from both material experts, media experts, and students are changed by category. The score obtained is converted into a value on a Likert scale with four choices described in the following table:

Table 2. Conversion of Scores to Values [15]

Interval score	Category
$X \geq (\bar{X} + 1.SBx)$	Very feasible
$(\bar{X} + 1.SBx) > X \geq \bar{X}$	Feasible
$\bar{X} > X \geq (\bar{X} - 1.SBx)$	Not feasible
$X < (\bar{X} - 1.SBx)$	Very unworthy

Results and Discussion

Results of Expert Validation

1. Material Validation Validation

The material validator assessed the product of the development of animated videos from 4 aspects, namely: the feasibility of content, language, presentation, and expediency. The assessment criteria use four categories, which are very feasible, feasible, inappropriate, and very inappropriate, with intervals 1-4 to 20 items. The presentation of the results of the analysis of each aspect of the feasibility of the video animation material can be seen in graphical form in the following figure.

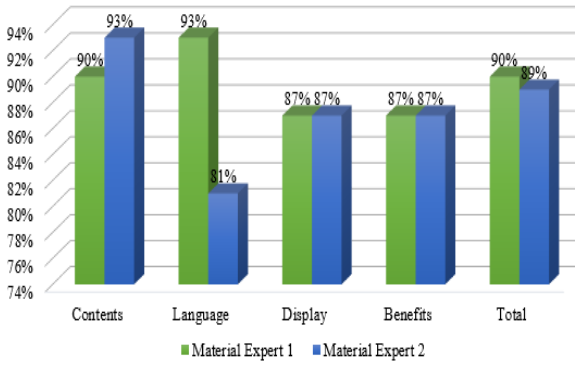

Figure 1. Material assessment graph

The total score of 2 material experts in the overall aspects score was 71.5 with an average percentage of 89.50% being obtained from an average score of 2 experts with a score of 71.5 divided by a maximum score of 80 multiplied

by 100 %. The score is located in the range of scores of X ≥ 60 categories "very feasible." This category can be interpreted that the suitability of the material in the animated video as a practical learning media for lathe machining techniques is stated to be very feasible to be used and tested on students.

2. Validation of Media Experts

The media validator assesses the product development of animated videos from 5 aspects, namely: appearance, ease of use, consistency, format, and graphics. Assessment criteria are the same as material validation. The presentation of the results of the analysis of each aspect of the feasibility of the video animation material can be seen in graphical form in the following figure.

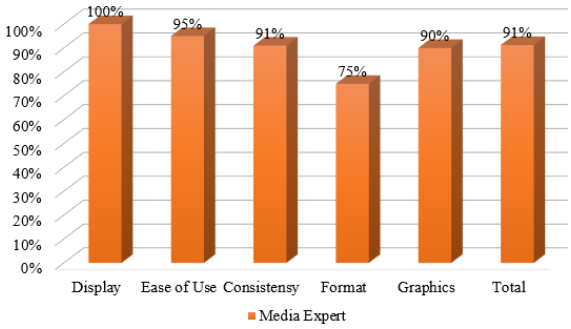

Figure 2. Media expert assessment chart

The results of media expert scores on all aspects obtained a score of 73 with a percentage of 91% obtained from a total score of 73 divided by a maximum score of 80 multiplied by 100%. The score is in the range of scores X ≥ 60, which fall into the category of "very decent." This category can be interpreted that the suitability of aspects of the media in animated videos as a practice learning media for lathe machining techniques is stated to be very feasible to be used and tested on students.

Revision 1

1. Material Aspects

There is an error in calculating the average lathe machining time parameter and the face lathe machining time (TM). The error is in the formula used. Thus, the researcher revised 1 of the parameters by changing the correct formula.

2. Media aspects

a. Divide the animation video into six

Figure 3. Number of videos after revision 1

b. Clarifying information about the final results of flat turning work

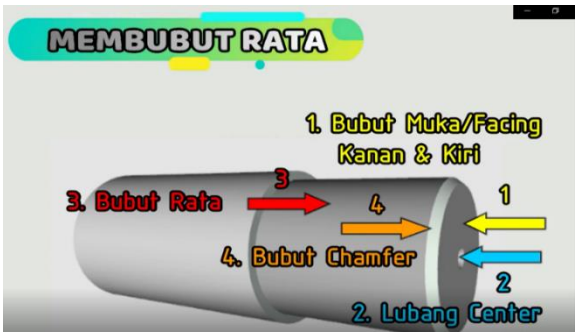

Figure 4. Work Description After Revision 1

c. Minimize the size of the animated video

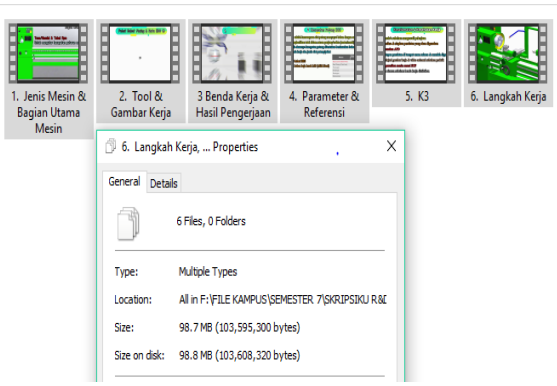

Figure 5. Size of Video Animation After Revision 1

Animated Video Draft II

After revising 1, there are suggestions and responses given by the validator to the researcher. The result is that the animated video breaks into six (6) based on the subject. Also, animated video files are uploaded to the researcher's youtube channel account by including links so that students can more easily access the file.

Test Results

Animated video products were tested for machining class XI with a total of 19 students in small class trials and 54 students in large class trials which simultaneously provided responses and assessments using questionnaires. The results of the assessment of small classes show in the category of "very feasible" with the number of respondents 17 students or by 89%

and the assessment in the category "feasible" with the number of respondents two students or equal to 11% of the total number of respondents. The total results of the average score of students' assessment of animated videos amounted to 62.31 with a percentage of 86% included in the category of "very feasible" because of X ≥ 54.

Table 3. Results of student responses to each aspect in a small class

No	Aspect	Average Score for Each Aspect
1	Material	21
2	Linguistics	13,16
3	Intefrity	14,10
4	Benefits	14,05
	Average Total Response	62,31

The results of the assessment of the large class showed in the category of "very feasible" with the number of respondents 42 students or by 78% and the assessment in the category of "feasible" with the number of respondents 12 students or equal to 22% of the total number of respondents. The total results of the average score of student assessment of animated videos amounted to 59.55 with a percentage of 83% included in the category of "very feasible" because of X ≥ 54.

Table 4. Results of student responses to each aspect in a large class.

No	Aspect	Average Score for Each Aspect
1	Material	19,89
2	Linguistics	13,12
3	Integrity	13,26
4	benefits	13,28
	Average Total Response	59,55

So, it can be interpreted that the results of the development of job sheet lathe-based video animation engineering techniques as practical learning media that students really understand the contents of the material in animated videos, students really understand the language used in animated videos, students really understand the graphics/displays in animated videos and animated videos are very useful for learning media for lathe machining techniques.

Revision 2

The researcher made several improvements to the animation video, including:

1. Speed up the duration of No. 6 animation videos about flat turning work steps
2. Change the color of the writing that is still dark

3. Change the animation video intro to be different in each subject.

Final Video Animation Product

After revising 2, the final product or final product is obtained from the process of developing an animation video based job sheet. The final video animation product produced at this stage consisted of six (6) animated videos based on the subject matter. This is intended to make it easier for students to learn the material in each animated video.

1. No 1. Type of machine and main parts of lathe.
https://youtu.be/YfcRr-uJlIs

Figure 6. Display of Machine Types and Main Parts of the Machine

2. No 2. Tool and drawing of flat lathe work

https://youtu.be/I10XE0feJkE

Figure 7. Display Tools

3. No 3. Workpiece and Flat Turning Process

https://youtu.be/-_bxD_zKQHo

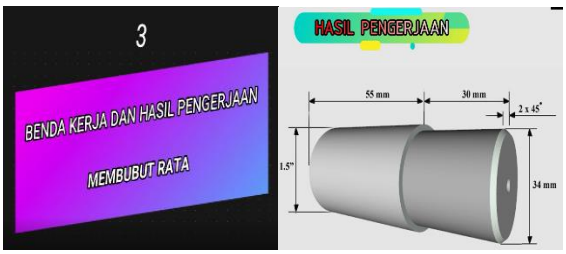

Figure 8. Display workmanship

4. No 4. Lathe machining parameters and reference

https://youtu.be/fvdbcNbaguE

Figure 9. Parameter display

5. No 5. Occupational safety and health / k3 turning practice

https://youtu.be/BKfWMmV8PhA

Figure 10. Display of K3

6. No 6. Steps to Turn Flat

https://youtu.be/2xRVgO_tGjs

Figure 11. Display of work steps

Disseminate

The product distribution was developed by researchers by distributing animated videos to students during product testing in research schools, uploading animated video files to youtube, and submitting manual books to the development of animated video-based job sheet learning media for machining skills competency teachers so that it can be used as a guideline in making other animated video-based learning media.

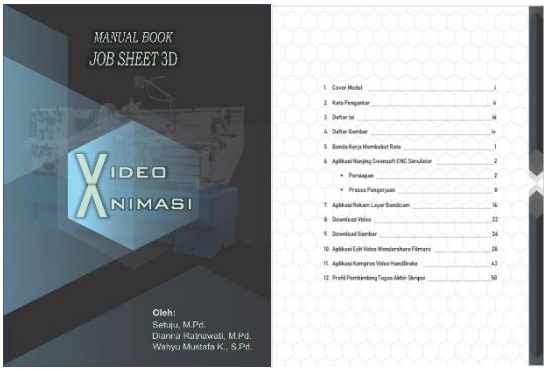

Figure 12. Manual book for developing 3D job sheets / animated videos

Discussion

1. Development of an animated video-based lathe machining job sheet

There was a previous development study that also used the 4-D Models development model, as in this study. Like research that uses the 4-D Models development model, which results in an online learning model for learning media that can enhance learning activities, and students can learn independently with existing technology [16]. Other studies using the development model of 4-D Models that produce job sheets that are feasible are used as a source of learning measurement practices [17].

Based on this research and previous research proves that the use of the 4-D Models development model can produce development products that are worthy of being used as learning media. This means that 4-D Models are effectively used as a development research procedure. So, the development process that has been carried out by researchers using the 4-D Models above has produced a product in the form of an animated video. The product of the development can be used as a learning media for the practice of lathe machining techniques.

2. Feasibility of animated videos

There was previous development research that produced animation-based learning media as in this study. Like research that produces animation-based learning media that are suitable for use in learning and student learning outcomes have increased after the following learning by using animation-based learning media [18]. Other studies that produce animated video-based learning media that are suitable for use in learning and student learning interest have increased after using animated video-based media [19].

Based on this research and previous research proves that the product of video animation based development is feasible to be used as a learning media. Besides that, the product of learning media development based on animation is also able to improve learning outcomes and student learning interest. This is because there are benefits from learning media that with learning media it will make it easier to give students an idea of something abstract, students can receive information in various forms (writing, drawing, animation, film or multimedia) not only from the teacher's voice. So that information can be more easily digested and remembered. The right learning media will also be able to attract students' attention and not be boring [20].

Conclusion

The procedure for developing a job sheet video animation based lathe machining technique as a practical learning media was developed using a 4-D development model. The results of the assessment of the feasibility of animated videos by material experts, media experts, and trials obtained the category of "very feasible." So it can be concluded that the animation video-based job sheet is very feasible to be used as a practice learning media for lathe machining techniques in SMK.

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