

**LEARNING DEVELOPMENT ON THE SUBJECT OF  
MACHINE ELEMENTS USING MACROMEDIA FLASH  
IN MECHATRONICS ENGINEERING DEPARTMENT  
OF POLYTECHNIC OF MALANG**

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**ABSTRACT**

Machine element is a subject, in which there is mechanical engineering expertise, that must be mastered by mechatronics engineering students. At advanced level, it will be learned the style occurring in an engine, which serves as the basis for planning the design of a particular machine. There are a lot of students who have difficulty in studying this subject, and get a score less than satisfactory. The presence of multimedia technology brings changes for education world, particularly to help lecturers explain certain concepts to students to understand the subjects considered complicated. In this study, there are three stages of research, the first stage is

multimedia material making, the second stage is testing the products consisting of data type, trial test subject and trial test design, in the third stage it will be discussed the improvement in the multimedia. The research results show that the learning multimedia of machine elements is stated feasible, it is proved from the test results (1) From content experts, it is obtained feasibility with the percentage of 87,5% (very good). (2) From manual book experts, it is obtained feasibility level with the percentage of 87.5% (very good). (3) From multimedia experts, it is obtained feasibility level with the percentage of 88.89% (very good). (4) From learning design experts, it is obtained feasibility level with the percentage of 90% (very good). (5) From small group trial test, it is obtained feasibility level with the percentage of 80,83% (very good). It can be concluded that this media is feasible for use in learning activities.

Keywords: development, machine elements, multimedia

## **Introduction**

Machine element is a subject, in which there is mechanical engineering expertise, that must be mastered by mechatronics engineering students. At advanced level, it will be learned the style occurring in an engine, which serves as the basis for planning the design of a particular machine. There are a lot of students who have difficulty in studying this subject, and get a score less than satisfactory. The presence of multimedia technology brings changes for education world, particularly to help lecturers explain certain concepts to students to understand the subjects considered complicated. The rapid development of multimedia technology brings changes in the way people learn. Multimedia also provides opportunities for teachers to apply a variety of learning techniques. Similarly, students have the opportunity to determine learning materials and determine suitable learning techniques, form a knowledge based on individual needs and experience the atmosphere of learning more interesting and impressive.

According to the American Heritage Electronic Dictionary (1991) Multi is a Latin word which means a lot or variety. Medium in Latin means a device used to deliver and convey information. F.

Hofstetter (1995) states *“Multimedia is the use of a computer to present and combine text, graphics, audio and video with links and tools that let the user navigate, interact, create and communicate”*.

According Hasrul (2010) interactive multimedia is a new technology that can change a person's way of learning and how to get information. Using multimedia, someone learning can be more independent, comfortable and appropriate with to his or her ability. Macromedia Flash is an animation software familiar to most people involved in animation making program. With this software. teachers can also create an interactive and innovative learning to make students motivated.

Multimedia serves as a medium to convey materials to students. Multimedia is composed of design, animation, video, sound and text. A software that can be used as an interactive multimedia is Macromedia Flash. Macromedia Flash is common animation software for education, which serves as a presentation or to make an animation to explain materials in the learning process. With macromedia flash software, teachers can create an interactive and innovative learning so that the teaching learning atmosphere will be more alive.

Using multimedia, it is expected to create an interactive and effective learning environment in the learning that has been designed in the subject of machine element.

## **Methods**

Multimedia development method in this study uses a procedural development model, that is a model descriptively illustrates the stages taken for product development. Development method used in this study refers to the systematic method of teaching Machine Elements in the study program of Mechatronics Engineering at Polytechnic of Malang. This learning multimedia development procedure includes three stages, namely content analysis, product testing, and product revision as shown in Figure 1.

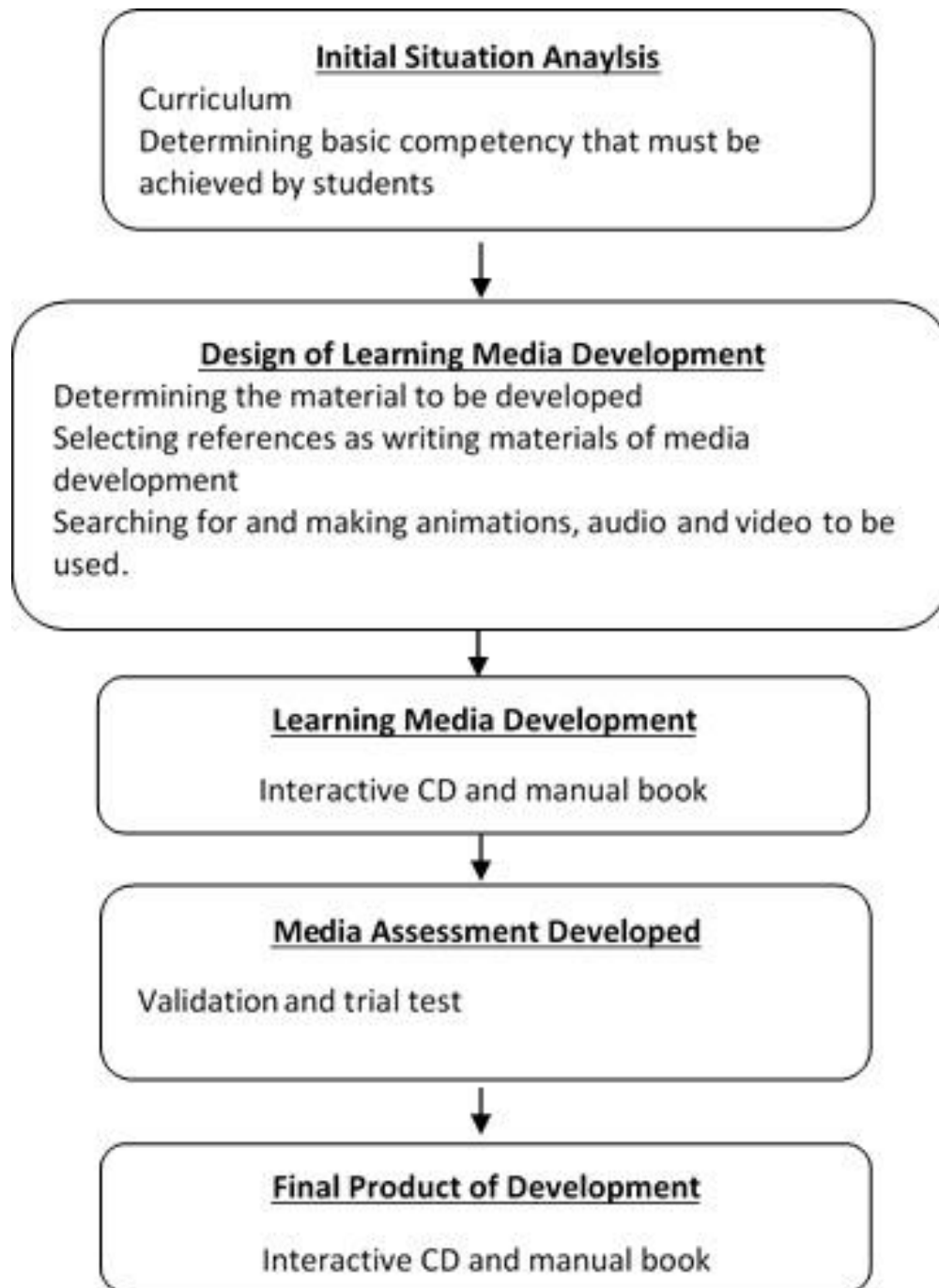


Figure 1 Scheme of Development Stages

The first stage of content analysis discusses multimedia machine element multimedia consisting

of transmission shaft, V-belt and gears based on the teaching in the subject of machine elements. The second stage discusses product trial test consisting of data type, trial test subject and trial test design. The third stage discusses the improvements and revisions based on product trials test and suggestions from multimedia material experts, and students of production machine.

To collect the necessary data, the writer conducts a literature study on transmission shaft, V-belt and gear obtained from books Sularso's book and animations (videos) on youtube. After collecting the data in the form of text, images, sound and video, the next step is designing a layout using Photoshop, Corell Draw, Ulead and adobe premiere before compared in macromedia flash to create multimedia.

The instrument of data collection is product trial test questionnaire. The questionnaire is used to determine the percentage of effectiveness, suitability and attractiveness of the product on expert test activities of content, multimedia, learning design, and small groups. Data analysis obtained from the trial test subject is descriptive, in the form of advice and comments from experts after providing an assessment on the product developed.

The assessment is based on answers existing on the questionnaire.

Table 1 Questionnaire for lecturers of machine elements subject

No	Evaluation Indicator	Evaluation Scale			
	<b>CONTENT AND CONTENT ORGANISATION</b>				
1.	Consistency of content organization and its suitability with competency standards of mechatronics engineering of Polytechnic of Malang.	4	3	2	1
2.	Consistency of this multimedia content emphasis with material basic principles.	4	3	2	1
3.	Usefulness of this teaching material to	4	3	2	1



	stimulate critical thinking.				
4.	Its strength in stimulating students to form learning objectives of and do self-evaluation	4	3	2	1
5.	Its usefulness in providing problem-solving situations.	4	3	2	1
6.	Its usefulness in program sustainability in terms of systematics and order of lesson.	4	3	2	1
7.	Clarity of sentence expressions.	4	3	2	1
8.	Attractiveness of the contents.	4	3	2	1
9.	Complexity of the contents	4	3	2	1
10.	Feasibility of content organization and	4	3	2	1

	ordering of competence levels				
11.	Adaptability of the contents in classroom situation and diversity of students ability.	4	3	2	1
12.	Level of challenge to prepare students to think rationally.	4	3	2	1
13.	Further usefulness for students	4	3	2	1
14.	Usefulness for students slow to learn	4	3	2	1

Table 2 Questionnaire of Manual Book

No	Evaluation Indicators	Evaluation Scale			
		4	3	2	1
1	The language used in the manual	4	3	2	1
2	Clarity of information / instructions for use	4	3	2	1

3	Illustration	4	3	2	1
4	Display / layout	4	3	2	1
5	Size of manual book	4	3	2	1

Table 3 Questionnaire of machine element multimedia display

No.	Evaluation Indicators	Evaluation Scale			
	<b>MULTIMEDIA FORMAT</b>				
1.	Introduction display	4	3	2	1
2.	Attractiveness of cover design, content design	4	3	2	1
3.	Appropriateness of typing lay out	4	3	2	1
4.	Suitability and attractiveness of icon or image as attention drawing in presentation.	4	3	2	1
5.	Quality of pictures	4	3	2	1

6.	Readability of words or letters	4	3	2	1
7.	Clarity of pictures	4	3	2	1
8.	Attractiveness of animation	4	3	2	1
9.	Attractiveness of video	4	3	2	1

Table 4 Questionnaire of learning design in learning multimedia

No	Evaluation Indicators	Evaluation Scale			
		4	3	2	1
1.	Attractiveness of multimedia CD content design	4	3	2	1
2.	Clarity of information / instructions for use	4	3	2	1
3.	Material organizing design	4	3	2	1
4.	Display/layout design	4	3	2	1

5.	Design of material contents presentation	4	3	2	1
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Table 5 Trial test of small group users for students

N O	Guiding Questions	Evaluation Scale			
		4	3	2	1
1.	How is the multimedia introducing display?	4	3	2	1
2.	How is the size of multimedia display?	4	3	2	1
3.	How is the display of words, pictures and animation in the home menu?	4	3	2	1
4.	How is the video display?	4	3	2	1
5.	How is the material content?	4	3	2	1
6.	How is the animation in the display?	4	3	2	1

Once the data is obtained from of multimedia expert team, lecturers and university students, the next step is analyzing the data based on the percentage of those completing the questionnaire. To analyze the data resulted from the checklist of 5 questionnaires above, it is conducted several steps as follows:

1. Calculate checking results according to the indicators specified in the questionnaire.
2. Making a data tabulating table.
3. Determining the validity of learning media using descriptive statistical analysis, as shown in the formula 1.

$$P = \frac{\sum_{i=1}^5 x_i}{\sum_{j=1}^5 x_j} \times 100\% \quad (1)$$

Description:

P = Percentage of validity level

$\sum_{i=1}^5 x_i$  = Number of assessor's answer

$\sum_{j=1}^5 x_j$  = Number of highest answer

4. From the result of percentage calculation that has been obtained, it will be inserted into the tables of range percentage and program qualitative criteria as seen in Table 6 in order to facilitate the data reading. To determine the qualitative criteria, it is performed by:

- a. Determining the ideal percentage score (maximum score) = 100%.
- b. Determining the percentage of the lowest score (minimum score) = 0%.
- c. Determining the range =  $100 - 0 = 100$ .
- d. Specifying the desired interval = 4 (good fair, poor, and not good).
- e. Determine the width of the interval ( $100/4 = 25$ ).

Based on the calculations above, the percentages range and qualitative criteria can be defined as in table 6.

Table 6 Qualitative criteria of machine elements multimedia

No	Interval	Criteria
1	$76\% \leq \text{score} \leq 100\%$	Very Good
2	$51\% \leq \text{score} \leq 75\%$	Good
3	$26\% \leq \text{score} \leq 50\%$	Fair
4	$0\% \leq \text{score} \leq 25\%$	Poor

The product revisions in the form of CD and manual book are given in the form of accomplishment advice and further product development.

## **Results and Discussion**

### **Content Expert Data Analysis to Subject**

Questionnaire method that has been used in the data collection regarding the feedback from content expert to the content and content organization on the learning multimedia products of transmission shaft system, V-belt and gear can be seen in the table below:

Table 7 Analysis of Subject Content Expert Test Data



No	Evaluation Indicators	Respondent Scores		Total
	<b>CONTENT AND CONTENT ORGANISATION</b>	1	2	
1.	Consistency of content organization and its suitability with competency standards of mechatronics engineering of Polytechnic of Malang.	4	4	8
2.	Consistency of this multimedia content emphasis with material basic principles.	4	3	7
3.	Usefulness of this teaching material to stimulate critical thinking.	4	4	8

4.	Its strength in stimulating students to form learning objectives of and do self-evaluation	3	3	6
5.	Its usefulness in providing problem-solving situations.	4	3	7
6.	Its usefulness in program sustainability in terms of systematics and order of lesson.	4	3	7
7.	Clarity of sentence expressions.	3	3	6
8.	Attractiveness of the contents.	4	3	7
9.	Complexity of the contents	4	3	7
10.	Feasibility of content organization	3	4	7

	and ordering of competence levels			
11.	Adaptability of the contents in classroom situation and diversity of students' ability.	3	3	6
12.	Level of challenge to prepare students to think rationally.	4	3	7
13.	Further usefulness for students	4	3	7
14.	Usefulness for students slow to learn	4	4	8
	Total .			98

In accordance with the product feasibility table used, it is found that this learning multimedia has feasibility level with the percentage of 87.5 %, meeting the feasibility in terms of content, namely very good.

## Data Analysis of Manual Book

Questionnaire method that has been used in data collection regarding content expert feedback on manual book of the multimedia use of transmission shaft system, V-belt and gear is shown in the following table:

Table 8 Analysis of Manual Book Data

No	Evaluation Indicators	Respondent Score		Total
	CONTENT AND CONTENT ORGANISATION	1	2	
1.	The language used in the manual	3	4	7
2.	Clarity of information / instructions for use	4	3	7
3.	Illustration	3	3	6

4.	Display / layout	4	4	8
5.	Size of manual book	3	4	7
	Total			35

In accordance with the product feasibility table used, it is found that the average feasibility level of multimedia manual book is 87.5%, which is at a very good level. By considering the score of analysis above, the developer considers that it is necessary to complete it with the written and verbal suggestions given.

Table 9 Analysis of Multimedia Expert Feedback Data

No	Evaluation Indicators	Respondent Score		Total
	<b>CONTENT AND CONTENT ORGANISATION</b>	1	2	

1.	Introduction display	4	3	7
2.	Attractiveness of cover design, content design	3	4	7
3.	Appropriateness of typing lay out	4	4	8
4.	Suitability and attractiveness of icon or image as attention drawing in presentation.	3	3	6
5.	Quality of pictures	3	4	7
6.	Readability of words or letters	3	4	7
7.	Clarity of pictures	3	3	6
8.	Attractiveness of animation	4	4	8
9.	Attractiveness of video	4	4	8

	<b>Total</b>			64
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In accordance with the product feasibility table used, it is found that multimedia product meets the feasibility with the percentage of 88.89%, that is at a very good level. By paying attention to the analysis score above, the developer considers that it is necessary to complete it with the written and verbal suggestions given.

### **Data Analysis of multimedia design experts**

Data obtained from multimedia design experts as the reference of product improvement are as follows:

Table 10 Analysis of multimedia design expert data

<b>No</b>	<b>Evaluation Indicators</b>	<b>Respondent Score</b>		<b>Total</b>
	<b>CONTENT AND CONTENT ORGANISATION</b>	1	2	

1.	Attractiveness of multimedia CD content design	4	4	8
2.	Clarity of information / instructions for use	4	4	8
3.	Material organizing design	3	3	6
4.	Display/layout design	3	4	7
5.	Design of material contents presentation	4	3	7
	<b>Total</b>	4	4	8

In accordance with the product feasibility table used, it is found that multimedia product meets the feasibility with the percentage of 90%, that is at a very good level. By paying attention to the analysis score above, the developer considers that it is necessary to complete it with the written and verbal suggestions given.



Table 11 Trial Test of learning multimedia to small group users

No	QUESTIONS	Respondent Score					TOTAL
		1	2	3	4	5	
1.							
2.	How is the multimedia introducing display?	3	4	3	3	3	16
3.	How is the size of multimedia display?	2	3	3	3	3	14
4.	How is the display of words, pictures and animation in the home menu?	3	4	3	3	3	16

5.	How is the video display?	3	3	3	3	3	15
6.	How is the material content?	4	4	3	3	3	17
7.	How is the animation in the display?	3	4	4	4	4	19
<b>Total</b>							97

The small group trial test shows feasibility level with the percentage of 80,83%, with the feasibility level criteria of very good. It can be concluded that this media can be used in learning activities.

Of the research results of multimedia development in the subject of machine element on transmission shaft, V-belt and gears, it is obtained the data that, the lecturer test shows that this multimedia has the feasibility level of 87,5% with the criteria of criteria very good. From multimedia design expert test, it is obtained that the learning multimedia of machine element meets the feasibility

with the percentage of 88.89%, with the criteria of very good. In learning expert trial test, it is found the percentage value of 90% with the criteria of very good. With regard to the learning multimedia manual book, it is obtained the percentage of 87,5% with the criteria of very good. In addition to lecturers and multimedia experts, the feasibility of this study is also strengthened by the trial test to students of mechatronic engineering, Polytechnics of Malang

## **Closing**

## **Conclusion**

This learning multimedia of machine elements is declared feasible by content experts, media experts, learning design experts, as well as small group trial test as a learning media in students of mechatronics engineering, Polytechnic of Malang. It has been proved from the calculation results that: (1) From content experts, it is obtained the feasibility level with the percentage of 87,5% with the success rate criteria of very good. (2) From manual book experts, it is obtained the feasibility level with the percentage of 87.5% with the success rate criteria of very good. (3) From multimedia experts, it is obtained the feasibility level with the percentage of 88.89% with the criteria of very good. (4) From

learning design experts, it is obtained the feasibility level with the percentage of 90% with the feasibility level of very good. (5) From small group trial test, it is obtained the feasibility level with the percentage of 80,83% with the feasibility level of very good. Therefore, it can be concluded that this medium can be used in learning activities.

### **Suggestion**

First, the testing performed on this research are still in the form of feasibility testing, therefore, in the future it is necessary to perform applicative testing in classroom in order to test the effectiveness of this multimedia, which could be a comparison between students not using the multimedia and students using the multimedia, then it will be obtained the effectiveness of a multimedia. There will be difference charts between those using and those not using multimedia. Second, it is necessary to make multimedia comprehensively, not only per chapter but in one book. Indeed, it does take a long time and a lot of fund, so that the multimedia can truly be interactive.

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