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Learning Media Development for Continuously Variable Transmission Automatic Transmission System Subjects on Motorcycles

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ABSTRACT

Teaching aids that have similarities to tools are actually very helpful in learning. In improving students' understanding, learning media is needed, namely a simulator. This study aims to design a Continuously Variable Transmission (CVT) simulator with validity, practicality and effectiveness, useful to be used as a medium of learning in schools in the subject of automatic transmission systems. The type of research used is Research and Development (R&D) with 4-D model development procedures. This research consists of four stages, namely: Define, Design, Develop, and Disseminate. The subjects used were students of SMKN 1 Koto Baru Dharmasraya, the technical analysis of the data used was technical analysis from experts by looking at the validity, practicality and effectiveness of the simulator. To see the difference between the average score of learning scores before and after using a simulator with Gain Score and Standard Deviation. The results showed that the simulator met the principle of relevance from expert judgment with a level of 0.81 which was declared a valid category, on practicality based on the teacher's response it was declared practical with a value of 87.33% and student responses with a value of 92.42%. The effectiveness of the tool is declared effective. On the results of the pretest with an average score of 56.00%, the results of the posttest with an average score of 73.00%, on the N-gain the overall average of students is 0.37 and on the standard deviation seen from the N-gain of 0.12. Based on the development of this media, it can be concluded that the simulator is valid, practical and effective in learning at school.

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A. INTRODUCTION

Competition in the industrial world today is increasingly difficult to predict. Global competition that occurs will increase creativity and innovation, with technological advances will create innovative products (Ghufron, 2018). The development of the automotive industry has undergone changes in global competition as recorded in the 2016 ASEAN Automotive Federation (AAF) data which has reached 3,164,742 units (Sembiring, 2018). In the ASEAN automotive industry competition map, Thailand occupies 1.9 million units of production, Indonesia occupies 1.1 million units, while Malaysia has 545 thousand units of automotive industry production (ASEAN) (Indonesia investement, 2017). Indonesia and Thailand are

experiencing competition, Thailand is trying to strengthen its position as the largest automotive industry producer in Southeast Asia. In its development, Thailand and Indonesia experienced dynamic competition to become the main production in Southeast Asia (Prawira Saputra, 2021). It can be seen that the automotive industry competition in ASEAN is experiencing intense competition.

This competition causes problems in the industrial world. The problems that occur are limited technology masters, limited experts in the field of research, lack of an education system that is in accordance with competencies, lack of cooperation in the world of education/university to produce ready-to-use human resources in accordance with the needs of the business world (Ridho et al., 2019). The strategy to overcome this problem is to increase the competence of human resources in order to create humans who innovate, adapt to the environment and are able to carry out the learning process (Rachmawati & Rismayani, 2019). The education system can apply technology in conducting learning to prepare seeds of resources that can competen in the global environment (Nuraini, 2019).

Schools are educational institutions that seek to improve the quality of educational achievement by improving the quality of learning. Teachers have a role in the learning process. To carry out the teaching process, it is necessary to use optimal and maximum learning media. A teacher is required to develop innovation from skills to make new learning media if the old learning media is less effective to be used as a learning medium (Permana, 2017).

The understanding and success rate of a material varies between students, some immediately absorb the material, some take a long time to understand the material because most of them do not focus on visuals and audio (Devega & Suri, 2019). After making observations at one of the State Vocational Schools in Dharmasraya, namely SMK Negeri 1 Koto Baru in the Motorcycle Engineering Department, from the availability of learning media facilities to improve learning competencies, it has decreased, in the learning process it can be seen when practicing automatic transmission systems in school workshops, students do not know or know what an automatic transmission system is *Continuously Variable Transmission* (CVT) on Yamaha motorcycles (Nofendri & Christian, 2020), so the expected learning output is not maximized, this is caused by:

1. The teacher who always writes on the blackboard and sometimes gives examples in the form of photos from the internet about the automatic transmission system so that students feel bored.
2. When the teacher demonstrates how to use and work the Continuously Variable Transmission (CVT) automatic transmission system on a Yamaha motorcycle in the workshop, the tools used are not available, sometimes the teacher uses his own motorbike to become student practice material because there are no practical tools for learning.
3. The unavailability of a manual on the Continuously Variable Transmission (CVT) automatic transmission system at SMK Negeri 1 Koto Baru Dharmasraya

From the phenomenon above, educators must make a change. Expected changes will provide positive things. The use of media will be very helpful for achieving changes in technological progress at this time. Learning and media are mutually sustainable achievements. Learning will run effectively if it is equipped with good learning media. The use of media during teaching activities will help the effectiveness of the learning process and the material presented can be understood.

Achievement of the maximum and optimal learning process, an educator should be able to use learning media so that the expected goals are achieved. An educator is also expected to be

able to develop skills in making new learning media if the old learning media are still not effectively used as learning media. Media is a collection of components and tools in the environment that can help educators to give messages and motivate students in the learning process (Destiana & Utami, 2017). In the current teaching process with technological advances, not only teaching with conventional science, there are still many learning processes that use conventional methods, namely lectures/demonstrations, followed by practical activities in workshops/workshops.

Conventional learning methods applied by teachers in teaching are still lacking in motivating students, using conventional methods, because this method does not involve students in the learning process which makes students less active. To overcome this, educators need to develop learning media that can support the teaching and learning process, this makes teachers have no difficulty explaining the material and is no longer charged when practicing using a teacher's motorbike, but can be replaced with a simulator on the Continuously Variable Transmission automatic transmission system (CVT). Simulator is a program that serves to conclude a piece of equipment, but it works a bit slower than the actual situation (Afham et al., 2018). Ari Subagia and Adi Atmika (Ruan et al., 2018) said that the transmission system is used on scooters and is known as Continuously Variable Transmission (CVT), which is a new system for gearless transmission. The shape and construction of this transmission system is very compact and simple compared to previous transmissions.

Teaching aids that are used as learning media for students will attract attention and motivate students in carrying out learning activities. Teaching aids have the ability to know directly which parts of the CVT component become clearer and visually and audio work simultaneously to attract students' attention to pay attention to the learning given. However, any learning media has its drawbacks. The process of making learning media using teaching aids takes a long time and the costs required are not small because it requires accuracy and caution in its manufacture to display innovative learning aids so that they can be used in the teaching and learning process. Based on the results of Sholekhan's research (Srivastava & Haque, 2009), the results of the control and experimental class analysis obtained an average score of 75 for the control class and 85 for the experiment, it can be concluded that there is a significant difference between students who have not used CVT and students who use CVT simulator media. It can be explained that CVT media can be used in learning media.

Based on the background of the problem, the researcher intends that the Continuously Variable Transmission (CVT) automatic transmission system simulator can be used as a learning media tool at SMK Negeri 1 Koto Baru Dharmasraya in the Motorcycle Engineering Department, as a learning method that provides positive changes to improve the learning process in order to compete in a global environment.

B. METHOD

The procedure for developing a Continuously Variable Transmission (CVT) simulator in a motorcycle automatic transmission system lesson using a 4-D model. This model consists of 4 stages of development, namely Define, Design, Develop and Disseminate. The stages of research on the development of the Continuously Variable Transmission (CVT) simulator are described as follows.

1. Defining Stage (Define)

Activities at this stage are carried out to determine and define development requirements that are in accordance with the needs and research and development models. At this stage, determine the basic problems faced in learning so as to analyze to develop learning media using a simulator. With this analysis, an overview of facts, expectations and alternative solutions to basic problems can be obtained, which makes it easier to determine the media to be developed. The steps taken are as follows:

a. Observation

Observation is an activity by observing an object directly to get data. Observations were made by analyzing the Teaching Program Unit (SAP) for Automatic Transmission System Subject Matters. The purpose of this analysis is to determine the basic directions needed in the development of teaching aids. In the implementation of this analysis in terms of the Teaching Program Unit (SAP) Lessons of the motorcycle automatic transmission system and the availability of media in the school..In carrying out the initial analysis, the researchers conducted observations and interviews with subject teachers and saw the availability of simulators at the school, especially the media used in the material regarding the automatic transmission system. This aims to determine whether the material being taught has been achieved in accordance with the expected competency standards. In addition, to find out whether the learning material for the Automatic Transmission System already has a Continuously Variable Transmission (CVT) Simulator.

b. Student Analysis

In this study, the subjects of the study were students who took lessons on automatic transmission systems at SMKN 1 Koto Baru Dharmasraya. From the results of this analysis will be used as a frame of reference in developing this simulator development tool.

c. Curriculum Analysis

Curriculum analysis refers to the synopsis and syllabus of subjects automatic transmission systemso that the resulting product does not deviate from the learning outcome.

2. Stage of Design (Design)

Activities carried out at this stage are planning as follows:

a. Product Design

The product design for this simulator is carried out through the stages of designing physical, functional, logical and workflow designs. In carrying out this media design we will collect/combine several systems into a media. Initial Concept of Continuously Variable Transmission (CVT) illustrated by Figure 1 follows.

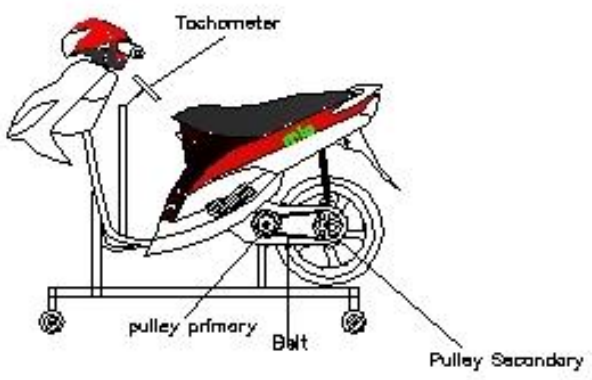

Figure 1. Initial Concept of Continuously Variable Transmission (CVT)

b. Product Manufacturing
This stage aims to produce an initial product, namely the Continuously Variable Transmission (CVT) Simulator tool that simulates the workings of the Automatic Transmission System on a Yamaha Mio Sporty motorcycle and we can easily see how it works.

3. Development Phase (Development)

After the simulator tool product is designed, product development is carried out, at this stage it is described as follows:

a. Validation Stage
Validity is the accuracy and accuracy of an instrument in measurement. According to Arikunto (Riyantono & Hatmawan, 2020) that "validation is a measure that shows the level of reliability or validity of a measuring instrument". Validation serves to check whether the developed tool can be used as a simulator in school subjects. Tools that have been designed will be consulted and discussed with experts (validators). After that, validate by filling out the validation sheet and discussion until obtaining a valid and usable media.
According to Anggaryani (Sugiharni, 2018), the media is said to be valid if it meets the following requirements:
1) Didactic Terms
This requirement relates to finding concepts that are in accordance with the applicable curriculum and paying attention to individual differences so that the media used in learning can measure students' abilities.
2) Construction Terms
This requirement is related to the preparation of sentences, the simplicity of the use of words and the right clarity so that it is easily understood by students.
3) Technical Terms
Terms relating to the use of language, writing, images and appearance in making the Simulator.

b. Trial Subject
The test subjects are class XII students who will be given an automatic transmission system subject using a Continuously Variable Transmission (CVT) Simulator. Subjects for the Continuously Variable Transmission (CVT) Simulator trial at SMK Negeri 1 Koto Baru Dharmasraya. The validity test was carried out by an automotive lecturer in the Department of Automotive Engineering, FT-UNP. The practicality test was carried out by a Yamaha West

Sumatra instructor, a teacher at SMK Negeri 1 Koto Baru Dharmasraya. The effectiveness test was conducted on students majoring in Motorcycle Engineering at SMK Negeri 1 Koto Baru Dharmasraya.

C. RESULTS AND DISCUSSION

This simulator is one of the effective learning media to be used as learning media. A complete and detailed discussion using the 4-D method is as follows:

1. Defining Stage (Define)

The definition stage is carried out to get an image conditioned by the field. This stage analyzes the needs (needs analysis) needed for the process of making the Continuously Variable Transmission (CVT) simulator

2. Design Stage

At this stage, the design of the tool that will be used as a simulator is carried out. Making the initial design of the CVT simulator. Before the tool is worked on, first create an initial concept image that will be developed, below is a description of the tool that is adapted to the design.

3. Development Phase (Development)

This stage aims to get a valid, practical and effective simulator. This development stage consists of the following:

a. Validation Stage

From this stage the CVT simulator validation test data was obtained from the responses of 2 (two) validators by looking at 3 categories: didactic requirements, construction aspects and technical requirements. Continuosly Variable Transmission (CVT) Simulator Validation by Validator illustrated in Table 1 below.

Table 1. Continuosly Variable Transmission (CVT) Simulator Validation by Validator

No	Rating Items	V	Information
Didactic Terms			
1	The simulator was developed referring to the Yamaha curriculum at SMK	0.75	Valid
2	The simulator developed can support understanding activities concepts that delivered in learning	0.75	Valid
3	The simulator developed can improve the quality of the effective learning process	0.75	Valid
4	The simulator developed is made by considering the character of students in learning	1	Valid
5	The developed simulator can guide students in learning	0.75	Valid
6	The developed simulator can attract students' interest and attention	0.88	Valid
Average		**0.81**	**Valid**
Construction Aspect			
1	Simulators that are made to support learning objectives	1	Valid
2	The simulator made contains the subject matter and details	0.88	Valid
3	The simulator created has an identity (material title)	0.75	Valid
4	Use simulator could used by simple, clear, and easily understood by students	0.75	Valid
5	This simulator can be used for independent learning	0.75	Valid
6	Learning with this simulator becomes more Interesting	0.88	Valid
7	The use of this simulator can improve student learning	0.88	Valid

Average		**0.84**	**Valid**
Technical Terms			
1	Attractive continuously variable transmission (CVT) simulator display	0.75	Valid
2	The combination of media used is appropriate and attractive	0.75	Valid
3	The components on the simulator are clear and understandable	0.75	Valid
4	The quality of the simulator display that is made supports the material presented	0.88	Valid
5	Media system according to how the simulator works	0.75	Valid
Average		**0.78**	**Valid**
Overall Average		**0.81**	**Valid**

b. Practical Stage

1. Teacher Practicality Stage

The practicality of the CVT simulator is obtained from practitioners' responses about the practicality of being used in automatic transmission system subjects. Practitioners for practicality on 2 (two) responses of teachers who teach subjects on automatic transmission systems. Practicality results by teacher illustrated in Table 2 below.

Table 2. Practicality Results By Teacher

No	Rating Points	G1	G2	Σ	Percentage	Category
Theory						
1	The simulator used is already in accordance with the wishes of the user	5	4	9	90	Very Practical
2	The use of simulators can generate interest in student learning	5	4	9	90	Very Practical
3	Learning to use this simulator can make students understand the material faster	4	4	8	80	Practical
4	The use of this simulator can make more interesting learning	4	4	8	80	Practical
5	The simulator developed can be implemented by Guru	5	4	9	90	Very Practical
6	Simulator designed according to the material Learning	4	4	8	80	Practical
7	The use of this simulator can save time in presenting material	5	5	10	100	Very Practical
8	The developed simulator can be a standalone simulator	5	4	9	90	Very Practical
9	This simulator can be used because it has clear instructions	4	5	9	90	Very Practical
10	A continuously variable transmission (CVT) simulator helps teachers provide a learning experience for students	4	4	8	80	Practical
11	This simulator can help teachers develop student knowledge	4	5	9	90	Very Practical
12	The learning process using the simulator student centered	4	5	9	90	Very Practical
13	With this simulator as a tool learning in delivering material	5	4	9	90	Very Practical
14	The simulator is easy for students to understand	5	4	9	90	Very Practical

15	As a learning motivation for students	4	4	8	80	Practical
Average				131	87.33	**Very Practical**

2. Student Practicality Stage

Assessment of student responses is carried out at the end of the learning activity after using the simulator. Assessment of student responses was carried out using a student response questionnaire instrument that had been prepared in the previous stage. The results of this questionnaire assessment are then used to determine the practicality of using the simulator as a medium. Practicality results based on student responses illustrated in Table 3 below.

Table 3. Practicality Results Based on Student Responses

No	Rated aspect	V	Category
Ease of Use of Media Simulator			
1	By using this simulator I can find out the learning objectives that I do	93	Very Practical
2	I can learn Continuously variable transmission simulator automatic transmission system with this simulator	91	Very Practical
3	I can follow the steps learning that is in this simulator	93	Very Practical
4	I Easy to use this simulator	94	Very Practical
5	I can understand the workings of a continuously variable transmission (CVT) automatic transmission.	90	Very Practical
6	I can follow the instructions in the continuously variable transmission (CVT) simulator	90	Very Practical
7	This simulator motivated me to learn about automatic transmission system	94	Very Practical
8	This simulator interest me to learn about automatic transmission system	91	Very Practical
9	Improve my ability to do theory and work on automatic transmission systems	90	Very Practical
10	My understanding of the process learning increases	96	Very Practical
11	I understand the material clearly	95	Very Practical
	Average	**92.45**	**Very Practical**
Time used in Implementation			
12	It didn't take me long to learn about the continuously variable transmission (CVT) automatic transmission with the help of a simulator	90	Very Practical
13	The time used is quite efficient	92	Very Practical
14	This simulator helps me make it easier to understand continuously variable transmission (CVT) material.	94	Very Practical
15	This simulator can facilitate me to learn independently	92	Very Practical
	Average	**92**	**Very Practical**
Media Appeal			
16	The language used by this simulator is	87	Very Practical

	easy to understand		
17	The information in the simulator is clear	89	Very Practical
18	Is the development of this simulator good?	94	Very Practical
19	Nice simulator shape	98	Very Practical
20	Do you agree with this new simulator	96	Very Practical
	Average	**92.8**	**Very Practical**
	Overall Average	**92.42**	**Very Practical**

4. Effectiveness Stage

Student learning outcomes are an effective aspect to be observed in the learning process. This aims to see the extent to which the effectiveness of the tools developed are able to help students understand the material being studied. The learning outcomes test is carried out at the end of the learning activities on the material after testing the tool. Evaluation of learning outcomes in the form of multiple-selected 20 items that have been validated, the results of this test are then used to measure the effectiveness of using the CVT simulator that has been developed.

Testing the significance of the differences is done by using Gain Score analysis which consists of two types, namely: Pretest (initial test) and Posttest (final test) and the results of the average Gain Score of students overall. Statistics of Pretest, Posttest and Gain Score illustrated by Table 4 below

Table 4. Statistics of Pretest, Posttest and Gain Score

score	**Control**				
	N	**X_{Min}**	**X_{Max}**	$\bar{x}$	**SD**
Pretest	20	8	15	56.00	2.17
Posttest	20	13	17	73.00	1.10
N-Gain	20	0.14	0.55	0.37	0.12
Comparison of % Posttest and Pretest = 16.67%					
Maximum Score = 20					

Based on the results of the pretest to students before being given learning media, an average score of 56.00 was obtained, after being given learning media, a posttest was carried out with an average score of 73.00, from these results we can see an increase in student learning outcomes. However, judging from the data of each student's assessment score, during the pretest 2 students got the lowest score of 40 and after the posttest 2 students got the lowest score of 65, from these results we can analyze that these students do not understand the material from the CVT, namely about the CVT component, primary pulley, the advantages of CVT and how CVT works.

The results of the lowest student scores during the pretest, the authors emphasized the CVT material by applying the CVT simulator learning media with demonstration and simulation methods. After learning to use the media, the author conducted a posttest and assessed the results by looking at the highest score of 85, from these results we can see an increase in students' understanding when given CVT simulator media on automatic transmission system subjects.

From the results of the pretest, there were students who got a score of 13 and when the posttest got a score of 13 with the same results, it was seen that there was no improvement in learning. One of the factors that affect student achievement is concentration, in the learning

process students are able to follow the learning that can be seen in student questionnaires on learning media, it's just that students lose concentration in answering posttest questions.

5. Deployment Stage

The socialization was carried out to XI students of SMKN 1 Koto Baru Dharmasraya, teachers of SMKN 1 Koto Baru Dharmasraya, and SMKN 1 Koto Baru Dharmasraya so that they could be used as widely as possible.

D. CONCLUSIONS AND SUGGESTIONS

Based on research on the Development of a Continuously Variable Transmission (CVT) Automatic Transmission System Simulator on Motorcycles as a learning medium, it can be concluded that the Development of a Continuously Variable Transmission (CVT) Automatic Transmission System Simulator has succeeded in making simulator props that can be used for learning by demonstrating and being able to measure expertise by applying the CVT simulator tool.

The results of data analysis on the Development of a Continuously Variable Transmission (CVT) Automatic Transmission System Simulator as a learning medium from product validity tests based on material validation are declared "Valid" with an average score of didactic requirements 0.81 with valid category, construction aspect 0.84 with valid category and technical requirements 0.78 with valid category. The results of data analysis seen from praticality based on the responses of 2 (two) teachers got an average score of 87.33% with a very practical category and the results of data analysis seen from praticality based on student responses, it was known that the average value was 92.42% with a very practical category. Then for the effectiveness test, it was obtained from analyzing the percentage increase in student learning outcomes, the average pretest score was 56.00% and posttest was 73.00%, when viewed the overall N-gain average was 0.37.

As for suggestions to students, they should make the best use of the facilities provided by teachers and schools, then teachers should continue to create innovations that can improve student learning outcomes, both in terms of learning media and others, for further researchers. in order to develop the subjects of automatic transmission systems, both in the media and in teaching materials in these subjects.

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