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DEVELOPMENT OF LEARNING MODULES ON THE BASIC MATERIALS OF AUTOCAD 3D DRAWING FOR CLASS XII TPM AT SMKN 1 DRIYOREJO

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Abstract

This study aims to develop teaching materials in the form of learning modules for valid 3D coordinate system material and basic 3D drawing and get positive responses from students. Development of learning modules using 4D models. The subject of this study was students of class XII Mechanical Engineering at Driyorejo State Vocational School 1 in semester 2 of the 2022/2023 academic year. Based on the results of the development, it was obtained that the module validity from the material aspect was 0.9 which was categorized as high validity, and for the media aspect the validity was obtained was 0.8 which was categorized as high validity. In the Dissemination stage of the learning module, improvements are made according to validator input, and trials are also carried out on students to find out the response to the learning module being developed. Of the students' responses, around 91% gave a positive response.

Keywords: Learning Modules, 3D drawing, 4D Models, Mechanical Engineering.

INTRODUCTION

Education is a process in which each individual can develop by getting input either verbally or nonverbally. Based on the National Education System Chapter 1 Article 1 Paragraph 20 in Law No. 20 of 2003 it is stated that learning is a process of interaction between students and educators and learning resources in a learning environment. Therefore a real effort in realizing good quality education with the interaction of students with learning resources is the provision of learning materials. Teaching materials are one of the important instruments in learning activities. Good teaching materials can create interactions with students in achieving competency in learning objectives(Ulum & Arsana, 2019). In the manufacturing engineering drawing subject, there is still a minimum use of teaching materials, therefore the development of teaching materials in the form of modules is the main focus of this activity, This is also supported by the importance of manufacturing engineering drawing subjects for mechanical engineering expertise programs.

(Priambodo & Nuryanto, 2020)in his research explained that the teaching materials developed were declared valid by material experts with an average feasibility percentage of around 82%. The same thing is done by(Darwin et al., 2020)which is a constructivism-based learning module that was developed based on effectiveness tests including modules that are effectively used in learning activities.

Based on previous research, observational research was carried out which concluded that there were several problems described, namely that there were no teaching materials for the subject of manufacturing engineering drawing which is one of the important subjects for the mechanical engineering expertise program at SMK Negeri 1 Driyorejo.

Therefore, it is necessary to develop teaching materials in the form of systematic learning modules. In developing teaching materials this module uses the 4D development model. In the development of the learning module, the level of validity of the learning module was obtained and also the responses given by students in the use of teaching materials in learning activities

RESEARCH METHODS

Good teaching materials are teaching materials that can facilitate students to achieve the competence of learning objectives. Because teaching materials are important instruments for students to achieve a competency base that is determined(Prasetya & Sukardi, 2016). Therefore the development of learning modules uses the 4D model, to obtain optimal results efficiently. The 4D development model consists of divine, design, development, and dissemination(Wardani et al., 2019).

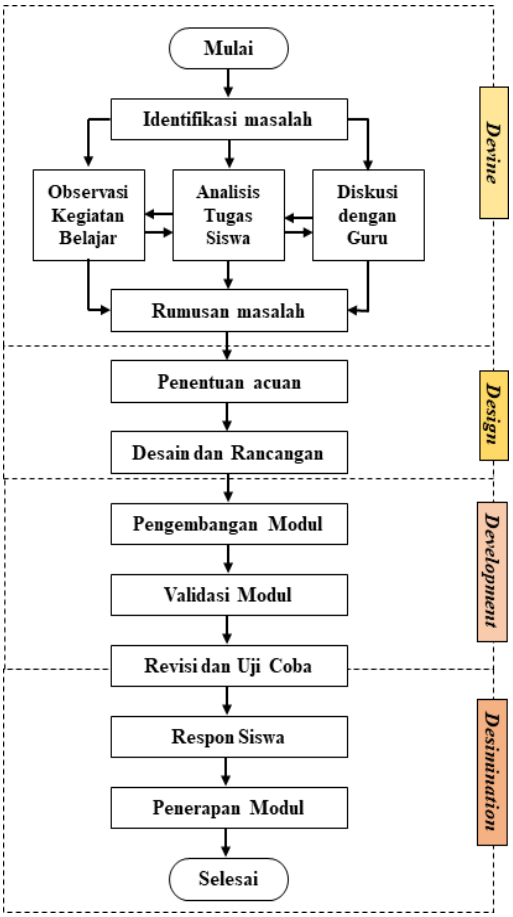

Figure 1. 4D development model flowchart

The purpose of using the 4D model is that the steps are detailed but simple and easy for researchers to implement(De Soto et al., 2017). The 4D model development stage starts from the Devine stage with problem identification followed by observation, analysis, and discussion related to real conditions in learning manufacturing engineering drawing subjects(Golparvar-Fard et al., 2009). After that, the problem formulation is determined to determine the reference so that it can be designed related to the design of the development learning module. At the development stage, module development is followed by validation in terms of material and media to obtain validated module teaching materials. In the validation, there are several inputs to improve the learning module. Trials were carried out to find out student responses regarding the application of module teaching materials(Sari & Marlena, 2022). At the dissemination stage, the learning process on the basic material of 3D drawing is oriented to the Project Learning (PjBL) learning model which is based on the completeness and achievement of students in achieving competence based on projects obtained during learning activities(Frank et al., 2003). In addition, the ability of students to think critically to solve problems is the focus used in achieving learning competencies(Guo et al., 2020). However, apart from that the use of the PjBL model requires a fairly systematic learning time so a slightly longer implementation time is needed, which is used to increase the collaboration power of each student.(Doppelt, 2003). In addition, the application of project-based learning makes learning more interactive so that it can improve the more enjoyable learning atmosphere (Genec, 2015).

The data generated from validation is ordinal scale data, Then converted into a Likert scale, which weights 4, 3, 2, and 1. Communicative data is processed using the validity test using the Aiken formula. As follows:

$$V = \Sigma s/[n(c-1)] \qquad \text{(Harpuri, 2019)}$$

Information:

n = Many Appraisers
c = High validity rating score
lo = Low validity research figures
s = r-lo

The above assessment can be classified according to the category, to obtain a level of validity by existing criteria(Aziz, 2019)

Table 1. Validation Criteria

Validity Level	*Range*
High	V>0.8
Currently	0.4<V<0.8
Low	V<0.4

RESULTS AND DISCUSSION

This development research was carried out using a 4D model which consisted of define, design, development, and dissemination stages which are oriented to the project-based learning model. Project-based learning is a cooperative learning model that influences learning outcomes in the cognitive, affective, and psychomotor domains(Hasanah et al., 2018).

Define stage

This activity is a problem identification activity to formulate the problems experienced in learning of the Manufacturing Engineering Drawing subject which is carried out by observing learning activities to obtain data related to the student learning process and the constraints experienced. In addition to analyzing student assignments to obtain supporting data related to the constraints experienced during the learning process. After that, hold discussions with the teachers of the Manufacturing Engineering Drawing subject regarding solutions to the

formulation of the problems found so that they are efficient and optimal in overcoming the problems they face.

Design Stage

At the design stage, a design is made related to the development of a learning module which is the answer to the specified problem formulation. Also at this stage to compiling several designs are used to support the development activities carried out, namely by compiling student response instruments that are used to accommodate student responses related to the development and application of learning modules.

Development Stage

The development stage is carried out by developing a 3D Coordinate system learning module and drawing a 3D basis. After the development has been successfully carried out, the learning module will be validated to find out and improve errors in the learning media developed. Validation is carried out using 2 aspects, namely material validation and media validation. In material validation, three aspects are translated into several questions which are then assessed by the validator to determine the validity level of the learning media. For aspects of material validation are as follows.

Table 2. Material validity value

No	Aspect	Validity Value	Ket.
1	Compatibility of Material with KD	0.78	currently
2	Serving Technique	0.93	tall
3	Coherence and Consistency of Thought Flow	0.89	tall

For the results of material validation as a whole, the following values are obtained. $V = \Sigma s/[n(c-1)]$

$$CapV = \frac{45}{51} = 0{,}9$$

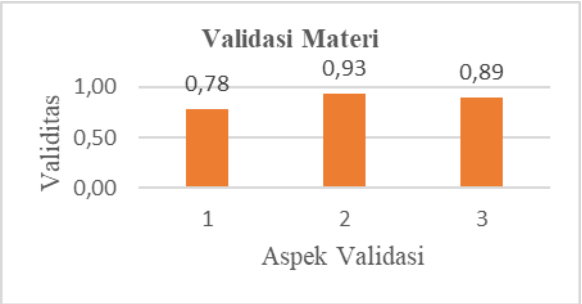

Figure 1. Graph of material validity from the GTM learning module

The validity of the media consists of 3 aspects which are explained by several questions. Related to the results of the validator's assessment in terms of media can be seen as follows.

Table 3. Media Validity Value

No	Aspect	Validity Value	Ket.
1	Module Size	1.00	Tall
2	Module cover design (Cover)	1.00	Tall
3	Module content design	0.74	Currentl y

For the media validation results as a whole, the following values are obtained. $V = \Sigma s/[n(c-1)]$

$$CapV = \frac{38}{45} = 0{,}8$$

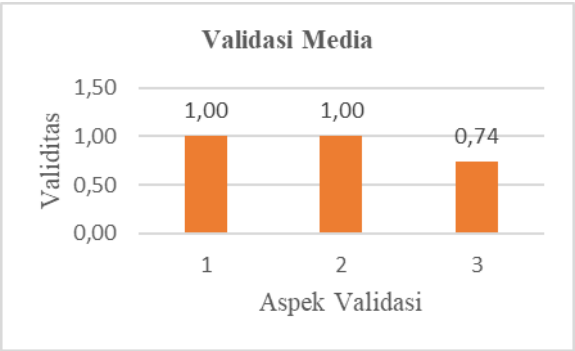

Figure 2. Media validity graph from the GTM development module

After the developed media is validated to correct errors from the input given by the validator.

Decimation Stage

At this stage, data was collected related to student responses to the developed learning modules, by giving questionnaires containing questions related to responses to learning media which would then be accumulated in the form of a percentage to determine the level of presentation of the developed learning modules. The results of

student responses were obtained as follows.

Table 4. Student Response Results

Question indicator	Percentage
The illustrations and pictures in the module are easy to understand and fit the story	80
The material presented in the module is appropriate	91
The explanation presented in the module is appropriate	91
The sentences used are easy to understand	91
This module is easy to use	95
Object images can be seen clearly	92
The visualization of this module is clear	98
The layout of the pages and images do not interfere with learning activities	89
The images in the module help us understand the material presented	89
The arrangement in the book does not make it confusing in reading	89
The material presented is clear and concise	92
The evaluation questions given are by the material presented	92
The job sheet provided is by the material provided	94
The language used is not convoluted	92
The colors used in this module are attractive	91

From the data above, the average results for the results of student responses to the development of 3D coordinate system learning modules and basic 3D drawing are obtained, as follows:

$$V = \frac{\Sigma\ Presentation\ of\ the\ Questions}{Number\ Of\ Questions}$$

$$V = \frac{1366}{15} = 91\%$$

Figure 3. Graphs of items on the results of student responses

From the data above, it can be concluded that student responses to the development of learning modules for 3D coordinate system material and 3D basic drawing for the Manufacturing Engineering Drawing subject average 91% of student responses to learning modules developed.

CONCLUSIONS AND SUGGESTIONS

Conclusion

Based on the results of the discussion the following conclusions are drawn:

4. The 3D coordinate system learning module and basic 3D drawing get a value of 0.9 which is categorized as having high validity.
5. The learning module also scores 0.8 for the media aspect which is also categorized as having high validity;
6. From the Dissemination stage of the learning module, it was found that student responses to the developed learning module indicated that 91% of students gave positive and good responses to the 3D coordinate system learning module and basic 3D drawing for the Manufacturing Engineering Drawing subject.

Suggestion

1. For Master
   a. Do development for some advanced material from AutoCAD 3D drawing so that it can meet all needs according to the competencies to be achieved.
2. For school
   a. Provide facilities and motivation in efforts to develop self-competence to improve the quality of teachers.

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