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Teacher's Perception of Thermodynamic Law Module Developed in Training through Student's Critical Thinking Skills

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Abstract

This study determined teacher's perceptions about the ability of modules developed in training students' critical thinking skills. This research is a part of research and development with the development model used, namely 3D Development, namely Define, Design, and Develop which was adapted. The instruments used were observation sheets, student needs questionnaire sheets and teacher perception questionnaire sheets. Questionnaire needs were given to 100 students of class XI Science while perception questionnaires were given to 30 high school/vocational school physics teachers. Data analysis techniques used are quantitative analysis techniques and qualitative analysis techniques. The instrument used to obtain perception data was categorized as valid with a value of Va = 3.11 and reliable with a Crobach's Alpha Coefficient calculated 0.925 greater than the standard Crobach's Alpha Coefficient value of 0.60. The results of the perception questionnaire analysis obtained an average percentage of teacher perceptions of 77.87% with a very good category.

Keywords: Teacher's Perception; Thermodynamic Law Module; Critical Thinking Skills

A. Introduction

Education is one of the main factors in creating a generation of people with high insight and good character (Purmadi & Surjono, 2016). The development of science and technology is increasingly pushing for renewal efforts in the use of technological outcomes in the learning process (Purwaningtyas & Hariyadi, 2017).

Life in the global era demands various educational changes, one of which is the curriculum. This is an awareness that changes and curriculum development are felt very necessary to improve the education system in Indonesia (Liani et al, 2018). In Indonesia now, schools,

especially the high school, have implemented the 2013 Curriculum and some have even implemented the Revised 2013 Curriculum (Peranti et al, 2019). The 2013 curriculum development is based on competence in the context of 21st century education (Handayani et al, 2018). The learning process in the implementation of the 2013 curriculum in the education unit is held interactively, inspirational, fun, challenging, motivating students to actively participate, as well as providing sufficient space for initiative, creativity, and independence in accordance with the talents, interests and physical and psychological development of students (Mertayasa et al, 2018).

Physics learning currently emphasizes the orientation of students as subjects in the learning process (Fadilah et al, 2018). One of the skills students must have according to the Department of Defense Education Activity (DoDEA) is critical thinking skills (Ningsih et al, 2018). Ennis in (Sumarmo et al, 2012) defines critical thinking as reflective thinking that is reasonable and focused on determining what is believed or done. Critical thinking skills need to be equipped for every student to be able to survive in a competitive society (Syamsu, 2020). One of the tips to practice students' critical thinking skills is the use of teaching materials that are developed based on indicators of critical thinking. The initial step of critical thinking is to focus on the problem or identify the problem well, find out what the real problem is and how to prove it. The next step is to formulate arguments that support conclusions, look for evidence that supports the reasons for a conclusion so that conclusions can be accepted or in other words the reasons given must and in accordance with the conclusions. If the reasons stated are correct, then it must be shown how strong the reason can support the conclusions made (Mahmuzah, 2015).

A module is a learning package that deals with a unit of subject matter. Students can achieve and complete their learning material by studying individually, with modules students can control their abilities and intensity of learning (Auliya & Kosim, 2017). The use of modules in teaching and learning activities not only looks at the teacher's activities alone, but also involves students actively in learning. Using modules also creates an independent learning process (Sukiminiandari et al, 2015). the benefits derived from learning by applying modules include. a) Increase students' motivation, b) After evaluating, the teacher and students know in which part of the module that students have succeeded and in which part of the module they have not succeeded, c) Students achieve results according to their ability, d) Materials lessons are divided more evenly in one semester (Ibrahim & Yusuf, 2019)

Based on the things that have been described above, it is necessary to develop a module to train students 'critical thinking skills and it is necessary to collect teacher perceptions data to find out if the module developed is appropriate to be used to train students' critical thinking skills.

B. Methods

This type of research is research and development (Research and Development). Research and development methods (Research and Development) are research methods used to produce certain products, and test the effectiveness of these products (Sugiyono, 2010). The research and development model used in this study can be seen in Figure 1.

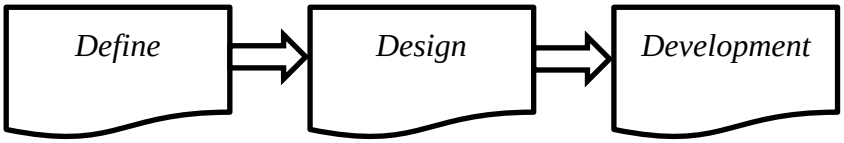

Figure 1 Steps of the 3D Model

(Sriwahyuni et al., 2019)

The research and development model used is the 4D (Four D Models) development model which is limited to the development stage. The limitation of the 4D model to 3D is due to the limited time and cost, so this research is only carried out with three stages namely define, design, and development. The research conducted will produce a product in the form of a learning module.

The module developed is a physics learning module for thermodynamic law material for high school class XI to practice students' critical thinking skills. In this study the validity and reliability of the perception questionnaire was used. Questionnaire is said to be valid if the validity level is greater or equal to 3, and it is said to be reliable if the value of the Crobach's Alpha Coefficient count is greater than the standard Crobach's Alpha Coefficient value of 0.60 (Triana & Oktavianto, 2013).

Teacher perception data collection is done by using perception questionnaire sheets. Analysis of the results of the perception questionnaire was carried out quantitatively using the following formula.

$$p = \frac{n}{N} \times 100\%$$

Where P is the percentage of perception results, n is the total score of expert judgment, and N is the maximum score possible. For the Likert scale the interpretation of the scores can be seen in table 1.

Table 1. Interpretation of Likert Scale

Percentage (%)	**Category**
0 % - 25 %	Very not good
26 % - 50 %	Not good
51 % - 75 %	Good
76 % - 100 %	Very good

From the data from this interpretation, the research can be said to be successful and valid or very valid if the questionnaire data processing produces a score between 51% to 100% or within the criteria of "Good" and "Very Good" (Hayati et al., 2015).

C. Results and Discussion

Define phase

The first activity is problem analysis which is carried out through a process of observation and dissemination of the needs of the module to 100 students of class XI Science. Based on the analysis of the questionnaire the need for modules in learning obtained an average percentage data of 81.87%, so it can be concluded that students strongly agree the development of physics learning modules in the concept of thermodynamic law.

Design phase

At this stage, the researcher chooses the media and learning material to be developed. The selected media is electronic media with the help of 3D PageFlip Professional software and QR Code. The material implied in this study is the Law of Thermodynamics for High School Grade XI students. Learning modules are designed as teaching materials that students can use anytime and anywhere. The learning module as teaching material is more emphasized to train students' critical thinking skills.

Develop phase

Products in the form of thermodynamic law modules that have been developed can be seen in Figure 2-10.

Figure 2 Cover Page

Figure 3 Welcome and Introduction

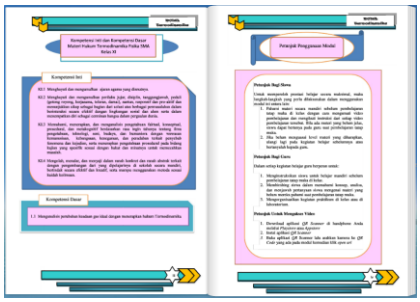

Figure 4 Core Competencies, basic Competencies, and Instructions Using Modules

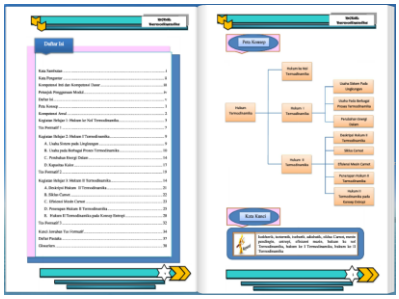

Figure 5 Basic Contents, Concept Maps and Keywords

Figure 6 Initial Competence and Learning Objectives

Figure 7 Video Display on 3D PageFlip Professional

Figure 8 Video Display with QR Code

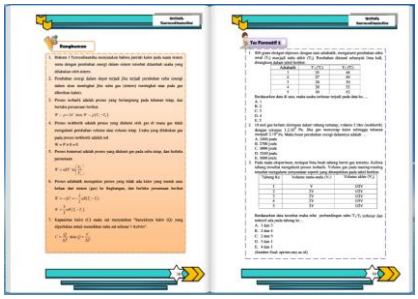

Figure 9 Summary and Formative Test

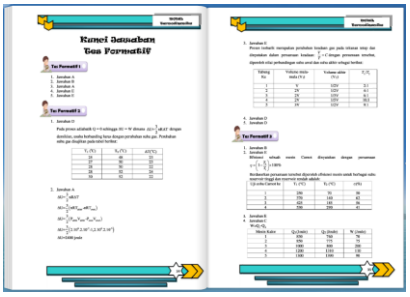

Figure 10 Key To Formative Test Answer

In this study an analysis of the validity and reliability of the perception questionnaire used. From the analysis, the results are obtained that all items in the questionnaire perception are valid. In more detail can be seen in the following table.

Table 1: Validity Test Results for Items of Question on Perception Questionnaire

Respondents	**Question**										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1	4	4	4	4	4	4	4	4	4	4	4
2	3	3	4	3	3	3	3	3	4	3	3
3	3	3	3	3	3	3	3	3	3	3	3
4	4	3	3	3	3	3	3	3	3	3	3
5	3	3	4	4	3	4	4	4	3	4	3
6	3	3	4	4	4	3	3	3	3	4	4
7	3	3	3	3	3	3	3	3	3	3	3
8	3	3	3	3	3	3	3	3	3	3	3
9	3	3	3	3	3	3	3	3	3	3	3
10	4	3	4	3	3	3	3	3	3	3	3
11	3	3	3	3	3	3	3	3	3	3	3
12	4	3	3	3	3	3	3	3	3	3	4
13	4	3	3	3	3	3	3	3	3	3	3

14	4	4	4	4	4	4	4	4	4	4	4
15	3	3	3	3	4	3	3	3	3	3	4
16	3	3	4	4	3	3	3	3	4	3	3
17	3	3	3	3	3	3	3	3	3	3	3
18	3	3	3	3	3	3	3	3	3	3	3
19	3	3	3	3	3	2	2	3	3	2	2
20	3	3	2	2	2	2	2	2	2	2	3
21	3	3	3	3	3	3	3	3	3	3	3
22	3	3	3	3	3	3	3	3	3	3	4
23	3	3	3	4	4	3	3	3	4	4	3
24	3	3	3	3	3	3	3	3	3	2	3
25	3	3	3	3	3	3	3	3	3	3	3
26	3	3	3	3	3	3	3	3	3	3	3
27	3	3	3	3	3	3	3	3	3	3	3
28	3	3	3	3	3	3	3	3	3	3	3
29	3	3	3	3	3	3	3	3	3	3	3
30	3	3	3	3	3	3	3	3	3	3	3
Sum	96	92	96	95	94	91	91	92	94	92	95
	3.2	3.067	3.2	3.167	3.133	3.033	3.033	3.067	3.133	3.067	3.167
Category	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid

From table 1 it can be seen that all questions have a validity level above 3 which means that all items in the teacher's perception questionnaire are valid and for an average Va value of 3.115 are also categorized valid.

Besides being valid, the teacher's perception questionnaire used was also reliable. In more detail, you can see in the following table.

Table 2: Results of Reliability Tests on Question Items in Perception Questionnaire

Number Of Question Items	Crobach's Alpha Coefficients are Calculated	Crobach's Alpha Coefficients Default	Information
11	0,925	0,60	Reliabel

From table 2, it can be seen that the calculated value of Crobach's Alpha coefficient is greater than the standard Crobach's Alpha coefficient value so that the perception questionnaire can be said to be reliable.

In this study also conducted data collection on teacher perceptions about the ability of modules developed in training students' critical thinking skills. The teacher's perception of the module's ability to practice critical thinking skills was obtained from a questionnaire data consisting of 11 questions. Based on questionnaire data filled out by 30 respondents who are high school physics teachers it is known that the modules developed are in the very good category with a percentage of 77.87% of 100%. The 100% percentage is the ideal maximum

percentage for this assessment. The results of teachers' perceptions about the module's ability to practice critical thinking skills in more detail can be seen in table 3.

Table 3 Results of Teacher's Perception Data About Module Capabilities in Practicing Critical Thinking Skills

Validator	Total Score (n)	Max Score (N)	Percentage $P = \frac{n}{N} x100\%$	Category
30 High School Physics Teacher	1028	1320	77,87%	Very Good

D. Conclusion

Based on the analysis results, the questionnaire used in this study was categorized as valid with an average value of validity level of 3.115 and reliable with a calculated value of 0.925 greater than the value of r-table of 0.361. Based on the teacher's perception data about the ability of the module in training students' critical thinking skills carried out by 30 high school physics teachers, it was concluded that the module developed was able to train students' critical thinking skills because they received a positive response with a percentage obtained by 77.87% with the category very good.

E. Acknowledgement

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