Validity of physics learning module based on multirepresentation to improve the problem solving ability

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Abstract. A usage of multirepresentation module either one to improve the problem solving abilities of student’s because its able to facilitate each student’s who have different abilities to knew the subject lesson be effective. To make use of this module, then it needs to be validated. The purpose of the validation is to know appropriateness of physics learning to use Aiken’s V with 5 validators (3 experts and 2 practitioners). The data collection used questionnaire method. The results by 3 experts composed of content validation 90%, construct validation 93%, language validation 84% and graphical validation 89% with valid categories. While from 2 practitioners composed of content validation 90%, construct validation 94%, language validation 86% and graphical validation 94% with valid categories. Conclusion, overall the physics learning module based on multirepresentation be avowed valid with the average 90% and it can be use to determine the improve of problem solving ability an in school.

1. Introduction

Education is the main thing that is needed by everyone. However, in reality, the quality of education in Indonesia is still classified as low, especially in the field of physics. Physics is a subject that’s difficult to learn, where the lessons of physics covers theories, laws, the formulas/equation mathematically and should have a more in-depth analysis capabilities. Therefore required capabilities that can give rise to potential student’s in learning physics, one of which is the ability of problem solving. However, in reality the physics learning in the classroom are more likely to prioritize on mastery of concept only and override the ability of physics problem solving on the student’s [1,2,3], and result in the ability of student’s in solving a problem it still belongs in the category of low [4].

Problem-solving ability is very needed by student in the learning activities to especially physics. Where is the learning in physics there is a problem-solving activity that can help learners to constructed the new knowledge and can facilitate student’s in physics learning [5]. In addition, the students also experience difficulties in solving physical problems because knowing the formula that will be used, but do not understand the meaning of qualitative conceptual from the formula [6]. Where it can be noted that the ability of the students in understanding the concept hasn't been well honed.

However, if the concept presented just emphasized to a representation, then it will benefit most from student’s and not to other student’s, so its required a lot of representations in physics learning. In addition, with the appearance of a wide variety of forms of representation in fostering a concept of predictable can help students better understand the concepts had been learned in the learning
activities. This is because that individual student have different specific ability on each individual. Where are the student’s who are more prominent on the ability of its verbal compared with the spatial and quantitative abilities, but some are otherwise. Another example is if the concepts presented only verbal representation, then the learners who already stand out with spatial ability will be the difficulty in understanding the concepts presented [7]. It is therefore necessary the appropriate learning strategies, in this case is the multirepresentation learning strategies.

The learning that used this multirepresentation not only help student’s resolve the troubles, however, used of multirepresentation in learning using concept can also give student’s the opportunity is good enough to be able to understand the concept and communicate it well [8]. Multirepresentation can also make the physics learning of students more meaningful and can understand the concept to be better. Multirepresentation can also be used to describe and represent, symbolize the object or a process [9]. Multirepresentation can increase the ability of student’s to understand the physics concept [10], as well as the use of a good multirepresentation is also the key of physics learning [11]. In addition, the use of multirepresentation can also be as key of physics learning is as helpers and drivers of student’s in building understanding of the situation more in depth [12] as well as building knowledge and problem solving [13].

However, not only the strategies in the learning that needs to be fixed, but also the ability of teachers in developing learning materials to appropriate that student’s needs in learning to achieve the goal of education. To achieve the learning objectives in education, educators as spearheading education in schools should be able to compose their own learning materials that match the characteristics of the student’s, environment and material. Where learning materials that can be developed by educators in accordance with character physics subjects in schools is in the form of modules materials, i.e. based on multirepresentation [14].

The module is the learning materials are arranged systematically educators with easy-to-understand language by student’s, where with that materials the student’s are able to learn independently [15]. Because the module is designed to enshrine the independence of students in learning activities, then its in accordance with the theory of constructivism. This constructivism theory where appropriate to the material characteristics of physics learning requires not only an understanding of concepts, theories and laws of physics that is built with facts. In addition, in mastering the concepts, theories and laws of physics student’s not only requires the learning of mathematical equations or verbally only, therefore need a learning presented through multirepresentation, which the multirepresentation used include the representation of mathematical, verbal, pictures and graphs [14]. So it can be said that multirepresentation in the modules materials learning mainly physics learning.

Based on the above listing may note that modules relating to multirepresentation, in which multirepresentation was also able to get around the student’s who basically have different specifications abilities. Therefore, then developed a physics learning modules that base on multirepresentation to enhance the problem solving ability of student’s. But instead of that, the formulation of problems that would like to be answered by researchers is whether physics learning module base on multirepresentation is capable to improve problem-solving abilities of the student’s?. Therefore, the need for validation against on the module to get answers from the formulation of the problem above.

2. Research Method

This study aimed to look at the feasibility of a product that is used by the researchers validated by 5 validators, i.e. 3 experts and 2 practitioners. Validation is performed on the stages of develop in the development model ADDIE which ADDIE development phase, namely Analysis, Design, Develop, Implementation and Evaluation. The purpose of the validation by the validators is to assess and see the truth or validity of the module as a good learning resources used by student’s. In addition, there are 4 kinds of validity that is used on materials by expert and practitioner, namely the content validation, construct validation, language validation and graphical validation.
The data collection in this study used questionnaire method. The questioners form given to 5 validators and then the final score from validators are measured using Likert scale with the Aikens’V formula. Step-by-step analysis of the validity of using the Likert Scale is as follows:

- Give a score to the excellent answer to each item (4), (3), sufficient (2) and (1).
- Add up the total score of each indicator for all validators
- Granting validity value using the formula Aikens’V, which are:

\[ V = \frac{\sum s}{n(c-1)} \]  

(1)

Where \( s = r - l_0 \), \( l_0 \) is the lowest validity assessment figures (in hail this = 1), \( c \) is the validity of the assessment to the highest number (in this case = 4) and \( r \) is the number given by the validator. Where the category validity is as [16] :

| No | Value | Criteria |
|----|-------|----------|
| 1  | \( \geq 0.6 \) | Valid |
| 2  | < 0.6 | Not Valid |

3. Result and discussion

The data already accumulated in this research is validation data of 5 validators, i.e. 3 experts and 2 practitioners, where sheets of validation of physics learning modules will be implemented in the SMAN 8 Kota Jambi. As for the results of validation experts and practitioners for an individual component validation module is presented in Table 2.

| No | The Validation Component | Expert (%) | Category | Practitioners (%) | Category |
|----|---------------------------|------------|----------|-------------------|----------|
| 1  | Content Validation        | 90         | Valid    | 90                | Valid    |
| 2  | Construct Validation      | 93         | Valid    | 94                | Valid    |
| 3  | Language Validation       | 84         | Valid    | 86                | Valid    |
| 4  | Graphical Validation      | 89         | Valid    | 94                | Valid    |

In table 2 there are content validation component consists of 12 contents statement which includes: Topics presented in the module is in compliance with the demands of KI, The topics presented in the module is in compliance with the demands of KD, The topics presented in the modules already in accordance with the demands of the indicators were formulated, The information provided add knowledge learners, The facts presented in accordance with the theory, The concepts presented are not ambiguous, The material is given in accordance with the material for the achievement KI and KD, The examples that are given up to date, Description of the material that was provided to attract the attention of student’s, e.g. the given problem can help student to understanding the material, and practice questions can helps student achieve learning objectives. Based on the validation result of validation on this component, we can see that between the expert and the practitioners alike provides value/score stating that the content validation components on module was valid/viable for use in
research. Where on the basis of Table 2 above average results contents validation of expert and practitioner validator shows numbers 90% and 90% with the valid category because of result validation is ≥ 0.6.

The components of this construct validation consisting of 12 statements include: Learning modules are presented systematically, Learning activities of base on multirepresentation module with the problem solving ability, The visualization, The describe the problem in physics, the existence of a plan the solution, Execute the plan, The existence check and evaluate material, Clearly imaged on the module concept maps, Consistency in the using of the symbol/emblem, Available guidelines and example problem to implement process related to the problem-solving ability of student, Problem-solved exercises help students to achieve learning objectives and modules list the references are clear. Based on Table 2 to see that the validation results of construct validation from experts and practitioners not to be far too, i.e. 94% and 93%, where the number obtained were ≥ 0.6. The average results shows that in part construct validation in the module has deserves to be used by researchers in his research or expressed by valid category.

In addition content and construct validation, there are language and graphical validation. Next on the language validation there’s a statement that consists of 7 statements, which statements on this component include: The language that used communicative, Language used to motivate learners to do the work, The language used is not ambiguous, The language used is clearly, Spellings used in reference to the english language has been allowed, and Consistent in using the term describing the concept. On the validation component of this language is which one of the validator is a truly expert in their fields, namely the linguistic field. From Table 2 it can be seen that the average results of language validation is ≥ 0.6 with valid category, i.e. by number 84% and 86%. The figure is not far to be embedded, this proves that the expert and practitioner validator alike declared language validation component in modules to be used is already feasible for use by researchers in his research.

The last component is graphical validation. Where is the statements that loaded in this validation component consists of 9 statement that includes the following: There is balance between the illustration picture with the caption, The combination of the writing color contained in the module interesting, Font used is clear, Font used is readable, Regular arrangement, Regular layout, Design interesting visible, Design simple visible and clear images. Based on these statements, then the average of the results validation graphical component from experts and practitioners is 89% and 94%, i.e. ≥ 0.6 by valid category. The number that resulted was connected not so much, but this is due to a slight difference in the view of graphical from experts and practitioners. But a slight difference that view does not matter in determining the appropriateness of the modules will be used. In addition, a slight difference of views is considered reasonable, because an expert and a practitioner has its own way to understand and analyze a product or module. From the description and Table 2 above, then it can be said that the average results of the graphichal validation component indicates the feasibility for use in studies by researchers.

Based on the discussion above, then the overall of validation results from the content validation, construct validation, language and graphical validation stated that physics learning module base on multirepresentation already viable used to improve problem solving ability of student’s. Where the overall average results of the validation was 90% and ≥ 0.6 by valid category. So, the conclusion of this research is physics learning module base on multirepresentation a physics-based multirepresentasi learning modules can be use to determine the improve of problem solving ability an in school.

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