Practicability of physics module based on contextual learning accompanied by multiple representations in physics learning on senior high school

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Abstract. The purpose of this research was to describe the practicability of a physics module based on contextual learning accompanied by multiple representations. Practicality of this module could be determined from observation of learning implementation using this module and student’s response after using this module. This research used development model of 4-D (define, design, develop, and disseminate). Practicality was determined to develop a step and disseminate steps. However, practicality could be determined after the module was valid. Based on the results of logic validity and empiric validity data analysis, the module could be said to be very valid with a percentage of 86.88% and 89.96% respectively. Limited trial and class trial in develop step was done in SMA Nuris Jember and disseminate trial was done in MA Nuris Jember. Based on observation of learning implementation using this module, it could be known that this module was very practical with an average percentage of 80.46%. Based on student’s responses after using the module, it could be known that this module was very practical with an average percentage of 95.22%. Therefore, the physics module based on contextual learning that accompanied by multiple representations was very practical to use in physics learning on senior high school.

1. Introduction

The challenge of Indonesia’s national development in the 21st century is to prepare qualified, professional and competent human resources in various fields of life, especially in the field of education by preparing a flexible, creative and proactive generation. Thus, the teacher plays an important role in creating creative and innovative learning. One of them is by developing teaching materials that suit their needs so that the learning process takes place effectively, efficiently and pleasantly [1].

The curriculum that was implemented from the 2013/2014 school year was the 2013 curriculum by directing the student-centered learning process. In other words, in the learning process students are directed to learn independently. One of the teaching materials that can support the student's independent learning process is the module [2]. Modules are printed teaching materials consisting of...
material descriptions, exercises, and evaluations that are designed systematically with certain formats and packaged in the form of learning units according to a particular curriculum and can be used by students to learn and understand concepts independently [3,4]. With teaching materials in the form of modules, students can learn more directed and systematically so that students can master the competencies taught in learning activities as well as possible.

Physics is a branch of natural science (IPA) which discusses nature and its symptoms, from the real (visible in real) to abstract or even in the form of theories whose discussion involves the ability of imagination or the involvement of a strong mental picture [5,6]. Thus, in the learning process Physics is expected to occur a learning process with the aim of obtaining and processing knowledge about the events and symptoms of nature [7]. The results of the identification carried out by the Ministry of National Education on the objective conditions of learning Physics in schools showed problems including 1) many students were able to memorize the material they had learned but they did not understand the concept of the material; 2) most students are not able to apply or utilize the knowledge they get, and; 3) students have difficulty understanding abstract material using only the lecture method. [8]. In addition, Physics teaching materials have been linear in nature, only presenting concepts and principles, examples of problems and solutions, and practice questions [9]. Teaching materials are less associated with real problems that exist in everyday life. Responding to these problems, we need contextual teaching materials, meaning that the teaching materials contain learning material that is related to real-world situations and conditions in the student environment so as to encourage students to apply them in daily life [10,11].

Natural phenomena in physics are formed by the interaction of various physical quantities. Functional relationships that occur between physical quantities in a natural phenomenon are usually formulated in verbal and mathematical form and then visualized in the form of images and graphics[12]. With such characteristics, students are required to have the ability to master and manage changes among different representations simultaneously [13]. Multiple representations are one of the good and developing methods to instil an understanding of physics concepts so that they can be used as an approach in developing Physics teaching materials. [14]. The form of various representations is predicted to be able to help students understand the concepts learned and the students' ability to understand the concepts becomes more evenly distributed because the presentation of concepts is not only emphasized in one representation but verbal, mathematical, image and graphic representation [12]. Multiple representations help students think creatively by connecting various forms of representation with application in real life so that the representation presented in learning Physics must be contextual [13]. Thus, one alternative teaching material that can be developed is a contextual-based Physics module accompanied by multiple representations. Physics module based on contextual learning accompanied by multiple representations is an independent student teaching material that contains a series of learning activities that are based on real problems that exist in daily life and are presented in the form of verbal, mathematical, image, and graphic representations so that the material concepts that he gets can be meaningful and can be applied in everyday life.

Teaching material has not been said to be good if it cannot be used by teachers and students [15]. Therefore, it is necessary to analyze the practicality of the modules that have been developed. According to Akker, practicality refers to the level of use in the easy, preferred, and applicable category [16]. Practicality can be measured by evaluating the learning implementation and student’s response [17,18]. Previous research has shown that students’ responses to contextual modules are very good [19]. Similar research states that students’ responses to multiple representation modules are positive [20]. Other research shows that the use of contextual-based learning modules accompanied by multiple representations gets a positive response from students [21].

2. Methods
The type of this research is research and development. The development model used by researcher is a 4-D development model (Define, Design, Develop, and Disseminate). The practicality of the module
can be determined at the development stage and the disseminate stage. However, practicality can be assessed after the module is declared valid.

Practicality was measured through observations of learning implementation using modules and questionnaires of student response after using the module. To describe the practicality of Physic modules based on contextual learning accompanied by multiple representations, the formula for the percentage of learning implementation (P) is as follows:

\[
P = \frac{\text{number of aspects implemented}}{\text{number of all aspects}} \times 100\%
\]  

With practicality assessment criteria can be seen in Table 1 below.

**Table 1. Practicality assessment criteria**

| Number | Percentage (%) | Practicality Criteria | Information |
|--------|----------------|-----------------------|-------------|
| 1      | P > 80         | Very Practical        | Not revised |
| 2      | 61 < P ≤ 80    | Practical             | Not revised |
| 3      | 41 < P ≤ 60    | Practical Enough      | Not revised |
| 4      | 21 < P ≤ 40    | Less Practical        | Revised     |
| 5      | P ≤ 20         | Not Practical         | Revised     |

To describe the practicality of the module based on the response questionnaire given to students, the formula is used:

\[
P = \frac{N}{M} \times 100\%
\]

**Information:**
P = percentage of student responses  
N = number of scores obtained  
M = maximum number  

With student response criteria can be seen in Table 2 below.

**Table 2. Student response criteria**

| Number | Percentage of student’s response (%) | Criteria |
|--------|-------------------------------------|----------|
| 1      | 81-100                              | Very good|
| 2      | 61-80                               | Good     |
| 3      | 41-60                               | Good enough|
| 4      | 21-40                               | Less     |
| 5      | 0-21                                | Very Less|

3. Results and Discussion

The practicality of the module can be determined at the development stage and the disseminate stage. However, practicality can be assessed after the module is declared valid. Based on the results of logic validity and empiric validity data analysis, the module could be said to be very valid with a percentage of 86.88% and 89.96% respectively. Practicality was measured through observations of learning implementation using modules and questionnaires of student response after using the module. The observation of learning implementation using modules was carried out by three observers from the education community, namely one Physics subject teacher at SMA Nuris Jember and two other people who graduated from the Physics education of Jember University. Assessment is done by filling out the questionnaire of learning implementation using modules at each meeting.
The graph of the average percentage of learning implementation observations using a module from the first stage of development trials (limited trials), the second stage (class trials), and the disseminate stage can be seen in Figure 1 below.

![Graph of the average percentage of learning implementation at each stage of development](image1.png)

**Figure 1.** Graph of the average percentage of learning implementation at each stage of development

Based on Figure 1 above, it is known that the percentage of learning implementation in the limited trial is 73.61%, in the class trial is 83.47%, and at the dissemination stage is 84.31% so that there is an increase in the practicality of the module based on the learning implementation at each development stage with an average of overall stage is 80.46%. Thus, it can be said that based on the aspects of the learning implementation, the Physics module based on contextual learning accompanied by multiple representations is very practical to use in Physics learning. This is in accordance with the theory according to Widoyoko which states that product development is said to be very practical to use if the percentage of practicality is more than 80% [22]. The increase in module practicality occurs because the module is still going through a revision process based on observer suggestions at each development stage so that the resulting modules are more practical and easy to use in the learning process. This is supported by a similar study by Fatmala which states that multiple representation modules based on contextual are easy to use in the process of learning Physics [23].

The graph of the average percentage of student’s response after using a module from the first stage of development trials (limited trials), the second stage (class trials), and the disseminated stage can be seen in Figure 2 below.

![Graph of the average percentage of student’s response at each stage of development](image2.png)

**Figure 2.** Graph of the average percentage of student’s response at each stage of development
Based on Figure 2 above, it is known that the percentage of student’s response in the limited trial is 94%, in the class trial, is 95%, and at the dissemination stage of 96.67% so that there is an increase in the practicality of the module based on the student’s response at each development stage with an average of the overall stage is 95.22% with a very good category. This is in accordance with the theory according to Riduwan which states that the student’s response to the module is said to be very good if the percentage of student responses is 81% to 100% [23]. The increase in the percentage of students' responses to the module is because Physics modules based on contextual accompanied by multiple representations can motivate students to learn independently by understanding the application of the learning material in everyday life. This is supported by similar research which states that contextual modules can help students associate material with real life so that they can motivate students to learn meaningfully [24]. In addition, the multiple representations add to the students' interest in learning modules. This is supported by the results of research which states that multiple representations are the key in learning Physics, thus motivating students to learn how to use various forms of representation in understanding Physics. Thus, it can be said that based on the aspects of the learning implementation, the Physics module based on contextual learning accompanied by multiple representations is very practical to use in Physics learning.

4. Conclusion
Based on result and discussion above, we can conclude that Physics module based on contextual learning accompanied by multiple representations was stated to be very practical with the percentage of learning implementation is 80.46% and percentage of student response is 95.22%.

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