Development of mathmodule based on local wisdom and 21st century skills: linear equation system

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Abstract. The purpose of this research is to develop a math module that emphasizes aspects of local wisdom and 21st century abilities. Procedure in this study refers to the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model. The instruments used in this study are using test and non-test. Non-test instruments used in the form of a questionnaire to determine the assessment of experts and a questionnaire to determine student responses, while the test instrument is used to determine the feasibility of the product based on the percentage of student mastery learning. In this study involving media experts and content experts from teachers and lecturers who are experts in their respective fields. The number of subjects in this study were 29 students. The results showed that the percentage score obtained from media experts 93.81%, from material experts 87.56%, student responses 84.56%, and percentage of total students who achieve mastery learning 75.86%. In addition, the effectiveness test showed that the average of student learning outcomes above the passing grade score. Based on these results it can be concluded that the Math Module is feasible to use and can be used as teaching material in the learning process for teachers and students.

1. Introduction

Teaching material is one of the important components needed in the learning process both by the teacher and students [1]. There are two types of teaching materials, namely printed and non-printed. Currently, there are many teaching materials which consist of non-printed such as interactive portable document format (PDF), interactive power point, web-based learning, etc. Non-printed teaching materials can easily be accessed by students using their gadget. Indeed, there are some students who prefer to learn from non-printed teaching materials, but there are still many students who prefer to learn from printed teaching materials. The reason of some students still learn from printed teaching materials is emitted by gadgets makes their eyes tired if used for a long time, so students can’t learn for a long time. Therefore, some students choose to learn from printed teaching materials.

One of the printed teaching materials is a module. The module is one of the learning materials commonly used by students. Teaching materials such as modules are needed so that the learning process in the classroom is more structured [2]. Modules are one form of teaching materials that are arranged systematically based on a particular curriculum and have specific objectives that enable students to learn independently [3]. Modules as one of the teaching materials are very useful in the teaching and learning. A module is a book written with the aim that students can study independently without teacher direction or guidance. It means that module can be used for learning even though there are no instructors.
None of the modules currently available emphasize on aspects of local wisdom and 21st century abilities. Learning based on local wisdom is very important to be applied by teachers in learning to improve student knowledge and understanding, and as a tool to instill pride to their local wisdom. Positive character training in accordance with the values of the local wisdom of the region can equip students to deal with all problems outside of the school [4]. The importance of local wisdom values are separate tasks for teachers so that their students are able to compete and adapt to changes in the future. Teachers are required to innovate in presenting local wisdom values in the learning process. Therefore, the values of local wisdom can be raised, one of which is in teaching materials used by students.

In addition to aspects of local wisdom, 21st century abilities are also very important to be mastered by students. A field survey shows a trend towards the importance of basic mathematical abilities in the world of work [5]. Living and working in the 21st century, according to ministry predictions will require knowledge, skills, results, standards and systems that have not been provided by schools. Thus, Indonesia needs qualified human resources in the fields of mathematics and science and technology in order to keep abreast of the times [6]. Success of a student depends on 21st century skills, so students must have it. These skills including critical thinking and problem solving, collaboration, and communication skills. These are commonly referred to as 4Cs (Critical thinking and problem solving, Creativity, Collaboration, and Communication skills) [7]. Students are expected to have the ability of the 21st century to be able to keep abreast of the times. 21st Century Skills are skills needed by students to face life and work environment in the 21st century that are more complex and unpredictable, so these abilities are absolutely mastered by students. Therefore, this research will develop teaching materials in the form of modules that emphasize on the values of local wisdom and 21st century abilities. Hopefully, this module can facilitate student learning to maintain aspects of local wisdom and be able to master 21st century abilities.

2. Method

The procedure in this study refers to the ADDIE model. The ADDIE model contains five stages, include: Analysis, Design, Development, Implementation, and Evaluation [8]. At analysis stage, researcher define the problem, identify the beginning of the problem, and determine the solution of the problem. At design stage, there are results from the solution of the problem in the first stage, to plan product development strategies. At this stage, the researcher designs how to achieve the desired target according to the analysis stage. At the development stage, the product begins to be made and developed in such a way, starting from the design, content, examples of questions and their discussion, assignments, and exercises. Implementation stage includes validity test by experts. There are two validation in this study, namely content and media validation test with each validation test involving three experts. One of the criteria as an expert is experienced in the relevant field for at least five years. The final stage is evaluation. At this stage, the results of product validation are analysed using the specified percentages and criteria.

The subjects in this study were eight grade students of SMP Negeri 7 Cilegon, Banten Province. The number of subjects in this study were 29 students. The instruments used in this study are using test and non-test instrument. Non-test instrument is using a questionnaire to determined expert validation and student responses, while the test instrument to determine the eligibility of the product from the percentage of student mastery learning score. There are two kinds of data generated from this study, namely quantitative data generated from closed questionnaires with Likert scale and test instruments for student learning outcomes, while qualitative data are obtained from expert comments and suggestions.

Quantitative data on the results of closed questionnaire filled out by experts and students were analysed using descriptive quantitative techniques to determine the level of product eligibility, using the following formula:

\[
\text{Percentage of final grade} = \left( \frac{\text{average score}}{\text{maximum score (100)}} \right) \times 100\% \tag{1}
\]
The level of product eligibility is determined through the percentage of student who achieve mastery learning. The percentage is obtained from the following formula:

\[
\text{Percentage of total student mastery learning} = \frac{\text{total student who complete their learning}}{\text{total student}} \times 100\% \quad (2)
\]

Eligibility criteria are determined based on percentage of final grade and percentage of student mastery learning. Products are feasible if only if the percentage of final grade and percentage of student mastery learning more than 70%. If the percentage is less than 70%, the product is not feasible and it has to correction based on the research objectives.

3. Result and Discussion
Module which developed in this research is specifically for the topic of linear equation systems of two variable for eighth grade junior high school students. There are six indicators of competency achievement in this module, namely: 1) identifying the linear equation of two variables; 2) make a linear equation of two variables; 3) identify the solution of linear equations of two variable; 4) create the linear equation system of two variable; 5) make a mathematical model and determine the solution of the linear equations system with the graphical method; and 6) make a mathematical model and determine the solution of the linear equations system by substitute and eliminate method.

This module developed based on local wisdom and 21st century abilities, which are then called the Math Modules. The Math Module contains learning material, examples of questions and their discussion, assignments, exercises, and competency tests. The context of local wisdom, especially Banten, is found in the description of learning materials, examples of questions, and exercises that are equipped with relevant pictures. The context of Banten's local wisdom is inserted in the description of learning material in the module so that students are able to maintain and preserve their culture.

The 21st century aspects of capability in this module are focused on four abilities commonly referred to as the 4Cs, namely critical thinking and problem solving, creativity, communication, and collaboration. These abilities are applied in the description of assignment, exercises, and competency test questions. The existence of these four abilities supports students to be active in learning. The following are some pictures of the Math Module.

![Module cover](image)

**Figure 1.** Math module cover.

This section displays the front page of the Math Module in blue base which contains the name of the module development team, module title, material in the module, and the reference curriculum used in
the module. "Berbasis Kearifan Lokal Banten dan Kemampuan Abad 21" are also included on the front page of the module to show that this module not only contains material descriptions, but also includes aspects of local wisdom, especially Banten and 21st century abilities that distinguish this module from other modules.

![Figure 2. Math module guide.](image)

Figure 2 displays the module usage guide page. This page briefly explains the content contained in the module. In addition, it also explains the symbol in the assignment and also the icon in the description of the exercises and competency test.

![Figure 3. Aspects of 21st century skills.](image)
Figure 3 shows some exercises that measure aspects of 21st century abilities, namely critical thinking, creative, and communication. For the aspect of collaboration, students are required to solve problems related to the linear equations of two variables together. This is done so that they are accustomed to and able to work in groups.

Figure 4 shows an example of material description in a module relating to one of Banten's local wisdoms, namely Rabeg. Rabeg is one example of typical foods originating from Banten Province. The Math Module is further tested by experts. The experts in this study were divided into two groups, media and content experts, each with three experts. The results of the media expert validation are used to determine the eligibility of the product of Math Module in the presentation and graphic aspects. The results of media expert validation can be seen in Table 1.

### Table 1. Media expert validation

| No | Aspects   | Percentage of Final Grade (%) | Criteria |
|----|-----------|------------------------------|----------|
|    |           | Expert 1 | Expert 2 | Expert 3 | Average |
| 1. | Presentation | 92.00  | 96.00  | 96.00  | 94.67   | Feasible |
| 2. | Graphic    | 97.80  | 93.30  | 88.90  | 93.33   | Feasible |
|    | Total Percentage (%) | 95.70 | 94.30  | 91.40  | 93.81   | Feasible |

Total percentage for presentation aspect is 94.67% and categorized as very feasible, while total percentage for graphic aspect is 93.33% and categorized as very feasible. According to Table 1, an overall score was obtained for the media expert test involving three expertsis 93.81%. This result can be concluded that the overall score for the media expert validation has very good eligibility criteria.

The results of the content expert validation are used to determine the eligibility of the product in the content and language aspects. The results of content expert validation can be seen in Table 2.

### Table 2. Content expert validation

| No | Aspects | Percentage of Final Grade (%) | Criteria |
|----|---------|------------------------------|----------|
|    |         | Expert 1 | Expert 2 | Expert 3 | Average |
| 1. | Content | 90      | 88       | 80       | 86      | Feasible |
| 2. | Language | 92     | 100      | 80       | 90.67   | Feasible |
|    | Total Percentage (%) | 90.67 | 92      | 80       | 87.56   | Feasible |
According to the Table 2, total percentage for content aspect is 86% and categorized as very feasible, while total percentage for language aspect is 90.67% and categorized as very feasible. An overall score was obtained for the content expert test involving three experts at 87.56%. This result can be concluded that the overall score for the content expert test has very good eligibility criteria.

There are two instruments in product trials, namely test and non-test instrument. Non-test instrument use is a questionnaire to determine student responses to the products of math module, while test instrument use essays to determine student mastery learning score. The results of student response can be seen in Table 3 below.

### Table 3. Student responses.

| No. | Aspects   | Percentage of Final Grade (%) | Criteria |
|-----|-----------|-------------------------------|----------|
| 1.  | Content   | 85.34                         | Feasible |
| 2.  | Language  | 84.69                         | Feasible |
| 3.  | Presentation | 84.14                     | Feasible |
| 4.  | Graphic   | 86.90                         | Feasible |
|     | Total Percentage (%) | 84.56                     | Feasible |

According to Table 3, total percentage of student responses is 84.56% and categorized as very feasible. It can be concluded total percentage of student responses have a very decent level of eligibility criteria. In addition to responding the products, students are also given test in the form of essays. This test is used to determine the level of product feasibility through the percentage of mastery learning score. The results of student learning outcomes can be seen in Table 4.

### Table 4. The achievement of student learning outcomes.

| No. | Variables                                      | Score  |
|-----|-----------------------------------------------|--------|
| 1.  | Total students                                 | 29     |
| 2.  | Passing grade score                            | 75     |
| 3.  | Minimum score                                  | 30     |
| 4.  | Maximum score                                  | 100    |
| 5.  | Average score                                  | 81.03  |
| 6.  | Percentage of total students who achieve mastery learning | 75.86% |

According to Table 4, the percentage of student mastery learning score is more than 70%. It can be concluded that the product based on the percentage of student mastery learning has good feasibility criteria. In the interview session, students said that through this math module they can learn on their own to explore the concepts learned in the class. Students can also learn mathematics concepts in a structured and systematic way.

Table 4 also shown that students who learn using the Math Module obtain an average learning outcome of 81.03 which is above the passing grade score. This result is possible because the module can provide immediate feedback so students know their shortcomings and immediately make their own improvements. In addition, each student has a different learning speed. Through the Math module, students have the opportunity to complete learning in accordance with their own learning speed and abilities. Math Modules also provide students the opportunity to study with sufficient time to master the subject matter.

Math Modules as a form of teaching materials have functions such as independent teaching materials and evaluation tools. The existence of modules and their use can make students able to learn
on their own [9]. Students can learn independently by using modules without always depending on the teacher's presence [10]. This makes students have the skills to dig up information and develop it independently, not always having to depend on the teacher. Through this Math Module, students can also continue to practice solving problems that can improve their abilities according to their own learning environment. Some of relevant studies have proven that the use of modules helps the effectiveness of teaching and learning for both students and lecturers [11–13].

4. Conclusion
Module which developed in this study is called the Math Module. The results of the media expert validation obtained an overall score 93.81% with feasible category. The results of the content expert validation obtained an overall score 87.56% with feasible category. Total percentage of student response to product is 84.56% with feasible category, while the percentage of total student who achieve mastery learning score is 75.86% with feasible category. The effectiveness of the use of Math Module showed that the average of student learning outcomes is 81.03 above the specified passing grade score. This result means that the Math Module is feasible to use and can be used as teaching material in the learning process for teachers and students.

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