Moh. Mahfud_UMM_Jurnal Artikel Al Ishlah

by Turnitin ®

Submission date: 06-Feb-2023 09:30PM (UTC+0800)
Submission ID: 2007602397
File name: Moh._Mahfud_UMM_Jurnal_Artikel_Al_Ishlah.docx (655.05K)
Word count: 5571
Character count: 31821

Al-Ishlah: Jurnal Pendidikan
Vol.14, 1 (January, 2023), pp. 61-70
ISSN: 2087-9490 EISSN: 2597-940X, DOI: 10.35445/alishlah.v14i1.973

Development of Active Learning-Based Math Modules Type The Power of Two in the Junior High School Curriculum

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ARTICLE INFO

Keywords:

Module;
Valid;
Active Learning;
The Power of Two;

Article history:

Received 2021-08-14
Revised 2021-11-12
Accepted 2022-01-17

ABSTRACT

Modules in learning emphasize more on the activeness and activity of students. This study aims to develop a mathematics module based on the Active Learning strategy type The Power of Two. This study uses an R&D research design with the ADDIE model, which consists of 5 stages: analysis, design, development, implementation, and evaluation. This study involved three validators in assessing the validity of the module and 12 small group students to test student responses to the module, which was used to assess the practicality of the module. Based on the research results, it is known that the module developed has very valid criteria, with a percentage of 91,48% by two expert lecturers and a math teacher. The results of student response tests used to assess the practicality of the developed module have very practical criteria, with a percentage of 90,22% by students. This shows that the mathematics module developed on the basis of the Active Learning strategy type The Power of Two, is very valid and very practical.

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1. INTRODUCTION

The curriculum is a core part of the implementation of education. Over time, the curriculum in Indonesia often changes. Currently, the curriculum that can be an option to be implemented at the junior high school level is the 2013 curriculum. The 2013 curriculum demands student-centered learning, so it is expected to be an active learner. The 2013 curriculum also emphasizes the active involvement of students in the learning process, which aims to gain direct experience and be trained to discover the knowledge they are learning for themselves. The 2013 curriculum requires students to be active and have new knowledge in learning, especially in learning mathematics (Febriyanti & Mandasari, 2020; T. F. Rohmah & Sumardi, 2020).

Learning mathematics requires student activity. This statement is in line with the opinions of Betyka, Putra, & Erita (2019) and S. N. Rohmah (2021) that learning mathematics is a learning activity in which

students are actively involved in building mathematical knowledge in their way. However, the fact is that some students do not like learning mathematics because they consider mathematics a difficult subject (Febriyanti & Mandasari, 2020; Mashuri, 2019; Rosmala, 2021; Sitorus, 2021). As a result, students become lazy to follow mathematics learning. Interest in learning mathematics is still lacking (Sumartini & Fitri, 2021). Thus, the activity and activeness of students is low. Meanwhile, student activity and activity is an indicators of the success of the learning process (Sihaloho, Sitompul, & Appulembang, 2020). Therefore, it is necessary to develop learning devicess that can direct student activity to achieve success in the mathematics learning process. This statement is in line with Aprianti et al. (2021) argument that learning devices can influence learning success.

Learning devices are used as a reference in a lesson. This is because learning devices are indicators of good-quality learning (Effendi & Susanti, 2021). Learning devices in learning activities are in the form of syllabi, lesson plans, textbooks, modules, and others that are used as implementation plans in learning (Delfero & Handayani, 2020). Learning devices that are able to activate students are modules. This is in accordance with the opinion of Ilahiyah, Yandari, & Pamungkas (2019) that modules can help students learn actively to understand lessons.

The module directs student activity because the module focuses on student activity. This statement is reinforced by Khoirudin (2019) that the module focuses on student activity and student creativity in the learning process. In addition, learning objectives can be achieved using modules (Putri Rosyadi & Khusna, 2020). Modules can be used to measure student abilities (Ummah, 2021). Modules are arranged as creatively as possible (Ismail & Jamil, 2019). In using the module, students must be able to build on the knowledge they have. So students must be more active than teachers. Thus the module needs to be designed based on learning strategies. This is because learning strategies are able to attract and activate students in learning (Nirwana & Rezeki, 2020). A learning strategy that is able to activate students is Active Learning (Alfiani, 2021).

This active Learning is able to keep students' attention focused on learning (ellisa fitri tanjung, Tobroni, Samsul Hady, 2019). Active Learning can optimize the learning process (Uno & Mohamad, 2022). In active Learning, students must actively express ideas (Asmani, 2016). Active Learning objectives are classified into three; that is, students are conditioned from the start to be active, support students to acquire knowledge, skills, and attitudes actively, and strengthen students' memory (Kamalia, Nasution, & Nasution, 2022). The Active Learning strategy focuses on the involvement and activeness of students in the learning process. This statement is reinforced by the opinions of Neti & Amini (2020); Rahayu, SD, & Vidya (2022); Sunarsih & Yulianti (2021) that the Active Learning strategy directs students to be active and motivated in learning. When students are actively learning, students will dominate the lesson (Hartono & Yetyastuti, 2019). Therefore, learning modules are designed based on Active Learning learning strategies that aim to direct student activity and activeness. The type of Active Learning chosen is The Power of Two because this type can activate students (Ardi, Latuconsina, Angriani, & Kusumayanti, 2020).

The Power of Two type involves two people. The Power of Two type requires students to work in pairs so that students are active (Nirwana & Rezeki, 2020). So with this type students play an active role in the learning process.

A similar study was conducted by Aldo, Revita, & Nurdin (2021) with the title Development of Problem-Based Learning Modules in Class VIII Middle School Statistics Material. The results of this study indicate that the PBL-based module on junior high school statistics can increase student activity and interest. Based on previous research, it is necessary to develop another strategy-based module, namely the Active Learning strategy. Learning mathematics using the Active Learning learning strategy type The Power of Two directs student activity and activeness. So what distinguishes this research from research conducted by Aldo, Revita, dan Nurdin is the learning strategy.

Several previous studies discussed the development of mathematics modules based on different learning strategies. One of them is the development of Active Learning-based math modules. However, there has been no research in the form of developing a mathematical module based on the Active Learning

type The Power of Two. So what distinguishes the development of the mathematics module in this study from previous research lies in the type of Active Learning chosen.

Based on the description above, a mathematics module based on the Active Learning type The Power of Two, will be developed in the junior high school curriculum. So the purpose of this research is to develop a module based on the Active Learning type The Power of Two in the junior high school curriculum. The results of this study contain the validity and practicality of the Active Learning-based mathematics module type The Power of Two in the junior high school curriculum.

2. METHODS

The research design used in this research is Research and Development (RnD). The development model used is the ADDIE model; the stages consist of analysis, design, development, implementation, and evaluation (Nababan, 2020; Purwaningsih, Anggoro, & Fadila, 2019). The analysis phase aims to conduct a preliminary study. The preliminary study of this research was carried out by observation and interviews. Observations and interviews were conducted to determine material requirements, lesson plans, and learning tools related to mathematics. At the design stage, the aim is to design learning tools that are in accordance with the characteristics of mathematics lessons and material needs, student conditions, and student needs in general. At the development stage, it aims to develop the module into a complete form that has been revised and validated by expert lecturers and mathematics teachers. Modules that have been revised according to the suggestions of expert lecturers and math teachers will then be validated. At the implementation stage aims to conduct trials. Module trials were carried out in junior high schools. Each student uses the module. Students are given the opportunity to study the material in the module. Then students are given a student response questionnaire for module assessment. At the evaluation stage an analysis of the practicality criteria of the module is carried out. The practicality criteria of the module can be known based on student response questionnaire data.

The research was conducted at Muhammadiyah 1 Malang Junior High School. Subjects or respondents who participated in this study were class VIII students of Muhammadiyah 1 Malang Junior High School, with details of a small group of 12 students. The research was conducted in December 2022.

Data collection techniques in this study were interviews, observations, and questionnaires. The questionnaire was prepared based on the Likert scale used to test the validity of the module by expert lecturers and mathematics teachers and the practicality test questionnaire by students. The following is a table of assessment questionnaire scales.

Table 1. Assessment Questionnaire Scales

Score	Description
5	Very good
4	Good
3	Enough
2	Not enough
1	Very less

The following is a grid of expert lecturer and mathematics teacher module assessment questionnaires. This grid is a reference in making module validation assessment sheets. The module validation assessment sheet grid table is presented as follows.

Table 2. Module Validation Sheet Grid

Number	Aspect	Indicators	Number of Item	Item Number
1	Module Design	The illustration of the module cover describes the	1	1

		contents/teaching materials and reveals the object's character.		
		The module title color contrasts with the background color.	1	2
		Do not use too many font combinations.	1	3
2	Didactic Requirements (according to the principles of effective learning)	Modules can be used for all levels of student ability.	1	4
		The module emphasizes the process of discovering concepts.	1	5
		Have a variety of stimuli through various media and student activities to provide opportunities for students to write, draw, and dialogue with friends.	1	6
3	Content Feasibility Aspects	Conformity of material with core competencies, basic competencies, and indicators.	1	7
		The concept of presenting material in the module is easy for students to understand.	1	8
4	Aspects of Language Feasibility	The language used is easy for students to understand.	1	9
		Conformity with good and correct Indonesian rules	1	10
5	Based on Active Learning	The module can encourage student learning activities.	1	11
		The module can encourage students to be actively involved in learning.	1	12
		The module attracts students' interest.	1	13
6	Based on the Power of Two type	Modules can encourage students to work in groups or collaborate.	1	14

The following is a student response questionnaire grid on the module. This grid becomes a reference for making student response questionnaires to determine the practicality of the module. The student response questionnaire grid table is presented as follows.

Table 3. Student Response Questionnaire Grid

Number	Aspect	Statement	Item Number
1	Graphic	The module has an attractive appearance.	1
		Pictures on interesting modules.	2
2	Language	The language in the module is easy to understand.	3
		The text on the module is clear and easy to read.	4
3	Utilization feasibility	Learning using modules becomes practical.	5
		Modules make learning effective.	6
		The use of modules makes learning easier.	7
4	Content	The questions in the module make it easier for students to understand the material.	8
5	Student engagement	The use of modules makes students become active in learning.	9
		The use of modules encourages students to collaborate with other students.	10

The data analysis technique used to manage the data obtained in this study is descriptive statistical analysis. The validity level of the module is obtained by calculating the percentage using the following formula:
(Karina, Yulita, & Ramdhani, 2019)

$$\text{Validity Percentage (\%)} = \frac{\text{total score of research result}}{\text{expected score}} \text{ x } 100\%$$

After obtaining the percentage of module validity, then this value will be matched with the validity table to determine the module validity criteria. The following is the validity table (Alimin & Effendi, 2020).

Table 4. Validity Criteria

Number	Achievement Level (100%)	Score
1	81 – 100	Very Valid
2	60 – 80	Valid
3	40 – 60	Quite Valid
4	20 – 40	Less Valid
5	0 – 20	Invalid

The practicality criteria of the module based on the student response questionnaire data are obtained by calculating the percentage using the following formula:
(Alimin & Effendi, 2020)

$$\text{Practical Value} = \frac{\text{the total score obtained}}{\textit{maximum score}} \text{ x } 100\%$$

After obtaining the practicality value of the module, this value will be matched with the practicality table to determine the practicality criteria for the module. Here is a practicality table (Alimin & Effendi, 2020).

Table 5. Practicality Kriteria

Number	Achievement Level (100%)	Score
1	81 – 100	Very Practical
2	60 – 80	Practical
3	40 – 60	Quite Practical
4	20 – 40	Less Practical
5	0 – 20	Impractical

3. FINDINGS AND DISCUSSION

Analysis

This development begins with the analysis stage, which is carried out by interviews and observations to determine the material needs of students and innovative products according to student characteristics. The results obtained from interviews and observations in class VIII Muhammadiyah 1 Malang Junior High School, namely, the subject matter of mathematics that demands student activity is a system of two-variable linear equations. In addition, learning tools are also needed to direct student activity because schools do not yet have Active Learning-based modules. For core competencies, basic competencies, and learning device indicators will be adjusted to those listed in the learning implementation plan.

A mathematics module based on the Active Learning type The Power of Two, will be developed based on the problems above. There is software used to create this module. The software required is Microsoft Word. This software is used for word processing. In addition, Microsoft Word is also used to create module covers.

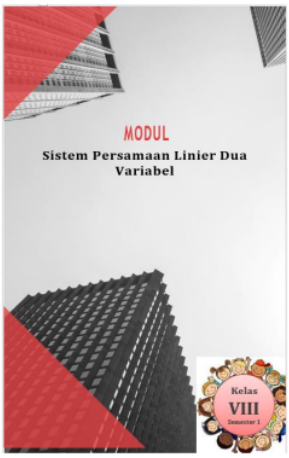
Design

The second stage in this development is design. Design activities are carried out by compiling schedules in the preparation of Active Learning-based math modules, designing module components, and arranging the layout of Active Learning-based module components. The designed module components include (1) Cover; (2) preface; (3) table of contents; (4) glossary; (5) introduction; (6) learning activities; (7) summary; (8) exercise; (9) reflection; and (10) bibliography. The arrangement of module components also includes the arrangement of text and images. The results of this activity are in the form of module component designs, module component layouts, and module arrangement flowcharts.

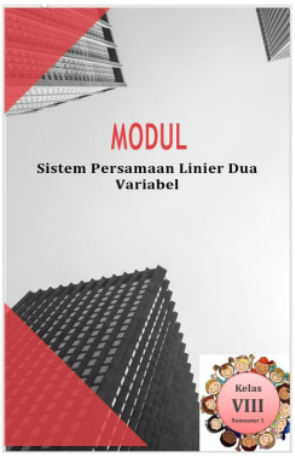
Development

The development stage aims to create a complete module that has been validated and revised based on suggestions and input from the validator. The validity test aims to determine the validity criteria of the developed module. The module was validated by two expert lecturers from the University of Muhammadiyah Malang and a math teacher from Muhammadiyah 1 Malang Junior High School. The aspects assessed include module design, didactic requirements, content feasibility, language feasibility, Active Learning, and The Power of Two. The validator provides suggestions for modules. The suggestions are as follows:

1. Enlarge the title on the module cover



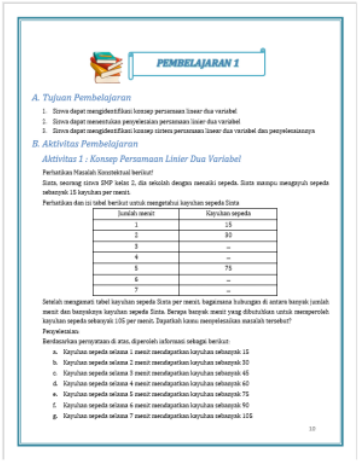
(a) Title on the cover module before revision



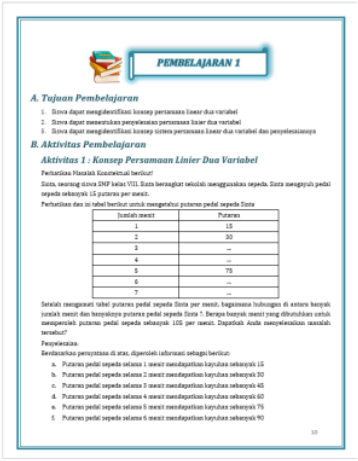
(b) Title on the cover of the module after revision

Figure 1. Module cover before and after revision

2. Sharpen the color of the sub-chapter text in the module



(a) The color of the module sub-chapter text before revision



(b) The color of the module sub-chapter text after revision

Figure 2. The color of the sub-chapter text before and after revision

After the module is revised, the validator gives an assessment of the module validation sheet. Data processing is calculated based on each aspect. The following results from the data processing validation sheet math module based on the Active Learning type The Power of Two in the junior high school curriculum.

Table 6. Results of Validation of Each Aspect

Aspect	Score
Module Design	82,22 %
Didactic Requirements	93,33 %
Content Feasibility Aspects	93,33 %
Aspects of Language Feasibility	93,33 %
Active Learning	93,33 %
Type The Power of Two	93,33 %
Average	91,48 % (**Very Valid**)

The module design aspect in the table above obtained a percentage of 82,22% which is classified as a very valid criterion. The cover illustration for the module already describes the contents or teaching materials and reveals the character of the object. The developed module has a title color that contrasts with the background color. The developed module does not use too many font combinations. The didactic aspect of the module obtained a percentage of 93,33% which is classified as a very valid criterion. This means that the module can be used for all levels of student ability. In addition, this module emphasizes the concept discovery process. Then the module has various stimuli through various media and student activities, thus providing opportunities for students to write, draw, and have a dialogue with their friends. The feasibility aspect of the contents of the module obtained a percentage of 93,33% which is included in the very valid criteria. This means that the material is in accordance with core competencies, basic competencies, and indicators. In addition, the presentation of the material in the module is easy for students to understand.

The language feasibility aspect of the module obtained a percentage of 93,33% which is included in the very valid criteria. This means that the language used in the module is easily understood by students. In addition, the language in the module is in accordance with the rules of good and correct Indonesian. The Active Learning aspect of the module obtains a percentage of 93,33% which is included in the very valid criteria. This means that the module directs to encourage student learning activities. The briefing module encourages students to be actively involved in learning. In addition, the module attracts students' interest. The Power of Two type aspect of the module obtains a percentage of 93,33% which is included in the very valid criteria. This means that the module is able to encourage students to work in groups or collaborate with each other.

Based on table 6, the module validity value is 91,48%. This value is included in the very valid criteria. This means that the modules that have been developed can be declared very valid. Furthermore, the module is ready to be tested on students.

Implementation

The fourth stage is implementation. Modules that have been declared valid are then printed in as many as 12 modules. Then the module is tested in learning at school. The trial was carried out in small groups consisting of 12 students, namely class VIII students of Muhammadiyah 1 Malang Junior High School. The tryout was carried out on December 23, 2022. The tryout was carried out by means of students studying the modules. Then students are given a response questionnaire for module assessment. Students were asked to fill out a response questionnaire. After obtaining the student response questionnaire data, the data will be processed in the form of a percentage. The data that has been processed will be used to determine the practicality criteria of the module.

Evaluation

The final stage is evaluation. Evaluation is carried out to determine the practicality criteria of the modules that have been developed. The practicality of this module can be seen from the student response questionnaire that has been filled in. The following table presents the average practicality percentage of the module based on the calculation of the student response questionnaire.

Table 7. The Average Percentage of Practicality of The Module

Aspect	Score
Graphic	90,83 %
Language	91,67 %
Utilization feasibility	89,44 %
Content	88,33 %
Student engagement	90,83 %
Average	90,22 % (**Very Practical**)

The graphical aspect of the module obtained a percentage of 90.83% which is a very practical criterion. This shows that the module has an attractive appearance and that the images on the module are attractive. The linguistic aspect of the module obtained a percentage of 91.67% which is included in the very practical criteria. This shows that the language in the module is easy to understand, and the text in the module is clear and easy to read. The feasibility aspect of using the module obtained a percentage of 89.44% which is included in the very practical criteria. This shows that learning using modules is practical, modules make learning effective, and using modules makes learning easier. Aspects of module content obtained a percentage of 88.33% which includes very practical criteria. This shows that the questions in the module make it easier for students to understand the material. Aspects of module content obtained a percentage of 90.22% which includes very practical criteria. This shows that the use of modules makes students active in learning, and the use of modules encourages students to collaborate with other students.

Based on table 7 above, the average practicality of the module based on the student response questionnaire data obtained a percentage of 90,22%. Thus, the practicality of the modules that have been developed is included in the very practical criteria.

Discussion

Based on the assessment of expert lecturers and mathematics teachers, the module is included in the very valid criteria with a score of 91,48%. The practicality of the Active Learning-based module type The Power of Two in the junior high school curriculum is included in the very practical criteria with a percentage of 90,22%. On the results of the assessment of the Active Learning aspect, a score of 93,33% was obtained, included in the very valid criteria. Meanwhile, the type aspect of The Power of Two is also said to be very valid, with a percentage of 93,33%. So, it can be said that the module focuses on student activity and activeness and directs students to collaborate with other students. Student activity is influenced by several factors, including the learning process, the media used, and student motivation (Danver, 2016; Nawas, 2018; Sugiarti, Taufik, Rosyadi, Khusna, & Azmi, 2018). This study states that the module used can be used as a reference for student activities. Student activity itself is an important aspect of learning (Alfiani Athma Putri; Rosyadi & Sa'dijah, Cholis; Susiswo; Rahardjo, 2022). This is also in line with the results of research by Yazar Soyadı (2015) which states that student activity is related to students' critical thinking.

From the results of the explanation above, it can be seen that the development of a mathematics module based on the Active Learning type The Power of Two in the junior high school curriculum can be stated to be very valid and very practical. The Active Learning aspect is also very valid. This means that the module was developed based on an Active Learning strategy. Where this module will direct students to be active in learning. This module will emphasize the activities and activeness of students. Meanwhile, the type aspect of The Power of Two is also very valid. That is, this module was developed based on the type of The Power of Two. Where this module directs students to work in groups with other students. Furthermore, the content feasibility aspect is included in the very valid criteria. Where this aspect includes the suitability of the material with core competencies, basic competencies, and indicators. These Core Competencies, Basic Competencies, and Indicators have been adapted to the 2013 Curriculum for Junior High Schools. So that this module can be used for junior high school level.

Research on the application of learning modules has been carried out by Mirkouei, Bhinge, McCoy, Haapala, & Dornfeld (2016) and Alfiani Athma Putri Rosyadi (2018). The results of the two studies state

that using modules can facilitate students in using conceptual and procedural abilities. Research by Yasa, Chrisyarani, Akbar, & Mudiono (2018) states that modules can activate students during the learning process. This shows that it is important to prepare modules to support the instrument (Effendi & Irene, 2021).

Neti & Amini (2020) Explain that Active Learning directs students to be active and motivated in the learning process. So the Active Learning strategy here places more emphasis on student activity. Active Learning is able to generate student motivation to understand the material. The motivation itself appears after students are given a problem or initial action (Kurniawati, 2020). In this study, modules were developed according to the Junior High School curriculum based on the Active Learning type The Power of Two.

Andriadi, Fitraini, & Suhandri (2018) Describe valid and practical Active Learning-based modules that have an impact on students' creative thinking. Active Learning-based modules are effectively used in facilitating students' creative thinking. This is in line with the research results of Ningrum (2016), and Wahyudi (2017), and Kertayasa (2019) which state that modules can support students to be more active and creative in solving the problems given. Apart from that, the skill aspect also increases after using the module (Effendi & Susanti, 2021). Active Learning-based modules are effectively used to facilitate students' creative thinking (Pratiwi, Effendi, & Ummah, 2020). So here, students are more active in thinking, which will improve their creative thinking skills.

4. CONCLUSION

Based on the results of the research and data processing, it can be concluded that the Active Learning-based mathematics module of The Power of Two type in the curriculum in junior high schools has been developed using the ADDIE development model. the developed module has very valid module validity criteria with a percentage of 91.48% by two expert lecturers and a mathematics teacher. The results of the student response questionnaire in using the module have very practical criteria with a percentage of 90.22% by 12 small group students. The weakness of this research is that the module is still in printed form. Therefore, it is suggested that further research is to develop this module in the form of an e-module.

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