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Orginal Article

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Abstract
One of the abilities that educators must pay attention to when learning mathematics is mathematical reasoning abilities. Various efforts have been made by teachers, researchers and educational practitioners to improve mathematical reasoning abilities, but in reality, reasoning abilities are still in the low category. The aim of this research is to develop a lecture module with a problem-based learning model with local cultural nuances to improve reasoning abilities. Learning packaged in local culture is one way to make it easier to understand mathematics.The method used in this research is the development method with the Thiagarajan 4-D development design The research results show that the module developed is valid, effective and practical and can improve mathematical reasoning abilities.

Keywords: Module, Problem Based Learning, Local Culture, Reasoning

1. Introduction

Mathematical reasoning is important to study because mathematics is formed by human thinking about ideas, processes and reasoning (Hakim, L. et al., 2006). This is also strengthened by the profile of Pancasila students as stated in Minister of Education and Culture Regulation number 22 of 2020, where one of the dimensions of the Pancasila student profile is critical reasoning. Reasoning and mathematical abilities cannot be separated from each other because solving mathematical problems requires reasoning abilities, while reasoning abilities can be trained by studying mathematics (Simanungkalit, et.al (2021), Simanungkalit, et.al. (2022), Kusumawardani, et al. (2018)). Isnani, et al. (2020) said that reasoning is one of the scientific disciplines that underlies mathematics, and Wahyudin (2008) & Bozkuş, F., Ayvaz, U. (2018) previously reported that mathematical reasoning is a very important ability in the mathematics learning process, because mathematics is knowledge obtained through reasoning. Fauziyah, et al (2017) and Dewi & Harahap (2016) explained that attention and in-depth research into mathematical reasoning abilities is needed. The current reality shows that students' mathematical reasoning abilities are still in the low category compared to other mathematical abilities.

To improve students' mathematical reasoning abilities, educators must prepare and plan good and thorough preparation. One form of thorough preparation is the preparation of lecture modules. Brata (Komalasari: 2011) preparing learning modules is a form of preparation carried out by teachers before they carry out the learning process. Therefore, in carrying out their duties, educators must compile and develop learning/lecture modules.

The development of lecture modules must be adjusted to the student's level of knowledge and experience and structured based on an appropriate learning model. To develop lecture modules, references can be obtained from various sources, whether in the form of one's own experience or knowledge, extracting information from expert sources or colleagues and can also be obtained from books, mass media, the internet, and so on. One learning model that can foster and develop high-level thinking (reasoning) is the problem-based learning model. In

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problem-based learning, students are able to develop thinking skills so that students themselves can discover how concepts are formed.

Learning packaged in local culture is one way to make it easier to understand mathematics. Andriyani & Kuntarto (2017) stated that mathematics teaching for students should be adapted to their culture. Currently, there are not many lecture modules developed by lecturers related to the concept of problem-based learning with local cultural nuances. This is a challenge for researchers in developing lecture modules with problem-based learning models with local cultural nuances. It is hoped that using lecture modules developed with a problem-based learning model with local cultural nuances will foster students' creative ideas and help students' understanding of learning because it is related to students' cultural backgrounds.

2. Method

The method used in this research is the development method with the Thiagarajan 4-D development design. After obtaining the final lecture module (suitable for use), the module will then be printed into a lecture book with an ISBN and will be registered to obtain Intellectual Property Rights (HaKI). A detailed flow diagram of Thiagarajan's 4D development model can be seen in Figure 1.

Figure 1.

4d Model Module Development Chart

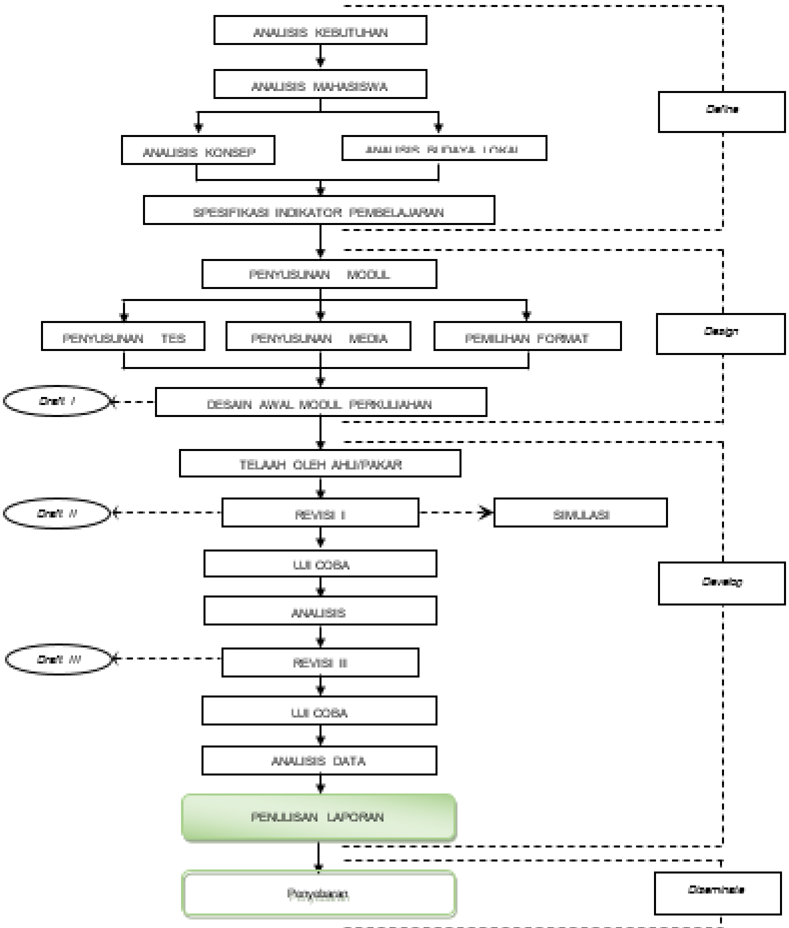

Figure 1 shows the flow diagram of this research, which uses the development of Thiagarajan's 4D development model which begins with analyzing the needs of the research object to be studied. The devine stage is the stage of carrying out needs analysis. Starting from student needs, learning concepts and integrating local culture in modules and learning. At the design stage, namely the stage of preparing lecture modules based on the needs analysis in Devine. at

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the development stage, namely this stage is the stage of testing the feasibility of the lecture module being developed. Starting from review activities by experts/experts, phase I (limited) trials and phase II (extensive) trials. And finally at the dissemination stage, namely preparing activity reports, printing books with ISBN, submitting IPR and preparing output in the form of articles that will be published in accredited journals Sinta 4

3. Results and Discussion

This research was carried out in two stages, namely first, the device development stage and second, the implementation stage of the learning devices that had been developed (experimented). The tools developed in this research are (1) Lecture Module, (2) mathematical reasoning ability test, (3) learning implementation observation sheet.

1. Lecture Module

The tool developed in this research is a lecture module with a PBM model with local cultural nuances. The devices that researchers have developed are reviewed and validated to see the quality of the devices developed. The aspects studied are content aspects, format aspects or presentation construction, and language aspects. The validation results of the developed device are presented in Table 1. below.

Table 1.
SAP Quality Assessment Data

No	Rated aspect	Average Rating Score		Avarage	Criteria
		Validator 1	Validator 2		
1	Format	3.50	3.50	3.50	Good
2	Contents	3.08	3.50	3.29	Good
3	Language	3.33	3.33	3.33	Good

Conclusion: The quality of the lecture module is good, so it can be used in learning with minimal revision

Based on table 1, it can be concluded that the quality of the lecture module is good, so it can be used in learning with minimal revision. This explanation means that the lecture module is considered to be of high quality and suitable for use in the learning process. However, there are some areas that may require revision or adjustment to better suit specific learning needs or contexts. These revisions may include improving the material, adding examples or exercises, adjusting language, or changing the delivery method to make it more effective for the target audience.

2. Reasoning Ability Test

The mathematical reasoning ability test is an evaluation tool to measure students' cognitive abilities, especially mathematical reasoning. The reasoning test was developed in the form of essay questions that refer to the Revised Bloom's Taxonomy which contains two dimensions, namely the knowledge dimension and the cognitive process dimension. The questions developed consisted of 5 questions in the form of test descriptions. The mathematical reasoning test that had been developed was then validated by experts in the field of Mathematics Education with results as in Table 2. below.

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Table 2.
Quality Assessment Data for Learning Outcome Tests (THB)

No Soal	Contents				Rated aspect presentation construction				Language				Score Avarage	Conlusion
	V1	V2	Score Avarage	categori	V1	V2	Score Avarage	categori	V1	V2	Average Score for Material Aspects	categori		
1	4	4	4.00	Very Good	4	3	3.50	Good	4	4	4.00	Very Good	3.83	Very Good
2	4	4	4.00	Very Good	4	2	3.00	Good	4	4	4.00	Very Good	3.67	Very Good
3	4	4	4.00	Very Good	4	2	3.00	Good	4	4	4.00	Very Good	3.67	Very Good
4	4	4	4.00	Very Good	4	2	3.00	Good	4	4	4.00	Very Good	3.67	Very Good
5	4	4	4.00	Very Good	4	2	3.00	Good	4	4	4.00	Very Good	3.67	Very Good

Conclusion: The quality of the mathematical reasoning test is very good in the content and language aspects, and good in the construct aspect, so it can be used in learning with a little revision

Based on table 2, The quality of the mathematical reasoning test is very good in the content and language aspects, and good in the construct aspect, so it can be used in learning with a little revision. This explanation shows that the mathematical reasoning test is considered to have very good quality in terms of content and language, which means that the questions and material presented are relevant and presented clearly. The construct aspect, which relates to the structure and design of the test, is considered good, but there may still be room for improvement. For its use in learning, this test is considered quite good but still requires some minor revisions. These revisions may include adjustments to the format, layout, or order of questions, as well as perhaps refining instructions to improve clarity and accessibility for test takers.

3. Learning Implementation Observation Sheet

The Learning Implementation Observation Sheet is an instrument for measuring the percentage of learning implementation using the lecture modules developed. The assessment aspects in this observation sheet are based on the PBM learning stages. The Learning Implementation Observation Sheet was adapted from the checklist type Rating Scales observation method contained in the book "Observation Skills for Effective Teaching" (Borich, 1994). The form of the instrument is in the form of a table with columns containing the aspects to be observed, namely the stages of PBM learning for each type and a column for the observation results which consists of two sub-columns, namely the column implemented and the column not implemented. The Learning Implementation Observation Sheet that had been developed was then validated by experts in the field of Mathematics Education with results as in Table 3 below.

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Table 3
Quality Assessment Data on Learning Implementation Observation Sheets

No	Rated aspect	Average Rating Score		Avarage	Criteria
		Validator 1	Validator 2		
1	Format	3.40	3.60	3.50	Good
2	Contents	3.00	3.50	3.25	Good
3	Language	3.25	3.50	3.38	Good

Conclusion: The quality of the Learning Implementation Observation Sheet is good, so it can be used as a research instrument with minor revisions

Based on table 3, The quality of the Learning Implementation Observation Sheet is good, so it can be used as a research instrument with minor revisions. The statement suggests that the Learning Implementation Observation Sheet has been assessed as good in quality, making it suitable for use as a research instrument. However, it also indicates that there may be some areas where minor revisions are needed. These revisions could involve improving clarity, adjusting the format, or refining the criteria used in the observation sheet to ensure it accurately captures the necessary information for research purposes.

4. Student Activity Observation Sheet

The Student Activity Observation Sheet is an instrument for measuring the frequency of student activity in PBM learning activities using the developed lecture module. The assessment aspects in this observation sheet are based on activities that are appropriate to the PBM learning stages. This instrument was adapted from the "coding system" observation method observation sheet found in the book "Observation Skills for Effective Teaching" (Borich, 1994). The student activity observation sheet that had been developed was then validated by experts in the field of Mathematics Education with the results as in Table 4 below.

Table 4
Data on Quality Assessment of Activity Observation Sheets Student

No	Rated aspect	Average Rating Score		Avarage	Criteria
		Validator 1	Validator 2		
1	Format	3.60	3.80	3.70	Very Good
2	Contents	3.00	4.00	3.50	Good
3	Language	3.00	3.50	3.25	Good

Conclusion: The quality of the Activity Observation Sheet is good, so it can be used as a research instrument with minor revisions

Based on table 4, The quality of the Activity Observation Sheet is good, so it can be used as a research instrument with minor revisions. The statement indicates that the Activity Observation Sheet is considered to be of good quality, suggesting it effectively captures relevant aspects of the observed activities. It can be utilized as a research instrument, but minor revisions may be needed to enhance its effectiveness. These revisions could involve refining the criteria for observation, clarifying instructions, or adjusting the layout to ensure comprehensive and accurate data collection. Based on the research results that have been obtained, developing lecture modules with problem-based learning models with local cultural nuances can improve reasoning abilities. This is in line with research conducted by Saragih, at all (2019) where the

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research results show that student-centered learning based on local cultural models and high-level mathematical instruments for thinking skills is valid and effective for use in junior high school mathematics learning. Local cultural connections need to be developed and applied in learning.

4. Conclusion

The research results show that the module developed is valid, effective and practical. The conclusion of this research is that the module developed with a problem-based approach with local cultural nuances has proven to be effective in improving students' reasoning abilities. This approach helps students to be more critical and analytical in understanding and solving problems. The integration of local culture in learning provides a more familiar and relevant context for students, which can increase motivation and involvement in the learning process. This module helps link theory with practice, providing examples relevant to everyday life and local culture. This helps students understand abstract concepts through concrete examples that are close to their experiences.

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