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by Izwita Dewi

Development of Mathematics Learning Strategy Module, Based on Higher Order Thinking Skill (Hots) To Improve Mathematic Communication And Self Efficacy On Students Mathematics Department

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Abstract. In general, this research is conducted to improve the quality of lectures on mathematics learning strategy in Mathematics Department. The specific objective of this research is to develop learning instrument of mathematics learning strategy based on Higher Order Thinking Skill (HOTS) that can be used to improve mathematical communication and self efficacy of mathematics education students. The type of research is development research (Research & Development), where this research aims to develop a new product or improve the product that has been made. This development research refers to the four-D Model, which consists of four stages: defining, designing, developing, and disseminating. The instrument of this research is the validation sheet and the student response sheet of the instrument.

1. Introduction

In an effort to qualify for university graduates in Indonesia, the government has issued Presidential Regulation No.08 of 2012 on the Indonesian National Qualification Framework (KKNI). Given this KKNI is expected to change the way one sees one's competence, no longer merely a diploma but by looking at a nationally agreed upon qualification framework as a basis for the recognition of a broad and accountable (formal, informal, or formal) outcome of a person's education. Along with the pattern of changes that occur due to changing patterns of graduate requirements and curriculum changes based on KKNI and Implementation of the 201[17]urriculum,

According to Saragih (2015) most teachers teach mathematics by explaining the concepts a[18] operations of mathematics, giving examples of doing things, a little questioning (if any), followed by asking students to work on similar problems with the problems already explained by teachers. The researcher's experience when becoming a PLPG instructor saw that many teachers who teach with lectures or learning activities are still teacher-centered. It certainly boils down to the teacher's "kitchen", perhaps when they are still studying with learning resources that do not support the learning process that is centered on the students. When students study with learning tools that allow them to develop higher order thinking, they are likely to become qualified teachers.

During this time the lecturers of mathematics teaching strategies in mathematics majors usi[1]s different learning sources or modules. For that reason researchers want to develop a module of mathematics learning strategy based on higher order thinking skills to improve mathematical communication and self efficacy students in math majors.

2. Review of literature and definition of terms

2.1 Higher Order Thinking Skills

High-order thinking or commonly known as higher order thingking (HOT) is an important factor in mathematics learning. This is evident from what is well-documented in the Education Unit Level Curriculum (KTSP) as well as the National Council of Teachers of Mathematics (2000), mathematics education is aimed at the development of skills aspects (Puskur, 2005):.

1. The ability to mathematical problem solving, other lessons, and real-life problems
2. The ability to use mathematics as a communication tool (*mathematical communication*)
3. The ability to connect mathematical ideas (*mathematical connections*)
4. The ability to reasoning (mathematical reasoning) that can be used in any situation, such as critical thinking, logical, and systematic; be objective, honest, discipline and solve problems.
5. Positive attitudes toward mathematics.

Thomas dan Thorn (2009) say *HOT takes thinking to higher levels than restating the facts and requires students to do something with the facts — understand them, infer from them, connect them to other facts and concepts, categorize them, manipulate them, put them together in new or novel ways, and apply them as we seek new solutions to new problems*.

2.2 Mathematical Communication Skills

In addition to thinking tools, mathematics as well as language. Mathematical language also has the same function as common language, that is (1) naming or labeling, (2) interaction and (3) information transmission. In expressing mathematics, symbols are used to represent objects, share ideas, and share information. But the language of mathematics must also have the character of mathematics, using logic and words used as agreed or clearly defined.

Dewi (2009) says mathematical understanding can be related to mathematics as a language, symbol language, which is seen in symbolization and formulation that is transforming a statement into formulas, symbols or drawings. The relationship between language and mathematics as a symbol language is very close. Symbol language is a tool to explain a mathematical concept to be simple. In contrast, mathematics is a tool to simplify one's math understanding into symbol language.

Mathematics as a language called "the language of science" as well as the language of engineering and language economy (commerce). Even mathematics is referred to as the "universal language," therefore humans all over the world can use mathematics to communicate even though they have different languages. Then Baroody (1993) also says there are two reasons why communication is needed in mathematics learning. (1) Mathematics as a language means mathematics not only as a tool of thought, finding patterns, or solving problems but also as a means of communicating ideas clearly, precisely and concisely; and (2) mathematics as social activity, meaning as language, mathematics is a social activity in learning, such as the interaction between students with teachers, and student interaction with students

A person's mathematical understanding can not be seen and heard, but mathematical communication facilitates students "voicing" what they think about their mathematical knowledge. The explanation implies that mathematical learning that gives students the opportunity to communicate mathematically can make students feel confident and have a positive attitude

2.3 Defenition of Self Efficacy

Walgito (2011) defines self efficacy as one of the most influential aspects of self-knowledge in everyday human life. This is due to the efficacy of self-owned influence the individual in determining the actions to be taken to achieve the objectives including the estimated incidents to be faced.

The basic concept of self efficacy theory is the problem of the belief that every individual has the ability to control his thoughts, feelings and behavior. Thus self efficacy is a matter of subjective

perception. Self efficacy is defined as one's consideration of his or her ability to achieve desired or determined levels of performance, which will affect the next action. According to Zulkosky (2012) says that self efficacy also affects people's choices in behavioral settings, the number of their efforts to complete the task, and the length of time they stay in the face of obstacles. .

3. Methodology

This research is a research development (Research and Development) is a type of research that develops a new product or refine a product that has been there before. This development research refers to the development of 4-D (four-D Model) proposed by Thiagarajan, which consists of four stages: define, design, development, disseminate. This development model has been focused on the development of module. Module that are developed is a book of mathematics learning strategy..

Analysis of validators in the form of values that have a range and descriptive value of suggestions and comments. Determining the average value of the expert for each indicator by the formula:

$$Average(Va) = \frac{\text{Total Score}}{\text{number of aspects}}$$

Va : validation value

For student response data is analyzed by counting the percentage of many students giving positive response and on each category stated in the questionnaire by using the following formula:

$$\text{Percentage} = \frac{A}{B} x100\%$$

A : The proportion of students who choose

B : Number of students (respondents)

The student's response is said to be positive if 80% or more of the students respond in a positive category (happy, new, interested, clear, and interested) to every aspect that is responded.

The effectiveness of module is seen from the data of student activity improvement with the formula:

$$\text{Percentage} = \frac{\text{the frequency that appears}}{\text{Total Frequency}} x100\%$$

The increased value of mathematical communication is analyzed by the formula

$$Indeks\ Gain = \frac{\text{Postes} - \text{Pretes}}{\text{Ideal Score} - \text{Pretes}}$$

While the improvement of self efficacy is seen in each trial and between trials. improvement seen from the change of self efficacy indicator in a better direction.

4.Results and Discussion

Having analyzed the validation sheet of experts, then obtained a count of validity and that is

Table 1. Validation Results

Validator	Value	criteria
Validator I	4,9	Valid
Validator II	4,76	Valid
Validator III	4,85	Valid
Average	4,83	Valid

Based on table 1 it can be concluded that the module developed is valid and can be continued testing process in small group, while comments in the form of suggestions and criticism used to revise module

4.1 Small Group Anlisis

Small group trial was conducted to 10 students who have taken courses in mathematics learning strategies, as a test of the legibility of learning materials that are developed that is a mathematics learning strategy book.Here is the table of test results of the legibility of module.

Table 2. Module readability

	Score	Pecentage	criteria
Average	41.36	83.2	Baik

From the results seen in Table 2, it is illustrative that the module of mathematics learning strategy has a good readability value or in other words it can be concluded that the book of mathematics learning strategy is easy to understand.

4.2 Large Group Trial Analysis

The big group is here is a semester V students majoring in mathematics education FMIPA UNIMED who took the mathematics learning strategy, which amounted to 31 students, this analysis to see the practicality and effectiveness of the module

Table 3. Practicality of Module

	Score	Percentage	criteria
Average	21,12	84.5	Baik

From Table 3, the test value of practicability is at 84.5 with good criteria, in other words a practical mathematics learning strategy book to use.

Table 4. Improvement Of Math Communication Skills

	Pre-test	Post-test	Gain
Average	50.8	81.2	0.61

Based on Table 4 above shows an increase of the average score of students' mathematical communication ability from pre test to post test. Based on the increase index is 0.61 which is categorized as high or significant increase.

Table 5. Student Response

	Positive	Percentage	Negative	Percentage
Average	26.8	86.45	4.2	13.5

Based on Table 5 above, the average that responded positively was 86.45% while the negative responded 13.5%

Table 6. Student Activity

Student Activity	Pertemuan						Average
	I	II	III	IV	V	VI	
	83.3 %	82.6%	84.6%	82.6%	81.3%	92%	84.4%

Based on Table 6 above, the average student activity for 6 meetings is 84.4% with good category.

4.3 Discussion

4.3.1.Define The stage to determine the conditions of learning that begins with curriculum nanalisis, curriculum used by this students in the Faculty of Mathematics and Natural Sciences of Medan State University is a block-based curriculum. Then analyzing the character of the students, semester students of mathematics education is not familiar with the subjects of mathematics learning strategy, because each course in the previous semester is integrated with some mathematics learning strategies, such as approach and learning model. Cognitive students are already at the operational level of formal meaning already able to think abstract. In the next stage the researcher identifies the material on mathematics learning strategies, collects and selects relevant material and organizes systematically. The result of syllabus and material analysis then formulated the purpose of the lecture and its indicator in accordance with the competency standard of the mathematics learning strategy.

4.3.2.Design This stage the researchers designed the prototype module begins with the preparation of the test. The test is used to measure students' mathematical communication skills, the test is a matter consisting of 4 items that will be tested before and after the learning. In addition to the test also prepared a questionnaire that is used to measure the criteria of student self efficacy. Next select the media, media used in mathematics learning strategy in the form of book media. The reason for choosing a book media is that students easily analyze, search for information in books, solve problems, make conclusions about mathematics learning strategies and applications in education such as schools. Then make the first design in the form of prototype which will be validated to the expert validator.

4.3.3. Development This stage begins with the testing of draft 1 to three lecturers from state university of medan. A good criterion of a book if the validity score is in the range of 4-5. From table 1 the average mean value given by the expert is 4.83 which gives the illustration that the module is valid and can be continued to the small group test, this test is done after revising the book according to experts' comments

After being reviewed by an expert and revising the book produced draft 2 which will be test of readability.This tested to 10 mathematics students who have taken the course of mathematics learning strategy, this test was conducted on August 15, 2017. Based on table 2, the overall average is 83.2% with good category or this module easy to understand. Next is a large group test, which is to test the effectiveness and practicality of teaching materials by testing the module's implementation, student activities, student responses and improvement of communication skills and self-efficacy enhancement. This test is done to 31 students who are taking courses in mathematics learning strategy. The test results are used to revise the draft 2 so as to produce draft 3. From table 3 can be seen the overall average of 84.5% with good practicality category. Textbooks developed can be used practically in the learning process of mathematics learning strategy. Table 4 shows the improvement of students' mathematical communication skills. In the first meeting of the lecture on August 24, 2017, the first test is pre test (pre test), the average pre test of the students is 50.8 is still in the category of E score or not pass, then at the 7th meeting of the lecture done the final test (post-test) on October 10, 2017, the average post test score is 81.2 with category B value (pass). There was a significant increase by seeing the average value of gain is 0.61 with the category of high increase.

Similarly, the value of student self efficacy, self efficacy questionnaire distributed at the beginning and the meeting to 7 lectures. At the initial meeting the results of self efficacy test already has a good category, after 6 lecture meetings self efficacy test results increased towards the positive.
The use of mathematics learning strategy book gives good result on student activity in learning. Seen in table 7, the average student activity for 6 meetings was 84.4% with good activity category. Similarly, the response given by students to the book is equal to 86.4% which gives a positive response.

5.Conclusion

The process of developing the module in the form of a book of mathematics learning strategy is done up to stage 3 that is define, design and development. The design phase produces draft 1, then in the development phase, draft 1 which is validated by 3 validators and revised according to expert comments then produce draft 2, then draft 2 tested small group that yields good legibility value. Furthermore the book tested large groups produce value of practicality and good effectiveness.

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