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The Development of Learning Devices Based Guided Discovery Model to Improve Understanding Concept and Critical Thinking Mathematically Ability of Students at Islamic Junior High School of Medan

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Abstract

The purpose of this research was to: 1) development of learning devices based guided discovery model in improving of understanding concept and critical thinking mathematically ability of students at Islamic Junior High School; 2) describe improvement understanding concept and critical thinking mathematically ability of students at MTs by using learning devices based guided discovery model; 3) describe students' responses toward learning devices based guided discovery model in improving of understanding concept and critical thinking mathematically ability of students at MTs; and 4) describe the settlement process of the student's answers in solving problems of understanding concepts and critical thinking mathematically ability of students. This research was a research development, it was conducted in two stages, the first stage is the development of learning devices based guided discovery with the reference Four-D model, and the second stage is to try-out of learning package. The populations of this research were all of the students at Private MTs of Medan and the sample chosen is purposive sampling which were in eighth grade A of Private MTs IRA and eighth grade A of MTs Lab. IKIP Al-Washliyah. From the results of trials I and trials II obtained: 1) learning devices that meet the criteria of effectiveness, effectiveness in terms of a) students mastery learning in the classically; b) achievement of learning purpose; and c) learning time; 2) learning devices based guided discovery model is able to improve the understanding concept and critical thinking mathematically ability of students; 3) Students' responses to components of learning devices and learning activities were positive 4) the settlement process of the students' answers to problems solving about the understanding concept and critical thinking mathematically ability of students with guided discovery model more varied and better. Furthermore, it was suggested that teachers can use guided discovery learning model by presenting problems related to daily life as an alternative student learning.

Keywords: Guided discovery model, understanding concept, critical thinking mathematically, and 4-D development model.

1. Introduction

Mathematics is a science with the concept of systematically arranged, ranging from the simplest concept to the most complex concepts there for learning mathematics should be directed to the understanding of the concept. This is in directing way with that raised by Sumarmo (2013) that mathematics needs to be directed to the understanding of mathematical concepts and principles are then required to solve mathematical problems as well as other science issues. But in fact many students have difficulty in solving capability of understanding the concept, this is due to the weakness of the basic concepts of the students, even though the procedure without the basic concept is the only rule for no reason that would lead to errors in mathematics.

In learning, understanding concept is a very important thing that should be owned by the students. If the student received the basic concept wrong, then it would difficult to improve there turn, especially if it is applied in mathematical problem solving, because understanding concept makes it easy to improve procedural knowledge of mathematics students. Besides, there is another important things that affect student learning achievement, namely is critical thinking. According to Chukwuyenum (2013), critical thinking has been one of the tools used in our daily life's to solve some problems because it involves logical reasoning, interpreting, analyzing and evaluating information to enable one take reliable and valid decisions. The same thing also expressed by Saragih and Napitupulu (2015), the students are expected to use mathematics and mathematical mindset in daily life, and to study many kinds of sciences which stress to be logical arrangement and student's character building and also ability to apply mathematics.

Wherever in fact, when the learning difficulties students to problem solve related in daily life that require to use of mathematics and compile them into a mathematical model. This is because all this time the questions given don't non-routine matters, so as not to make the students perform activities of reflection, experimentation, inquiry, conjecture, and generalization. The difficulties encountered can be seen from how students think critically to solve the problems which is given. The same thing also expressed by Saragih and Habeahan (2014) stated when students are exposed to issues that are not routine, for example, related a story about solving problems related to everyday life, the value obtained by the student will be usually be lower when compared to the multiple-choice questions.

It is necessary to get attention because the material math and thinking are two things that cannot be separated, students should be able to connect ideas with one another to understand mathematics, so it can use mathematical models to solve the given problem, in other words a learning mathematics must be able to be high order thinking or critical thinking. One of cause low mathematical ability of students are learning device used in the learning process is not effective against the achievement of the desired learning purpose.

Based on the interviews with several math teachers, obtained information that during these teachers rarely make lesson plans such as developing development of learning devices. Learning tools that teachers use for this is the syllabus, lesson plans, and handbooks. Teachers prepare lesson plans with models or approaches innovative learning which is written in the lesson plan (RPP) but has not been implemented properly, often lesson plan (RPP) are not prepared in accordance with the learning process is carried out, the handbook used in the learning process does not lead to problems the contextual problems and questions that are used in the handbook are routine matters.

Departing from the above phenomenon, the learning device occupies an important position in achieving learning purpose. As explained by Haggarty and Keynes (Muchayat, 2011), that in order to improve the teaching and learning of mathematics in the classroom takes effort to improve understanding of teachers, students, materials used for learning and interaction between them. In order to achieve the learning purpose are good purpose, the need for the selection of appropriate learning models, as well as the development of learning tools that fit well with the learning model used? The importance of learning devices in the learning process also raised by Sanjaya (2010), through careful and accurate planning, the teacher is able to predict how much success to be achieved, thus the possibilities of failure can be anticipated, in addition, the learning process will take place in a focused and organized, as well as more effective use of time.

Based on the above, it can be concluded that the use of learning devices provide good benefits, teachers will also be more creative, be creative and be innovative in the learning process. One model that is effective and gives effect to understand concepts and critical thinking ability of students is a guided discovery model. Effendi (2012) states, to produce an invention, the student should be able to connect mathematical ideas they have, representing the ideas through images, symbols or words to be more simple and easy to understand. Familiarize students with learning indirectly invention also familiarize students in representing information, data, or knowledge to produce a discovery.

Guided discovery model purposely designed to improve students' activeness larger, process-oriented, to find their own information required in achieving the learning goals. This kind of learning activities to make students actively in the learning process, the teacher only acts as a facilitator to set the course of learning. Such learning process had a positive impact on the development of students' critical thinking and help students develop intellectual discipline and skill needs to arouse curiosity and seeking answers from curiosity. Besides, the guided discovery model could encourage students to think for themselves, analyze themselves so that they can find the general principles based on material or data provided by the teacher. In the guided discovery model, students are trained to build the thinking ability that focuses on understanding. The same thing also expressed by Risdianto, dkk (2013) is learning by the purpose of guided discovery model to provide a way for students to develop intellectual abilities (thinking skills) associated with the processes of reflective thinking.

Developing of learning devices based guided discovery model, based on the understanding that its own guided discovery model. National Research Council (Sunismi and Nu'man, 2012) states, guided discovery model is a series of learning activities that emphasizes the process of critically and analytical thinking to seek and find their own answers to the question of a problem with the guidance of teachers. The series of activities in the learning process guided discovery is an activity in critical thinking.

This was confirmed by the results of research Saragih and Afrianti (2012) states, improve students' understanding of concepts in graph trigonometric functions to obtain guided discovery approach assisted Software Autograph higher than students who received the usual approach and completeness and learning activities of students who obtain a guided discovery approach assisted Software Autograph higher than students who received usual approach. Based on the above, it can be concluded that the guided discovery learning can be improve understanding concepts and critical thinking ability of students as a series of activities in the learning process guided discovery is in critical thinking activities focusing on the discovery of concepts, principles, or mathematical procedures.

Based on the above, the issues to be studied in this research is how: 1) development of learning devices based guided discovery model in improving of understanding concept and critical thinking mathematically ability of students at Islamic Junior High School; 2) describe improvement understanding concept and critical thinking mathematically ability of students at Islamic Junior High School by using learning devices based guided discovery model; 3) describe students' responses toward learning devices based guided discovery model in improve understanding concept and critical thinking mathematically ability of students at Islamic Junior High School; and 4) describe the settlement process of the student's answers in solving problems of understanding concepts and critical thinking mathematically ability of students.

2. Literature

2.1 Understanding Concept Ability

Mathematics is a science with concepts that are arranged in a structured, logical, and systematic ranging from the simplest concept to the concept of the most complex, because the concept is an idea that is grouped by a term. Understanding of the concept will be able to tell which is an example and not an example. This is in line with the statement Saragih and Afrianti (2012) states that the concept is an abstract idea that allows one to classify objects or the events, so it can determine whether the object or the incident is an example or not an example of the idea. While Arends (2008) states that "the concept has attributes that describe and help define it". Based on the above it can be concluded that the concept is an abstract idea that allows us to classify objects into examples and non-examples, which is usually expressed by a definition.

As well as the understanding concept Saragih and Afrianti (2012) concept is an abstract idea that allows one to classify objects or events, so it can determine whether the object or event. In the technical manual regulation Dirjen Dikdasmen Depdiknas No. 506/C/ PP/ 2004 (Wardhani, 2008) about assessment of the development junior high school students included

an indicator of the understanding concept ability as a result of learning mathematics. The indicator is (1) Restate a concept; (2) classify objects according to certain properties in accordance with the concept; (3) provide examples and non-examples of the concept; (4) presents the concept in different forms of mathematical representation; (5) develop a condition necessary or sufficient condition of a concept; (6) use, utilize and choose specific procedures; and (7) apply the concept to algorithm to problem solving. So that concluded the understanding concept ability is students' ability in restate concept, provide example and not an example from the concept, and apply the concepts into problem solving.

2.2 Critical Thinking Ability

Critical thinking ability is one of the higher order thinking ability, someone who is able to think critically, not just to solve the problem, but also able to give a plausible reason on a solution which he gave, because basically thinking is an activity undertaken to reach a conclusion. This is in line with the statement Hasratuddin (2009) which states that the critical thinking skills is the ability of a person to analyze, reflect the results of his thinking and drawing conclusions based on reasons that are reasonable and logical. Meanwhile, according Palinnusa (2013) critical thinking ability is the ability of a person to identify problems, connect, analyze and solve mathematical problems. Furthermore Trilling and Fadel (2009) also stated that the critical thinking ability consist of the ability to analyze, interpret, evaluate, summarize, and synthesize all the information. From the above opinion, it is concluded that the ability of critical thinking is the ability to think that having characteristic analyze, synthesize, recognize and solve problems, as well as concluding.

2.3 Guided Discovery Model

One of learning model which student-centered is guided discovery model. The invention is not a model of learning is done to find something that is really new, but in this model, students are expected to find knowledge actively like to do guesses, estimates, and try so that students can find concepts, formulas and the like with guidance teachers. Students find the concept through the guidance and direction of the teacher because in general most students still require basic concepts to be able to find something. This model is extremely useful for mathematics courses according to the mathematical characteristics. This is in line with the proposed Sugiyono (2009) that the guided discovery model is one of the using discovery learning, where students get knowledge to be understood with the guidance of teachers, such as through questions, show-demonstration or other media.

Likewise, according Markaban (2006) measures guided discovery model are(1) to formulate the problem to be given to students with the data to taste; (2) of the data provided by the teacher, students prepare, process, organize, and analyze data; (3) The students draw up a conjecture (forecast) of the results of the analysis done; (4) if necessary, a conjecture that has made the students are checked by the teacher; (5) verbalization conjecture also handed over to the students to arranging; (6) After students find what they need, teachers should provide exercises or additional questions to examine whether the findings were true.

From the above description, it was concluded that the guided discovery model is a learning model that presents a problem or question that makes the students can think, observe, make conjectures, explain, and analyze to find a knowledge with guidance and instructions from teachers.

3. Research Methods

This type of research his depelopment research.The development model used is the 4-D model of Thiagarajan.

3.1 Population and Sample

Population in this research were all students eighth grade of Private MTs of Medan. Sampling was done by using purposive sampling, so that the elected eighth grade A of Private MTs IRA and eighth grade A of MTs Lab. Al-Washliyah. Trials I done in eighth grade A of Private MTs IRA and trials II in eighth grade A of MTs Lab. Al-Washliyah.

3.2 Development of Learning Devices

Development of learning devices includes: Guide Book Teacher, Student's Book, Lesson Plan, Student Activity Sheet, and research instruments are understanding concept ability test and critical thinking mathematically ability test. Development of learning devices is done by using Thiagarajan, Semmel, and Semmel model (1974) namely 4-D model which consists of four stages are define, design, develop, and disseminate. Summary modifications development of learning devices using 4-D models, is presented in Figure1below:

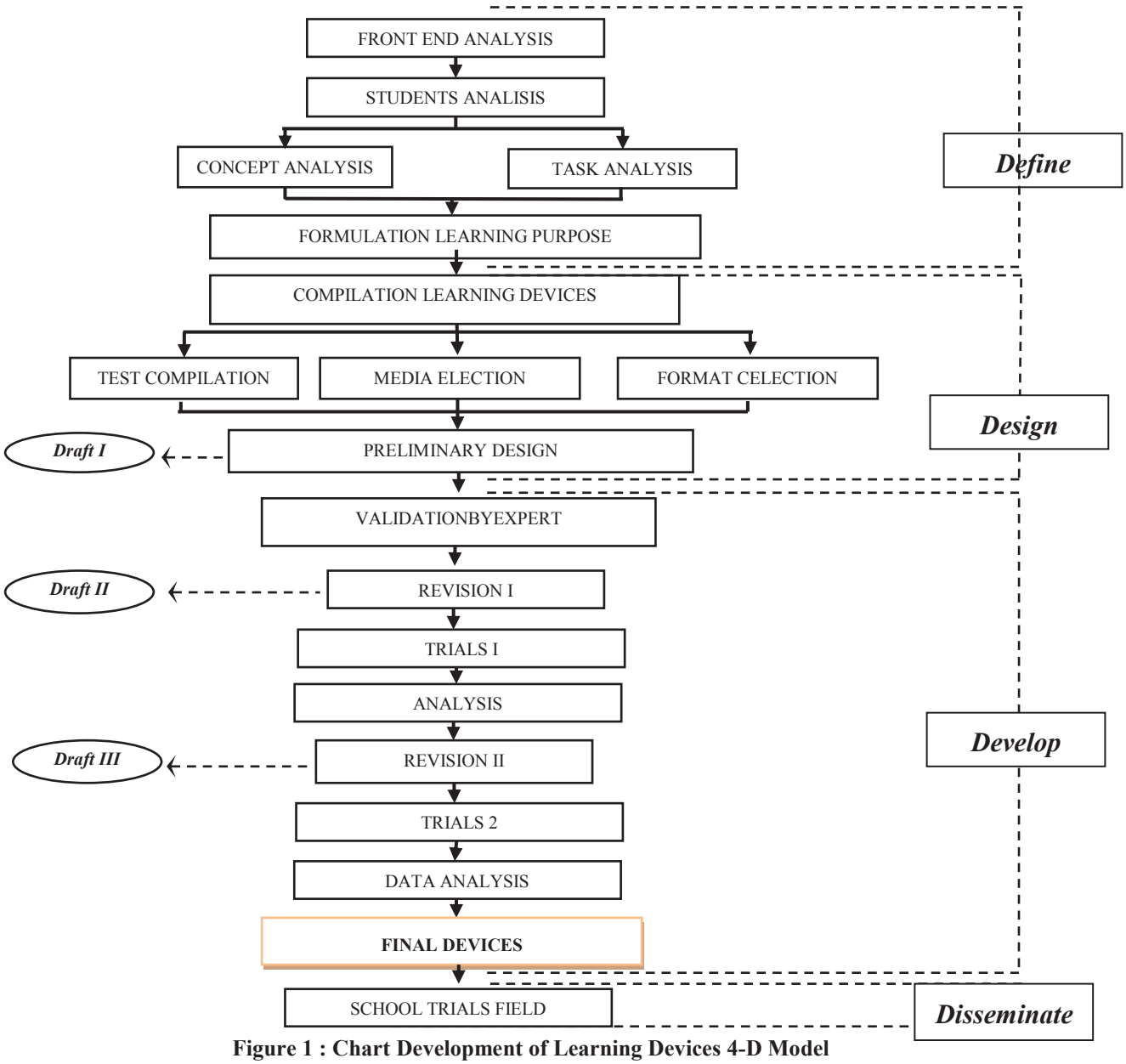


Figure 1 : Chart Development of Learning Devices 4-D Model

3.3 The instrument and the data analysis techniques

The instrument or tool for collecting data in this research were a test, questionnaire and observation sheet. The test is used to measure the understanding concepts and critical thinking mathematically ability. The questionnaire used to collect student responses, and the observation sheet used as a sheet observations on the implementation of the developed learning tools in the classroom.

Before the tests used in the trials I and II trials, first tested the samples outside the classroom, then the test results are analyzed validity and reliability. The formula used to calculate the validity is product moment correlation formula (Sugiyono, 2013), namely:

$$r_{xy} = \frac{N\sum_{xy} - \left(\sum_x\right)\left(\sum_y\right)}{\sqrt{\left\{N\sum x^2 - (x)^2\right\}\left\{N\sum y^2 - \left(\sum y\right)^2\right\}}} \quad (1)$$

Description:

r_{xy} : coefficient between the variables x and y

$\sum_{xy}$: the amount of the multiplication of x and y

x : score acquisition of items
y : total Score
N : number of students

Furthermore, to calculate the reliability coefficient description about the formula used Alpha (Arikunto, 2009):

$$r_{11} = \left(\frac{k}{(k-1)}\right)\left(1 - \frac{\sum \sigma_h^2}{\sigma_t^2}\right) \quad (2)$$

Description:

r_{11} : coefficient of reliability test

k : number of item

$\sum \sigma_h^2$: The amount of variance test scores of each item.

σ_t^2 : Total variance

While learning to see the effectiveness of learning devices, seen from three aspects:

3.3.1 Mastery learning students in the classical

Mastery learning students classically analyzed by considering that the students said complete if the value of individual students achieve scores $\geq$ 65, while a study is said to have been completed in the classical i.e. if there are 85% of students who take the test have achieved a score of $\geq$ 65.

3.3.2 Achievement of learning purpose

Achievement of learning purpose for each item used formula(Fauzi, 2002) :

$$T = \frac{\text{Totalscore ofstudentsforitem to}-i}{\text{Totalmaximum scoreitemto}-i} \text{ x } 100\% \quad (3)$$

The criteria are:

0 % ≤ T< 75 % : Learning purpose has not been achieved.

75 % ≤ T ≤ 100 % : Learning purpose achieved.

3.3.3 Achievement of learning time

Achievement of learning time refers to the suitability of the time available to the curriculum KTSP.

While the data from the questionnaire related to the students' responses were analyzed with descriptive quantitative, calculated using the formula (Sinaga, 2007):

$$\% \text{ response each aspect} = \frac{\text{Total studentsrespondingcertainaspects}}{\textit{Total of students}} \text{ x } 100\% \quad (4)$$

To determine the achievement of learning goals of students' responses, when the number of students who give positive responses greater than or equal to80% of the number of subjects studied for each test. Furthermore, for settlement process of the student's answers seen from the students' answers conformity with indicators of understanding concepts and critical thinking mathematically ability.

4. Results

4.1 Description of Development of Learning Devices Based Guided Discovery Model Stages

Development of learning devices is done by using 4-D model of which consists off our stages of development that define, design, develop, and disseminate. In detail the stages of development of learning devices as follows:

4.1.1 Define stages

A. Front end analysis

Results formulation of learning purpose is done adapted to the standards and basic competencies curriculum KTSP.

B. Students analysis

Results of the research characteristics students of Private MTs IRA and MTs Lab. Al-Washliyah in eighth grade of the school year2014/2015, namely students eighth grade average age of 14-15 years. If it is associated with the stage of cognitive development according to Piaget (Trianto, 2011), then the students eighth grade at stage of development of formal operational. Principal characteristic of this phase is the development of the child is capable of abstract thinking and logical. Therefore, it is appropriate to the learning of mathematics begins with concrete or abstract objects close to their living, so it is expected to help the process of students' understanding and critical thinking mathematically. Further the review of the background knowledge of students known to have studied the material triangles and rectangles in seven grade as a material pre requisite for studying circle in eighth grade.

C. Concept analysis

Results of the concept analysis of a circle of matter refers to the curriculum KTSP, including the understanding circles, elements of the circle, circumference and area of a circle, and the relationship central angle, arc length and wide segment.

D. Task analysis

The results of tasks analysis are tasks performed by students during the learning using learning devices, i.e. find the sense circle, found the elements of a circle, find the circumference and area of a circle, and find relationships central angle, are length arc wide segment, And problem solving related to daily life with the elements of a circle, circumference and area of a circle, and the relationship corner of the center, and a wide arc length segment.

E. Formulation learning purpose

Results formulation of learning purpose is done adapted to the standards of competence and basic competences of curriculum KTSP.

4.1.2 Design stages

A. Test compilation

The test used test of understanding concepts and critical thinking mathematically ability in the form of description.

B. Media election and tools

Media and tools used, they area ruler, cardboard, scissors, compass, pencil, pen, arc, drawing, replica wheels, calculators, and erasers.

C. Format election

Format of RPP adapted to the format used in the curriculum KTSP, learning activities consist of preliminary activities, core activities and cover. While the format Guide book Teachers, Student's Books and LAS created in color so that students will be interested and motivated to learn.

D. Preliminary design

At this stage produced a preliminary draft lesson plan (RPP) to be 5 sessions, user guide teachers for each meeting, students books and LAS for each meeting, tests of understanding concept and critical thinking mathematically ability, scoring guide lines, and the answer key. All results are at the design stage is called Draft-I.

4.1.3. Develop stages

Results from define and design stages to produce the preliminary design of a learning device called the draft I. After the guided discovery model designed in the form of a first draft, then tested validity by expert and field trials.

A. The results of the validation expert

The prior to learning devices and research instruments have been tested, first learning device and research instruments validated to five validator which included experts in the field. From the results of the validation, the criteria obtained learning and research instruments developed are "valid" and can be used with minor revisions. Furthermore, the research instrument which tests understanding concepts and critical thinking ability, first tested on a sample outside the classroom, and then tested the validity and reliability.

B. Trials I.

After learning devices developed have valid. Then the next learning device in the form of draft II is trials in eighth grade Private MTs IRA. Results of the data analysis trial I is learning device in effective, because there are several indicators of the effectiveness of which has not been achieved. Results classical completeness understanding concepts and critical thinking mathematically ability of students on trials I can be seen in Table1.

Table 1. Results classical completeness understanding concept and critical thinking mathematically ability of students on trials I

Category	Understanding Concept Ability		Critical Thinking Ability	
	Students total	Percentage	Students Total	Percentage
Complete	33	84,62%	30	76,92%
Incomplete	6	15,38%	9	23,08%
Total	39	100%	39	100%

From Table 1 shows that in the classical completeness learning students from the understanding concept ability which is total students who completed were 33 of 39 students (84.62%) and total students who did not complete were 6 of 39 students (15.38 %). While the critical thinking mathematically ability is total students who completed were 30 of 39 students (76.92%) and total students who did not completed were 9 of 39 students (23.08%). In addition, the results of achievement of learning purpose in the trials I on the understanding concepts and critical thinking mathematically ability has not been reached on the item number 2 and 3. While the instructional time is used in accordance with the criteria of achievement of the learning time.

Based on the analysis and trials I there should be a revision of some components of the learning devices developed with the hope learning devices based guided discovery learning model can improve understanding concepts and critical thinking mathematically ability of students.

C. Trials II

After trial I in the draft II, further improvements to produce learning devices that meet the effectiveness of good. Revised on the first trial resulted in a draft III which will be tried in the eighth grade students of MTs Lab. IKIP Al-Washliyah. Trial II is performed five times a meeting in accordance with the lesson plan (RPP) has been developed. Trial II conducted to measure the effectiveness of the learning devices (draft III) developed based a guided discovery learning model which aims to improve understanding concept and critical thinking mathematically ability of students. Overall, the level of understanding concept and critical thinking ability of classical completeness trials II can be seen in table 2.

Table 2. Results classical completeness understanding concept and critical thinking mathematically ability of students on trials II

Category	Understanding Concept Ability		Critical Thinking Ability	
	Students total	Percentage	Students total	Percentage
Complete	36	90,00%	34	85,00%
Incomplete	4	10,00%	6	15,00%
Total	40	100%	40	100%

Based on data in Table 2, it appears that in the classical completeness learning of students from the understanding concept ability which is the total of students who complete were 36 of 40 students (90.00%) and the total of students who did not complete were 4 of 40 students (10.00%). While the critical thinking mathematically ability which is the total of students who completed were 34 of 40 students (85.00%) and the total of students who did not complete were 6 of 40 students (15.00%). Furthermore, achievement of learning purpose have been achieved for each item on the understanding concepts and critical thinking mathematically ability. Similarly, the learning time is used in accordance with the criteria of achievement of learning time. It can be concluded that learning device based guided discovery model trials II which is a revision of the trial I have met quality for effective learning device.

4.1.4 Disseminate stages

Dissemination of the development of learning devices based guided discovery model done at the private MTs IRA and MTs Lab. IKIP Al-Washliyah, and disseminated to other MTs that have the same characteristics as trials schools. With the aim that can be used in the next semester on the material circle.

4.2 Improvement understanding concept and critical thinking mathematically ability of students at MTs by using learning devices based guided discovery model

Based on the results of the analysis improvement understanding concept of students at trials I and II showed that the average understanding concept ability of students on post-test, results on the trials I was of 77.92 improved to 81.81on trial II. Thus, improvement the average value of the understanding concept ability of students amounting 3.89. Furthermore, the improvement of each indicator of the understanding concept ability that improve in the average understanding concept ability of the indicator restate a concept amounting 0.01, the indicators provide examples and non-examples of the concept amounting 0.13, and the indicators to apply the concept into problem solving amounting 0.21. This shows understanding concept students have used learning devices based guided discovery model improved.

While the results of the analysis of the improvement critical thinking mathematically ability in the trials I and II showed that the average critical thinking mathematically ability on the post-test results on the trials I was 73.88 improved to77.58 on trial II. Thus, improvement the average value of critical thinking mathematically ability of students amounting 3.70. Furthermore, the improvement of each indicator of the critical thinking mathematically ability that improve in the average critical thinking mathematically ability of the indicator analyze amounting 0.11, indicator synthesize amounting 0.26, the indicator recognize and solve problems amounting 0.08, and the concluded indicator amounting 0.16. This shows the critical thinking mathematically ability of students have used learning devices based guided discovery model improved. Thus concluded that learning devices based guided discovery model can improve understanding concept and critical thinking mathematically of students.

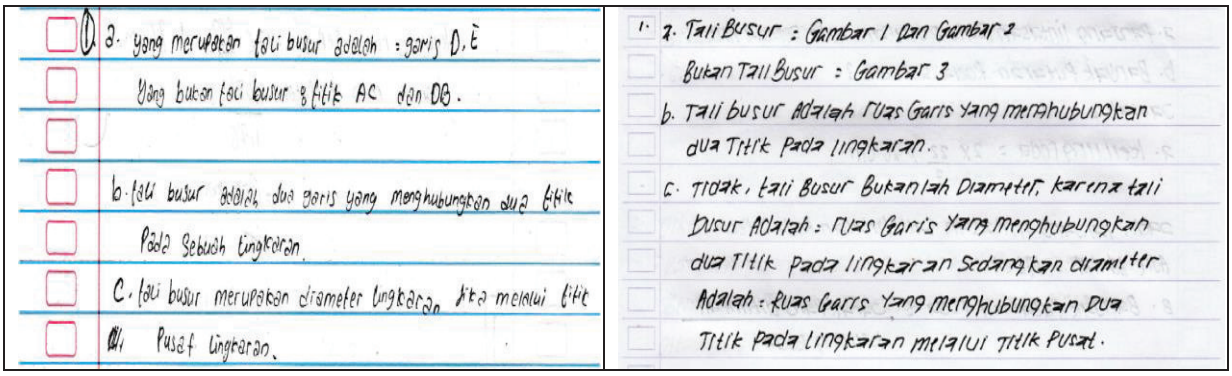
4.3 Students' responses toward learning devices based guided discovery model in improve understanding concept and critical thinking mathematically ability of students at MTs

Based on the analysis of data on student responses trials I and II are given at the end of learning, the overall student felt helped and pleased with learning devices based guided discovery model were developed, in other words the response given after the students were given learning using learning devices based guided discovery model is very positive. It is based on student responses on trials I and II the components learning devices based guided discovery model meet the criteria of effectiveness. If the observed percentage of students' response to learning device components are developed, using the model of guided discovery always meet the criteria which student responses were positive, if the percentage of student responses to every aspect of greater than 80%. Thus concluded that the components of learning devices that have been developed to contribute positively to the learning activities of students.

4.4 The settlement process of the student's answers in problems solving of understanding concepts and critical thinking mathematically ability of students

The settlement process of the student's answers trials I and II purpose to see the student's ability to solve the problems. Trials I done in eighth grade A of Private MTs IRA and trials II done in eighth grade A of MTs Lab. IKIP Al-Washliyah. Based on the answer sheet, the following will be presented several settlement process of the student's answers to the test of understanding concept and critical thinking mathematically ability.

Problem to Item No. 1

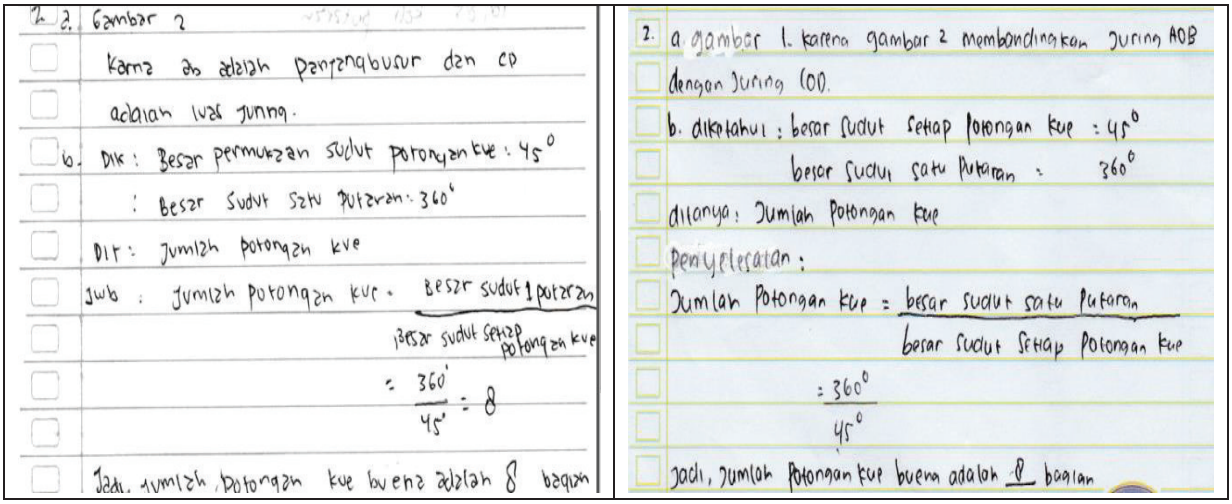


(a) **(b)**

Figure 2. (a) Answer PK Trials I, (b) Answer PK Trials II

From figure 2.(a) Students can provide examples and non-examples, but students cannot restate the concept appropriately. While in figure 2.(b) Students can determine examples and non examples of concepts and students can restate a concept.

Problem to Item No. 2

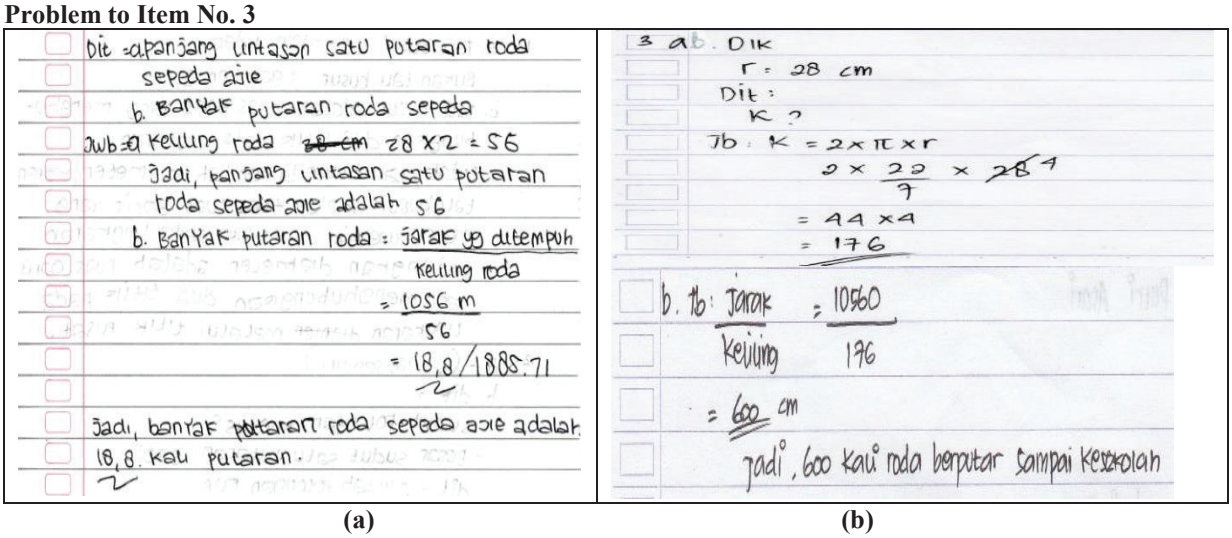


(a) **(b)**

Figure 3. (a) Answer PK Trials I, (b) Answer PK Trials II

From figure 3.(a) Students can provide examples and non-examples, but students can not apply the concept into problem solving. While in figure 3.(b) students can determine examples and non-examples of the concept and students can apply the concept into problem solving.

Problem to Item No. 3



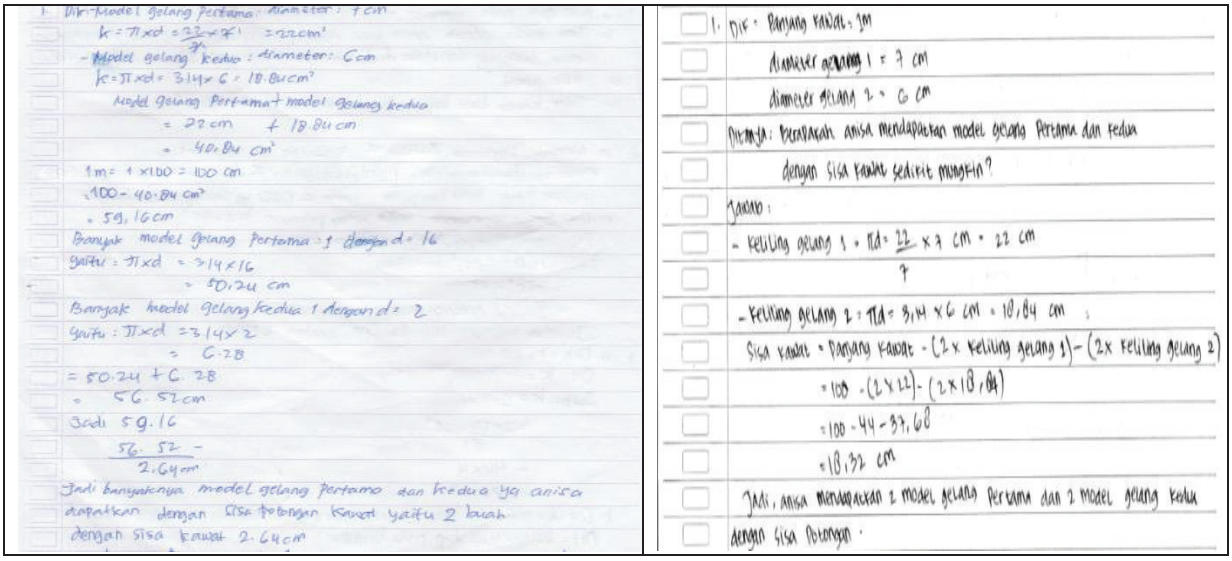
(a) **(b)**

Figure 4. (a) Answer PK Trials I, (b) Answer PK Trials II

From figure 4.(a) The formula used student wrong and the student can not apply the concept into problem solving. While in figure 4.(b) Step completion students complete and student can apply the concept into problem solving. This suggests that the settlement process of the student's answers to the test of understanding concept on trials II better than the settlement process of the student's answers on trials I.

Based on the student answer sheets, the following will be presented the settlement process of the student's answers to the test of critical thinking mathematically.

Problem to Item No. 1

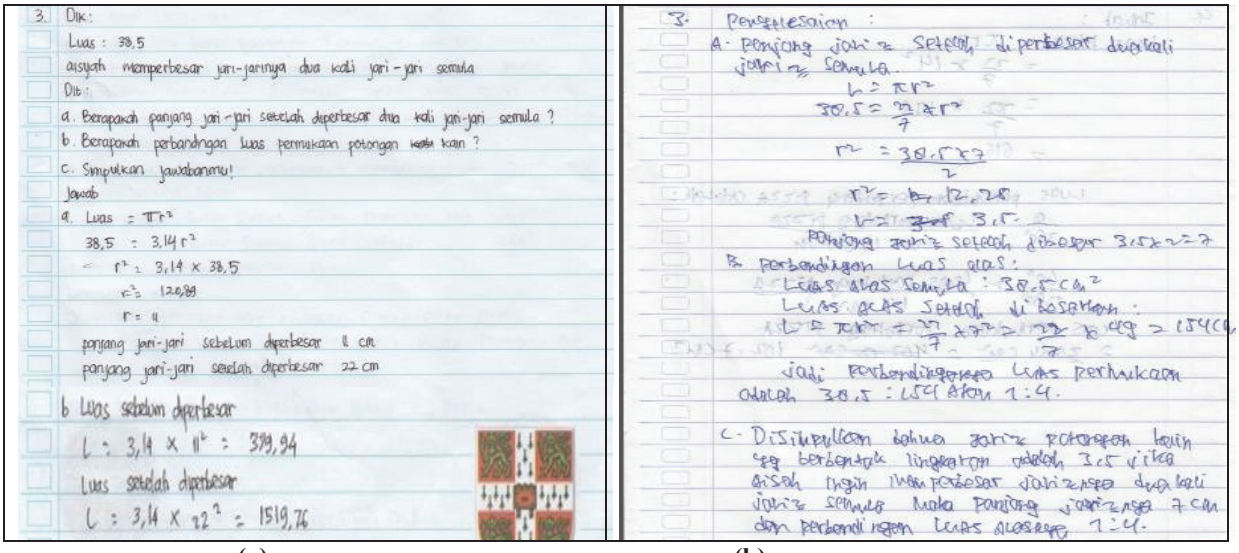


(a) **(b)**

Figure 5. (a) Answer KBK Trials I, (b) Answer KBK Trials II

From figure 5.(a) Steps completion of student in complete and student incorrect in analyzing problems. While the figure 5.(b) Students have been able to analyze the given problem.

Problem to Item No. 2

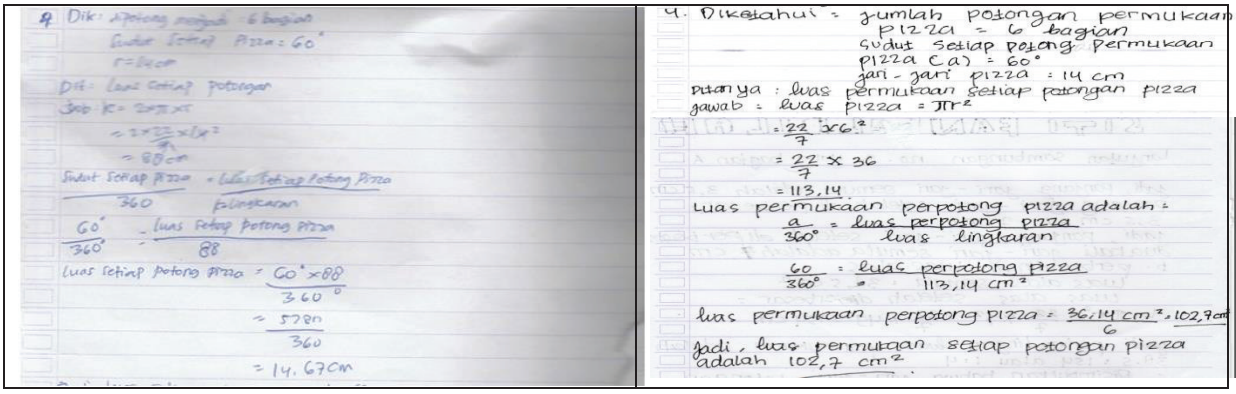


(a) **(b)**

Figure 6. (a) Answer KBK Trials I, (b) Answer KBK Trials II

From figure 6.(a) calculation of students wrong in synthesize stage, students are not able to analyze the questions and student's answers do not complete, then the students do not conclude the answer. While the figure 6.(b) students have been able to analyze problems and concludes with a good answer.

Problem to Item No. 3



(a) **(b)**

Figure 7. (a) Answer KBK Trials I, (b) Answer KBK Trials II

From the figure 7.(a) Students can recognize the problem and steps to resolve the student correctly but the calculations students wrong. While the figure 7.(b) Students can recognize and solve problems. From the analysis of the settlement process of the student's answers, the students' answers on the trials II more acquire the assessment criteria of "good". The process of the settlement process of the student's answers trials II more structured, systematic, varied, and in accordance with the indicators understanding concept and critical thinking mathematically when compared with the settlement process of the student's answers on trials I.

5. Discussion

The results showed that the learning devices based guided discovery model have met the criteria of effectiveness. This is because by applying learning devices based guided discovery model, the students actively seek, developing their own knowledge, and making inferences from the knowledge that is found with the guidance and instructions of the teacher in the form of questions that lead. This is reinforced by Hamalik (2009) guided discovery model is a two-way system that involves students in answering the question as those questions given by the teacher.

The same thing also expressed by Vygotsky (Trianto, 2011), the learning process will occur if the child work or hand let asks that have not been studied, but the task is still with in their reach is called the zone of proximal development. Thus, the more active the students handle the tasks of learning, the more effective the learning is done. This is reinforced by the constructivist theory of Piaget (Sugiyono, 2009), emphasizes the importance of the activities of learners to actively construct their own knowledge, such as the activities of learners in processing materials, work on the problems, make conclusions, and formulate a formula with their own words which are indispensable activity so that learners can build knowledge.

Furthermore, improvement understanding concept and critical thinking mathematically ability of students by using the learning devices based guided discovery model is a natural thing, This is because the students themselves who find the concept and master the correct findings, while the role of the teacher guiding students to give direction (guided) and students are encouraged to think for themselves so that they can find the general principles under the direction / questions given by the teacher and the extent to which students are guided depends on its ability and the material being studied. The same thing also expressed by Andarwati and Hermawati (2013) guided discovery model puts the teacher as a facilitator so that teachers guide students only if necessary. This was confirmed by the results of research Sunismi and Nu'man (2012), as well as the results of research Afrianti and Saragih (2012), respectively on the development of learning materials through guided discovery model of the material geometry and trigonometry assisted computer and Software Autograph in strengthening students' conceptions showed improvement understanding concept mathematically ability of students.

In addition, given the positive response caused students because teachers have given a stimulus in the form of feedback and reinforcement in accordance with the characteristics of the students after studying the state of the class. Based on the characteristics of students, teachers create lesson plans that contain student activities undertaken, time, and evaluation of customized guided discovery model. Teaching programs are also outlined in learning devices, such as student book, guide book teacher, and LAS as a guide for students and teachers in guiding students to obtain solutions to problems and achieve learning purpose. This statement is reinforced by Sanjaya (2010) that the learning process is a complex process, which should take into account the various

possibilities that will happen, possibilities that were subsequently require careful planning of every teacher. In line with the results Effendi (2012) show that students have a positive attitude towards mathematics and learning by guided discovery method. Thus concluded that the components of the learning devices developed to contribute positively to the learning activities of students.

The learning process using the learning devices based guided discovery model, requires students to think more exploratory than just thinking of mechanical and procedural. In addition, students are trained to solve problems that are often experienced by students, by providing a common problem experienced by the students, then the mind set students not just limited to text books, but they can solve the problems in their own way and the measures they deem appropriate settlement. So that it affects of the results of understanding concept and critical thinking mathematically ability, where most of the students' answers systematic, structured, varied, and according to the indicators of the understanding concepts and critical thinking mathematically ability.

6. Conclusion

Based on the research that has been presented in the previous section, some of conclusions can be drawn with: 1) learning devices that meet the criteria of effectiveness, effectiveness in terms of a) students mastery learning in the classically; b) achievement of learning objectives; and c) learning time; 2) learning devices based guided discovery model is able to improve the understanding concept and critical thinking mathematically ability of students, with an average achievement of each of the trials I amounted to 77.92 improved to 81.81 on the trial II and the trial I was 73, 88 improved to 77.58 on trial II; 3) Students' responses to components of learning devices and learning activities were positive 4) the settlement process of the students' answers to problems solving about the understanding concept and critical thinking mathematically ability of students with guided discovery model more varied and better.

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