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The Development of Geometri Teaching Materials Based on Constructivism to Improve the Students' Mathematic Reasoning Ability through Cooperative Learing Jigsaw at the Class VIII of SMP Negeri 3 Padangsidimpuan

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Abstract
The purposes of this research were to know the validity, practicality, and effectivity of geometrical learning material based on the constructivism to Increase students' mathematic reasoning ability and increasing students'mathematic reasoning ability by using learning material at the grade VIII of SMP Negeri 3 Padangsidimpuan. Type of the research was the development of research by using modification of the 4-D development models. The steps of this research were the defining step, designing step, developing step, and dissaminating step. The experiment was done at the grade VIII students of SMP Negeri 3 Padangsidimpuan. Result of the research Showed that: 1) The validity of geometrical learning material based on the constructivism to Increase students' mathematic reasoning ability at the grade VIII of SMP Negeri 3 Padangsidimpuan was very valid, 2) practicality of geometrical learning material based on the constructivism to Increase students 'mathematic reasoning abilityat the grade VIII of SMP Negeri 3 Padangsidimpuan was practical to be used, 3) geometrical learning material based on the constructivism to Increase students' mathematic reasoning ability at the grade VIII of SMP Negeri 3 Padangsidimpuan was effective, and 4) increasing of students' mathematic reasoning ability by using geometrical learning material based on the constructivism at the grade VIII of SMP Negeri 3 Padangsidimpuan was on the medium category.
Keywords: Development, Geometrical Learning Materials based on the Constructivism, Mathematic Reasoning

1. Introduction

Along with the development of science and technology, people are required to have the ability to think critically, systematic, logical, creative thinking, and cooperate effectively so that they can be developed forward in this globalization era. Formal education in this regard has an important role in the development of the things which had been mentioned above, namely by making quality learning. One of the most influential in the learning is appropriate teaching materials.

Teaching materials that can accommodate the diversity of students' ability with their characteristics and make them become active that's a must at this time. Wijaya and Rohmadi (2009: 239) states the success of a teaching-learning process is not solely determined by reliable teacher, good input, and teaching facilities such as school buildings, teaching tools, libraries, and so were adequate, but the election of appropriate and quality teaching materials also have a dominant role. The cause of the difficulties students in understanding mathematical concepts after analized is the less of effective material, so it is needed the effective material.

Teaching material is one of learning tools that can help students in learning. (Pangesti, 2012: 2) argues that the teaching material is the foundation of learning in the classroom. This opinion can be interpreted that the teaching materials are fundamental in the learning process, so important these materials it needs attention in its design. The success of the mathematic learning purpose is very influenced by teaching materials used. As found by Ramdani (2012: 50), which focuses on developing teaching materials directed to improve thinking skills high level math students, such as communication skills, reasoning, and connections mathematical problem solving is not routine, prove or submit justification, as well as discover patterns and propose general form well.

Learning math exacts standards of mathematical process can be cultivated by making teaching materials that support the standard process capabilities. National Council of Teachers of Mathematics (NCTM, 2000), stated that the 5 skills necessary process of the students, namely: (1) problem solving; (2) reasoning and proof; (3) communication; (4) connection; and (5) representation. Those skills are the a high order mathematical thinking that is important to be developed by students in the learning process of mathematics. Reasoning ability is something that must continue to evolve and have different stages in life on each individual and it is important in knowledge. Tan (2007) in (Koray, 2013: 2746) Reasoning ability has an important role in construction of science meaningfully concepts.Depdiknas (in Sadiq, 2004: 3) states that "mathematical material and mathematical reasoning are the two things that can not be separated, ie, mathematical material is understood through reasoning and reasoning can be understood and trained through learning math ". Reasoning aspect is the ability which has been had by the learners as a standard which enables a person can master the concept generally and specifically in depth.

Mathematical reasoning skills students in Indonesia, can be seen from the results of research conducted by The International Trends In Mathematics and Science Study (TIMSS) in Sanjaya (2006: 4), coordinated by the International Association for the Evaluation of Educational Achievement (IEA). The results of the TIMSS in 2011 showed Indonesia was ranked 38 out of 45 countries with an average score of 386, it means it is stiil low level. The questions which are developed by TIMSS include four cognitive domains namely knowledge of the facts and procedures, application of the concept, a routine problem solving and reasoning. Based on the previous exposure, so the development of teaching materials and improving reasoning skills should be an attention focus in mathematics learning, because by trying to develop appropriate teaching materials such as books and worksheets which are accompanied by supporting lesson plans will push to develop the skills of mathematical processes. Context's ability in this regard emphasized the reasoning.

At this time, learning is emphasized on student-centered learning where students are given the opportunity to make sense of the problems which is faced until he obtained a settlement or the appropriate conclusions. Remembering the demands of an active learners, reasoning and teaching are just enough as facilitator then one suitable approach is constructivism. Constructivism assumes that learning is an active process where learners using all five senses to construct their understanding. Constructivism also can improve reasoning. The constructive nature of students' learning processes, have important implications for teachers who wish to model of scientific reasoning in an effective fashion for their students (Cakir, 2008; 193). It was clearly said that constructivism learning is one of the solutions for scientific reasoning which is appropriate with the learners.

Constructivism assumes that knowledge cannot be granted. Knowledge can only be offered to students, the rest depends on the efforts of students to construct knowledge in order to get a good learning outcomes. That is if it is related Yerizon's research, et al with the use of geometry-based Instructional Materials Constructivism applied effectively used as teaching materials and to improve learning outcomes (Yerizon, et al, 2012; 56-57), so that the combination of teaching materials and the theory of constructivism is one of the good breakthrough.

The results of the survey researchers (dated 22 September 2015 for the provision of diagnostic tests to students of SMP Negeri 3 Padangsidimpuan showed that 70% of the total number of students face the difficulty in solving problems in the form of reasoning geometry measurement of mathematics. Remembering one of the subjects that are important in school is geometry. Geometry by Kartono (2012: 25) "based on the point of view of psychology, geometric abstraction was the presentation of visual and spatial experience, eg field, pattern, measurement and mapping". Diagnostic tests performed showed that students feel the difficulty in resolving questions that test reasoning ability analogy. As many as 70% of students are not able to resolve the questions reasoning analogy. This case requires us as a teacher to improve reasoning and select appropriate learning strategies to the material in order to reduce that errors. Anticipating these circumstances, the strategies which is done need to be reformed. Tasks and role of the teacher are no longer as informants but as a driver of student learning in order to construct their own knowledge, in addition to approaches, teaching staff are also required to have teaching materials learning is the handle in carrying out teaching and learning activities in the appropriate grade student characteristics. Based on the observations and informal interviews were conducted to the teachers and students of SMP Negeri 3 Padangsidimpuan on September 22, 2015. The results that can be seen was instructional materials which is used had not been effectively to sharpen students' reasoning. More specifically, because of the lack of teaching materials such as books, LKS (Student Worksheet) that support reasoning ability also affecting patterns of RPP (lesson plan) is very conventional and impressed it is just.

Further observation, books and worksheets that are used during the time in SMP Negeri 3 Padangsidimpuan only in the form of books and worksheets with questions about the routine without a method to enable the student activity prior to the material geometry depends on teaching materials in addition, RPP (lesson plan) which is used also less in accordance with the character of the students which are very diverse with conventional methods that have been there from many years ago without any renewal. The limitations which are exist for a long time cause students rely on notes from the teacher and always rely on the teacher's explanations, no effort / desire to find their own solutions. Here's a picture worksheets and lesson plans used in the school:

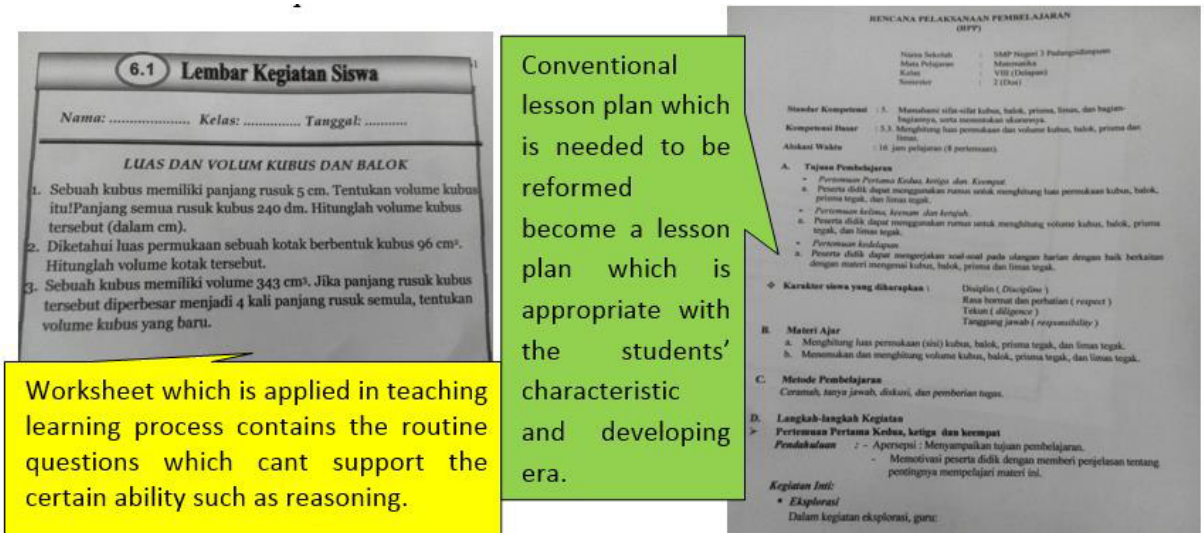


Figure 1. Example of worksheets and lesson plans used in SMP N 3 Padangsidimpuan

According to a series of interviews and direct observation dated September 22, 2015, clearly described how the necessary a creation of a teaching material that is based on constructivism. The other combination except teaching materials based on constructivism is a learning strategy. Applying cooperative learning in the classroom based on several studies, which have found that when students work together to achieve a group goal, making them express good norm in doing whatever which is necessary for the success of the group. Jigsaw type of cooperative learning can enhance students' learning activities. As Menduo and Xialing (2010: 114) argue that "Jigsaw is said to be Able increase of student's learning since a) it is less threatening for many students, b) it increases the amount of student participation in the classroom, c) it reduce the need for competetiveness and d) reduce it's the teacher's dominance in the classroom ". Consequently, jigsaw strategy can successfully reduce students' reluctance to Participate in the classroom activities and help create learner-centered active in atmospher. Jigsaw is said as the learning which can improve students' learning activities because a) reduce the penalty for students, b) increase the participation of students in the classroom, c) reduce the necessary to compete d) reduce the dominance of the teacher in the classroom as the effect, learning strategies jigsaw can reduce the reluctance of students to participate in the classroom activities and help create student-centered liveliness.

Based on the explanation above, the question of this study are as follows: (1) How is the validity of the development of teaching materials based constructivism geometry to improve students' mathematical reasoning through Jigsaw cooperative learning in class VIII of SMP Negeri 3 Padangsidimpuan? (2) How is the practicality of teaching materials based constructivism geometry to improve students' mathematical reasoning abilities through Jigsaw cooperative learning in class VIII of SMP Negeri 3 Padangsidimpuan? (3) How is the effectiveness of teaching materials based Geometric Constructivism to improve students' mathematical reasoning abilities through Jigsaw cooperative learning in class VIII of SMP Negeri 3 Padangsidimpuan? (4) How is the increasing ability of mathematical reasoning class VIII of SMP Negeri 3 Padangsidimpuan using Geometry teaching materials based constructivism through cooperative learning of Jigsaw?

2. Theoretical Description

2.1 Ability of Mathematical Reasoning

Reasoning ability is the ability of students to think logically according to specific workflow framework. Reasoning is an ability that must be owned by the students when doing the math learning process. This reasoning abilities is also as one of five standard mathematical learning process that has been set. The fifth standard process that is problem solving, reasoning, communication, representation and the connection). (NCTM, 2000)

Reasoning is a thinking process to take a conclusion from the information obtained. Bruner (Lohman, 2009: 3) states that the reasoning Refers to the process of drawing Conclusions or inferences from information. Reasoning always requires going beyond the information that is given (Bruner, 1957). Reasoning as the outline has two types, namely inductive reasoning and deductive reasoning which is also called as deduction. Sumarwo (2007: 116) explains that "Equality between deduction and induction is that both arguments have a structure consisting of several premises and a conclusion. The difference between deduction and induction on the basis of inferences and conclusions properties which are lowered."

Bani (2011: 13) reveals,

> Inductive reasoning is a thought process that attempted to link facts or special events which had been known strives to the conclusion of a general nature. Deductive reasoning is a thought process to draw conclusions about specific things that rested on a common things or things that have previously been

demonstrated (assumed) the truth.

A. Inductive Reasoning

Based on the Bani's opinion above, it can be concluded that inductive reasoning is drawing conclusion based on the number cases or limited example. It explains that the reasoning is reasoning which is continue from the specific things to the general things (generalization). It means that the thinking activity draw a conclusion or making a new statement of a general based on the facts that are specific which had been known well. Learning begins by giving examples or specific case towards a general concept.

Inductive reasoning is divided into two, namely:

1) Generalization

(Rahman, 2014.38) Generalization is a process of reasoning which is based on the examination of things to taste and then get the conclusion for all or most of these things, for an advanced level mathematics, to verify the correctness of results which is gotten in a conlusion, so it is done examination in mathematical induction. It is intended to prove whether the inference obtained apply to all. This means in generalization doing observations of specific examples and then be able to find patterns or rules from these examples that are generally.

2) Analogy

Analogy is the reasoning of a certain thing to another similar one thing and then conclude it. The conclusions which is gotten from the analogy way, that the conclusion of a special opinion of some special opinion of others, by comparing the situation or pattern of the previous one. This is in accordance with the opinion of Rahman (2014: 38), "The analogy is the reasoning of a certain thing to another similar thing then conclude what is right for one thing will also be true for other things".

B. Deductive Reasoning

Based on the opinion of Bani and Sumarmo which have been disclosed previously, it can be concluded that deductive reasoning is reasoning that goes from things that are common (generalization) to things that are special. This deductive reasoning must be a previous statement which was assumed to be true, so that produce a new statement which is referrenced to the statement that had been assumed to be true before. Making a deductive proof process will involve theory and other mathematical formulas which have previously been substantiated the truth as deductively also.

There are two types of deductive reasoning, namely:

1) Syllogism

Deductive reasoning is often used is the syllogism. Syllogism is reasoning indirectly. In the syllogism there are two premises and a conclusion premise. The second premise is the premise of the general / specialized major premise and the premise / minor premise. From both of those premises, the conclusion is formulated.

2) Conditional

Conditional Reasoning is a part of the thinking that is changing the information which had been provided to get a conclusion. The existing problems in the conditional explain the relationship between the two conditions or circumstances, which are expressed by the relationship if ..... then .....

Reasoning conditionally divided into two, namely:

a) Ponens Modus

Ponens Modus is the relationship between premises. The first premise is a conditional statement that is using "If ... (is antesenden), then ... (is the conclusion)". The second premise is not conditional statement. There are two types of ponens modus reasoning, they are strengthening antesenden (component P) and strengthening consequent / conclusion (q component).

b) Tollens Modus

There are two types of reasoning, they are denying antesenden and consequently denying consequent. Denying antesenden means if the second premise denies the right antesenden on the first premise.

Based on the understanding of some experts and the explanations above, it can be concluded that the ability of reasoning is a thinking activity to make a new statement or conclusion which are referrenced to the previous statements which are assumed to be true. Reasoning indicators are gotten on the basis of the conclusions which are gotten after making the observation, looking for the truth of revelation, and find patterns to make generalizations. Mathematical reasoning is the ability to think for obtaining a logical conclusion based on the facts and the relevant sources. The conclusion which is gotten based on the previous statement that is assumed to be true.

Researchers set, the indicators which are used in this study are 4 indicators which are perceived appropriate with the characteristics of students and some clarification on aspects of the reasoning which had been explained above. Indicators reasoning skills of students as follows:

1. Can determine the similarity relationship in a pattern of nature
2. Can draw general conclusions
3. Can make the conclusion of an argument by using the principle of modus ponens

4.Can make the conclusion of an argument by using the principles of syllogism

2.2 Theory of Constructivism

Based on constructivism view, knowledge is a construction (formation) of people who know something (schemata). Knowledge can not be transferred from the teacher to the others, because each person has their own schemata about what he knows. The most basic constructivism is form piagnet and Vygotsky. In this case the understanding as the reference is Vygotsky's theory.

Vygotsky in (Cahyono, 2010: 443) states that learners in constructing a concept needs to pay attention to the social environment. This Constructivism by Vygotsky (Cahyono, 2010: 443) called socio-constructivism. There are two important concepts in Vygotsky's theory, namely the Zone of Proximal Development (ZPD) and scaffolding. Zone of Proximal Development (ZPD) is the distance between the actual developmental level which is defined as the ability of problem solving independently and the level of potential development is defined as the ability of problem solving under the guidance of adult or in collaboration with more capable peers. Scaffolding is giving some assistance to students during the early stages of learning, then reduce aid and provide an opportunity to take over greater responsibility after he can do it. Scaffolding is the assistance provided for learners to learn and solve problems. The assistance can be in the form of guidance, encouragement, warning, describe the problem in solving steps, provide examples, and other measures that allow learners to learn independently.

Formation of knowledge is a cognitive process which occurs assimilation in order to achieve a balance so that formed a new schemata. Constructivism assumes that knowledge can not simply be transferred to the student. Knowledge can only be offered to students, the rest depends on the efforts of students to construct knowledge. (Gabert, 2011: 37) Constructivism emphasises the importance of the knowledge, beliefs and skills that an individual brings to the experience of learning. In its many different forms (from a Piagetian notion of an individual's adaptation and assimilation of new information to an emphasis on learning as the product of complex socio-cultural processes, as suggested by Bruner, Lave, Rogoff, and Vygotsky), the learner is an active participant. Based on the experts' suggestion that learning is an active process of the subject learn to construct meaning something, whether it is text, dialogue, physical experience and others, so that learning is a process assimilate and relate experiences or material which are learned with the understanding which they have, so understanding will be developed.

A teacher's constructivist class does not teach students how to get results, but present the problem and encourage students to find their own way to solve the problems. Teachers try to not say that the answer is correct or not correct when the student gives an answer, but teachers encourage students to agree or disagree to the idea of a person. Exchanging of ideas until agreement was reached on what can be a reasonable student. Students are empowered by the knowledge that resides within them and the environment. In line with the statement of Thompson (2013: 1) There are two principle schools of thought within constructivism: radical constructivism (some people say individual or psychological), and social constructivism.

Based on constructivism understand Vygotsky. The principles that are often taken out of constructivism according Trianto (2013: 75), among others:

a) The knowledge built by students actively
b) The pressure in the process of learning lies in students
c) The teaching is to help students learn
d) The pressure in the process of learning more on the process rather than the final result
e) The curriculum emphasizes student participation
f) Teacher as facilitator (giver scafholding)

2.2.1. Geometry-Based Instructional Materials Constructivism

Teaching materials is prepared by using a constructivism approach, where students build / find themselves how geometry concepts. With there are questions which are given require students to work and experience by themselves the knowledge. Finally, the students understand the learning materials which are provided and acquiring new knowledge.

Constructivism based teaching material (Adina, 2012: 24) contains the following elements:

1) Orientation, it means that teaching materials provide opportunities for students to develop motivation in researching a topic. Students are given the opportunity to conduct observations of the topics to be studied.
2) Elicitation, it means that using teaching materials help students express ideas clearly by discussing, writing, creating posters, and others. Students are given the opportunity to discuss what will be obesrved, in the form of text, images, or posters.
3) Restructuring of ideas, in this case there are three things.
    a) Clarification of ideas which are contrasted with the ideas of other people or friends through discussion or through the collection of ideas. Faced with other ideas, someone could be

stimulated to reconstruct the ideas that did not fit or otherwise, become more confident if his ideas is suitable.

b) Build a new idea is happened if in the discussion his idea is contrary to another idea or his ideas cannot answer the questions which is given by the friends.

c) Evaluate new ideas with experiments, if it is possible, it is better if the new idea is formed to be tested with an experiment or a new issue ones.

4) The use of the idea in many situations. The idea or knowledge that have been formed by the students need to be applied in a variety of situations encountered. This will create a more complete knowledge of students and even more detailed with all sorts of exceptions.

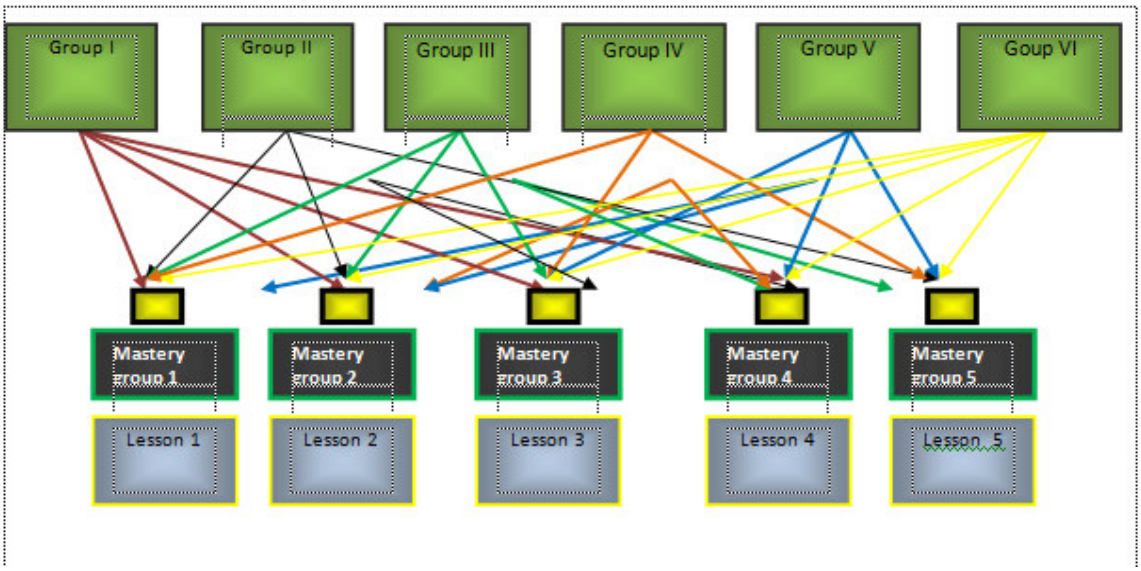
5) Review, how the idea was changed, may occur in the application of knowledge to the situation faced every day, someone needs to revise his ideas either to supplement it with an explanation or perhaps turn it into a more complete.

2.3 Cooperative Learning Jigsaw

Cooperative learning model is one model of learning that supports contextual learning. Jigsaw type of cooperative learning is a type of cooperative learning that consists of several members in one group responsible for mastering parts of the material and able to teach the material to other members in the group (Arends, 1997). Khanafiah (2010: 54) argues in a jigsaw type of learning, students are divided into groups whose members heterogeneous. Each is responsible for studying the assigned topic and teach the group members, so that they can interact and help each other. This means cooperative learning jigsaw model is a cooperative learning model in a way students learn in small groups of four to six people are heterogeneous and students work together in positive interdependence and responsible independently. The mechanism of this technique, students can work together with other students and have more responsibility and also have many opportunities to process information which is gotten and improve the skills to communicate and socialize. The learning model like this should be optimized because it can improve the ability to create on the students and certainly improve student achievement.

Cooperative learning jigsaw can be implemented by following the steps as suggested by RJ (2012: 271), namely:

i. Students are grouped into four member team
ii. Each person in the team is given a different part of the material
iii. Each person in the team is given a part of the material assigned
iv. Members from different teams who have studied the same sections / subsections meet in the new group (group of experts) to discuss their section
v. After finishing discussions with a team of experts, each member returns to the original group and take turns teaching their teammates about their master section and any other member listened sincerely
vi. Each team of experts presented the results of discussions
vii. Teacher gives evaluation
viii. Closing



3. Research Methods

This research includes depelopment research using 4-D model of development Thiagarajan, Semmel, and Semmel (1974).

3.1 Subject and Object

Subjects in this study were students of class VIII of SMP Negeri 3 Padangsidimpuan 2015/2016 academic year, whereas the object of this research is Geometric Constructivism Teaching Material based on limas and prism material and mathematical reasoning abilities of students. A test I is done in class VIII / 2 and II trials is done in class VIII / 1.

3.2 Development Procedure Learning Tool

Learning toolswhich are developed: the implementation of the Lesson Plan (RPP), Student Books, Teacher Books, Student Worksheet (LAS) and the Learning Ability Test, especially mathematical reasoning skills students. Learning model of learning tools use the 4-D model. But, this stages was not done, so that it was not explained in depth. The development model of this research is described in Figure 1 below.

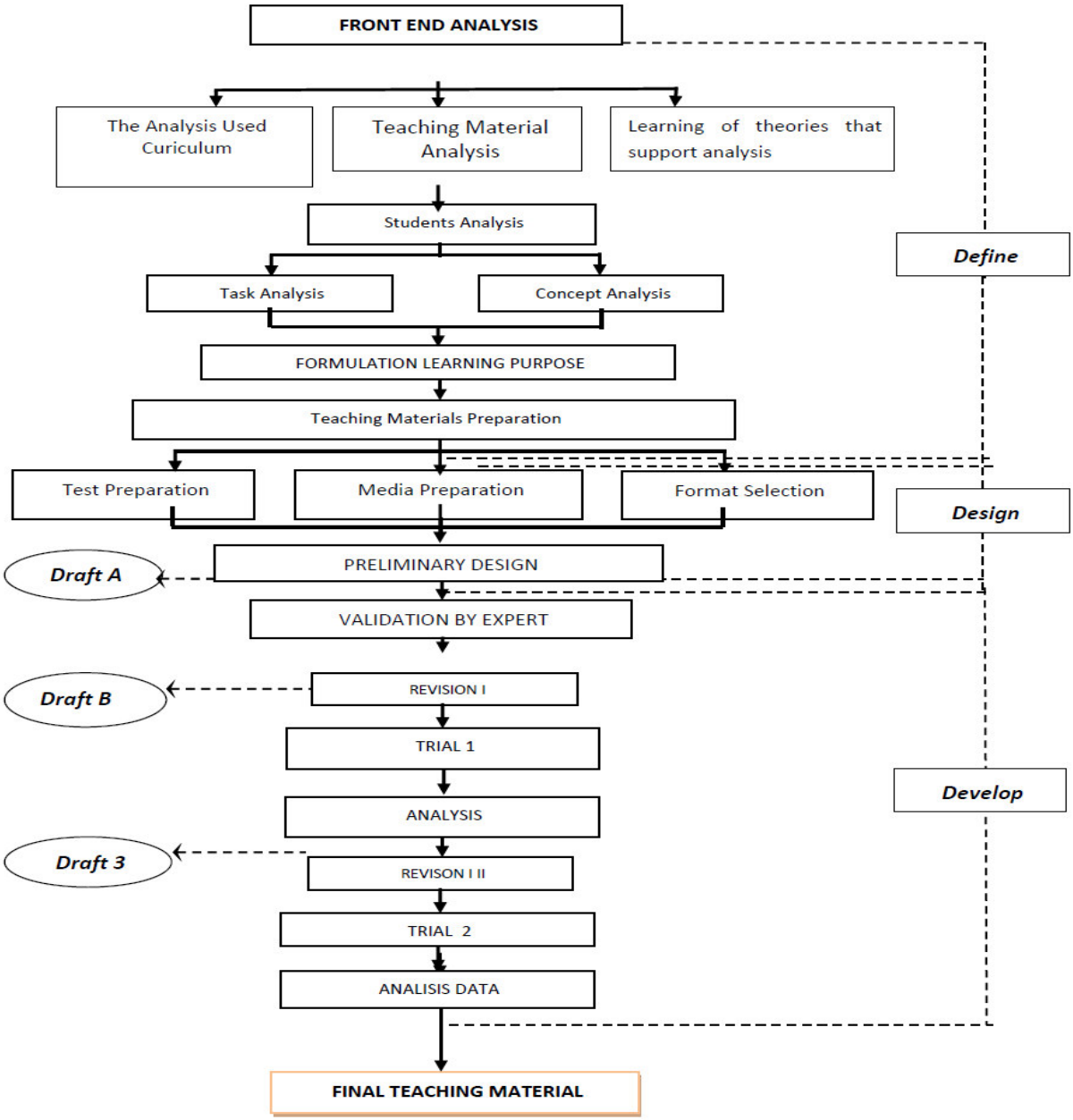


Figure 3 : Chart Development of Learning Devices 4-D Model (Modified Yuliani & Saragih, 2015:119)

3. 3. Instruments and Data Analysis Techniques

Instruments and tools for collecting data in this study are test, questionnaire and observation sheet. For more details can be seen in Table 1 below.

Table 1. Instruments and Techniques for Collecting Data

Aspect assessed	Instruments	Data observed	Respondents
validity of Teaching material	Validity sheet	Validity of learning implementation plan, student's book, teacher's book, worksheet, mathematical reasoning ability test	Expert
Practically of Teaching material	Validity sheet	Practically of learning implementation plan, student's book, teacher's book, worksheet, mathematical reasoning ability test	Expert
	Quistionnaire	Student's response	Subject test
Effectiveness of Teaching material	Test	Mathematical reasoning ability test	Subject test
	Observation sheet	Student activity	Observer
Enhancement of reasoning ability	Test	(Pretest and Posttest of mathematical reasoning ability)	Subject test

3.3.1. Validity Analysis of Geometri Teaching Materials Based Constructivism

Development of Teaching Materials are validated by five validator. The criteria for the validity of Subjects as follows:

Table 2. Validitas Category Level

No	*Va* or average value	Criterion validity
1	$1 \leq Va < 2$	Invalid
2	$2 \leq Va < 3$	less valid
3	$3 \leq Va < 4$	enough Valid
4	$4 \leq Va < 5$	Valid
5	Va	very Valid

Source: (Sinaga, 2007:161)

Note:

Va is the value of determination level validity Subjects Geometry based Constructivism.

The criteria stated teaching materials have a good degree of validity, if the validity of the minimum level reached is valid ($4 \leq Va < 5$).

Teaching materials have been revised based on input from experts and samples tested outside of the classroom in order to get eligible Subjects. Then, the test results are analyzed for validity and reliability. The formula used to calculate the validity is the product moment correlation (Arikunto, 2012: 87), that is:

$$r_{xy} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{\{N\sum X^2 - (\sum X)^2\}\{N\sum Y^2 - (\sum Y)^2\}}}$$

Note:

X : score items

Y : total score

r_{xy} : correlation coefficient between the item score and total score

N : the number of students who take the test (sample)

Then, to determine the coefficient of reliability of a test used in narrative form alpha formula (Arikunto, 2012: 122) as follows:

$$r_{11} = \left(\frac{n}{(n-1)}\right)\left(1 - \frac{\sum \sigma_i^2}{\sigma_t^2}\right)$$

Note:

r_{11} : reliability coefficient test

n : the number of test items

$\sum \sigma_i^2$: the number of variance test scores of each item.

σ_t^2 : total variance

3.3.2 Practical Analysis of Geometri Teaching Materials Based Constructivism

Geometry Teaching Materials based constructivism to improve reasoning ability to be practical if it fills indicators :

1) Validator stated that geometri teaching materials based constructivism can be used with little revision or not. How to provide practicality on teaching materials have been created by giving a questionnaire about

the assessment of teaching materials to validator with validation sheets of geometry teaching materials based constructivism. The evaluation criteria for instructional materials are:

A : Can be used without revision
B : Can be used with little revision
C : Can be used with many revisions
D : Not usable

2) positive response of students indicated from questionnaire.

Analysis of the answers questionnaire responses of students to the teaching material is used as a reference that students are able to use teaching materials. To analyze the data are responding students use the formula:

$$RS = \frac{f}{n} \times 100\%$$

Note:
RS : The percentage of students with specific criteria
f : Total Score
n : maximum score

Determine the average score of the positive response of students, and then determine which categories of response or the response of students to a criterion by matching the results with the percentage of positive criteria, according Khabibah (Yamasari, 2010), that is:

85% ≤ RS : very good
70% ≤ RS < 85% : good
50% ≤ RS < 70% : less good
RS < 50% : not good

Geometry teaching materials based Constructivism to improve the reasoning ability to be practical when respond of students is well on teaching materials.

3.3.3. Effectiveness Analysis Geometry Teaching Materials Based Constructivism

Geometry teaching materials based constructivism is said to be effective if it fills indicators :

a. Geometry teaching materials based constructivism to improve mathematical reasoning abilities are effective if ≥ 80% of all test fill mastery learning (Yamasari, 2010).
b. The activities of the students indicated positive of the observation sheet. To analyze the scores given by the observer by using the formula:

$$AM = \frac{f}{n} \times 100\%$$

note:
AS : Percentage of Student Activities
f : Total Score
n : maximum score

Determine an average score of student activity then matches the results with the percentage of positive criteria, according Khabibah (Yamasari, 2010), that is:

85% ≤ AS : very positive
70% ≤AS< 85% : Positive
50% ≤AS< 70% : less Positive
AS< 50% : not Positive

3.3.4. Analysis enhancement of mathematical reasoning ability

Enhancement of mathematical reasoning ability students after using teaching materials calculated by using N-gain. calculating N-gain formula is used:

$$\text{N-}Gain = \frac{postest\ score - pretest\ score}{maxsimum\ possible\ score - pretest\ score}$$

gain index criteria are :

g > 0,7 : High
0,3 < g ≤ 0,7 : Medium
g ≤ 0,3 : Low (Hake, 1999)

4. Results

The results of the development Geometry teaching materials based constructivism are presented as follows :

4.1 Define

Geometry teaching materials based constructivism to improve reasoning ability is designed based on fond-end

analysis start from interview with teachers, analyze mathematic syllabus, analyze and meriview reference books that can be used to teach the subjects of mathematics, as well as studying the characteristics of the students.

4.2 Design

This stage, designed learning implementation plan (RPP), books and worksheets for geometry material based constructivism and cooperative learning *jigsaw* as well as designing the assessment that leads to mathematical reasoning abilities of students.

a. Learning Implementation Plan.

Learning implementation plan arranged for 4 meetings each contains 1. Identification of subjects, standards of competence, basic competence, indicators, learning objectives, teaching materials, fittings, learning model, learning scenarios and assessment of learning outcomes. The material at the first meeting determine the formula is the surface area of the cube, at the second meeting of determining the surface area of the beam, at the third meeting of determining the volume of a cube, and the fourth meeting of determining the volume of the beam. Learning implementation plan is designed using the syntax cooperative learning *jigsaw*.

b. Book

Based on the analysis front-end, designed a geometry teaching materials based constructivism to improve mathematical reasoning skills students according to student characteristics. The book contains material developed extensive geometry and volume as well as problems to be solved by the students in groups and independently. Teaching materials in the book using the concept of questions and explanations that support the process of constructivism. Geometry Teaching materials based constructivism focused on improving students' mathematical reasoning abilities.

b. Student Worksheet

Student worksheet arranged for containing four meetings about, the cube surface area, surface area beam, cube volume and the volume of the beam. Student worksheet is designed for cooperative learning *Jigsaw*.

c. Mathematical reasoning ability test.

Preparation of the test the ability of reasoning based on indicators. Tests are arranged in the form description. This test uses the reference benchmark assessment (PAP), because this test is used to measure how far the indicators that have been formulated and attempted to rise. Shaped mathematical reasoning ability test description consists of four items. The time allotted to complete all of these questions is 80 minutes.

4.3 Develop

a. Validation

validation of implementation plan, books, worksheets and reasoning ability tests conducted by experts and practitioners. Validation of experts made to the equipment and instruments developed to produce devices and instruments eligible. The expert in question in this case is the validator competent covering Lecturer Mathematics Education courses Unimed, teacher in SMP Negeri 3 Padangsidimpuan and teacher in Ponpes Nurul Palah South Tapanuli. Based on the results of expert assessment then made revisions to devices and instruments. Advice from validator is used for the improvement of devices and instruments. Following the assessment of validators:

No	Devices is rated	Average	Criterion validation Result
1	Learning Implementation Plan	89,07	very valid
2	Book	89,07	very valid
3	Student worksheet	90,25	very valid
4	Mathematical Reasoning Ability Test		Little Revision and not

Based on the validation results of learning implementation plan, books, worksheets and tests of mathematical reasoning skills obtained information that all validators say that the device developed valid. Questions about the validity of research geometry teaching materials based constructivism to improve mathematical reasoning has been answered.

b. Trial of Teaching Material

Teaching material were tested in field trials stage a revised teaching materials based on the comments given students in the testing phase. Books revised expected to be effective for use in learning..

a. Practically Test

The first criterion, from experts / validators and practitioners (teachers) is based on responses of experts / validators and practitioners (teachers) states that geometry teaching material based constructivism has to be used with a little revised so that, in summary criteria of practicality first been filled which can be used with little revision.

The second criterion is on the analysis of answers to questionnaire responses of students to teaching materials response analysis results of students to teaching materials. Based on calculations score obtained: RS = 81.58%.

The results of students' response to geometry teaching materials based constructivism to improve mathematical reasoning has a value of 81.58%. That is, students respond well to the Subjects. Thus the teaching materials developed practical used.

b. Effektivenees Test

The effectiveness of teaching materials in terms of:

1) Mastery Learning

Mastery learning students can be obtained from the analysis of data on students' reasoning abilities after getting learning by using teaching materials

Geometry teaching materials based constructivism to improve mathematical reasoning ability is said to be effective if ≥ 80% of all test subjects fill mastery learning with the average score reached KKM 70. According to the table below, there was information that the average reasoning skills students have an average value 78.39 in category 'Good'. When seen from the number of research subjects, then there are as many as 87.50% of students who achieve mastery. In conclusion, teaching materials fill the criteria of effectiveness

. Results of Mathematical Reasoning Ability Test							
result	Items score (X)				Total (Y)	Value	Exp
	1	2	3	4			
Total	86	76	74	65	301	1881,25	**Completed = 21**
average	3,58	3,17	3,08	2,71		**78.39**	**Not Completed = 3**
Percentage							**87,50 %**

2) Student activity

Meeting	aktivity was observed					
	VA(%)	OA(%)	WA(%)	DA(%)	MA 1(%)	MA 2(%)
I	100%	37,5%	83,33%	75%	75%	29,17%
II	100%	41,67%	91,67%	87,5%	83,33%	16,67%
III	100%	54,17%	91,67%	91.67 %	83,33%	12,5%
IV	100%	58,33%	100%	95,83%	91,67%	8,33%

According to the table above were obtained information about the activities of students during study shows that geometry teaching materials based constructivism is taught by cooperative learning *jigsaw* to improve math reasoning skills students can bring positive activities and reduce the appearance of negative activity of students. Activities that often and successfully implemented in the class is reading books and doing exercises on worksheets. This activity more appear at each meeting. geometry teaching materials based Constructivism to improve the ability of mathematical reasoning in general can make students actively in learning.

c. Enhancement of Student Mathematical Reasoning Ability

Data of Mathematical reasoning abilities is obtained and analyzed for knowing mathematical reasoning skills students using teaching materials. Description of the results obtained in which each student has a positive improvement from pretest to postest. More clearly presented in the following graph:

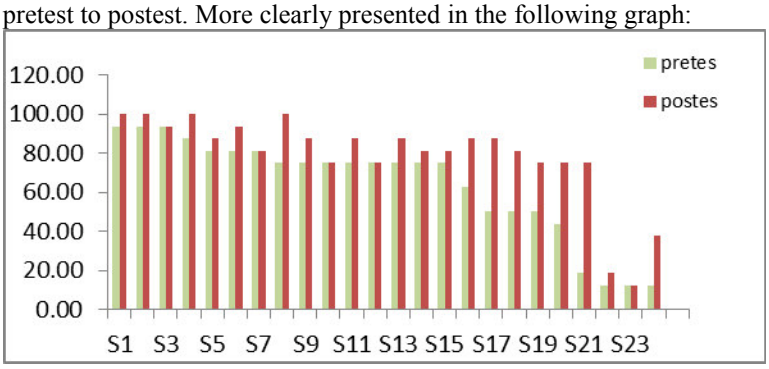


Figure Graph pretest and posttest results Students

The figure shows that results of Prestes and posttest each students which is clearly visible almost every student has increased on posttest, from the data obtained pretest and posttest results of mathematical reasoning skills and n-gain. after analyzed the presence or absence of mathematical reasoning abilities seen an increase of N-gain. N-obtained results the student's overall gain of 0.41 means that there is increasing students' mathematical reasoning abilities after using teaching materials developed. Increased happened to be on the criterion of "medium".

The increase in every aspect of reasoning can be presented by the following chart:

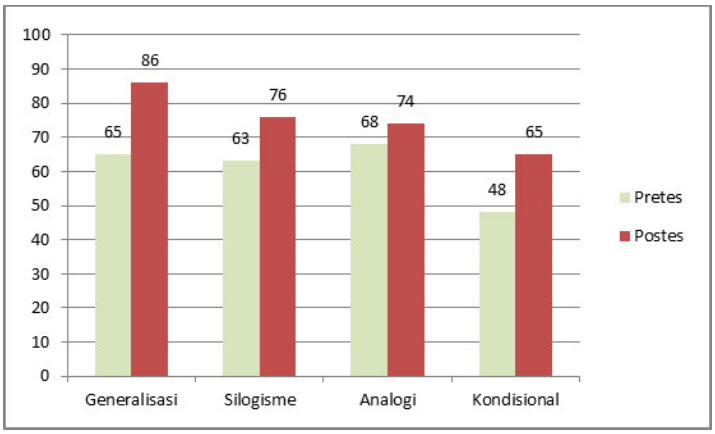


Figure Graph pretest and posttest results each indicator of Reasoning Ability

Every aspect of reasoning looks all have increased but in more detail seen in the table below:

No	Aspect	Pretes	Postes	N-Gain	Criteria
1	*Generalization*	65	86	0,7	High
2	*Syllogism*	63	76	0,4	Medium
3	*Analogy*	68	74	0,2	Low
4	*Conditional*	48	65	0,4	Medium

Table N-Gain each Indicator

According to information above has been obtained that the highest increase in mathematical reasoning ability is the aspect of *generalization* that is equal to 0.7 with"High" criteria. The lowest increase is in the aspect of the *analogy* that is equal to 0.2 with "low" criteria.

5. Discussion.

A learning device of good quality if it meets the quality aspects that validity, practicality and effectiveness (Nieveen, 2007). (1) The research question "How validity of geometry teaching materials based constructivism to improve mathematical reasoning students through cooperative learning *Jigsaw* in class VIII SMP Negeri 3 Padangsidimpuan?" Has been answered based on the description of the results of the validation device by validator and teaching materials, to fix some problems presented by the validator, the learning device of geometry teaching materials based constructivism to improve mathematical reasoning can accomplish what you want to measure as, Sugiyono, (2008: 173) argues that the instrument is valid means of measuring instruments used to obtain data (measures) were valid , Valid means the instrument can be used to measure what should be measured.

The results of the validation of teaching materials for materials formulated as valid. This means that the material presented on teaching materials loading indicator of the ability of mathematical reasoning, material loading concept, contains a description, an example of the problem, exercise, and the material can also improve the quality of learning, Problems can encourage students to improve the ability of mathematical reasoning students ,

Based on the results of the validation by the validator can be concluded that the development of Learning Implementation Plan (RPP), books, worksheets and tests of math reasoning abilities considered valid. (2) the research question of "How the practicality of geometry teaching materials based constructivism to improve mathematical reasoning students through cooperative learning jigsaw in class VIII SMP Negeri 3 Padangsidimpuan?" Has been answered, namely teaching materials based geometry constructivism to improve mathematical reasoning practical use. Here, presented about the practicality of teaching materials in the classroom trials.

Based on the results of the analysis, practical teaching materials developed for use in learning geometry. This is in line with research Holila (2016) who received practical teaching materials after getting analysis from experts (validator) and practitioners (teachers) and got a good response from students. (3) The question of the effectiveness of the learning guide developed in terms of mastery learning, student activities and teachers in managing learning activities.

- Mastery learning

Mastery learning is measured in the form mathematical reasoning abilities of students. This capability is presented according to the indicators of mathematical reasoning. Test of reasoning ability descriptions shaped comprising two stages, namely pretest and posttest, each stage has four items that must be completed within 80 minutes. Fifth validator provide an assessment of the components in Mathematical Reasoning Ability Test with invalid votes, for content validity and construct such clarity of instructions / goals, and understandable to the

validity of the language. The study concluded the development of geometry teaching materials based constructivism to improve students' mathematical reasoning is valid. Problem of Mathematical Reasoning Ability Test 4 have the maximum score.

The results of the examination conducted by the researchers, in general the students already understand how the process of resolving the problems of reasoning with 4 types of reasoning aspect and can be considered complete that can be seen in the results. Researchers further directs students to do exercise routine with the steps in accordance with the concept of reasoning each item asking. The results showed that the effectiveness of the completeness criteria are filled.

- Student activity

Student activity observed by two observers at different times of the first observer on learning 1 and 2, the second observer on learning 3 and 4. Observers watched by groups formed, Analysis the average activity of students are in the learning effectiveness of the restriction criteria (criteria effectively filled),

VA (Visual Activities) have a percentage of 100%. This means, students actively read a given book. OA (Oral Activities) which has a percentage of 21.13%, This shows that, in the learning of the students who have questions or respond to questions. WA (Writing Activities) have a percentage of 100%, ie the students work on a given workout. DA (Drawing Activities) has a percentage of 87.5%, ie student draw a picture or table. MA 1 (Mental Activities) has a percentage of 81.25% which students respond, troubleshoot, analyze, look at the relationship and make conclusions. MA 2 (Motor activities) have a percentage (9.38%) is only few student disturbing friends, daydream or play.

Student activity can also be seen based on the analysis of student worksheet. Students are actively working on worksheets assigned by teacher, with student worksheets easier to understand the problems of mathematical reasoning, This is in line with research Yerizon (2012) which says that the teaching materials are valid and effective would be to enable students to construct knowledge,

Discussion on the whole that the results of this study have developed a teaching materials that fill the criteria for a valid, practical and effective. The results of this study strengthen the results of research Adina (2011) who argued that teaching materials in the form of module-based constructivism valid, practical, and can effectively improve student learning motivation on the subjects of Algebra II. The study also reinforces the results Khoirunnisa (2007) who argued that the reasoning abilities of students in trigonometry material can be increased through the development of teaching materials. (4) The question of a study on the increase, to determine the increase of mathematical reasoning skills students are given learning by using teaching materials to do the analysis that the average increase in overall mathematical reasoning skills students is 0.41 which is the criteria for a modest increase.

The results of the analysis students' answers on the pretest showed that low levels of mathematical reasoning abilities students. There are still many students who are not able to plan the solution of the problem and determine the reasoning and conclusions apply. Students do not know how to answer the problems of reasoning process in question.

The results of the analysis of students' answers on the posttest showed that many students were able to solve the problem of mathematical reasoning. When viewed from four indicators reasoning the highest increase in reasoning ability is the aspect of generalization (can draw general conclusions) that is equal to an increase of 0.7 criteria "High" whereas, the lowest is the aspect of analogy (notice a pattern) that is equal to 0.2 to criteria for the increase in "Low". It is often influenced whether or not the applied aspects in learning by teachers. Teaching materials developed and taught by using cooperative learning jigsaw in the learning process of students make learning can be increased so that, ultimately impact on increasing students' mathematical reasoning abilities. Increased mathematical reasoning abilities of students, because of the group of experts in cooperative learning jigsaw. Each student in the group of experts is required to master the full problem of reasoning, then demanded also to be able to present it to the group of their friends. Activities of the expert group explained to the native group, can strengthen his memory to the problem solving process of reasoning that was given to them.

The results of this study strengthen the results Qomariah (2013) which concluded that the effect of reasoning ability mathematics students who received the learning type of cooperative Jigsaw better than students who received teaching ordinary (conventional) ie learning by lecture method does not involve students in active processes and generative , based on the whole student.

Based on the above discussion. The study concluded that an increase in students' mathematical reasoning abilities after a given learning by using teaching materials based geometry constructivism to improve mathematical reasoning skills through cooperative learning *jigsaw*.

CONCLUSION

Based on the development and testing that has been done, the conclusion as follows:

1. the validity of Geometri teaching materials based constructivism to improve mathematical reasoning skills students through cooperative learning *jigsaw* in class VIII SMP Negeri 3 Padangsidimpuan is valid with

index validation 89.45.

2. Practicality geometry teaching materials based constructivism to improve mathematical reasoning skills students through cooperative learning jigsaw in class VIII SMP Negeri 3 Padangsidimpuan is practically used. It is obtained from the analysis of response data educators and students that teachers and students give a positive response..
3. Geometry teaching materials based Constructivism to improve mathematical reasoning skills students through cooperative learning *jigsaw* in class VIII SMP Negeri 3 Padangsidimpuan effectively used. This is evident from the results of tests of mathematical reasoning skills students after learning by using teaching materials is complete for ≥ 80% of test subjects fill their mastery learning and positive activities of the students.
4. Increased mathematical reasoning skills class VIII SMP Negeri 3 Padangsidimpuan with cooperative learning *jigsaw* using geometry teaching materials based constructivism are the medium criteria. Increasing the capability of reasoning viewed from four aspects, namely generalization, analogies, conditional and syllogism. As for Improvement of reasoning skills that are in the highest and lowest generalization aspect is the aspect of the analogy..

Reference

Adinda, Anita. (2012). Pengembangan Modul Aljabar II Berbasis Konstruktivisme Mahasiswa Pendidikan Matematika. Universitas Negeri Padang. Thesis, Unpublished.

Bani, Asmar. (2011). Meningkatkan Kemampuan Pemahaman dan Penalaran Matematika Siswa Sekolah Menengah Pertama Melalui Pembelajaran Penemuan Terbimbing. Jurnal Penelitian dan Pemikiran Pendidikan. Khusus (1): 12-20.

Cahyono, (2010), Vygotskian Perspective: Proses Scaffolding untuk mencapai Zone of Proximal Development (ZPD) Peserta Didik dalam Pembelajaran Matematika, National Seminar Papers mathematics ; 27th November 2010 at Mathematics major FMIPA UNY.

Cakir, Mustafa. (2008). Constructivist Approaches to Learning in Science and Their Implications for Science Pedagogy: A Literature Review. International Journal of Environmental & Science Education . Turkey: Vol. 3.

Gabert, Down. (2011). Constructivism Deconstructed in Science Teacher Education, Australian Journal of Teacher Education: The University of Auckland, Vol.36

Hake. (1999). Analyzing Change/Gain Scores. Dept. of Physics Indiana University.

Holila, Anni. (2016). Pengembangan Bahan Ajar Kalkulus 1 berbasis PBM untuk meningkatkan Kemampuan Pemecahan Masalah Matematis dan Kemandirian Belajar Mahasiswa STKIP Tapanuli Selatan Padangsidimpuan. Thesis UNIMED, Unpublished.

Kartono. (2012). Hands On Activity Pada Pembelajaran Geometri Sekolah Sebagai Asesmen Kinerja Siswa. Mathematics major FMIPA UNNES.

Khoirunnisa. (2007). Pengembangan bahan ajar berpijak pada teori Van Hiele sebagai upaya mengembangkan penalaran dan komunikasi konsep segitiga dalam trigonometri siswa SMU kelas X / Khoirunnisa. Journal MIPA, Universitas Negeri Malang.

Koray, Abdullah. (2013) The Effectivness of Problem Based Learning Support with Computer Simulation on reasoning Ability. Elsevier.New Horizon in Education, Konferensi Internasional : Ke. 4.

Lohman, David F. Lakin, Joni M. (2009). Reasoning and Intelligence, New York: Cambridge University Press.

Mengduo, Q dan Xiaoling, J. (2010). Jigsaw Strategy as a Cooperative Learning Technique: Focusing on the Language Learner. Chinese Journal of Applied Linguistic.

National Council of Teachers of Mathematics. (2000). Principle and Standards for School Mathematic, United States of America: National Council of Teachers of Mathematics.Inc.

Nieveen, Nienke. (1999). Prototyping to Reach Product Quality, University of Twente, Chapter 10.

Pangesti, Fida. (2012). Pengembangan Bahan Ajar Pendidikan Berpikir (Kritis Dan Kreatif) Berbahasa Indonesia Sma Melalui Pembelajaran Lintas Mata Pelajaran. Pendidikan Bahasa dan sastra, Journal of University of Malang.

Pujianto, Andi. (2015). Pengertian dan langkah-langkah model pembelajaran Jigsaw. *http://www.infoduniapendidikan.com/2015/06/pengertian-dan-langkah-langkah-model-pembelajaran-jigsaw.html*. Education articles.

Qomariyah, Siti. (2013). Pengaruh Pembelajaran Kooperatif Jigsaw II Terhadap Kemampuan Penalaran dan Komunikasi Matematik. Tugas Akhir Program Magister, Universitas Terbuka.

Rahman R dan Ma'arif S. (2014) Pengaruh Penggunaan Metode Discovery Terhadap Kemampuan Analogi Matematis Siswa Smk Al-Ikhsan Pamarican Kabupaten Ciamis Jawa Barat, Scientific Journal of Studies of mathematics STKIP Siliwangi Bandung : Infinity, Vol. 3

Ramdani, Yani (2012). Pengembangan Instrumen Dan Bahan Ajar Untuk Meningkatkan Kemampuan

Komunikasi, Penalaran, Dan Koneksi Matematis Dalam Konsep Integral. FMIPA Unisba. Educational Research Journal. Vol. 13

Riyanto, Yatim. (2009). Paradigma Baru Pembelajaran, Jakarta: Kencana.

Sanjaya, Wina. (2010). Strategi Pembelajaran Berorientasi Standar Proses Pendidikan. Jakarta:Prenada Media Group.

Shadiq, Fajar. (2004), Pemecahan Masalah, Penalaran dan Komunikasi, Widyaiswara PPPG Matematika Yogyakarta.

Sinaga, B. (2007). Pengembangan Model Pembelajaran Matematika Berdasarkan Masalah Berbasis Budaya Batak (PBM-B3). Dissertation. Surabaya: Program Pascasarjana Universitas Negeri Surabaya.

Sugiyono. (2008). Metode Penelitian Kuantitatif Kualitatif dan R&D. Alfabeta:Bandung.

Thiagarajan, S, Semmel, Ds. Semmel, M. (1974). Instructional Development For Training Teachers Of Exceptional Children. A Source Book Blomingtn, Center For Innovation On Tesching The Handicapped.

Thompson, Patrick . (2013). Constructivism in Mathematics Education. In Lerman, S. (Ed.) Encyclopedia of Mathematics Education. SpringerReference (www.springerreference.com). Springer-Verlag Berlin Heidelberg. DOI: 10.1007/SpringerReference_313210 2013-05-10 00:00:07 UTC

Trianto, (2013). Model Pembelajaran Terpadu. Jakarta: Prestasi Pustaka.

Wijaya, Putu Dewa dan Muhammad Rohmadi. 2009. Analisis Wacana Pragmatik: Kajian Teori dan Analisis. Surakarta: Yuma Pressindo.

Yerizon, Yezita, Rosha. (2012). Mengkonstruksi Pengetahuan Siswa Pada Materi Segitiga dan Segiempat Menggunakan Bahan Ajar Interaktif Matematika Berbasis Konstruktivisme, Articles in the Journal of Mathematics Education, Vol. 1 No. 1, 2012.

Yuliani, K., & Saragih, S. (2015). 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. Journal Education and Practice, Vol. 6, No. 24, 2015.