MATHEMATICAL CONNECTION ABILITY WITH CONTEXTUAL LEARNING

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Abstract. This study used a model of Concurrent Embedded with the aim of: The aim of this study was to know mathematical conection on linier equation of one variable with contextual learning, then observed that mathematical connection. This study used mixed method research. Instrument that used in this study were observation, interviews, and test. Subject of this study was students at SMPN 6 Jepara with VII E as experiment class and VII D as control class. The results showed mathematical connection at experiment class with mathematical connection between concepts in material indicator was 92.6%, the ability of the connections between topics indicator was 80.1%, the ability to connect with other subject indicator was 63.2%, and the ability to connect with their daily lives indicator was 82.9%. Whereas, mathematical connection at control class with mathematical connection between concepts in material indicator was 82.7%; the ability of the connections between topics indicator was 60.1%; the ability to connect with other subject indicator was 58.1%; and the ability to connect with their daily lives indicator was 28.1%. Based on that results the ability of mathematical connection to connect with the daily life because of contextual learning.

Keywords: mathematical connection, contextual learning

1. Introduction

Mathematics is not a collection of separated sciences. Mathematics is the integrated field of studies. When students connect mathematical ideas, their understanding could be deeper and long-lasting. Students can see mathematics as a whole unity. They see mathematical relationships in interaction which is rich of mathematical topics, in the context of dealing with other mathematical subjects, and in their own lives and experiences.

Mathematical connection ability is an essential ability that must be mastered by students, both elementary school students (SD) and high school (junior and senior). The Importances of mathematical connections ownership contained in mathematics learning goals for students are to understand mathematical concepts, explain the relationship between concepts and apply concepts or algorithms in a flexible, accurate, efficient, and precise in problem solving. Mathematical connection becomes very important because it will help the understanding of the concept of meaningful mastery and help resolve the problem-solving task through linkages between concepts of mathematics and

between mathematical concepts with other disciplines concept (Sumarmo, 2014: 27-28). By mastering the ability to connect mathematics, students already have one of the standard ability to learn mathematics than five standard abilities that must be mastered those are the ability of problem solving, reasoning ability, communication skills, the ability to make a connection, and the ability of representation (NCTM, 2000: 29).

According to the connectionism theory proposed by Thorndike, learning process is divided into two processes namely trial and error (try and fail), and the law of effect, which means that all behavior that lead to a positive result will be remembered and studied well. Because of the law of effect, it will be created relationships or associations that bring behavioral outcomes (effect) (Purwanto, 2014: 98-99). Connectionism theory shows that the learning process is influenced by the self-experience which makes it be related each other for furtherso that it is creating beneficial results. Connectionism theory supports one of the standard process of learning mathematics mathematical connections. The association between ideas, analysis, and reasoning in learning activities become indispensable to find a satisfactory effect or result.

Bruner and Kenney state four theorems in mathematics learning process those are construction theorem, notation theorems, contradiction and diversity theorems, and the theorem of connection (Adityas, 2015). This connectivity theorem of Bruner is underlying mathematical connection cability, those are the construction theory and the theory of connection. Connectivity theorem states that any concept, principle, and mathematical skill are dealing with concepts, principles, and other skills.

The ability of the students in doing mathematical connections requires (1) inter connections between mathematical topics that relate the concepts or principles in the same topic, (2) the connections between topics in mathematics that links between the material in a particular topic with material in other topics, (3) the connection between the material with science besides mathematics, and (4) a connection with everyday life that may be encountered children (NCTM, 2000: 64).

In mathematics, it is important to bring students into real life experienced everyday. Embeding mathematics in the context of student's life is the basis of the meaningfull association formation between personal beliefs and the process of meaning formation"(Moellwald, 1997). By learning the context of student's life, separated knowledges, clear subject and distinct topic, it will be turned into a meaningful unity and one can connect them to the real life of their own, interest or necessity (Tray & catlouge, 2008).

According to the theory of constructivism, learning does not emphasize on the quality of cognitive development, but rather on the process of finding a theory that was built from the ground realities. Learning as a process of building an appreciation of the material presented. The learning process does not only deliver the normative material (textual) but should also convey the material that is contextual (Saekhan, 2007).

Constructivism assumes that knowledge is the result of human construction. Learners construct through interaction with objects, phenomena, experiences, and environment. An experience is considered true when such knowledge can be useful to face and solve the appropiate problem. For constructivism, knowledge can not simply be transferred from one person to another, but interpreted by each individual (Kokom, 2011). In studying contructivism, the teacher's role is to help making the process of knowledge construction by learners running smoothly. Teachers do not transfer knowledge but use this approach to help learners to form his own knowledge based on everyday real-life context (Asri, 2005).

Contextual teaching and learning approach is a concept of learning that help teachers to link between what is taught with real-world situation's students and encourage students to make connections between the knowledge possessed by the application in their life. The aim of this understanding is to get student's learning becomes more meaningful, so students can solve problems that occur in their life (Jumanta, 2014). Johnson identifies eight characteristics into contextual teaching and learning, namely: 1) Making meaningful connection; 2) Doing significant work (; 3) Self-Regulated learning; 4) Collaborating; 5) Critical and Creative thinking; 6) Nurturing the individual; 7) Reaching a high standard; 8) Using authentic assessment (Kokom, 2005).

By regarding the importance of contextual learning to construct knowledge of students in mathematical connection ability, this article will be reviewed on a mathematical connection abilitiy in the material of linear equation with one variable with contextual learning on VII Grade of SMP 6 Jepara, for further , it will analyze the cause of the connection abilities.

2. Methodologi Research

This research is an experiment with mixed method approach, which combines quantitative and qualitative research. In this study, there are two classes of research samples those are the experimental class with the treatment of contextual learning and and control class with teacher-centered lectures. The sample of this study consists of two classes, namely class of VII E as an experiment class consisting of 39 students and the class as control class of VII D with 36 students. The designs used in quantitative research is only posttest control group design using test methods for collecting the data, while to analyze the aility of mathematical connection with contextual learning, we use a qualitative approach by using the method of observation and interview to collect the data.

Material testing instruments of linear equation with one variable was in the form of describing test and developed based on the theory of connectivity to measure the four abilities of mathematical connections those are connections between concepts in a matter of mathematics, the connections between topics in the fields of mathematics, mathematical concepts connections with other fields, and connections between concepts to daily life. The tests of mathematical connection ability was given after the implimitation of learning linear equations with one variable. Furthermore, the results of these tests were categorized in five categories, namely mathematical connection capability; 1) very weak score of 0-20%; 2) a weak score of 21-40%; 3) Intermediate score 41-60%; 4) good score 61-80%, and 5) a very good score of 81-100%.

Interview and observation instruments were developed to further explore the mathematical connection ability of students and teachers learning activities which is carried out in the experimental class and control class. Observation method was performed during the implementation of learning, while the interview was conducted after the learning and test of mathematical connection abilities are implemented.

3. Research Finding

Research results related to the ability of an experimental class of mathematical connections and control class can be seen in Table 2 and Table 3. Percentage of achievement of each mathematical connection ability indicators can be seen as follows:

Table 1

Percentage of Indicator Achievement in Mathematical Connection Abilities

Experiment Class

No	Indicator	Percentage	Category of Ability
1	The ability to connect between concepts within a matter of mathematics	92,6%	Very Good
2	The ability to connect among the topics in the field of mathematics	80,1%	Good
3	The ability to connect between mathematical concepts with other fields	63,2%	Good
4	The ability to connect between mathematical concepts to	82,9%	Very Good

Percentage of Indicator Achievement in Mathematical Connection Abilities Experiment Class			
No	**Indicator**	**Percentage**	**Category of Ability**
	everyday life		
Average		79,7%	Good

Table 2

Percentage of Indicator Achievement in Mathematical Connection Abilities Control Class			
No	**Indicator**	**Percentage**	**Category of Ability**
1	The ability to connect between concepts within a matter of mathematics	82,7%	Very Good
2	The ability to connect among the topics in the field of mathematics	60,1%	Intermediate
3	The ability to connect between mathematical concepts with other fields	58,1%	Intermediate
4	The ability to connect between mathematical concepts to everyday life	28,1%	Weak
Average		57,25%	Intermediate

Normality test results of the ability to connect mathematical's score indicated that both classes of mathematical connection abilities data of students in the experiment class that uses the approach of contextual learning and control class that uses learning lecture has a normal distribution. Furthermore, the homogeneity test conducted for those two classes concluded that the value of the mathematical connection ability for both classes have the same variance or homogeneous. Then, it was conducted a comparison test on average to test the hypothesis.

Average comparison test used the t test because the data was in normal distribution and homogeneous. The results of the calculation, the average experiment class was 76.5 and 52.4 for the control class. Furthermore, t test was done and we got $t = 6.6497$ and t table = 1.9934. From these results, it was indicated that the $t_{hitung} > t_{tabel}$ then H_0 is rejected. This means that the mathematical connection ability of students in experiment class which is use contextual learning approach and the control class with the lecture methode is different. The average shows that the average in experiment class is higher thn th control class. This means that the ability of students' mathematical connection with contextual learning approach is better than the ability to connect students with learning lecture mathematical.

It is known that there are differences between each indicators of the students' mathematical connections ability. Furthermore, the indicators of the mathematical connections ability are grouped by measured connection aspects, namely the connection between concepts within a matter of mathematics, the connections between topics in the fields of mathematics, the connections between mathematical concepts with other fields, and connections between mathematical concepts to everyday life.

It is Indicated that the level of indicators achievement have differences on each indicator of the ability of mathematical connections. Firstly, in the aspect of the connection between concepts within a

matter of mathematics experimental class achievement percentage is 92.6%, while the control class is 82.7%. The percentages show the good category for each class. However, the experimental class have higher achievement than the control class by a margin percentage was 9.9%. Second, aspects of the connections between topics in mathematics in the experimental class is 80.1% with the good category and 60.1% for grade control with medium category. With the difference in the percentage of 20%, it appears that the experimental class has a higher capacity than the control class. Third, aspects of the connections between mathematical concepts with other fields shows the percentage of 63.2% and 58.1% respectively for the experimental class and control class. Margin reached 5.1%, the experimental class have a better ability to either category. While in the control class has the ability in the category with the percentage. Fourth, in the aspect of the connection between mathematical concepts to everyday life percentage is 82.9% experimental class with very good category has a higher capacity than the control class that has a percentage of 28.1% with a weak category. This is indicated by the difference in percentage is 54.8%.

The difference in the percentage of achievement in mathematical connections ability, each indicator shows the difference in the ability of the mathematical connection between the experimental class and control class. The largest difference occurs in the fourth indicator, that is the indicator connections between mathematical concepts to everyday life with the difference 54.8%.

Overall, the average percentage of achievement between the experiment class and control class is 79.7% and 57.25%. There is a difference between the average of experiment class which get treatment and learning with contextual approach with conventional learning control class. From these calculations, it is showed that the mathematical connection in experiment class is in good categories with a percentage of 79.7% and the average test scores of student's mathematical connection ability is 76.5. While in the control class has enough category in mathematical connections ability with the percentage 57.25% and the average test scores of student's mathematical connection ability is 52.4.

The big difference is certainly influenced by the different treatment given to the experiment class and control class. The experiment class was given the learning treatment with contextual approach in which the concept of learning that help teachers relate the material taught to students in real-world situations. The learning process was implemented by encouraging students to make connections between the knowledge possessed by its application in everyday life. This concept produced meaningful learning for students. While in the control class, teacher was doing learning process with expository lectures.

In the contextual learning, it contains the principles of constructivism that teaches the attainment of knowledge which is built by students from the knowledge that has been owned through a real experience. Constructivist theory was supported by theory of connections which was formulated by Bruner in which each concept, principle, and mathematical skills is dealing with concepts, principles, and other skills (Mwakapenda, 2008). The learning process of ecperiment class on basic competence which solves linear equations with one variable, for example, students are encouraged to associate with previous material which is a prerequisite that is reviewing the material number operations. Students solved linear equations in one variable to understand in advance the properties in operation numbers. With this association, the students were easier in working on issues related to the variable linear equations. Students applied the properties of number operations to solve problems related to the variable linear equations. In addition, students in understanding the material were facilitated by the process of group discussion and worksheet that contained student guided discovery. The learning patterns like this was appropiate with Bruner's argument about connectivity that a concept with other concepts in mathematics are a closer relationship, not only in terms of content but also in terms of formulas that are used (Erman, 2003: 43). Therefore, teachers need to explain how the relationship between something being described relates to an object or another formula.

It will be difficult if the concept is not built on the experience of the students themselves. As in the lecture expository learning that occured in the control classes, where the students listened to the teacher's explanation about the completion of one variable linear equations, performed frequently asked questions about the clarity of the material that has been taught, students was given an example

of one variable linear equations completion, and teacher also providea training and discussed solutions. With the learning process such that, students was not invited to discover the concept of knowledge itself. Students became hard work on the problems associated with other scientific fields or everyday life (interview teacher to teacher subject after learning on February 21, 2015).

Contextual learning in the experimental class also invites students to construct learning materials from real life. Students are encouraged to build new knowledge from prior knowledge related to daily life (Dahlan, 2015). This is shown in the experiment class learning with the students in real life when modeled and solved problems related to the variable linear equations. Teachers modeled the two objects in a classroom environment that was the width of the board and the width of the wall is a chalkboard. Students were asked to determine the width of wall class if known the width of the board. Another issue, for example, student is required to know the price of the book and pencil if known one of them. In addition to these construction, teachers also provide a worksheet that contains a guided discovery of students in modeling and solving the problems that exist (Bonotto, 2007). Teachers always invite students to discuss in groups with a heterogeneous group. Once the discussion is finished, the students were invited to present the results of their discussion to the class. Students exchange experiences from the worksheet that they do, in which the worksheet is different for each group. There is the group that received the mathematical problems associated with other materials, other disciplines, and relate to real life. Teacher conduct the learning approach that emphasizes the involvement of students in full process to be able to find the material studied and relate them to real life situations that encourage students to apply the material learned in everyday life (Wina, 2005: 109-110).

The percentage of mathematics connection ability on the experiment class showed in good category with a percentage of 79.7%. While the highest achievement indicators is contained in the mathematical connection capability with everyday life with the percentage of 82.9%. That high ability is caused by contextual learning, where learning is emphasizing the process of student's engagement to find a concept, encouraging students to find relationships between the material being studied to real life, and encouraging students to apply their learning outcomes in life. The concept of real life that is focused on contextual learning strongly supports the success of the ability to connect mathematical concepts to everyday life (Wina, 2005: 110)

4. Conclusion and suggestion

The average of students' mathematical connection ability on the material of linear equations with one variable in experiment class with contextual learning was 76.5 (79.7%) with good category, while the connection ability of the control class by using the learning expository lecture was 52.4 (57, 25%) with intermediate category. Based on the average comparative test using t test to obtain t_{hitung} = 6,6497 dan t_{tabel} = 1,9934. From these results, it is indicated that the $t_{hitung} > t_{tabel}$ then H_0 is rejected. This means that contextual learning can improve the ability of the connection, because the process of learning emphasizes student's engagement to find a concept, encourages students to find relationships between the material being studied to real life, and encouraging students to apply their learning outcomes in life. The highest achievement of the fourth indicator is the ability to connect math with daily life with a percentage of 82.9% due to stress to process the involvement of students to find material from real life.

Overall, contextual learning can improve the mathematical connection, but if it is viewed from all four indicators of the mathematical connection ability, the most significant improvement of mathematical connection ability is the ability to connect mathematics with daily life. It is advisable to look for strategies that can enhance the abilities the fourth mathematical connections.

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