

**THE ACHIEVEMENT OF MATHEMATICAL CONNECTION SKILLS BASED
ON COGNITIVE LEVEL THROUGH MEANS ENDS ANALYSIS (MEA)
STRATEGY OF LEARNING**

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Abstract

This research aims to analyze the effect of learning strategies (MEA and Conventional), cognitive levels (low, middle, and high), and interaction of learning strategies and cognitive levels to the achievement of mathematical connection skills. The quasi experiment design with Randomized Subjects Post-test Only Control Group Design of the research was conducted at one of junior high school in South Tangerang. The results of the research revealed that, first; there is significant effect from learning strategies to the student's achievement of mathematical connection skills. The difference learning strategy affects the student's mathematical connection skills. MEA strategy gives mathematical connection skills better than conventional strategy. Second, there is significant effect from cognitive level to the student's mathematical connection skills. Higher Cognitive levels are providing mathematical connection skill better. Third, there is no interaction effect of learning methods with the level of cognitive to student's mathematical connection skills. The differences of learning strategies and cognitive levels combination are not influence to the student's mathematical connection skills.

Keywords: MEA strategy, Cognitive Level, Mathematical Connection

INTRODUCTION

Education becomes a necessity for all humans. The requirement is supported by the government launched a program in a way compulsory 9 years. Through education people can develop their knowledge. Education will teach people achieve appropriate learning goals. Education consists of various subjects one of which is math. Math is taught from kindergarten level through college. Mathematics is the science which consists of several complementary concepts integrated with the concept of the other concepts. Mathematics is not a science that is separate and divided between concepts in it (Suhenda, 2007). Mathematics is useful in other areas of knowledge also in everyday life.

In fact, the skill of student's mathematical connection is still low. Based on the results of research interviews with teachers at junior high school mathematics South Tangerang area shows that many of the students who are not able to connect with the material mathematical material other and even with other areas of daily life (limited interview). This is due to the teachers at school are still using conventional learning

strategies that only occurs in one direction. Teachers do not pay attention to the skill of the students, not teach math of the real thing towards the abstract. This fact is also supported by a previous study conducted by NurulFazriyah at a school in South Tangerang. His research shows that the skills of students to use mathematical ideas to improve their understanding of mathematical ideas are still relatively low (Fazriyah, 2013).

Other studies have also pointed out that the difficulties that occur in students when faced with math problems is students skill to apply mathematical concepts and the linkages that exist between the concepts to each other (Kurniawati, 2007). Furthermore Lembke and Reys (Sugiman, 2012) in his research found that students are often times when learning mathematics is able to enroll mathematical concepts related to problems in real life, but only a few students were able to explain why the concept is used in the application.

To consider the importance of connections skills in mathematics learning and in the development of other sciences and in everyday life, hence the need to use appropriate mathematics learning strategies. Learning strategies that encourage students to construct their knowledge make the students to do something instead of doing something about the students and associate learning with real-life materials that will be meaningful. One alternative learning strategies that can be used is a strategy of Means Ends Analysis (MEA). Strategy of Means Ends Analysis (MEA) is a learning strategy that analyzes a problem to arrive at the final goal to be achieved.

Learning by using this strategy, will form a subproblems to simplify the process of reduction of the difference between the initial states to the goal states. On strategy of MEA there is a table of connection that connects between subproblems with steps or operations used to achieve the desired goals (Reed, 2011). Mathematical connections in the use of this strategy could also appear on the issues presented and the process of formation of new subproblems. The learning strategy is said to be meaningful because the students are given the understanding that the material has a mathematical relationship with other areas of everyday life and also in every step of the formation of subproblems, each student will learn to understand mathematical concepts and associations that exist between the concepts with other concepts. Therefore, the learning strategy by using the MEA mathematical connection skill students will be better trained.

Using strategies of Means Ends Analysis (MEA) to enhance the skill of the connection need to pay attention to students mathematical cognitive aspects with emphasis on the power of thought, knowledge, and reasoning. Cognitive level of each student is different, ranging from a low level, moderate, to high. In this study, the cognitive level is based on the cognitive division adaptation from Bloom and Levine, namely: knowledge, interpretation, and problem solving and evaluation (Professional Examination Service, 2013). Means Ends Analysis (MEA) consists of three words, which means, ends, and analysis. Means - Ends The term refers to the process of identifying the "ends" goal to be achieved and the result of the "means" steps/way to do to achieve that goal (Matlin, 2009). If interpreted as a whole, then the Means Ends Analysis (MEA) means a strategy that analyzes a problem to arrive at the final result or the desired goal by reducing the existing differences.

MEA strategy is a strategy that separates the known issues and objectives to be achieved and then continued with a variety of ways to reduce the differences that exist

between the problems and goals (Huda, 2013). According to Resnick (Schunk, 2012) in means ends analysis strategy needs to consider the successive steps "To use means- end analysis, one compare the current situation with the goals and Identifies the differences between them". That is, to use the means ends analysis, we must first compare the initial state to the goal and identify the differences between the two conditions. Davies and Ormerod (Matlin, 2009) also suggests the two important steps that should be known of the means-end analysis strategy, namely "The means- end heuristic has two important components: (1) First, you divide the problem into a number of subproblems, or smaller problems, and (2) then you try to reduce the difference between the initial state and the goal state for each of the subproblems ".Based on the above, can be formulated definition that learning strategies Means Ends Analysis (MEA) is a learning strategy that directs students in groups to form a sub problem to reach a solution based on information obtained from a problem.

Connection mastery is the skill to associate one idea or ideas with ideas or other ideas within the same or another field in another sphere (Suhenda, 2007).Another opinion states that the mathematical connection capskill is the skill to connect mathematical concepts both inter- concept in mathematics itself and linking math concepts with other concepts in the field outside of mathematics (Permana, 2013). The skill of mathematical connections help students understand more about the concepts they are learning.

Mathematical Connections aims to help shape the perceptions of students see mathematics as a way of dealing with life part. NCTM (Satriawati, 2008) classifies mathematical connections into three kinds, namely: (a) the connection between mathematical topics, (b) connections with other disciplines, and (c) connected in everyday life. Riedesel (Sari, 2013) classified into 5 types of mathematical connections, the connections between topics in mathematics, connections between several different types of knowledge, connections between several kinds of representation, the connection of mathematics to other curriculum areas, and connect students with math.

According Sumarmo (Natawidjaja, 2008), a person who studied mathematics can be said to have a mathematical connection skill if it meets the criteria of a person belonging to connect mathematical capabilities, including: (a) Finding the relationship of the various representations of concepts and procedures, (b) Understanding the relationship between mathematical topics, (c) Applying mathematics to other disciplines or real world, (d) understand the equivalent representation of a concept, (e) Finding the relationship between the equivalent procedure in the representation, and (f) Applying mathematical relationships between topics and between mathematical topics with topics outside of mathematics.

Based on the above definition that can be formulated mathematically connection skill in this study is the skill to find relationships of various representations of mathematical concepts and apply them in everyday life.As an indicator of the skill of mathematical connections based on the above are: (1) Find the relationship of various representations of the concept, (2) Applying mathematics in other fields, and (3) apply mathematics in everyday life.

RESEARCH METHODS

This type of research used in the study was a quasi-experiment with the design of the study subjects randomized posttest only control group design. In this study, the sampling technique is cluster random sampling. Based on 5classesavailable, class 2 obtained from randomized sampling. Class VIII-3 as a control class taught by expository strategy and class VIII-5 as an experimental class taught by MEA strategy. Before both of classes had been treated they tested about prior material required to dividing the cognitive level.

Cognition includes aspects of intellect that is used to know something (Abdurrahman, 2012). This means, cognition as knowledge is needed in the know and learn a thing. According to Bloom (Sudaryono, 2012), cognitive aspects are all efforts related to brain activity. Embodiment of cognitive function can be seen from the children's skill to use language and mathematics (Abdurrahman, 2012). Cognitive level of each person is not the same. There are people of high cognitive level, there is a moderate cognitive level, and there is also a low cognitive level. The following is adapted from the cognitive level of Bloom and Levine arranged in a hierarchy, namely: (Professional Examination Service, 2013).

Level 1 : Knowledge

At the knowledge level, which is measured is the skill to remember and understand the material prior learning. At this level, students are required to have a knowledge to understand the relationship between a given fact. Generally, activities at this level is becoming acquainted with the elements.

Level 2 : Interpretation

At the level of interpretation, the cognitive abilities of students constructed at a depth of understanding of the theory. This means that students must be able to understand the problem and the means used to resolve such a problem. At this level, students are given a problem that requires the application of a theory and extrapolation. Problems are given at this level may also require an analysis.

Level 3 : Problem Solving and Evaluation

At the level of problem solving and evaluation of this student can formulate a plan to solve a given problem. To arrive at a process or plan students need information that can be used for the process in the completion of the given problem. Then evaluate the plans that have been developed to achieve a solution to the problem.

The cognitive level we can see by the results previously obtained student learning, both of achievement and mastery of prerequisite when trying to learn new material. To determine student mastery of the material preconditions then the student will be given about who created the look that is adapted cognitive levels of Bloom and Levine. Referring to the cognitive level of explanation above, it can be formulated definition of cognitive levels in this study is based on students prior knowledge levels of mastery of the material prerequisites are categorized into Knowledge level (Low Level), the level of Interpretation (Medium Level), and the level of problem solving and Evaluation (High level).

Based on test results obtained that the material prerequisites of an experimental class of 36 students, 7 students classified as high cognitive level, medium level was 17 students, and 12 students have low level. While in the control class consisting of 36

students, 6 students classified as high level, medium level was 11 students, and 19 students have low level. The instrument consists of 10 items about mathematical connection skill.

RESULT AND DISCUSSION

The mathematical connection skill test results by grade level of students cognitive and grade control experiment can be displayed in the table the following:

Table 1
Results Data Structures Posttes Mathematical Skill Connection Based Cognitive Level
Students Experiment Group and Control Group

Cognitive Level	Learning Strategies						Total
	MEA			Expository			
Hight	100	73	50	90	70	47	\bar{X} = 68.46 Sd = 19.37
	90	67		77	53	37	
	83	53					
	\bar{X} = 73.71			\bar{X} = 62.33			
	Sd = 18.62			Sd = 20.02			
Moderate	90	67	47	63	50	33	\bar{X} = 53 Sd = 17.46
	83	57	47	60	43	27	
	77	57	40	50	40	17	
	77	53	40	50	37		
	73	53	33				
	70	50					
	\bar{X} = 59.65			\bar{X} = 42.73			
Sd = 16.59			Sd = 13.83				
Low	73	47	43	57	40	20	\bar{X} = 39.19 Sd = 14.77
	60	47	40	53	40	17	
	57	43	33	50	33	17	
	53	43	30	50	33	17	
				47	33	13	
				40	33	13	
				40			
\bar{X} = 47.42			\bar{X} = 34				
Sd = 11.91			Sd = 14.27				
Total	\bar{X} = 58.31			\bar{X} = 41.39		\bar{X} = 49.85	
	Sd = 17.86			Sd = 17.94		Sd = 19.71	

Based on the test results the skill of mathematical connections of 36 students in classroom experiments obtained the highest value is 100 and the lowest value is 30. Average value and standard deviation are 58,31 and 17,86. The skill of mathematical connections grade experiment in terms of indicators of the skill of mathematical

experiment class connections obtained the following results:

Table 2
Students Mathematical Connection Skill of Experiments Class
Based on Mathematical Connection Skill

No	Indicators Mathematical Skill Connection	Value	Percentage Value Each Indicator
1	Finding relationships of various representations of concepts	160	44.44%
2	Applying mathematics in other fields	256	47.41%
3	Applying mathematics in every day	147	81.67%
Total		563	52.13%

In the table above, the percentage of the largest mathematical connection skill indicators contained in third with 81.67%. Mathematical connection skill lowest percentage found in search for indicators of various representations of concepts relations with the percentage of 44.44 %. The test results on the students skill to mathematical connection obtained the highest value of 90 and a low of 13. Average value and standard deviation are 41.39 and 17.94. The Mathematical connection skill student when viewed from the mathematical connection skill indicator consists of three indicators, the percentage for the control class is as follows:

Table 3
Students Mathematical Connection Skill
Class Connection Control Based in Indicators

Mathematical Connection Skill Indicator	Value	Persen Indicator
1 Finding the relation ships of various representations of concepts	122	33.89%
2 Finding relationships of various representations of concepts	214	39.63%
3 Applying mathematics in everyday life	112	62.22%
Total	448	41.48%

In the able above, the percentage of the largest mathematical connection skill in the control class is also available on the indicators apply mathematics in everyday life with a percentage of 62.22%. Mathematical connection skill lowest percentage found in search for indicators of various representations of concepts relations with the percentage of 33.89%.

This study not only examines the mathematical connection capabilities as a whole but also see it partitioned seen by the student cognitive levels. In the table above the data is apparent that the highest student mathematical connections are students with

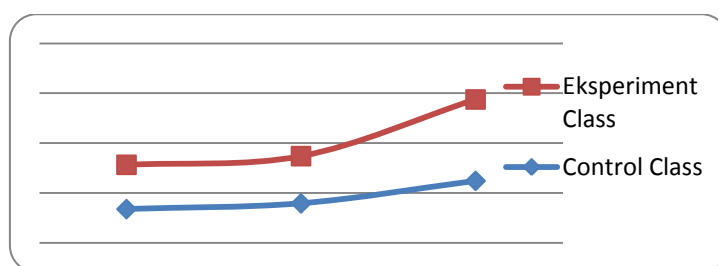
high-level cognitive learning strategies MEA treated with an average score of 73.71. Conversely low skill students mathematical connection is treated expository strategy with an average value of 34. Based on the average value of the mathematical connection skill students obtained the result that students who earn moderate cognitive level of learning with expository strategy is a low-level students in the class who earn MEA learning strategy.

Based on the test results proved the hypothesis that there is a study done on the effect of learning strategies and cognitive level of the students mathematical connection skill. But it is not proved that there is an interaction effect between learning strategies and cognitive level of the students mathematical connection skill. There are a few things that may be the cause of presence and absence of the effect of learning strategies, cognitive level, and the interaction between learning strategies and cognitive level of the skill of mathematical connections. The causes will be explained further in each of the following hypotheses:

1. The effect of MEA Strategy on Student Mathematical Connection Skill

Based on the hypothesis test results indicate that there is a significant effect of learning strategies on the skill of students' mathematical connections. To find out which learning strategy that gives greater influence to the mathematical connection skill students can be seen from the average value of each class. The average value of the mathematical connection skill students taught with strategies MEA at 58.31, while the average value of the mathematical connection skill students taught by expository strategy of 41.39. When compared with the overall average of 49.85, the experimental class taught by MEA strategies have connection mathematical abilities above average overall while the control class taught by expository strategy is under the overall average.

This happens as the effect of implementation of the MEA strategy in experiments class. Students are taught to learn in a group to be more active and are able to develop his own. How the delivery of learning by providing material problems are also capable of training the skill of students mathematical connections. Students learn to look for relationships of various representations of the concepts and applications of various concepts in other fields as well as everyday life. In addition, students also learn gradually through the formation of sub-sub problems, so it is easier for him to understand the mathematical concepts are studied. This is in line with the opinion of the Hayes (Reed, 2011) who suggested that teaching by giving those subgoal could help them in solving part of the problem that arises before the sub goal. In addition to the average value, the difference is also visible from the percentage of each indicator of the skill of mathematical connections between classroom experiments with classroom control. These differences are presented in the graph below:



Graph 1

Each indicator Percentage Comparison Between Experiments and Control Class

Graph 1 above shows a comparison of the percentage of each indicator between classes with a class experiment control. Class experiments have mathematical connection skill indicators higher than the control class. The highest percentage of both classes were equally present on the indicators to apply mathematics in everyday life but there is a difference between the two with a percentage value difference of 19.45%. This is because the third indicator more commonly appears in mathematical problems. In addition to the basic competence in every math lessons are basic competency which stated the application of a concept of everyday problem solving. Classroom experiments seem to have a higher percentage for each of the indicators.

Based on the results of the test of the hypothesis that elucidated the difference in the average value of each indicator and the percentage of classes with a class of control experiments shown that of these two strategies are used in research, strategy of Means Ends Analysis (MEA) have a better influence on the skill of mathematical connections students. It is supported by previous studies conducted by Elsindi (2011) about Learning Mathematics by using the Strategy Means Ends Analysis to improve the skill of junior high school students Mathematical problem solving. Results of the study stated that the increased skill of the mathematical problem solving of students who got the learning strategy Means Ends Analysis better than mathematical problem solving skills of students who have learning expository.

2. Effect of Level of Cognitive Skill Students on Student Mathematical Connections

Based on the hypothesis test results indicate that there is a different effect on the skill of the cognitive level of students' mathematical connections. Cognitive level of high, medium, and low impact differently on students' mathematical connections skills. This is made clear by the average value of students' mathematical connection skill of overall cognitive level . The skill of the highest mathematical connections is higher cognitive levels of students with an average score of 68.46, then the students medium cognitive level with an average value of 53, and the lowest value is lower cognitive levels of students with an average value of 39.19. This means that the higher cognitive levels of students, the greater its effect on the skill of students' mathematical connections.

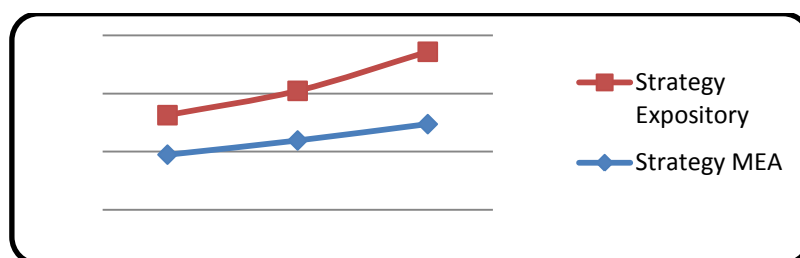
The difference is in accordance with the theory of cognitive level. On the level of problem solving and evaluation explained that to arrive at a process or plan students need information that can be used to process the given problem solving (Professional Examination Service, 2013). This means the higher cognitive level students will be getting a lot of concepts a must-have. These results support the findings in a study conducted Kurniawati (2006) against 37 students in each class. His research found that

category Kurniawati's skill to upgrade understanding of mathematics, mathematical reasoning, and overall.

3. Effect of Interaction between Learning Strategy and Level of Cognitive Skill on Students Mathematical Connections

Hypothesis test results test results showed the hypothesis that there is no influence of the interaction between the learning strategies and cognitive level of mathematical connection capabilities. Connection mathematical skill of students taught by expository and MEA reviewed strategies from a cognitive level of their students the same. There is no difference in the skill of mathematical connections based on the cognitive level of interaction between students and learning strategies. The results also support the findings Kurniawati (2006) conducted on 36 students. The research results obtained in that there was no interaction between the learning approaches used with the students skill of mathematical understanding and reasoning skill of students.

Based on the results of previous analyses we know that strategy and cognitive level has a positive influence on the skill of mathematical connections separately. The average value of the results of the students in each cognitive level indicate that the average value of student cognitive level, high, medium, and low, who studied with strategy MEA better than student cognitive level, high, medium, and low, who studied with expository strategies. This indicates conformance level students are high, medium, and low learning strategies with the MEA. For more details, the lack of interaction between the learning strategies and cognitive level of mathematical skill connection students are presented in the following graph:



Graph 2
Interaction Between Learning Strategies and Cognitive Level

CONCLUSION AND SUGGESTION

Based on the analysis and discussion of the research titled Strategic Influence Means Ends Analysis (MEA) to Skill Connection Mathematically Based Cognitive Level students gained some conclusions as follows: (1) there is the influence of the strategy Means Ends Analysis (MEA) on the skill of mathematical connections. The results obtained by ANOVA test results of two paths. Mathematical connection skill students taught with strategies Means Ends Analysis (MEA) is better than the mathematical connection skill students taught by expository strategy. It can be seen from the average value of the mathematical connection skill test results of students taught with strategies Means Ends Analysis (MEA) higher than students taught by

expository strategy. Such influence can also be seen from any mathematical connection capskill indicators, students are taught with a strategy Means Ends Analysis (MEA) has a percentage of each mathematical connection skill indicators higher than students taught by expository strategies. (2) there is the influence of cognitive level students of analytical mathematical thinking skill of students. The results obtained are based on test results ANAVA two lines. Test results show that there are differences in the cognitive level of influence on the skill of mathematical connections students. Based on the current average level of overall cognitive skill of mathematical connections concluded that students with high cognitive level better than cognitive level being students and low. (3) there is no influence of the interaction of learning strategies and cognitive level of students against the skill of mathematical connections students. The results obtained are based on test results ANAVA two lines. The interaction between the learning strategy with student's cognitive level has no effect on the skill of students ' mathematical connections. Does that mean there is no difference in the skill of students ' mathematical connections resulting from the interaction between the learning strategies and cognitive level.

Based on the research results that have been obtained, the researcher can provide the following suggestions: (1) For the school and the teachers, especially math teachers, can make a strategy Means Ends Analysis (MEA) as an alternative learning strategies to improve students mathematical connections. (2) Should the learning process with strategies Means Ends Analysis (MEA) is more frequently applied, so that the mathematical connection capskill can be increased because students acquire learning environment which can make them find their own concept of learning and practice of interaction between peers and teachers. (3) This study demonstrated only in mathematics on the subject SPLDV and eighth grade levels, therefore research should also be done on other mathematical subjects and levels of other classes. (4) For further research examining the influence of the strategy suggested Means Ends Analysis (MEA) on the skill of other students in addition to students' mathematical connection capabilities. (5) This study only examined the effect of cognitive level of the mathematical connection skill, then it is advisable to conduct further research to study the effect of other influences such as gender, student activity, motivation, and so forth. (6) Based on the findings in the field, researchers suggest for future research to examine the skill of basic mathematical calculations especially for junior high school students. (7) In dealing with students with moderate and low cognitive level should give teachers more opportunity and enrichment to students who are lacking in both inter-connecting material math mathematics, as well as with other areas of daily life.

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