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The Effect of the Jigsaw Cooperative Learning Model and the Student's Initial Mathematical Abilities and Its Effect on the Mathematical Representation Ability and Learning Motivation of Students in the PAB 10 Sampali Private Elementary School

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Abstract

The Influence of Jigsaw Cooperative Learning Model on Mathematical Representation Ability and Student Learning Motivation at PAB 10 Sampali Private Elementary School. Thesis. Medan: UNIMED Postgraduate Program, 2020. This study aims to determine 1) the magnitude of the influence of the learning model on students' mathematical representation abilities and learning motivation; 2) the magnitude of the influence of early mathematical abilities on the ability of mathematical representation and student learning motivation; and 3) the interaction between the learning model and the initial mathematical ability of the mathematical representation ability and student learning motivation. The research was conducted in private SD PAB 10 Sampali with a sample of 2 classes with each class totaling 35 students. This research is a type of experimental research all with a 2 × 2 factorial design. The results showed that there is an effect of the learning model on the students 'mathematical representation ability, where the jigsaw cooperative learning model has a 9.1% higher effect on students' mathematical representation abilities than the expository learning model, there is an effect of initial mathematical ability on students 'mathematical representation abilities, where the high initial mathematical ability of students has an 11.5% higher effect on students' mathematical representation abilities compared to low initial mathematical abilities, there is no interaction between the learning model and the students 'mathematical initial ability to the students' mathematical representation ability.

Keywords
jigsaw; expository; early mathematical ability; mathematical representation ability; learning motivation

I. Introduction

Mathematics as a basic science is one of the subjects that play an important role in every level of education as a means of logical, critical, analytical, rational and systematic thinking. Mathematics education is one of the fields of study that is currently developing rapidly both in terms of material and use, so that in the national education curriculum the field of mathematics is always studied at every level of education and at every grade level with a proportion of more time allocations than other fields of study. The field of mathematics study is expected to be able to fulfill the provision of reliable human resource potential, namely humans who have the ability to reason logically, critically, systematically, rationally, carefully, be honest, objective, creative, act effectively and efficiently supported by the thinking skills of students, in particular (Priyono and Hermanto, 2015).

Ruseffendi, as quoted by Ariyanti (2016), said that the uses of mathematics include solving problems and communicating daily, increasing the ability to think logically, precisely, and understanding space. However, in reality, the rank of students' mathematics ability in Indonesia is still very low. The results of the Program for International Student Assessment (PISA) test in 2012, a study conducted by the OECD (Organization for Economic Co-operation and Development) which is a combination of 15-year-old student math, science, and reading tests, shows Indonesia is ranked 64th from 65 participating countries (Ariyanti, 2016). Pohan (2020) states that at school, from elementary to secondary school or even college, students undergo, practice, and experience the learning process of various knowledge and skills.

This means that students have not reached all standards of mathematical ability, which according to the National Council of Teachers of Mathematics (NCTM), as quoted by Armadan, et al. (2017), there are five basic abilities that are used as standards in the mathematics learning process, namely problem solving abilities. , ability to reason and proof (reasoning and proof), ability to communicate (communication), ability to connect (connections) and ability to represent (representation).

Based on the description above, the researcher can conclude that the jigsaw cooperative learning model is the right model to be applied to mathematics learning. Because this model is able to provide learning conditions that involve students actively in the learning process and foster student learning motivation so that students are expected to achieve better mathematical representation skills. This is an alternative that researchers use to improve the quality of mathematics learning. In connection with the description of the problems above and the initial research that has been carried out, the researcher considers that further research is needed on the effect of the Jigsaw-type cooperative learning model and students' initial mathematical abilities and its effect on the mathematical representation ability and learning motivation of students in primary school PAB 10 Sampali.

II. Research Method

The method used in this research is a quasi-experimental research method. The research design used was a 2 × 2 factorial design. This research was conducted by applying the Jigsaw cooperative learning model which was compared with the expository learning model as the independent variable. While the moderator variable is the initial mathematical ability of students who are grouped into students who have high and low initial mathematical abilities. The dependent variable in this study is the ability of mathematical representation and student motivation. The data analysis technique used is descriptive analysis technique and inferential technique. Descriptive analysis techniques are used to describe the data, including the mean, median, mode, standard deviation, and data trend. The data obtained is then presented in the form of a frequency distribution table and in the form of a histogram. Inferential statistical techniques were used to test the research hypothesis, using two-way covariate analysis techniques (ANACOVA) at the 0.05 significance level. Before testing the hypothesis, the prerequisite test was conducted on the data using the normality test and the homogeneity test.

III. Discussion

3.1. The Essence of Mathematics

Until now, there is no unanimous agreement in defining mathematics, however, it can be identified by its characteristics. Meanwhile, the characteristics of mathematics can be understood through the nature of mathematics. In the early stages of mathematics, it is formed from human experience in the world empirically, because mathematics is a human activity then that experience is processed in the world of ratios, analyzed and synthesized by reasoning in the cognitive structure so that a conclusion is reached in the form of mathematical concepts. In order for the mathematical concepts that have been formed to be understood by others and can be easily manipulated appropriately, it is necessary to use accurate notation and terms that are mutually agreed upon globally (universally) known as the language of mathematics. According to Jamaris (2014), mathematics is a language that symbolizes a series of meanings and statements to be conveyed. Mathematical symbols are artificial, that is, they will have a meaning after a meaning is given to them. Without it mathematics is just a collection of dead formulas. Meanings and symbols play a key role in mathematics lessons. The teacher plays an important role in the transfer of meaning to students.

Mathematics grows and develops because of the thought process, therefore logic is the basis for the formation of mathematics. Etymologically, mathematics means knowledge obtained by reasoning. This does not mean that other sciences are obtained not through reasoning, but in mathematics it emphasizes activity in ratio (reasoning), whereas in other sciences it emphasizes the results of observations or experiments in addition to reasoning. According to Susanto (2014), mathematics is one of the disciplines that can improve the ability to think and argue, contribute to solving daily problems and in the world of work, and provide support in the development of science and technology.

Dundar and Cakiroglu (2014) argue that mathematics does not only include numbers, calculations, and theorems, but is also part of the solution to problems in society and the history of humanity. Learning mathematics is a process of thinking in understanding events to be conceptualized into mathematics, so that the form of the solution obtained is logical and scientific. Russefendi as quoted by Purwaningrum (2016), stated that mathematics is a language of symbols; deductive science which does not accept proof inductively; the science of organized patterns and structures, from undefined elements, to defined elements, to axioms or postulates, and finally to propositions. Furthermore, Purwaningrum (2016) explains that mathematics is also a tool for scientific thinking, meaning that mathematics is a tool for obtaining scientific knowledge, because mathematics is the highest form of logic that produces a scientific organizing system, is logical and can produce many statements in the form of mathematical models.

3.2 Early Mathematical Ability

The essence of learning mathematics is a mental activity to understand the meaning of relationships and symbols, then apply them to real situations. Learning mathematics is concerned with what and how to use it in making decisions to solve problems. Learning mathematics is an activity that is concerned with selecting sets of simple mathematical elements and is a new set which then forms new, more complex sets (Uno, 2014). Mathematics is the basis and provision for studying various sciences and is arranged hierarchically, so the students' initial mathematical abilities will make a big contribution in predicting the success of student learning in the future, either in studying mathematics on their own or in studying other sciences widely (Mallewai, 2016).

3.3 Mathematical Representation Ability

Mathematics is one of the most important sciences in education. Therefore, it is natural that mathematics is a major subject that is included in various levels of education ranging from elementary school to college. The objectives of learning mathematics at every level of education include developing students' abilities in mathematical thinking. The development of this ability is needed so that students better understand the concepts being learned, and can apply them in various situations. According to the National Council of Teachers of Mathematics (NCTM) as quoted by Armadan, et al. (2017), there are five basic abilities that serve as standards in the mathematics learning process, namely problem solving skills, reasoning skills and evidence (reasoning and proof),communication capabilities (communication), connection capabilities (connections) and ability representation (representation). This statement shows that one of the math skills that students need and important to master is the ability of representation.

The standard of representation emphasizes the use of symbols, charts, graphs and tables in connecting and expressing mathematical ideas. The use of these things must be understood by students as a way to communicate mathematical ideas to others (Syafri, 2017). This shows that representation is one of the standard abilities that must be present in learning mathematics. According to NCTM, the first standard of representation ability is to create and use representations to organize, record, and communicate mathematical ideas. The second standard is selecting, using and translating between representations to solve problems, and the third standard is using representations to create models and interpret mathematical, physical, and social phenomena (Syafri, 2017). According to Minarni, et al (2016), representation is a configuration that can represent something else in several ways. A person develops representations to interpret and remember the sequence of his experiences in an effort to understand the world. For example, a word could represent a real life object, a number could represent a person's weight, or the same number could represent a position on a number line. Furthermore, Vegnaud, as quoted by Syafri (2017), explained that representation is a very important element in the theory of teaching and learning mathematics, not only because of the use of symbolic systems which are very important in mathematics, rich, varied, and universal syntax and semantics. , but also for two strong epithymological reasons: (1) mathematics plays an essential part in conceptualizing the real world and (2) mathematics provides a very wide use of homomorpisms where the reduction of structures to one another is essential.

3.4 Motivation to Learn

The term motivation comes from the word "motive" which can be interpreted as the power contained within an individual, which causes the individual to act or act. The motive cannot be observed directly, but can be interpreted in the behavior either in the form of stimulation, encouragement, or power generator for the emergence of such behavior. Motivation and motivation are two inseparable things. Motivation is the manifestation of motives that can be seen from the behavior shown by a person. Motivation can also be said to be a series of attempts to provide certain conditions, so that someone wants and wants to do something, and if he doesn't like it, then he will try to eliminate or avoid that feeling of dislike. So motivation can be stimulated by external factors, but motivation grows within a person. Motivation to learn is a non-intellectual psychological factor. Its unique role is in the development of passion, pleasure and enthusiasm for learning. Students who have strong motivation will have a lot of energy to carry out learning activities. Learning achievement will be optimal if there is the right motivation (Manik, dklk, 2015). According to Simanjuntak (2020) the teacher is a very important factor in determining the success of the learning process, therefore the teacher must be able to increase student learning motivation so that students play an active role in the learning process so that they are expected to achieve good quality education. Lumbantobing (2020) states that good motivation in learning shows good results. In other words, by having high motivation, it produces good achievements. In learning activities, motivation can be said to be the overall driving force within students which ensures the continuity of learning activities and gives direction to learning activities, so that the desired goals can be achieved.

Motivation to learn is the overall driving force within students that gives rise to learning activities, which ensures the continuity of learning activities and gives direction to learning activities so that the goals desired by the learning subject are achieved. The existence of motivation to learn in each individual is very important to create a conducive learning atmosphere. Motivation to learn is a strong urge or desire to achieve satisfaction within individuals to learn, to get change so that it meets the need for a better direction (Sulamiasih, et al, 2015). Motivation plays an important role in helping the development of students' potential in life. Motivation also plays an important role in providing enthusiasm for learning. Without a certain motivation, someone will easily give up or give up because they feel they have no interests to fight for. The existence of learning motivation in students will lead to a mental urge to carry out learning activities to achieve goals (Rahayu and Hartono, 2016). According to Wulandari (2020) learning motivation can describe the processes that can bring up and encourage behavior, provide direction and purpose of behavior and can determine whether or not good in achieving goals so that the greater the motivation will be greater learning success.

3.5 Jigsaw Type Cooperative Learning Model

Cooperative learning is a learning model that involves students working collaboratively to achieve common goals. Cooperative learning does not evolve from an individual theory or from a single approach to learning. Cooperative learning has its roots in early Greece but its contemporary development can be traced to the work of educational psychologists and pedagogical theorists of the early twentieth century, as well as information processing theories related to learning and cognitive and developmental theorists such as Piaget and Vygotsky. Cognitive development theory is largely determined by the manipulation and active interaction of children with their environment. Piaget believed that physical experiences and environmental manipulation were essential for developmental change to occur. Vygotsky's theory places more emphasis on the social aspects of learning. According to Vygotsky, the learning process will occur when children work or handle tasks that are still within their reach. Vygotsky believes higher mental functions generally arise in conversation and cooperation between individuals (Hasbullah, 2014).

Cooperative learning comes from the word cooperative, which means doing something together by helping each other as a group or as a team. Lie (2015), calls cooperative learning the term mutual learning, which is a learning system that gives students the opportunity to cooperate with other students in structured tasks.

3.6 Expository Learning Model

The expository learning model is a teaching model to tell or explain. The expository learning model according to Sanjaya (2016) is learning that emphasizes the process of delivering material verbally from a teacher to a group of students with the intention that students can master the subject matter optimally. The expository model emphasizes the process of speaking orally or lecturing. The learning theory that underlies expository learning is behavioristic learning theory. The behaviorists explain that learning is a process of changing the level of behavior in which reinforcement and punishment become a stimulus to stimulate students to behave. Educators who still use a behavioristic framework usually plan a curriculum by arranging the content of knowledge into small pieces marked with a certain skill. Then the parts are arranged hierarchically, from simple to complex.

Based on all existing behavioristic theories, Skinner's theory has the greatest influence on the development of the theory of learning language learning. Learning programs such as programmed learning, modules and other learning programs based on the concept of stimulus- response relationships and emphasizing reinforcement factors, are learning programs that apply Skinner's theory of learning.

Behavioristic theory has been criticized because it is often unable to explain complex learning situations, because many variables or things related to education or learning can be transformed into just a stimulus and response relationship. This theory is unable to explain the deviations that occur in the stimulus and response relationships. The behavioristic view is also less able to explain the variation in the emotional level of students as learners, even though they have the same experiences of reinforcement. This view cannot explain why two children who have relatively the same abilities and experiences of reinforcement turn out to have different behavior towards a lesson, also in choosing tasks with very different levels of difficulty. The behavioristic view only recognizes the presence of observable stimuli and responses. They do not pay attention to the influence of thoughts or feelings that bring together the elements observed. Behavioristic theory also tends to direct students to think linearly, convergent, not creative and unproductive. The view of this theory is that learning is a process of shaping or shaping, which is bringing learners towards or achieving certain targets, so that students are not free to create and imagine. Even though there are many factors that influence the learning process, the learning process is not just shaping. Skinner and other figures who support behavioristic theory do not recommend the use of punishment in learning activities. However, what is called negative reinforcement tends to limit learners to think and imagine.

3.7 Relevant Research

The following are some of the relevant studies that are related to the variables in this study. Herviansyah and Megawanti (2016), who examined the effect of initial ability on mathematics learning outcomes, the research method used is a survey method with regression analysis. The results of his research concluded that there was a significant effect of initial ability on mathematics learning outcomes. Lestari (2017) examines the effect of early math abilities and learning motivation on mathematics learning outcomes. The research method used was the correlational survey method. The results of the study concluded that: (1) there was an effect of the initial mathematical ability on students 'mathematics learning outcomes, (2) there was an influence of learning motivation on students' mathematics learning outcomes, and (3) there was an interaction effect of early mathematical abilities. and learning motivation on student mathematics learning outcomes. Salahuddin (2018) examines the effect of initial ability, self-confidence, learning motivation on students' mathematical abilities. The type of research used is ex-post facto with a correlational survey method. His research concluded that: (1) there was a significant direct influence between students 'self-confidence on students' initial abilities, (2) there was a significant direct influence between student learning motivation and students 'initial abilities, (3) there was no direct influence between student self-confidence on students' initial abilities. Students' mathematical communication skills, (4) there is no direct influence between students' learning motivation and students' mathematical communication skills, (5) there is a significant direct effect between students' initial abilities and students' mathematical communication skills, (6) there is a significant indirect effect. between students' self-confidence through students' initial abilities to students' mathematical communication skills, and (7) there is a significant indirect effect between student learning motivation through students' initial abilities on students' mathematical communication skills.

IV. Conclusion

Based on the results of the research findings and hypothesis testing that has been done, several conclusions are obtained, including: (1) There is an effect of the learning model on students' mathematical representation abilities, where the average mathematical representation ability of students taught with the jigsaw cooperative learning model (83.91) is higher than students taught with the expository learning model (76.94). The type of jigsaw cooperative learning model has a 9.1% higher effect on students' mathematical representation abilities than the expository learning model. (2) There is an effect of initial mathematical ability on students' mathematical representation abilities, where the group of students with high initial abilities has an average mathematical representation ability (84.94) higher than the group of students with low initial abilities (76.17). The high initial mathematical ability possessed by students gave an 11.5% higher influence on the students' mathematical representation ability than the low initial mathematical ability. (3) There is no interaction between the learning model and the students 'initial mathematical abilities to the students' mathematical representation abilities. This gives an indication that the applied learning model and the students 'initial mathematical abilities interacted with no significant effect on students' mathematical representation abilities. (4) There is an effect of the learning model on students' motivation to learn mathematics, where the average mathematics learning motivation of students taught by the jigsaw cooperative learning model (83.29) is higher than students taught with the expository learning model (76.96). The jigsaw cooperative learning model has a 4.5% higher effect on students' motivation to learn mathematics than the expository learning model. (5) There is an effect of students 'initial mathematical ability on students' motivation to learn mathematics, where the group of students who have high initial ability on average their mathematics learning motivation (83.79) is higher than the group of students who have low initial ability (79.31). The high initial mathematical ability possessed by students gave an effect of 5.6% higher on students' motivation to learn mathematics than the low initial mathematical ability. (6) There is no interaction between the learning model and students 'initial mathematical abilities on students' motivation to learn mathematics. This gives an indication that the applied learning model and the students 'initial mathematical abilities interacted with no significant effect on students' motivation to learn mathematics.

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