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Influence of Cooperative Learning Model Type *Jigsaw* on Understanding Mathematical Concepts and Students' Self-Regulated Learning

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Abstract

This journal is motivated by students who still find it difficult to solve mathematical problems in the form of problems that lead to an understanding of the concept of a certain subject, so that students cannot answer the questions perfectly. The students' difficulties can be seen from the answers of students working on the concept of understanding problems given. Another situation that is also still happening in the field is the lack of awareness of students about the importance of learning mathematics, for example, there are still some students who when learning mathematics are just sitting in class without taking notes on the material. This is due to a lack of confidence, a sense of responsibility and initiative from students during the teaching and learning process. To overcome the above problems, and to improve students' understanding of concepts and Self-Regulated Learning, various efforts can be made by using a learning model that can actively involve students in learning. One of the learning models that can be used is the jigsaw-type cooperative learning model. Related to this, the researcher tried to conduct research on the influence of the jigsaw-type cooperative learning model on the understanding of mathematical concepts and Self-Regulated Learning of grade students. This type of research is a type of pre-experimental research. This study uses the research design of The Static Group Comparison. The population of this study is all grade VIII students of SMP Negeri 1 Bukittinggi in 2023/2024. The sampling technique used is random sampling first carried out normality tests, homogeneity tests, and average similarity tests of population data. The samples in this study are class VIII.A as the experimental class and class VIII.B as the control class. The research instruments used are Self-Regulated Learning questionnaires and tests for understanding mathematical concepts. The data analysis technique used is the t-test. The results of the study found that bakaghu religious activities have a deep meaning Based on the analysis of the data of the research results, it was obtained that the understanding of mathematical skills and Self-Regulated Learning of students who participated in learning with the jigsaw method was better than students who participated in learning with conventional methods in grade. The average score of the experimental class was 3.31 and the control class was 2.26. Meanwhile, the overall final average score in the experimental class was 57,54 and the control class was 45,04.

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1. INTRODUCTION

Education has a very important role in every level of society regardless of status, therefore there needs to be special attention from the government to education in Indonesia

so that it can advance the nation and state, because the progress of a country is based on the quality of that country's education. Education can be interpreted as a conscious effort carried out by humans through training and learning activities both within the school environment and outside the school environment. In life, education is very important. Education is essentially a human effort to improve or obtain knowledge to develop the potential that exists within him.

In RI Law no. 20 of 2003 concerning the National Education System Chapter 1 Article 1 Paragraph 1, namely: "Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble morals and skills that needed himself public nation and country".

Based on the Law above, the aim is to create a learning process and learning atmosphere, so as to obtain the skills, noble morals, intelligence, personality, self-control and religious spirituality that are needed by oneself and society. Education is expected to provide knowledge and skills for students so that they can develop their potential more actively in the learning process.

Learning is a process carried out by individuals with the help of teachers to obtain changes in behavior towards complete personal maturity as a result of individual interactions with their environment (Andi Setiawan, 2017). Learning is said to be successful and of high quality if the majority of students are actively involved and like the learning. One type of learning that has an important role in science is learning mathematics.

Mathematics is a science that can equip students with the ability to reason, think logically, critically, systematically, carefully and be objective and open in facing various problems (E. T. Rusfenddi, et al, 1991). The aim of mathematics subjects according to Minister of Education and Culture Regulation 58 of 2014 is for students to be able to understand mathematical concepts, explain the relationship between concepts and apply concepts or logarithms in a flexible, accurate, efficient and precise manner in solving problems (Refuna Oktavianda et al, 2019). In accordance with the learning objectives, it can be seen that understanding concepts is an important aspect and is one of the abilities that must be possessed by and developed by students.

According to Suherman, the ability to understand concepts is the most important part of learning mathematics, because the concepts in mathematics are organized systematically, logically, and hierarchically from the simplest to the most complex. Understanding mathematical concepts is a student's ability to understand and re-express concepts in a form that is easier to understand and to be able to solve a problem that is slightly different from the example problem (Rahmah, Novetri, et al., 20200). The characteristics or characteristics of questions about understanding mathematical concepts are training and measuring students' ability to understand concepts in adding rules that apply to mathematical objects in the form of facts, concepts, principles and skills (procedures, algorithms). Understanding of the objects measured is in accordance with mathematics subject content standards.

Sumarni and Hidayat stated that the learning process needs to be directed towards understanding mathematical concepts and principles which will later be needed to solve mathematical problems, problems in everyday life and scientific discipline problems (Hikmah, Yutia, et al, 2024). According to Nila Kesumawati, understanding mathematical concepts is an important basis for thinking and solving mathematical problems and everyday problems (Nila Kesumawati, 2008). Understanding concepts is the ability to derive meaning from abstract ideas so that they can be used to group or classify objects. Understanding mathematical concepts is a student's ability to understand, identify and

conclude a mathematical concept that has been developed in various forms of mathematical problems (Tito Nurdiyanto, 2019).

It can be concluded that understanding concepts has an important role and is a pillar in solving problem solving in mathematics learning. The indicators for understanding concepts according to the regulations of the Director General of Basic Education number 506/C/PP/2004 dated 11 November 2004 are being able to: 1) Restate each concept; 2) Classify objects according to certain properties; 3) Provide examples and non-examples of the concept; 4) Presenting concepts in various forms of mathematical representation; 5) Developing necessary or sufficient conditions for a concept; 6) Using, utilizing, and selecting certain procedures or operations; 7) Apply mathematical understanding concepts or algorithms (Heris Hendriana, et al).

Apart from that, according to Taher et al, the success of cognitive learning is also influenced by affective conditions. Students who are in a positive affective condition will express their feelings by studying certain subjects, so that they can achieve optimal learning results (Faisal, et al, 2020). As explained in the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 103 of 2014 concerning learning in Primary Education and Secondary Education, it is explained that "Learning is carried out in an interactive, fun, challenging, inspiring manner, motivates students to participate actively, and provides sufficient space for initiative, creativity and independence in accordance with the students' talents, interests, abilities and physical and psychological development."

Self-Regulated Learning is one of the factors that influences student success in the learning process. According to Basir, independent learning is a learning process that occurs within a person, and in an effort to achieve learning goals, the individual is required to be active or independent of other people, including the teacher (Rita Ningsih, 2016). According to Basir, independent learning is a learning process that occurs within a person, and in an effort to achieve learning goals, the individual is required to be active or independent of other people, including the teacher (Rita Ningsih, 2016). Self-Regulated Learning *(Self-regulated learning)* is the ability to monitor, regulate and control aspects of one's own cognition, motivation and behavior in learning (Karunia Eka Lestari and Mokhammad Ridwan Yudhanegara, 2017).

According to Tirtarahardja, Umar and La Sulo, independence in learning is a learning activity that is driven more by one's own will, one's own choice and one's own responsibility (Zikra Aulia, Armiati, 2019). So, Self-Regulated Learning is a real desire not to imitate and not depend on other people, students who are able to learn in their own way and with their own efforts, and can find effective ways of learning by carrying out learning activities independently. So, it can be concluded that Self-Regulated Learning can support success in achieving the learning process.

The characteristics contained in Self-Regulated Learning are that they describe the individual's high personality state and contain a metacognitive process where the individual consciously designs, implements and evaluates his or her own learning carefully. Students who have independence in learning will have awareness within themselves about the learning process which is not only focused on the teacher but also requires active participation of students in learning. According to Isnaniah, indicators of independence are: a) self-confidence, b) discipline, c) initiative and d) responsibility (Isnaniah,).

Implementing appropriate learning strategies will greatly influence learning, because students will be more active and not feel bored, and will be more in line with students' learning styles. With the appropriate learning strategies provided, it will increase students' passion for learning, and increase their ability to understand the material provided and take initiative in learning. Therefore, appropriate learning strategies are needed for the learning

process that can create a learning process that can help students develop insight, so that learning will feel more impressive. One possible learning model can be used is cooperative learning model.

Cooperative *learning* refers to a small group of students working as a team to solve a problem, complete a task or do something to achieve another goal. *Cooperative learning* emphasizes the presence of peers who interact with each other as a team in solving or discussing a problem or task. Slavin stated that cooperative learning is a learning model in which students learn and work through small groups collaboratively whose members consist of four to six people, with a structure group heterogeneous. One possible learning model can be used is type cooperative learning model *jigsaw*.

According to Wartono, et al, cooperative learning is a type of teaching where students are formed into small groups according to their level of proficiency and ability. Each team member tries to collaborate by helping each other to understand the material when carrying out group assignments (Syariful Akbar, et al, 2024). Type cooperative learning model *jigsaw* is a learning model that focuses on group discussions in small groups. In the type cooperative learning model *jigsaw* Students have many opportunities to express opinions and process and accept the information obtained and can improve communication skills, group members are responsible for the success of their group and the completeness of the material studied and can convey information to other groups.

Strategy *jigsaw* allows students to have many opportunities to express opinions, and manage the information obtained and improve communication skills and group members are responsible for the success of their group and the completeness of the material studied, and can convey it to their group (Alamsyah Said and Andi Budimanjaya, 2015). In method *jigsaw*, students work in groups twice, namely in their own group and in an "expert group". After each member explains their part to their group friends, they begin to prepare to be tested individually (usually with a quiz) (Miftahul Huda). According to Aris Shoimin, the steps for learning jigsaw are as follows:

a. The teacher plans lessons that will connect several concepts in one time span simultaneously.
b. Prepare study material handouts for each concept up. The teacher has three types of handouts about the material being taught.
c. The teacher prepares three types of quizzes according to the material the students will study.
d. Divide the class into three groups. The teacher delivers an introduction to the group discussion by explaining very briefly (1) the topic that each group will study, (2) the expected learning objectives and indicators, (3) the form of the bill for each group, (4) activity procedures, (5) learning resources that students can use. Discussion begins, students actively study the material, the teacher becomes a monitor and facilitator. Each group prepares to study three predetermined concepts. Each group is divided into subgroups, each studied one handout. During the discussion, each subgroup explores one concept each subgroup can ask each other questions to gain understanding. This group in English is called home groups. The term can be loosely translated as study group. At the end of this session, each group explores one concept in order to convey the material to other sub-groups. After meeting the time target and based on the teacher's monitoring, students have sufficiently understood the material, the discussion is temporarily closed.
e. Each subgroup explores the material in the handout they are assigned to. Explore facts, concepts and procedures for applying concepts so that the knowledge they learn can be passed back to their friends. In this phase there is no interaction between subgroups.

This reflection activity is a process of increasing mastery of the material to face the expert team discussion round.

f. Each subgroup that is an expert on the 1st concept is joined by an expert on the 1st concept from another group. Likewise with the 2nd and 3rd subgroups, forming an expert group structure. In this step, students discuss again. Each group discusses one handout of material in their area of expertise. Here there is a critical period that teachers need to monitor in each group, ensuring that the concepts students develop are as they should be or do not contain errors.
g. After exploring the material through expert group discussions, students return to their initial group or study group. The results of the discussion in the expert group were discussed again in the initial group. At the final stage of learning activities, each subgroup presents the results of the discussion to the expert group. In this way, all students repeat the study of all the material they must master. Each group member has notes on the results of the discussion in stage one, stage two of the expert team discussion, and returns to the original group.
h. Teachers measure student learning outcomes with tests or quizzes. Teachers can assess the level of learning completeness by comparing the results students achieve with the targets set in the RPP.

Jigsaw can improve students' understanding of concepts due to learning *jigsaw* responsible for studying and understanding certain material and then having to share information with group members, this can increase overall understanding of the concept and encourage students to understand it in depth (Yoman Ayu Putri Lestari, et al, 2023). Apart from that, there are advantages to jigsaw, one of which is to enable students to develop creativity, which is one of the indicators that Self-Regulated Learning according to Kurnia Eka Lestari and Mohammad Ridwan Yudhanegara is creative. So that *jigsaw* is considered capable of increasing students' Self-Regulated Learning (Yoman Ayu Putri Lestari, et al, 2023).

2. RESEARCH METHOD

The type of research used is experimental research. According to Sugiyono, experimental research is a research method that tries to find the relationship between certain variables and others under strictly controlled conditions (Karunia Eka Lestari and Mokhammad Ridwan Yudhanegara, 2017). The experimental research used in this research is pre-experimental research. Pre-experimental research is research that contains several experimental characteristics in small quantities (Sumadi Suryabrata, 2004). Experimental research is used to determine the influence of the type of cooperative learning model *jigsaw* towards understanding concepts and Self-Regulated Learning.

The design used by researchers is *"The Static Group Comparison Design"* , namely a group of subjects taken from a certain population grouped into two, namely group The experiment was given a type cooperative learning model *jigsaw* and the control group was given conventional learning.

The population in this study were class VIII students of SMP Negeri 1 Bukittinggi for the 2023/2024 academic year. The population in this study was 4 classes. The sampling technique used is Engineering *simple random sampling*. *Simple random sampling, namely* random sampling, where each member of the population or unit in the population gets the same opportunity to be selected.

The data source in research is the subject from which the data is obtained. The data used in research can be grouped into two, namely primary data and secondary data. The primary data in this research is the data from the results of tests on students' understanding of mathematical concepts in the experimental class and control class using a type of

cooperative learning model *jigsaw*, as well as the results of the students' Self-Regulated Learning questionnaire. Secondary data is data published or used by an organization that is not the processor. Secondary data in this research is data on the number of students and data on the results of tests on understanding mathematical concepts for class VIII SMP Negeri 1 Bukittinggi.

Time and Place of Research

This research was carried out from January to February 2024 at SMP Negeri 1 Bukittinggi. The choice of research location was based on the consideration that the selected research location was deemed appropriate to the research focus on the problem under study, namely to determine the effect of the jigsaw type cooperative learning model on students' understanding of concepts and Self-Regulated Learning. class VIII SMP Negeri 1 Bukittinggi.

3. RESEARCH RESULTS AND DISCUSSION

This section describes the results of the data instrument regarding understanding mathematical concepts and students' Self-Regulated Learning in class VIII SMP Negeri 1 Bukittinggi. The description of the data that the researcher will present is as follows:

3.1 Students' Self-Regulated Learning

Student independence data was taken in classes that used a type of cooperative learning model *jigsaw*. Data was taken at the end of the research meeting, there were no students who were absent during the learning process. The questionnaire given consisted of 32 items covering self-confidence, discipline, initiative and responsibility. The questionnaire statement consists of positive statements and negative statements. In this research, the calculation of questionnaire statement items uses a Likert scale. Choice of student opinions. consists of Always (SL) with a value range of 81% - 100%, Often (SR) with a value range of 61% - 80%, Sometimes (KD) with a value range of 41% - 40%, Rarely (J) with a value range of 41% - 60%, Never (TP) with a value range of 0% - 20%. For positive statements a score is given, namely SL = 5 SR = 4, KD = 3, J = 2, TP = 1. Meanwhile for negative statements a score is given, namely, SL = 1 SR = 2, KD = 3, J = 4, TP = 5.

Details of the questionnaire data on Self-Regulated Learning in students' mathematics learning in the sample class for each indicator can be seen as follows:

Table 4. 1 Comparison of Scores Obtained by Sample Classes on Questions for Each Indicator

Class	N	Average students' Self-Regulated Learning questionnaire score				Average score	Rate-rate
		1	2	3	4		
Experiment	28	89,5	112,4	91,5	101,4	3,31	82,82
Control	28	89,1	108,8	85,5	94,6	2,26	56,07

Based on table 4.1, it can be seen that the average score of the experimental class is higher for all questions than the control class, namely the average score of the experimental class is 3.31 and the control class is 2.26. while the overall final average score in the experimental class was 82.82 and the control class was 56.07. This means that the experimental class's ability to understand mathematical concepts is higher than the control class.

3.2 Ability to Understand Mathematical Concepts

Data collection regarding students' ability to understand mathematical concepts was carried out using a final test instrument. The final test was given to both class samples. The final test questions are in the form of essays consisting of six questions. The test is given to class VIII students. A as an experimental class using a type of cooperative learning model *jigsaw* and tests are also given to class VIII. B as a control class with conventional learning. The final test was taken by 52 students, 28 students from the experimental class and 28 students from the control class.

There is a difference in the average value between the experimental class and the control class, namely the experimental class has an average of 82.82, while the control class has an average of 0.567. so, on average the experimental class is superior to the control class. For more clarity, the test score data for understanding mathematical concepts in the sample class is described in the following table:

Table 4.2 Comparison of Scores Obtained by Sample Classes on Questions for Each Indicator

Class	N	Average final test score for understanding mathematical concepts					Average score	Average final score
		1	2	3	4	5		
Experiment	28	3,5	3,04	3,32	3,36	2,89	3,22	57,54
Control	28	2,25	3,29	3,14	2,50	1,43	2,52	45,04

Based on table 4.2, it can be seen that the average score of the experimental class is higher for all questions than the control class, namely the average score of the experimental class is 3.22 and the control class is 2.52. Meanwhile, the overall final average score in the experimental class was 57.54 and the control class was 45.04. This means that the value of the ability to understand mathematical concepts in the experimental class is higher than that in the experimental class *control*.

To draw conclusions about the data on Self-Regulated Learning and understanding of students' mathematical concepts in the two sample classes, statistical analysis was carried out, namely the t test. Before testing the hypothesis, a normality test and homogeneity of variance test were first carried out on the students' Self-Regulated Learning questionnaires and questions on students' understanding of mathematical concepts in the two sample classes.

3.3 Hypothesis Testing

After carrying out normality tests and homogeneity tests on the students' Self-Regulated Learning questionnaire, it was discovered that the two sample classes had a normal and homogeneous distribution. Next, a hypothesis test was carried out using the t-test at a significance level of 0.05. The t-test results at the confidence level $\alpha = 0.05$ are obtained $t_{count} = 1.22$ and $t_{table} = 1.29$, where $t_{count} > t_{table}$ means H_0 rejected and H_1 accepted, namely students' Self-Regulated Learning in mathematics learning for students who take part in learning using cooperative type methods *jigsaw* better than students who take learning using conventional methods in class VIII of SMP Negeri 1 Bukittinggi.

Then a normality test and homogeneity test were also carried out on the understanding of mathematical concepts at a confidence level of $\alpha = 0.05$ and obtained $t_{count} = 4.98$ and $t_{table} = 1.29$, where $t_{count} > t_{table}$ means H_0 rejected and H_1 accepted, namely understanding mathematical concepts in mathematics learning for students who take part in learning using cooperative type methods *jigsaw* better than students who take learning using conventional methods in class VIII of SMP Negeri 1 Bukittinggi.

4. CONCLUSION

Providing a statement that what is expected, as stated in the "Introduction" chapter, can ultimately result in the "Results and Discussion" chapter, so that there is a match. Apart from that, prospects for developing research results and prospects for applying further research can also be added (based on the results and discussion).

Based on the results of the analysis of the students' Self-Regulated Learning questionnaire at the α=0.05 level using the t-test, the average final score for the experimental class was 114.54, and the control class was 109.678. Whereas $t_{count} = 1{,}22$ And $t_{table} = 1{,}188$, Where $t_{count} < t_{table}$. Meanwhile, the test results using *software minitab* at a real level $\alpha = 0.05$ obtained $p_{value} = 0{,}089$ which mean $p_{value} > a$, so it is based on the test results H_0 rejected and H_1 accepted. There is an influence of the cooperative learning model type *jigsaw* towards students' Self-Regulated Learning.

Based on the results of the test analysis of students' ability to understand mathematical concepts at level $\alpha = 0.05$ using the t-test, the average final score for the experimental class was 57.54, and the control class, 45.04. Whereas $t_{count} = 4{,}98$ And $t_{table} = 1{,}88$, Where $t_{count} > t_{table}$. Meanwhile, the test results using *software minitab* at a real level $\alpha = 0.05$ obtained $p_{value} = 0{,}001$ which mean $p_{value} < a$, so it is based on the test results H_0 rejected and H_1 accepted.

Based on the hypothesis above, it can be concluded that there is a model influence learning cooperative type *jigsaw* towards understanding mathematical concepts, and learning cooperative type *jigsaw* to independence "learning is better than understanding mathematical concepts using conventional learning in class VIII of SMP Negeri 1 Bukittinggi for the 2023/2024 academic year."

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