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Comparison Of Inquiry And Problem Solving Approaches Towards Improving Students' Mathematical Reasoning Ability And Self Confidence High School Students

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Abstrak

Penelitian ini bertujuan untuk mengetahui perbedaan peningkatan kemampuan penalaran matematis siswa yang diajar dengan pendekatan inkuiri dan pendekatan pendidikan matematika *problem solving*; mengetahui perbedaan peningkatan *self confidence* siswa yang diajar dengan pendekatan inkuiri dan pendekatan pendidikan matematika problem solving; mengetahui perbedaan antara pendekatan inkuiri dan pendekatan pendidikan matematika *problem solving* terhadap peningkatan kemampuan penalaran matematis dan *self confidence*. Penelitian ini dikategorikan ke dalam penelitian *quasy experiment*. Penelitian ini dilaksanakan pada salah satu Sekolah Menengah Atas di Kab. Labuhan Batu pada tahun pelajaran 2023/2024, dengan jadwal pelaksanaan penelitian dikoordinasikan sesuai dengan kegiatan sekolah. Subjek penelitian ini ini adalah seluruh siswa kelas X Sekolah Menengah Atas yang berjumlah 72 siswa. Hasil penelitan ini menunjukkan bahawa; terdapat perbedaan peningkatan kemampuan penalaran matematis siswa dengan pendekatan inkuiri dan pendekatan problem solving; terdapat perbedaan peningkatan self confidence siswa dengan pendekatan Inkuiri dan pendekatan problem solving; terdapat perbedaan antara pendekatan inkuiri dan pendekatan pendidikan matematika *problem solving* terhadap peningkatan kemampuan penalaran matematis dan *self confidence*.

Kata Kunci: Inkuiri, Kemampuan Penalaran, *Problem Solving. Self Confidence*

Abstract

The study aims to identify differences between improved mathematical reasoning skills of students taught with inquiry approaches and mathematics problem solving education approaches; to determine differences in improved self-confidence of teaching students with inquisition approaches, and in mathematically solving educational approaches. This research is categorized into quasy experimental research. This research is being carried out at one of the Higher Secondary Schools in Labuhan Batu regency in the academic year 2023/2024, with the timetable for the conduct of research coordinated according to the school's activities. The subject of this study is a total of 72 high school X-grade students. The results of this survey show that; there is a difference between improved mathematical reasoning skills of students with inquiry approaches and problem solving approaches; there are differences in improved self-confidence students with Inquiry and Problem Solving Approaches; There is a distinction between inquery and problem-solving mathematics education approaches to enhanced mathematic reasoning ability and self confidence.

Keywords: *Inquiry, Reasoning Ability, Problem Solving. Self Confidence*

A. Introduction

Mathematical ability is an ability that students can use in facing problems both in mathematics and in real life, because in the Minister of National Education Regulation no. 22 of 2006 in Hasibuan, (2016:38-39) stated that school mathematics learning aims to ensure that students have the following abilities 1) Understand mathematical concepts, explain the relationship between concepts and apply concepts or algorithms in a flexible, accurate, efficient and precise manner in solution to problem; 2) use reasoning on patterns and properties, carry out mathematical manipulations in making generalizations, compiling evidence, or explaining mathematical ideas and statements; 3) solving problems which includes the ability to understand problems, design mathematical models, complete models, and interpret the solutions obtained, 4) communicate ideas with symbols, tables, diagrams, or other media to clarify situations or problems, 5) have an attitude of respect for the usefulness of mathematics in life, namely curiosity, attention and interest in studying mathematics, as well as a tenacious and confident attitude in solving problems.

Mathematical reasoning skills ensure that every student learns more and is involved in the learning process. However, apart from having good reasoning skills, students' self-confidence also has a significant influence on the way they memorize and remember the material they have studied. The feeling of self-confidence in each student is a feeling of confidence in one's own abilities and self-assessment in carrying out tasks and choosing a more effective approach in solving the problems faced. This includes confidence in one's own ability to face an increasingly challenging environment and confidence in one's own opinions or decisions. Paying attention to students' self-confidence will help educators speed up the learning process because it can make learning more meaningful and permanent.

According to Lautser in Surya et al, (2017:86) say: there are several characteristics to assess the confidence of individuals, such as: believe in their own abilities, to act independently in making decisions, have a positive self-concept, and the courage to express opinions. .From the quote above, it can be seen that students' self-confidence can be assessed based on several characteristics, such as self-confidence that students can make decisions independently, have positive beliefs about themselves, and the courage to voice their opinions. Meanwhile, according to Martyanti in Nurkholifah et al, (2018:59) self-confidence is a student's belief in all aspects of the advantages he has. This opinion shows that self-confidence is a student's belief that he is able to overcome a problem as well as possible and can provide something pleasant for other people. Self-confidence makes a student feel capable of achieving various goals in the mathematics learning process and in the future.

By cultivating self-confidence in students, a teacher can make demands that are not too excessive or too light on students. This is because there is a relationship between involvement in self-confidence and learning because involvement in self-confidence influences neural

activity in the learning process. By providing threats or positive pressure, the brain can be fully involved and allow neural activity to occur optimally

Therefore, self-confidence is the ability to feel optimistic in looking at and facing various things in life which describes students' thoughts or feelings, beliefs, abilities and courage regarding all aspects of their abilities. Intellectual abilities, attitudes, feelings, physical strength, and personal appearance are examples of these abilities. Students' interactions with other people, especially family and peers, as well as the community where students live is a form of self-confidence. However, age, gender, physical appearance, and frequency of student achievement are components that influence student beliefs.

Student self-confidence is also more important besides intellectual intelligence in contributing to a student's success in the learning process, this is because students must have reasoning abilities and self-confidence to achieve learning goals. Proven by (Purnama, 2019) in his research that intellectual intelligence is the ability needed to carry out various mental activities of thinking, reasoning and solving problems. Overall, it shows that students' self-confidence is indeed important in the learning process and has an impact on their learning outcomes. Therefore, it is important for educators to pay attention to and support the development of students' self-confidence, in addition to developing their intellectual intelligence.

Mathematical reasoning abilities play an important role in students' lives and need to be improved in mathematics learning so that students can solve mathematical problems and other scientific problems. In an effort to make mathematics more useful for students' lives, mathematics education in schools must focus on developing students' abilities for mathematical reasoning and self-confidence in solving mathematical problems. Not much emphasis is placed on applying specific algorithms or rules in solving problems. Thus, it is hoped that students will learn to use their abilities for mathematical reasoning and student self-confidence, both in mathematics and in other fields.

So, it can be said that mathematical reasoning is important for students to have. If students misunderstand basic concepts, then students will also find it difficult to correct them again, especially if students have used them in mathematical reasoning and solving problems in the form of mathematical questions. The mathematics textbooks used in mathematics subjects, especially class and student self-confidence. As a result, students' self-confidence in their mathematical abilities is still low. This is as shared by Napitupulu (2008:29) that students have difficulty answering questions related to the abilities being tested, which shows that they do not fully understand the subject, as a result students appear to have difficulty and take a long time to understand and solve problems. From the results of the initial study by researchers who asked questions that measured reasoning abilities in quadratic equations material to Bilah Hulu State

High School students, it was found that mathematical reasoning abilities were still low and students had difficulty in solving questions related to reasoning abilities. One of the students' answers to the question was as follows

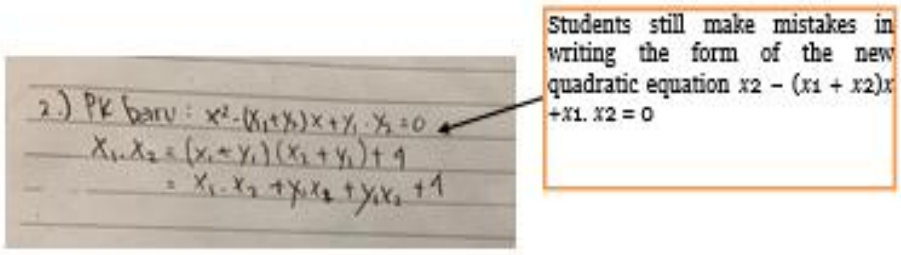

Figure 1. Student Answers to Mathematical Reasoning Questions

From the student answer process above, it can be seen that the students have not been able to write the new quadratic equation $x2 - (x1 + x2) + x1.\ x2 = 0$. It can be seen that students are only able to make conclusions without logical reasons. The student's answer clearly shows that the student does not understand the concept well. This example is one of the questions tested on 36 students who were present during the test. The number of students who were able to make statements in the form of mathematical equations was 15 people or 42%. The number of students who were able to explain the adequacy of data to solve the problem was 14 people or 39% and the number of students who were able to draw logical conclusions was 7 people or 19%. It can be said that students' mathematical reasoning abilities are still low.

This finding shows that students' mathematical reasoning abilities are still lacking, because students are not used to using logic to understand questions, this shows that students still have difficulty understanding the questions presented. In addition, when learning in class, students are less involved in responding to the teacher's questions, and when the teacher gives the class the opportunity to ask questions, no one does, thus making the teacher believe that the students have mastered the material, even though the teacher gives the students a good understanding of the subject. lessons and give them practice questions that encourage critical thinking and reasoning.

It is important for students to develop their mathematical thinking skills when dealing with phenomena that occur in the field. A teacher also needs to consider strategies to improve these skills. In this regard, teachers are very important in encouraging the best learning environment so that children can learn actively, and so that students are able to use mathematical reasoning to solve mathematical problems. A teacher must also be able to create a teaching design that can maximize the potential each person has. student.

According to Syahputra and Surya (2017:80) learning mathematics requires innovation and creativity from teachers and students. Student activities in learning activities are still passive,

which makes the learning atmosphere unpleasant, especially since the learning approach used by the teacher does not involve student activities so that students are not interested in mathematics lessons and have difficulty understanding mathematical concepts.

So one of the aims of giving mathematics lessons is so that students are able to reason about mathematical concepts, explain the relationship between concepts and apply concepts or algorithms, flexibly, accurately, efficiently and precisely in solving problems. So it can be said that students' mathematical reasoning abilities and self-confidence must be mastered by every student because this is one of the main goals in learning mathematics and is highly expected in every mathematics lesson at school. This is done so that students can understand every existing mathematical concept well, and are able to explain the relationship between these mathematical concepts and can apply the concepts they have learned in their future lives.

In inquiry learning, the teacher does not explain the material directly. Students are faced with a problem and then carry out an investigation, so that students can find the expected concept for themselves. This is in line with the opinion of Olibie and Ezeoba, (2014) who state that the guided inquiry learning model emphasizes student involvement in observing, investigating events, problems and phenomena that have been determined in the learning plan with guidance from the teacher, and students are given the opportunity to use their knowledge. under investigation.

Hendriana et al., (2017) stated that the guided inquiry model provides students with the opportunity to practice reasoning skills by formulating problems, proposing hypotheses, collecting data, and providing conclusions from the results of problem solving. In the guided inquiry learning steps, students carry out investigations in groups. In the investigation process, students will link the knowledge that each group member has with what will be researched. So in this case the student's reasoning process is needed to find solutions to problem solving. Therefore, guided inquiry learning is thought to be suitable for developing students' mathematical reasoning abilities because it can train them to understand and analyze problems, provide reasons for several solutions, and be able to draw logical conclusions from a solution.

The stages (syntax) used by teachers in designing inquiry-based learning according to Joyce and Well in Zubaidah, et al (2013 : 119) namely: a) Identifying and determining the scope of the problem, b) planning and predicting results, c) Investigation for data collection,d) Interpretation of the chest and developing conclusions

Learning using the inquiry method trains students to be able to discover concepts for themselves from the material being studied and build their knowledge. In this inquiry learning process, mathematical reasoning and problem solving abilities indirectly become part of the investigation process, so that with inquiry learning students' mathematical reasoning and problem solving abilities can increase.

Yusuf and Sutiarso (2017:281) say that "problem solving is an alternative in learning mathematics, one of which can develop students' thinking or way of thinking in solving a problem". Adnyani et al, (2018:95) say that the problem solving learning model is a problem solving model that provokes students' way of thinking in solving the problems given. Based on previous research descriptions, problem-based learning (PBM) is a learning model that can improve high-level thinking skills. PBM is a learning model that uses problems as a basis for learning (Napitupulu, Suryadi, & Kusumah, 2016, p. 119).

The inquiry approach and problem solving approach are good approaches for students to understand and remember a certain amount of information, because using a good approach can help students remember material for longer. With an inquiry approach and a problem solving approach, teachers can create a more focused teaching program, so that in implementing the teaching and learning process they can increase students' mathematical reasoning and self-confidence in the material being taught.By mastering mathematical reasoning abilities and self-confidence to the maximum, it will make it easier for students to increase their mathematical procedural knowledge, so that the difference in students' mathematical reasoning abilities between the inquiry approach and the problem solving approach can be measured, as well as the difference in students' self-confidence between the inquiry approach and the Problem Solving approach as well. can be measured. Based on observations made in the field, it can be seen that the teacher explains the material and gives students several example questions, then continues by giving practice questions.

Student activities only work on questions based on existing formulas and based on examples given by the teacher, students are not involved in the formula discovery process, but instead the formula is directly given by the teacher, this results in students not being actively involved in learning. The learning approach used by teachers also does not involve student activities so that students are not interested in mathematics lessons and have difficulty understanding mathematical concepts, thus affecting student learning outcomes during class learning.Based on interviews with researchers with mathematics teachers, the RPP and LKPD prepared by teachers as learning tools are not in accordance with the learning process carried out, the handbook used does not specifically address mathematical reasoning abilities and the students' self-confidence can be seen from the questions used in the book The guidelines are routine questions, and teachers have not yet developed many special questions to improve mathematical reasoning abilities.

Based on the results of interviews, the inquiry approach can help students understand mathematical concepts better and encourage them to think critically and creatively, its implementation may require significant changes in the way teachers teach and students learn so that teachers still rarely apply the inquiry approach in the teaching and learning process. Thus, the completeness of learning which is called learning tools occupies a very important position

because it will always be used every time you reach SKL in the independent curriculum, and therefore is in accordance with the focus of the independent curriculum on developing student abilities, self-empowerment, and contextual understanding of learning material. As explained by Haggarty and Keynes in Muchayat, (2011: 201) that in order to improve mathematics teaching and learning in the classroom, efforts are needed to improve teacher understanding, students' understanding, the materials used for learning and interactions between them. The purpose of creating learning tools is to make it easier for teachers and students when learning, because in essence there is no one learning resource that can meet all kinds of learning process needs, especially in terms of students' mathematical reasoning abilities and self-confidence. In the learning process, teachers and students have their respective roles. The teacher as a facilitator plays a role in teaching students to achieve learning goals, while the role of students is to actively participate in learning activities so that the learning material is mastered well. The learning process will run effectively if all abilities that influence the process support each other

In addition, the quality of learning will increase if learning components can be empowered optimally by carrying out reforms such as looking at the differences in students' mathematical reasoning abilities and self-confidence between the inquiry approach and the problem solving approach. From the statement above, the author is interested in conducting research which aims to answer the question "Is there a difference between inquiry and problem solving approaches to increasing the mathematical reasoning ability and self-confidence of students at SMA Negeri 1 Bilah Hulu"

B. Research Method

This research is categorized as quasi-experimental research. The design used in this research includes three stages, namely: 1) Research instrument creation stage, 2) Research instrument testing stage, 3) Experiment implementation stage. Each stage is designed so that valid data is obtained according to the characteristics of the variables and also in accordance with the research objectives. This research was carried out at SMA Negeri 1 Bilah Hulu in the 2023/2024 academic year, with the research implementation schedule coordinated in accordance with school activities. The population in this study was class X students at SMA Negeri 1 Bilah Buluh with a total of 72 students.

The research design used in this research is Pre test Post test Control Group Design. In this design, there are two groups selected from schools, then given a pre-test to determine the extent to which students are ready to receive learning on the material Systems of linear equations in two variables. The variables in this research consist of two, namely the independent variable and the dependent variable. The independent variable is the inquiry approach and problem solving approach, while the dependent variable is the students' mathematical reasoning ability and self-confidence. Data collection techniques in this research used tests and questionnaires.

The test used is a mathematical reasoning ability test consisting of a student's pre-test and post-test as well as a questionnaire to see the student's self-confidence.

C. Result and Discussion

A pre-test of students' mathematical reasoning abilities was given to students in both experimental classes. This test was given to determine the equality of experimental A and experimental B classes. This pre-test also aims to determine students' initial mathematical reasoning abilities so that it can be seen how students' mathematical reasoning abilities will improve after the treatment is carried out later. The pre-test given consists of 4 essay questions, then the data is analyzed descriptively to find out the average and standard deviation for each experimental class. The following is a summary of the pre-test results for students' mathematical reasoning abilities which are presented in table 1

Table 1. Description of Pre-test Results for Students' Mathematical Reasoning Ability

Statistics	Experimental Class	
	A (In)	B (PS)
N	35	35
Average	65,17	63,05714
Standard Deviation (SD)	9,963	8,025

Based on table 1 in experimental class A Inquiry Approach the average score was 65.17 and in experimental class B Problem Solving Approach the average score was 63.05714. It can be seen that the average score obtained by the Inquiry and Problem Solving classes. To find out the significance of the difference in KAPM scores for experimental class (A) Inquiry and experiment (B) Problem Solving, it is necessary to carry out analytical tests including the Manova test from the Pretest and Posttest data for Class A and Pretest Class B as shown in Table 2 as follows:

Table 2. Independent T Test of Students' Mathematical Reasoning Ability Based on Class

Independent Samples Test

									95% Confidence Interval of the Difference	
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PM	K Equal variance assumed	.510	.478	3.372	68	.001	7.571	2.246	3.091	12.052
	Equal variance assumed			3.372	66.902	.001	7.571	2.246	3.089	12.054

Based on table 2 above, it is known that the significant value of Levene's Test for Equality of Variances is 0.478> 0.05, so it can be concluded that the variance of class A and Class B data is the same or homogeneous, and based on the significant value of 2 tailed is 0.001 <0.05, then based on the test that has been done, it can be concluded that H_0 is rejected and H_1 is accepted, namely There is a difference in students' mathematical reasoning abilities between students who get the inquiry approach and the problem solving approach. Then the N-Gain Score test will be carried out based on each indicator of Mathematical Reasoning Ability to compare the N-Gain scores of each indicator in each class.

Based on the results of the pretest given before learning and the posttest given after learning to both classes, namely experimental class A and experimental class B, then the average calculation of the students' mathematical reasoning ability test results was carried out. The test results of students' mathematical reasoning abilities can be seen in Table 3 below:

Table 3. Average Pretest and Posttest Results of Mathematical Reasoning Ability in the Two Experimental Classes

Statistics	Learning			
	Inquiry Class		Problem Solving Class	
	Pretest	Posttest	Pretest	Posttest
Average	65,17	82,00	63,06	74,43

Based on table 3 above, it shows that the pre-test and post-test results in each class have increased, where in experimental class A the average post-test result is higher than the average pre-test result, namely 82.00 > 65.17. This shows that there is an increase in the average test results of students' mathematical reasoning abilities in experimental class A of 16.38. Likewise, in experimental class B, the average post-test result was higher than the average pre-test result, namely 74.43 > 63.06. This also shows that there is an increase in the average test results of students' mathematical reasoning abilities in experimental class B by 11.37. Based on this average increase, it can be seen that the average increase in experimental class A is higher than the average increase in experimental class B. Thus, inquiry approach learning has a higher impact on improving students' mathematical reasoning abilities than the problem solving approach.

The N-Gain score or normalized gain is used to determine the effectiveness of using a particular method or treatment in the two experimental classes. By calculating the N-gain score you will find out how much impact the treatment given has on improving the student's mathematical reasoning abilities. The categorization of the N-gain score can be determined based on the N-gain value or from the N-gain value in the form of a percentage (%). We can see the distribution of N-gain value categories in the following table.

Table 4. Distribution of Gain scores

Nilai N-Gain	Category
$g > 0{,}7$	Tall
$0{,}3 \leq g \leq 0{,}7$	Currently
$g < 0{,}3$	Low

In table 5 below, the calculation of the average total N-Gain value in the two experimental classes using SPSS 22 will be presented.

Table 5 Calculation of N Gain Total Score for Experimental Class A and Experimental Class B

Descriptives

	Learning Methods			Statistic	Std. Error
NGain_Score	Inkuiri	Mean		,4303	,06287
		95% Confidence Interval forMean	Lower Bound	,3026	
			Upper Bound	,5581	
		5% Trimmed Mean		,4586	
		Median		,5200	
		Variance		,138	
		Std. Deviation		,37193	
		Minimum		-,60	
		Maximum		,92	
		Range		1,52	
		Interquartile Range		,42	
		Skewness		-1,238	,398
		Kurtosis		1,496	,778
	Problem Solving	Mean		,2474	,06793
		95% Confidence Interval forMean	Lower Bound	,1093	
			Upper Bound	,3855	
		5% Trimmed Mean		,2746	
		Median		,3333	
		Variance		,162	
		Std. Deviation		,40191	
		Minimum		-,83	

	Maximum	,82	
	Range	1,65	
	Interquartile Range	,63	
	Skewness	-,918	,398
	Kurtosis	,638	,778

From Table 5 above, it is shown that the N-Gain value for experimental class A is 0.43 and is included in the medium category based on the N-Gain category classification explained previously. This means that learning using the inquiry approach carried out in experimental class A has a high impact. amounting to 43% of students' mathematical reasoning abilities. Furthermore, in experimental class B, it can be seen that the N-Gain value is 0.24 and is included in the low category. This means that learning with a problem solving approach carried out in experimental class B has a moderate impact of 24% on students' mathematical reasoning abilities.

D. Consclusion

Based on the results of data analysis and discussion in this study, several conclusions are put forward as follows: There is a difference in increasing students' mathematical reasoning ability with the inquiry approach and the problem solving approach. Based on the results of the Independent T Test Score analysis, a significance value of 0.001 was obtained. Because the sig. level is smaller than 0.05, so H-0 is rejected and H-1 is accepted. There is a difference in increasing students' self-confidence with the Inquiry approach and the problem solving approach. Based on the results of the Independent T Test Score analysis, a significance value of 0.000 was obtained. Because the sig. level is smaller than 0.05, so H-0 is rejected and H-1 is accepted. There is a difference between the inquiry approach and the problem solving mathematics education approach to increasing mathematical reasoning ability and self-confidence. Based on the results of the Manova Score analysis, a significance value of 0.000 was obtained. Because the sig. level is smaller than 0.05, so H-0 is rejected and H-1 is accepted.

Bagian ini berisi ringkasan dan saran. Ringkasan menyajikan resume dari hasil dan diskusi artikel, dan didasarkan pada tujuan penelitian. Saran dapat didasarkan pada tindakan praktis, pengembangan teori baru, dan / atau penelitian lebih lanjut.

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