COMPARISON OF PROBLEM SOLVING ABILITY BASED ON GENDER

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Abstract
This study aims to compare students' problem solving ability on arithmetic sequence material based on gender in class X students majoring in Visual Communication Design (DKV) at SMK Asy-Syadzili, Pakis, Malang. This research is a quantitative study with a comparative research design. The population of this study were all grade X students at SMK Asy-Syadzili in the 2023/2024 academic year. The research sample was selected randomly, by conducting a class draw. The results of the class drawing obtained class X DKV male and class X DKV female. Both classes used the problem-based learning model. Problem solving ability was measured using a written test in the form of a valid description. The data obtained were analyzed using independent t-test with a significant level of 5%. The results showed that there were differences in problem solving skills in class X DKV female and class X DKV male.

Keywords: Problem Based Learning, Problem Solving Skills, Vocational High School

INTRODUCTION

Education is one of the most important foundations in a country's development. In Indonesia, efforts to improve the quality of education have been a major concern of the government for many years. One of the key elements in this effort is the Vocational High School, or more commonly known as SMK. SMK is not just an educational institution, but also a driving force for economic progress and social development in the country.

Vocational High School (SMK) is a formal educational institution that aims to prepare young generations (students) who are skilled in a particular field of expertise to enter the workforce (Ariyanti 2018: 672). SMK are not just an alternative for students who do not continue to college, but they are an important pillar in preparing the younger generation to face challenges in an increasingly complex and competitive world of work. One of the most important subjects in the SMK curriculum is mathematics as a strong foundation for understanding various concepts and applications in various vocational fields. One of the concepts that has a significant impact on the understanding of mathematics and various sciences is the material of rows and series.

However, the reality in the field today and the view of the general public is that the understanding and knowledge of SMK is not equivalent to Senior High School or SMA. In fact, it is known that the SMK diploma is equivalent to SMA. This is what makes the author challenged to conduct research on learning in SMK. One of the most important lessons in the SMK curriculum is mathematics. Mathematics is a strong foundation for understanding various concepts and applications in various vocational fields.

LITERATURE REVIEW

Rows and series are used to describe patterns of numbers with repeated quantities and have wide applications in everyday life, including economics, computer science, social science, and many more. It can be realized that there are still many students who have obstacles in learning the material of ranks and series, one of them is class X students of SMK IT Asy-Syadzili, Malang Regency. Therefore, teachers need to find innovative and effective learning approaches so that students' understanding can be improved and the scores obtained are satisfactory. To achieve the objectives of this research, a problem-based learning model will be applied in teaching the material of rows and series in mathematics subject to students.

Problem-based learning (PBL) is a learning model that is directed to solve various problems, especially those related to subject matter in real life (Kamilah et al, 2019: 71). Problem-based learning has been proven effective in helping students understand mathematical concepts and apply them to real-world situations. This learning model is expected to help students of class X DKV SMK IT Asy-Syadzili in problem solving in the material of rows and series. Its implementation is not only into everyday life, but can also be to productive learning such as entrepreneurship and so on.

In this 21st century era, mathematics education aims to form students who have four main characteristics, namely: Communication, Collaboration, Critical Thinking and Problem Solving, and Creativity and Innovation. This is in line with the guidelines provided by the National Council of Teachers of Mathematics (NCTM), which sets five standards of mathematical abilities that students must master in learning Mathematics. These standards include problem solving, reasoning, communication, connecting concepts, and representing mathematical information. Therefore, learning mathematics at school does not only aim to understand the subject matter, but focuses more on developing students' abilities to think, communicate, represent ideas, and solve problems (Ika, et al. 2021).

Problem solving ability is very important for students because by students being able to solve a problem, students gain experience, use the knowledge and skills already owned by students to be applied in everyday life (Elita, Habibi, Putra, & Ulandari, 2019), especially mathematical problem solving ability. To find out the ability to solve math problems, the author needs to use the pre-test and post-test methods. The author uses the initial ability test method (Pretest) and the final ability test (Posttest). The initial ability test (pretest) is carried out before learning begins which aims to determine the initial ability of students (Sugiono, 2019: 111) and as a basis for heterogeneous grouping in learning. The post-test is conducted after the learning begins which aims to measure students' math learning outcomes. (Zaenal, et al. 2021).

In the pre-test and post-test, the author gave 20 description questions with different levels of difficulty. Questions about HOTS or High Order Thinking Skills are a type of question that will help students develop their ability to think critically, logically, metacognitively, reflectively, and creatively because students are required to think at a high level and use the process of reasoning. Students are trained to think at the analysis, evaluation, and creation stages in HOTS questions (Suryapuspitarini, Wardono, & Kartono, 2018). And questions that are not included in the level of analysis and above are then called LOTS (Lower Order Thingking Skills) questions. This means that questions included in the LOTS question category will tend to explore the ability to remember, understand, and apply. In the application of the two types of problems above, it can be the author's benchmark for determining students' mathematical problem solving abilities and skills. If students do more LOTS type problems, it is most likely that students lack the ability to solve math problems. However, if HOTS-type problems are more dominant, then students can be said to be skilled and capable in solving math problems. HOTS and LOTS type questions will both be applied in the pre-test and post-test.

The pre-test and post-test that will be applied in this study aim to find out whether students of class X DKV depend on teacher explanations and the teaching and learning process, or independently solve their mathematical problems. This can be seen in the results of students' pre-test and post-test work. One of the results of working on both the pre-test and post-test can be the final conclusion regarding students' mathematical problem solving skills. This research was conducted in two different classes, male and female X DKV classes at SMK IT Asy-Syadzili. The treatment to be given to male and female classes is equalized. The goal is to find out the differences in learning outcomes and students' math problem solving skills.

RESEARCH METHODS

This research was conducted at SMK IT Asy-Syadzili, Pakis, Malang Regency. In this study, researchers used quantitative research methods with the type of comparative research conducted to determine students' problem solving skills through pretest and posttest. The population in this study were all grade X students at SMK-IT Asy-Syadzili. Sampling in this study was done randomly with a draw system. The class was selected as it was formed without the intervention of the researcher and no individual randomization was carried out, the selected class was class X DKV male and DKV female class each consisting of 15 students. Both classes used the same learning model, namely using a problem-based learning model. Before learning, researchers conducted a pre-test in each class, as well as at the end of learning activities, researchers gave posttests to both classes. The instrument used in this study was a written test in the form of descriptions to measure students' problem solving skills. The scoring technique in this study uses an analytical scoring rubric on each item. The maximum test score is obtained by adding up the maximum score for each item.

Data analysis used independent sample t-test, which was used to test the research hypothesis. Before conducting hypothesis testing, prerequisite tests were first carried out, namely the data normality test and the variance homogeneity test of the pretest and posttest results. After all these prerequisite tests are met, then hypothesis testing is carried out. Hypothesis testing uses a significant level of 5% ($\alpha = 0.05$). The hypotheses tested in this study are:

a. $H_0: \mu_1 = \mu_2$ (there is no difference in students' mathematical problem solving ability between two classes)
b. $H_0: \mu_1 \neq \mu_2$ (there is a difference in students' mathematical problem solving ability between two classes)

RESULTS AND DISCUSSION

Results

Data Normality Test

The data normality test used the Pre-test and Post-test tests. The test results are presented in Table 1.

Table 1. Normality Test of Pre-test and Post-test Data

Students	Pre-test			Post-test		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
Male	0,888	15	0,063	0,932	15	0,2943

Female	0,923	15	0,216	0,898	15	0,090

Based on the table above, it can be seen that the pretest and posttest results of the experimental class and control class have a sig>0.05 value. So, H_0 is accepted and H_1 is rejected, so the samples come from a normally distributed population.

Homogeneity Test

After the normality test is carried out and it is proven that the sample comes from normal distributed data, then the homogeneity test is carried out to prove that the data has a significant difference or not. The results of the homogeneity test are presented in Table 2.

Table 2. Results of Homogeneity Test of Pre-test and Post-test

	Male	**Female**	**Sig.**
	Mean ± SD	Mean ± SD	
Pre-test	77,00 ± 11,307	87,67 ± 9,424	0,009
Post-test	86,67 ± 8,165	91,33 ± 6,114	0,087

Based on the table above, the sig value = 0.009 was obtained for the pretest homogeneity test. That is, sig = 0.009 <0.05 so that H0 is rejected. So, there is a significant difference in the initial ability (pre-test) of students between male and female classes. As for the post-test homogeneity test, the sig value = 0.087 was obtained. That is, sig = 0.087> 0.05 so that H0 is accepted. So, there is no significant difference in the final ability (post-test) of students between male and female classes.

Hypothesis Test (Independent t-test)

It is known that the results of the Independent Sample T-Test test using the posttest question show a sig value = 0.000 <0.05 so that H0 is rejected, which means there is a significant difference. This can be seen from the mean ± SD value of the control class is 43.74 ± 6.218 and the mean ± SD of the experimental class is 62.26 ± 9.933. The results of the independent t-test can be seen in Table 3.

Table 3. Independent Sample T-Test Results

Male Students	**Female Students**	**Sig.**
Mean ± SD	Mean ± SD	
86,67 ± 8,165	91,33 ± 6,114	0,087

Based on the results of hypothesis testing of post-test data on students' problem solving ability above, it can be concluded that there are differences between male and female classes.

Discussion

Table 1 shows the normality test of data in the male and female classes. The result of the data analysis in table 1 is that the sample comes from normally distributed data. Furthermore, in

table 2, is a homogeneity test where the purpose of the data in the homogeneity test is to determine the significant differences in the two classes. The results of the homogeneity test on existing data, are in the pre-test results, there are meaningful and significant differences in the male and female classes, namely mean ± SD; 77.00 ± 11.307 in the male class and 87.67 ± 9.424 in the female class. In the post-test data, after being tested, it can be concluded that there is a mean difference, but it is not significant, namely the mean ± SD; 86.67 ± 8.165 in the male class and 91.33 ± 6.114 in the female class.

In table 3, is a hypothesis test or Independent T-test. This test aims to determine whether there is a significant difference or not. In table 3, the author tests the post-test data on male and female class students. As a result, there is a difference even though it is not significant. The difference in these results is the mean ± SD; 86.67 ± 8.165 in the male class and 91.33 ± 6.114 in the female class.

The results of this study show that there is a significant difference between male and female students in terms of the assessment results of mathematics problem solving. In the math exam, the average score of female students tended to be higher than that of male students. This finding is consistent with the results of this study on the homogeneity and hypothesis tests of its data. (Ita, et al. 2022) stated that "male students and female students have differences in mathematics achievement". Given the same treatment, the math problem solving ability of female students tends to be higher than male students. This means that gender differences affect the ability to solve math problems in class X DKV students of SMK IT Asy Syadzili, Malang.

CONCLUSION

Based on the results of the study, it can be concluded that there are differences in the problem solving ability of students. This can be seen from the mean ± SD value of the male class is 86.67 ± 8.165 and the mean ± SD of the female class is 91.33 ± 6.114 with a sig value = 0.087 > 0.05. Suggestions that can be given for teachers are to always continue to innovate in the learning process and improve the quality of learning by using innovative learning models, one of which is the problem-based learning model. Hopefully, teachers can emphasize the ability to solve math problems in students so that they are not based on gender differences. For students, namely to always be enthusiastic and try to find out material independently in the learning process. Students are also given motivation to continue learning to train their mathematical problem solving skills. For researchers, it is hoped that they can innovate in the world of education.

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