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The Relationship between Problem-Solving Ability and Students' Characters Based on Islamic Perspectives

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Abstract: The purpose of this study was to analyze the mathematical problem-solving ability and characters of students who were taught using problem-based learning and ordinary learning based on Islamic perspectives. The instrument used in this study was a test of problem-solving ability and a students' character questionnaire. This research was a quasi-experimental research with pre-test and post-test control group design. The sample of this research was 84 students from Private Islamic School in Medan, North Sumatera, by using a purposive sampling technique. The data in this research was declared homogenous and normal after being tested using the Levene's Test and Kolmogorov-Smirnov Test. The hypothesis analyzes used was the Two Way-ANOVA test assisted by SPSS 25. The result showed that there was an improvement in mathematical problem-solving ability and students' characters through problem-based learning based on Islamic perspectives. However, there was no interaction between students' gender and problem-solving ability and character improvement based on Islamic perspectives. The gender factor in problem-based learning was not related to students' cognitive and affective aspects. Each student with any gender had difference characters, especially related to Islamic perspectives. This research-proven that problem-based learning model had an important role in teaching and learning, and it can be used to improve students' mathematical and character problem-solving ability.

INTRODUCTION

Mathematics education is one complex field of study. The complex phenomena in mathematics are related to other fields of science, which are the fields of practice, technology, culture, religion, teaching structures, and both the school learning and community learning. The main problem faced in learning mathematics is to link related mathematical content and organized relationship systems to all learning partners (students, teachers, and learning environments) who take part in realizing mathematics learning and can integrate it in a comprehensive educational and social context such as problems in everyday life (Diani, Herliantari, Irwandani, Saregar, & Umam, 2019; Raymond, 2018). Phenomena in mathematics can be found in our daily life problem, like in trade process, alms (*zakat*) calculation, bequest calculation, and many more. Mathematics needs to be taught to students because (1)

it is always used in all aspects of life; (2) all fields of life require appropriate mathematical skills; (3) is a robust, concise and transparent means of communication; (4) can be used to present information in various ways; and (6) providing satisfaction with efforts to solve challenging problems (Beswick, 2019). Teachers have an essential role in making students more creative and innovative in dealing with real-world problems (Ahmad, Yin, Fang, Yen, & How, 2010).

The standard process of learning mathematics, according to the National Council of Teachers of Mathematics (NCTM), is problem-solving, reasoning and proof, communication, connections, and representation. Problem-solving is a part of the standard mathematical process that is very important because, in the learning and completion process, students are allowed to use the skills and experience they have to be applied in solving non-routine problems. They are also must involve communities full of social problems (Midgett & Eddins, 2001).

Problem-solving ability is an essential thing in class management. Problems arise in everyday life, and problem-solving ability enables students to overcome various types of problems. Types of problems used in mathematics are divided into two groups namely routine problems and non-routine problems (Liljedahl, Santos-Trigo, Malaspina, & Bruder, 2016; Vos, 2018). Routine problems are problems found in textbooks and can be solved in the same way using a formula that was known before. Non-routine problems are problems that are mostly found in real life so they do not have unique formulas that can be solved using strategies that require creative and innovative thinking skills (Özreçberoğlu & Çağanağa, 2018). Complexity in solving problems can be reflected in the structure of the conceptual field, including problems, problematic situations, problematic spaces, and the process of resolution. In mathematics, a problem situation is a learning situation designed by the teacher to create a space for reflection and analysis around the problem or question to be solved (Căprioară, 2015; Csapó & Funke, 2017; Diani, Irwandani, et al., 2019).

When students are confronted with non-routine problems, for example, story problems related to daily life, the grades obtained by students will usually be lower when compared to multiple-choice questions. Thus, there is still a large gap between what is expected in learning mathematics and the reality that will be achieved. This has become one of the problems for teachers because problem-solving is needed to improve reasoning and train students to be able to think critically, logically, and with characters (Habibi et al., 2019). From the answers given by students, it can be seen that most students have difficulty in solving problems of mathematics. In solving problems, often found students only concerned with the final answer without understanding the answer process is correct or not. They tend to solve these problems with arithmetic operations, which they think are correct without understanding the existing problem first (Hartinah et al., 2020).

In addition to the ability to solve problems in non-routine problems, students also need characters, especially characters based on Islamic perspectives. Wahab Fuad explained the characters of Islamic morality are *Al-khairoh al-muthlaqoh, Al-sholahiyyah al-'aamah, Al-Tsabat, and Al-Iijam al-Mustajab*. Based on those characters, Foerster made essential traits of characters in education, which are: Regularity of interior, the coherence that gives courage, autonomy, constancy, and loyalty (Izfanna & Hisyam, 2012; Jamaluddin, 2013).

Education in Indonesia tends to be limited to the mastery of subject matter or relies on the development of low-level cognitive aspects that are unable to

develop student characters. The integration of mathematics learning in improving problem-solving ability that occurs in daily life does not necessarily become the only benchmark in improving learning outcomes (Lestari et al., 2019). Through mathematics learning, it is expected that by itself the goals to shape student characters such as being critical, careful, honest and so on can be achieved, and one of the learning model can be applied is Problem-Based Learning (Sagala, Umam, Thahir, Saregar, & Wardani, 2019).

The problem-based learning model is one of learning that is based on cognitive psychologists that depart from the assumption that learning is a process of behavior change thanks to experience. Learning is not merely a process of memorizing several facts, but a process of conscious interaction between an individual and his environment. Through this process, students will develop as a whole. This means that student development does not only occur cognitively, but also effective and psychomotor aspects through an internal appreciation of the problem at hand (Huda et al., 2019; Ramadhani, 2018; Ramadhani, Umam, Abdurrahman, & Syazali, 2019). Some mathematics education experts have tried to study learning models that can shape student characters, and they found that problem-based learning can be used as a tool to build students' characters (Macmath, Wallace, & Chi, 2009; Prabowo & Sidi, 2012; Soedjadi, 2000).

In addition to being seen from the aspect of the ability to solve the problem of the story also considered aspects of gender differences, gender differences have been in the spotlight since ancient times. Sex differences are no longer only related to biological problems but later developed into differences in ability between men and women (Mawaddah, Ahmad, & Duskri, 2018).

Gender differences not only result in differences in abilities of mathematics, but the way to obtain mathematical knowledge is also related to gender differences (Zhu, 2007). Gender, social, and cultural dimensions are powerfully interacting in the conceptualization of mathematics education. It can be concluded that gender, social, and culture influence mathematics learning (Leder, 2019). Gender differences affect mathematics learning during middle school (Cimpian, Lubienski, Timmer, Makowski, & Miller, 2016; Kersey, Csumitta, & Cantlon, 2019; Kyriakides & Antoniou, 2009).

Based on the results of the research described above, there is a diversity of research results regarding the role of gender in learning mathematics. Some results show the existence of gender factors in mathematics learning, but on the other hand, some studies reveal that gender has no significant effect on learning mathematics. Students will get more meaningful learning, gives a stronger impression to students, can overcome students' difficulties in learning mathematics, and students themselves can also solve problem-solving related to daily life, and can shape their characters.

METHOD

This research is a quasi-experimental study with a pretest-posttest control group design. The research units are determined by the learning model category (problem-based and ordinary learning). Thus, the increase in students' mathematical and characters problem-solving ability was done with the following research design.

Table 1. Research design

Group	Pretest	Treatment	Posttest
Experiment	O_1	X	O_2
Control	O_1	-	O_2

X = Learning with problem-based learning (PBL) models
O_1 = Initial test of students' mathematical and characters problem-solving ability
O_2 = Final Test of mathematical problem-solving skills

The population of this research was all students in a Private Islamic School in Medan, North Sumatera, Indonesia. Then, the research sample consisted of 42 students who were chosen by using a purposive sampling technique. The materials involved in mathematics learning are the eleventh-grade materials, according to the 2013 Curriculum.

This research used two classes, experimental class (taught by problem-based learning) and control class (taught by ordinary learning). Both classes had the pretest and posttest and Islamic characters questionnaire. It aimed to know the significant improvement of problem-solving ability and students' characters based on Islamic perspectives before and after learning treatment.

The research consisted of two types of research instruments, the quantitative instrument, and a qualitative instrument. The indicator of the research instrument was based on the competency of learning materials (trigonometry) and students' characters questionnaires (related in Islamic perspectives). The Islamic character scale consisted of 20 valid items consisting of five answer choices: strongly agree, agree, less disagree, disagree, and strongly disagree. The item of Islamic characters' statement consisted of four indicators; there is the regularity of interior, a coherence that gives courage, autonomy, constancy, and loyalty. The reliability of the Islamic character scale was on the medium category. The problem-solving ability test items of medium and challenging levels. The problem-solving ability test indicators were: understanding the problem, planning and implementing the plan of problem-solving; and related to another subject.

The data were analyzed using the Descriptive Test, Levene's Test, Kolmogorov-Smirnov Test, and Two Way-ANOVA. All statistical tests used a significant value below 0.05 with SPSS version 25.

RESULT AND DISCUSSION

Analysis of Improvement of Mathematical Problem-Solving Ability

The result of problem-solving ability test from students in experimental class and control class can be found in Table 2.

Table 2. Description of Problem-Solving Ability Test

	Min	Max	$\bar{X}$
Pretest expriment class	40	78	62.52
Posttest experiment class	75	90	83.57
Pretest control class	35	68	52.19
Posttest control class	68	85	75.50

The result of data calculated using the Kolmogorov-Smirnov test and Levene's test showed the data sample was normally distributed and had homogeneous variance. Based on Table 2, showed that the average pretest and posttest in the experimental class is higher than the pretest and posttest in the control class. It means that students in the experimental class had a new experience in the learning process when they taught with problem-based learning. That's an effect on students' problem-solving ability. In other ways, there was an improvement in students' problem-solving ability, and we can calculate normality gain (N-Gain) of students' result tests (pretest and posttest for each class).

The result of calculation students' problem-solving ability data based on N-Gain score seen from the student group and gender group of students can be found in Table 3 and Table 4.

Table 3. Description of Problem-Solving Ability Test Based on N-Gain Each Learning Class

Learning Class	Min	Max	$\bar{X}$	Category
Exprimen Class	0.33	0.73	0.56	Medium
Control Class	0.22	0.66	0.48	Medium

Table 4. Description of Problem-Solving Ability Test Based on N-Gain Students' Gender Factor

Gender	PBL		Ordinary Learning	
	N	$\bar{X}$	N	$\bar{X}$
Male	20	0.40	21	0.48
Female	22	0.57	21	0.47

Based on Table 3 and Table 4, showed that N-Gain on each class and each gender of students showed that, there was an increasing problem-solving ability between students in the control class and students in the experimental class.

Analysis of Students' Character Improvement

The result of students' characters questionnaire test based on Islamic perspectives from a student in experimental class and control class can be found in Table 5.

Table 5. Description of Students' Characters Questionnaire Test

	Min	Max	$\bar{X}$
Pretest expriment class	50	75	64.17
Posttest experiment class	78	93	83.09
Pretest control class	50	70	61.98
Posttest control class	70	88	80.93

The result of data calculated using the Kolmogorov-Smirnov test, and Levene's test showed the data sample was normally distributed and had homogeneous variance. Based on Table 5, there was an improvement of pre-test and post-test and students' questionnaire tests in each learning class. The description of students' questionnaire test based on N-Gain score seen from the student group and gender factor group of students can be found in Table 6 and Table 7.

Table 6. Description of Students' Characters Questionnaire Test Based on N-Gain Each Learning Class

Learning Class	Min	Max	$\bar{X}$	Category
Exprimen Class	0.33	0.75	0.52	Medium
Control Class	0.33	0.73	0.49	Medium

Table 7. Description of Students' Characters Questionnaire Test Based on N-Gain Students' Gender Factor

Gender	PBL		Ordinary Learning	
	N	$\bar{X}$	N	$\bar{X}$
Male	20	0.52	21	0.49
Female	22	0.53	21	0.50

After testing the prerequisites for analyzing data homogeneity of data variance and data normality are met, then data analysis can be continued. Testing the hypothesis in this study using a two-way analysis of variance (ANOVA).

First Hypothesis

The hypothesis proposed is that the increase in students' mathematical problem-solving ability taught by using problem-based learning is higher than the mathematical problem-solving ability of students who obtain ordinary learning. The hypothesis is tested with two-way ANOVA.

The testing criteria are rejected H_0 if the value of sig. < 0.05. The results of ANOVA test calculations for two N-Gain paths for the complete mathematical problem-solving ability of the experimental and control groups can be seen in Table 8.

Table 8. Test Result of Problem-solving Ability Hypothesis using Two-ways ANOVA

Test of Between-Subjects Effects					
Dependent Variable: N-Gain of Problem-solving Ability					
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Corrected Model	.131[a]	3	.044	5.178	.003
Intercept	22.485	1	22.485	2664.548	.000
Learning Class	.121	1	.121	14.285	.000
Gender	.001	1	.001	.143	.706
Learning Class *Gender	.007	1	.007	.855	.358
Error	.675	80	.008		
Total	23.343	84			
Corrected Total	.806	83			
a. R Squared = .163 (Adjusted R Squared = .131)					

Based on Table 8, it can be seen that for the learning factor, the calculated F value is 14.285, and the significant value is 0.000. It means that significant value is smaller than the significant level of 0.05. It can be concluded that H_0 is rejected and H_1 is accepted. Thus, it can be concluded that the increase in the mathematical problem-solving ability of students who obtain problem-based learning is higher than the mathematical problem-solving ability of students who obtain ordinary learning.

Second Hypothesis

The hypothesis proposed is that the increase in the characters of students who get problem-based learning is higher than the characters of students who get ordinary learning. The hypothesis is tested with two-way ANOVA. The test criteria are rejected H0 if the sig value < 0.05.

Table 9. Test Result of Students' Characters Questionnaire Hypothesis using Two-ways ANOVA

Test of Between-Subjects Effects					
Dependent Variable: N-Gain Students' Characters Questionnaire					
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Corrected Model	.019[a]	3	.057	4.004	.010
Intercept	21.591	1	11.841	834.855	.000
Learning Class	.018	1	.146	10.293	.002
Gender	.015	1	.015	1.048	.309
Learning Class *Gender	.009	1	.009	.623	.432
Error	1.135	80	.014		
Total	13.155	84			
Corrected Total	1.305	83			
a. R Squared = .131 (Adjusted R Squared = .098)					

Based on Table 9, it can be seen that for the learning factor, the calculated F value is 10.293, and the significant value is 0.002. It means that significant value is smaller than the significant level of 0.05. It can be made that H_0 is rejected, and H_1 is accepted. So, the increase in the characters of students who get problem-based learning is higher than the characters of students who get ordinary learning.

Third Hypothesis

The hypothesis is that there is an interaction between learning with students 'gender towards increasing students' mathematical problem-solving ability. The hypothesis is tested with two-way ANOVA. The testing criteria are rejected H_0 if the value of sig. < 0.05 (Maulidi, Apriliani, & Syazali, 2019).

Based on Table 8 in the first hypothesis test, it can be seen that for learning class and Gender factors, the

calculated F value is 0.855, and the significant value is 0.358. It means that significant value is higher than the significant level of 0,05. It can be made that H_1 is rejected and H_0 is accepted. Thus, it can be concluded that there is no significant interaction between learning with gender towards improving students' mathematical problem-solving ability to be accepted (Sumiyati, Netriwati, & Rakhmawati, 2018). This showed that the average gain of students' mathematical problem-solving ability with gender (male and female) students who are taught with problem-based learning does not differ significantly from students who are taught with normal learning (Noviyanti, Sugiharta, & Farida, 2019).

Graphically the interaction can be seen in the following Figure 1.

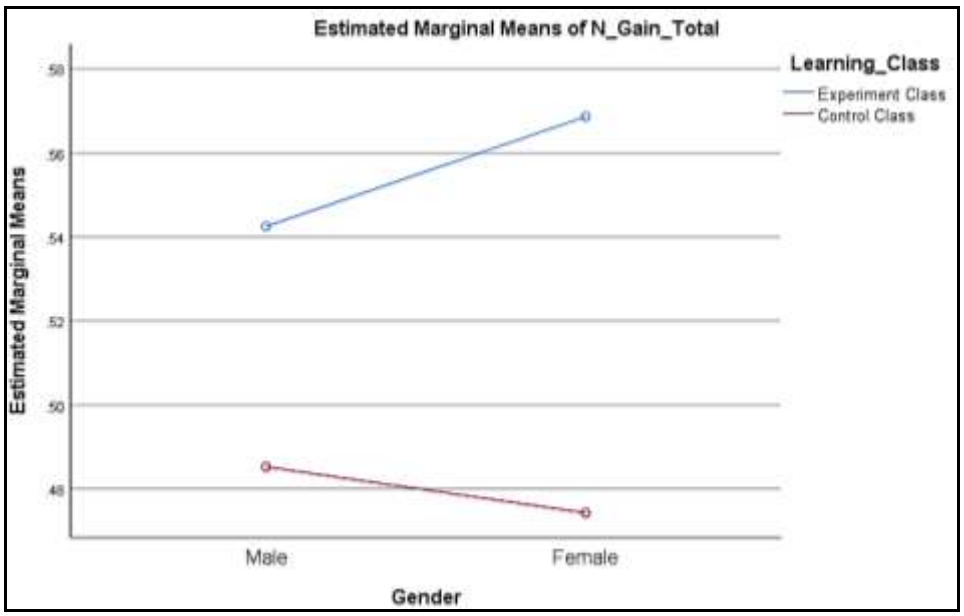

Figure 1. There is No Interaction between Learning and Gender in Improving Students' Mathematical Problem-solving Ability

Fourth Hypothesis

The hypothesis proposed is that there is an interaction between learning and student gender towards improving student characters (Suriati, 2019). The hypothesis is tested with two-way ANOVA. The testing criteria is H_0 is rejected if the value of sig. < 0.05.

Based on the table in the second hypothesis test, it can be seen that for learning and Gender factors, the calculated F value is 0.623, and the significant value is 0.432. It means that the significant value is higher than 0.05. It can be seen that H_1 is rejected and H_0 is accepted, which means that there is no interaction between learning with students' gender towards increasing students' characters can be accepted (Holidun, Masykur, Suherman, & Putra, 2018). This showed that the normalized gain of the male and female students who were taught with problem-based learning did not differ significantly from students who were taught using normal learning (Murti, Nasir, & Negara, 2019). Graphically, the interaction can be seen in the following Figure 2.

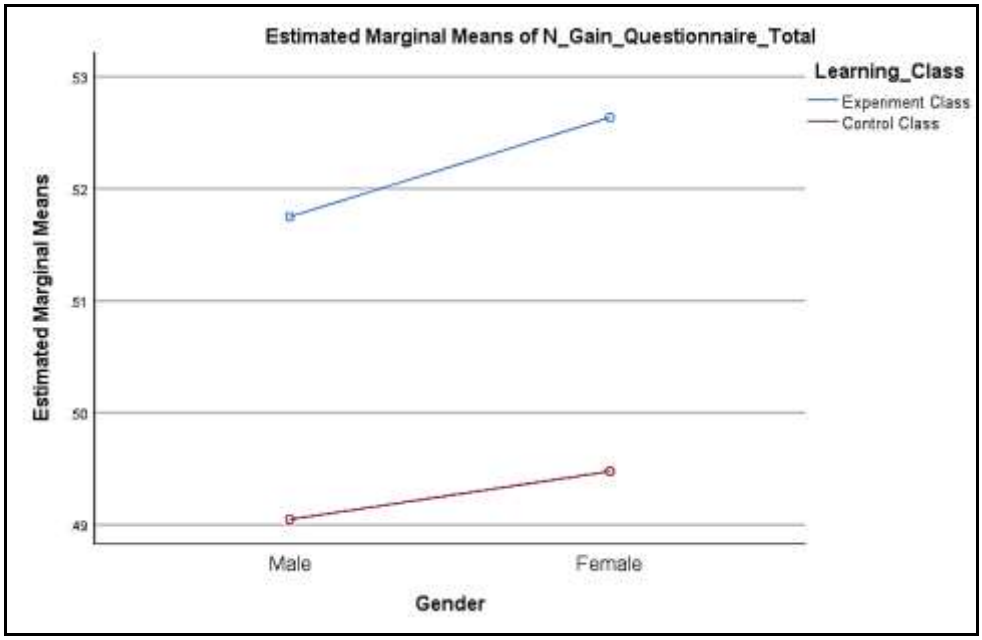

Figure 2. There is No Interaction between Learning and Gender on Improving Student Characters

The findings are in line with the statement that increasing cognitive level of student response in mathematics is determined not by the students' ability, but by the ability of the instructor to engage the student in mathematical practice (Demirel & Dağyar, 2016; LaForce, Noble, & Blackwell, 2017). Based on the argument, it suggested that students' cognitive level in mathematics is not defined by students' abilities, but by the expertise that teachers should engage students in mathematics activities. In comparison, problem-based research is also inspired by constructivism philosophy. The constructivism principle, which is focused on the theory of (Perkins, Piaget, and Vygotsky) suggests that individuals can create awareness in their context (Argaw, Haile, Ayalew, & Kuma, 2017; Scott, 2017).

In other ways, students' character in the teaching and learning process is an important thing. It can be made the learning process would be meaningful learning. Islamic character's perspectives make the student understand what they had taught and how to implement in daily life activities (Baharun & Ummah, 2018). Gender factors not related to improving students' cognitive aspects (Beyazsacli, 2016).

CONCLUSION

Based on the results of the analysis, the findings and discussion that have been presented in the previous chapter obtained several conclusions related to learning factors, student gender, mathematical problem-solving ability, and student characters. The result showed that problem-based learning could improve students' problem-solving ability and students' characters based on Islamic perspectives. The implementation of problem-based learning can make students contribute to the teaching and learning process with group investigations. Problem-based learning can build students' Islamic characters, and they can integrate their characters to understand and implement their knowledge.

Group investigation in problem-based learning aims to create a meaningful learning atmosphere. The collaboration among students, teachers, and learning environments (including

learning model) can create a meaningful and conducive learning atmosphere. The result of this research was found that the gender factor is not related to improving students' problem-solving ability and students' Islamic characters. Students in any gender can improve their cognitive and affective aspects by using a problem-based learning model.

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