Experimental Study of Learning Methods toward Students Learning Outcomes Viewed from Gender, Motivation, and Self-Efficacy

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Abstract. This research aims to test five research hypotheses, related to different students' outcomes test based on four factors: learning methods, gender, motivation and self-efficacy as well as the interaction among factors to independent variable. This research was experimental method study by implementing 2x2x2x2 factorial design. Each factor consists of two levels. The populations were the seventh grade of junior high school students in Donorojo sub district with 206 students consisting 111 male students and 95 female students. The data were selected by using cluster random sampling. Normality and homogeneity test which taken from students mid examination score were implemented before doing t-test for balance test. The final data were obtained from the final test scores of mathematics learning on probability theory material and statistical material for the experimental class (jigsaw cooperative learning method) and control class (conventional method), students gender documents, motivation questionnaire, and self-efficacy questionnaire. Questionnaire and tests were validated by experts and tested for its reliability. The data were analyzed by using two-way variance analysis techniques with SPSS. The results show that: (1) there were no differences in students' mathematics learning outcomes between experimental and control classes, (2) there were no differences in mathematics learning outcomes between male and female students, (3) there were no differences in mathematics learning outcomes between students with high and low motivation, (4) there are differences in students' mathematics learning outcomes between high and low self-efficacy, and (5) there is no interaction between learning methods, gender, motivation, and self-efficacy towards mathematics learning outcomes.

Keywords: *Learning Methods, Learning Outcomes, Gender, Motivation, Self-Efficacy*

1 INTRODUCTION

An optimal learning outcome is one of learning objectives for students in formal education. It means that the students deal with various subjects' material based on their grade and curriculum. The students learning outcomes indicators are measured by using a series of learning outcome test that show the students' progress score or students achievement during a period of time [1]. There are various alternative evaluation techniques for measuring learning outcomes used by teachers, schools, researchers, and government fit to their goals. Students

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competency tests were used to find out student learning outcomes after following learning process on certain materials and periods, such as the Mid Examination and Final Semester Examination.

The results become learning program evaluation for students, teachers, schools and government as in National Examination (UN). National Examination (UN) is conducted to monitor, encourage and improve the quality of learning [2]. The success of teachers and schools can be seen from the good average result of students' outcome or vice versa. Learning achievement is a success evidence of students learning process [3]. Learning outcome itself becomes a concern for education doers, including in Indonesia. This phenomenon encourages each educational institution to compete to show its excellence by managing variables that can improve student-learning outcomes.

However, yearly student-learning outcomes, such as the National Examination results have to be noticed because it shows decreasing results. Based on Statistics of 2016/2017 National Examination Results [2], the National Examination average in 2017 is 54.25 while the average in 2016 is 58.61. This happens due to the increasing integrity of 2017 UN implementation.

2 LITERATURE REVIEW

There are two factors that give effect to student learning outcomes including mathematics subjects, namely internal factors and external factors. Internal factors consist of intellectual, mental, and physical conditions while external factors consist of family, school, environment, and society factors [4]. This result becomes the considerations for researchers and practitioners to be the subject of discussion, study and research by various education experts and practitioners, including in this study.

Previous studies point out that communication, learning facilities, regulations, and family pressure are factors that influence student achievement [5]. Furthermore, the teacher's experience, family expenses, government expenditure, and the level of morbidity (susceptibility to illness) give significant influence to student outcomes [6]. Some researchers revealed the influence of teacher skills on student outcomes [7], [8], [9] as well as students' cognitive and emotional and social competencies [10]. Other researchers show that teachers and learning give effect on student behavior and attitudes or as affective aspects [11].

Based on this background, this study aims to test the differences of learning methods toward student learning outcomes, especially in mathematics subjects, as well as their interaction with gender factors and students' affective factors including motivation and self-efficacy through experimental research. Previous researchers have examined the correlation between gender and student learning outcomes [12], [13]; the correlation between motivation and learning outcomes [14],[15], the correlation between self-efficacy and learning outcomes [16],[17], the correlation between gender and outcomes motivation [18].

This research used 4-factor factorial design that is different from the previous study. The results of this study are expected to provide theoretical and practical contributions related to experimental design four factors that can influence student-learning outcomes in education.

3 METHOD

Viewed from the objectives, the researchers used quantitative research with pseudo experimental methods. Experimental studies, or design research is a good basic of research. It directs the experiment by regulating data collection, defining statistics for the data analysis, and

guiding the results interpretation [19]. Experimental study or design gives deeper analysis rather than just defining or directing statistical analysis of an experiment.

The steps to construct the experiment are as follows: (1) determining the problem and questions to be tested, (2) defining the population, (3) determining the sampling, and (4) determining the experimental design [20]. This study was quasi-experimental research. In quasi-experimental research, as in experimental research, testing hypothesis was seen as the "intervention" that the evaluated programs or design were tested to know the level of good impact measured by series of decided indicator [21].

The experimental method was chosen because the researchers intended to test four factors design as in design research [22], especially in mathematics education. These four factors acted as the main factor or as an independent variable, including research method, gender, motivation, and self-efficacy factor. Thus, this factorial design study aimed to determine the influence of the main factors toward the dependent variable (learning outcomes) and the interaction factors between the independent variables through experimental studies. Briefly, the factorial design of this research was 2x2x2x2. Therefore, there were four independent variables (factors) with each factor consisting of 2 levels. For example, the first factor (learning method) has two levels: jigsaw cooperative learning method and conventional learning method (lecturing). The second factor (gender) consists of two levels: male and female students. The third factor (motivation) and the fourth factor (self-efficacy), each consists of two levels: high and low categories. In general, factorial designs are described below.

Table 1. 4 Factorial Design

General Factor		**A_1 (Jigsaw Method)**		**A_2 (Conventional Method)**	
		B_1 (Male)	**B_2 (Female)**	**B_1 (Male)**	**B_2 (Female)**
C_1 High Motivation	D_1 High Self-Efficacy	$A_1B_1C_1D_1$	$A_1B_2C_1D_1$	$A_2B_1C_1D_1$	$A_2B_2C_1D_1$
	D_2 High Self-Efficacy	$A_1B_1C_1D_2$	$A_1B_2C_1D_2$	$A_2B_1C_1D_2$	$A_2B_2C_1D_2$
C_2 Low Motivation	D_1 High Self-Efficacy	$A_1B_1C_2D_1$	$A_1B_2C_2D_1$	$A_2B_1C_2D_1$	$A_2B_2C_2D_1$
	D_2 High Self-Efficacy	$A_1B_1C_2D_2$	$A_1B_2C_2D_2$	$A_2B_1C_2D_2$	$A_2B_2C_2D_2$

Generally, this research procedure includes eleven stages: (1) doing preliminary studies, consisting empirical facts, theoretical studies, as well as previous research studies, (2) identifying the problem, (3) formulating the problem, (4) formulating the research hypothesis, (5) determining population, sample, and sampling, (6) determining data collection techniques, (7) compiling and testing research instruments, (8) collecting data, (9) analyzing data, (10) explaining discussions and conclusions, and (11)) reporting the results of the study.

This research was conducted for 3 months, started from March-May 2018. The populations of this study were all seventh graders of SMPN 1 Donorojo and SMPN 2 Donorojo, Pacitan, East Java consisting of 206 students, with 111 male students and 95 female students. SMP Negeri 2 Donorojo was chosen because the average score of National Examination in mathematics was the lowest of the three main subjects, 44.21 (2015); 35.18 (2016); and 41.55

(2017). It also happens in SMP Negeri 1 Donorojo that has low average on National Examination for mathematics subjects 43.81 (2015); 40.04 (2016), and 47.73 (2017). This data were taken from the Ministry of Education and Culture of the Republic of Indonesia. The research sample consisted of one trial class, four classes as an experimental group (94 students), and five classes as a control group (113 students). The sample was selected by using simple random sampling. It means that the data were selected randomly from the population.

As mentioned before, the independent variable consisted of learning method factors (A1 and A2), gender (B1 and B2), motivation (C1 and D2), and self-efficacy (D1 and D2). Furthermore, the dependent variable was the result of students' mathematics learning outcomes. The learning method factor was in the form of interval data measured through students' mathematics learning outcomes data after participating in learning. Gender factor was obtained from documentation techniques. Motivation factors were measured through implementing a questionnaire with 32 questions, and self-efficacy factors were measured by implementing a questionnaire technique with 42 questions. Each research instrument was constructed through five stages: (1) compiling instrument blueprint adapted from theories used, (2) conducting expert validation, (3) testing instruments to trial classes, (4) conducting reliability testing of test instruments / questionnaire by using statistical tools (SPSS), (4) giving instruments to sample classes, both experimental and control classes, (5) analyzing data by using statistical tools.

This research used Jigsaw technique (experimental class) and conventional learning methods (control class). Researchers compiled a learning design containing learning steps based on the method blueprint, then compiled learning outcomes tests on probability theory and statistical material. The two sample classes were previously tested for its balance by using SPSS. The data were taken from Middle Semester Examination score. T-test was used to test the balance after the normality and homogeneity tests. The results were normal and homogeneous.

Self-efficacy questionnaire was constructed from Bandura's (1997) theory, containing three dimensions: level, strength, and generalization dimensions [23]. The level dimension consisted of outcomes motivation, ways of solving problems, and diligence aspects. Strength dimensions contained self-confidence, experience, and self-adjustment aspects. Furthermore, the dimensions of generalization contained cognitive, affective, and behavioral aspects. Based on the results of the reliability test, the questionnaire instrument can be used properly.

After being collected, the data were analyzed by using two-way variance analysis statistical tests using SPSS. As a prerequisite, the data balance test was carried out followed by testing the hypothesis. Two-way variance analysis aimed to examine the effect difference (effect) 4 factors as independent variables including the learning method (factor A), gender (factor B), motivation (factor C), self-efficacy (factor D), and interaction between 4 factor (factor ABCD) to the dependent variable.

4 RESULT AND DISCUSSION

The collected data were analyzed by using two-way ANOVA with SPSS after testing the balance of the initial data from the students' mid examination score previously. The final data are in the form of learning outcomes test scores for two groups after being given the treatment of learning method (A) and controlled by 3 BCD factors (gender, motivation, and self-efficacy). Before testing the hypothesis, normality, homogeneity, and t-test were conducted to test the balance with the following results.

Table 2. Data Normality Test on Experimental Class by Using Jigsaw Method (A1)

One-Sample Kolmogorov-Smirnov Test		
		Hasil Belajar
N		93
Normal Parameters[a]	*Mean*	70.67
	Std. Deviation	12.739
Most Extreme Differences	*Absolute*	**.098**
	Positive	.087
	Negative	-.098
Kolmogorov-Smirnov Z		**.948**
Asymp. Sig. (2-tailed)		.330
a. Test distribution is Normal.		

Based on Table 2, the normality test is performed on each row and column by using non-parametric statistical techniques and the result shows that data A1, A2, B1, B2, C1, C2, D1, D2 are normally distributed. For example, in Table 3 above, the Most Extreme Differences Absolute value is the statistical value for experimental group learning method (A1). The KS test (Kolmogorov-Smirnov) shows the value of .098. It means (p> 0.05), or H0 is accepted, so A1 data are normally distributed. Based on the Kolmogorov-Smirnov, Z value is 0.948. It means that p> 0.05, then H0 is accepted and A1 data are normally distributed.

Then, the homogeneity test on 4 factors was conducted as the independent variable toward the dependent variable (learning outcomes) by using the Lavene test with the following summary of data.

Table 3. *Output* Summary of Homogenity Test

Design	F	df1	df2	*Sig*.	Conclusion
Intercept + Method	.042	1	204	.837	Same Variation
Intercept + Gender	3.552	1	204	.061	Same Variation
Intercept + Motivation	.015	1	204	.904	Same Variation
Intercept + Self-Efficacy	.312	1	204	.577	Same Variation

(Data Source: SPSS)

Based on Table 3, same variation is obtained from the value of Sig. > .05, that significance value of learning outcomes is based on the independent variable. Then the balance test is implemented as shown in Table 4 below.

Table 4. Independent Samples Test

		Levene's Test for Equality of Variances				
		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*
Scores	*Equal variances assumed*	.042	.837	-.455	204	**.649**
	Equal variances not assumed			-.455	196.345	.650

(Data Source: SPSS)

Based on the output of T-Test Independent Sample, the Sig. (2-tailed) value is .649> .05. It can be concluded that H0 is rejected. It implies that the average learning outcomes of the experimental group and control group are equal or balance.

After implementing the prerequisite analysis test, the hypothesis is tested. There are 5 hypotheses proposed: (1) there are differences in the effect of learning methods toward student learning outcomes, (2) there are differences in the effect of gender toward student learning outcomes, (3) there are differences in the influence of motivation toward student learning outcomes, (4) there are differences in the effect of self-efficacy toward student learning outcomes, and (5) there is an interaction between learning methods, gender, motivation, and self-efficacy toward learning outcomes. After implementing 2 ways Anava statistical test by using SPSS, the output are as follows:

Table 5. *Output* Hypothesis Test

Tests of Between-Subjects Effects

Dependent Variable: Learning Outcomes

Source	*Type III Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Corrected Model	3969.270[a]	15	264.618	1.726	.049
Intercept	809422.736	1	809422.736	5.281E3	.000
Learning_Methods	65.654	1	65.654	.428	.514
Gender	.097	1	.097	.001	.980
Motivation	590.906	1	590.906	3.855	.051
Self-Efficacy	1051.390	1	1051.390	6.860	.010
Learning_Methods * Gender	.983	1	.983	.006	.936
Learning_Methods * Motivation	16.012	1	16.012	.104	.747
Learning_Methods * Self-Efficacy	296.294	1	296.294	1.933	.166
Gender * Motivation	30.133	1	30.133	.197	.658
Gender * Self-Efficacy	4.065	1	4.065	.027	.871
Motivation * Self-Efficacy	10.419	1	10.419	.068	.795
Learning_Methods * Gender * Motivation	2.595	1	2.595	.017	.897
Learning_Methods * Gender * Self-Efficacy	61.483	1	61.483	.401	.527
Learning_Methods * Motivation * Efficacy	169.149	1	169.149	1.104	.295
Gender * Motivation * Self-Efficacy	339.727	1	339.727	2.217	.138
Learning_Methods * Gender * Motivation * Self-Efficacy	79.128	1	79.128	.516	.473
Error	29121.162	190	153.269		
Total	1074805.000	206			
Corrected Total	33090.432	205			

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Total	1074805.000	206			

a. *R Squared = .120 (Adjusted R Squared = .050)*

(Data Source: SPSS)

Data in Table 5 can be analyzed to answer the hypothesis of main factors interaction toward the dependent variable with each interpretation. First, the interaction between learning methods toward learning outcomes shows the value of Sig. = 0.514> α = 0.05 then H0 is accepted. It means that learning methods do not affect student-learning outcomes. Second, the interaction among gender factors shows the value of Sig. = 0.98> α = 0.05, then H0 is accepted. Therefore, gender does not affect learning outcomes. Third, the interaction of motivation on learning outcomes shows the value of Sig = 0.051> α = 0.05, then H0 is accepted or the motivation factor does not affect learning outcomes. Fourth, the interaction between self-efficacy and learning outcomes shows the value of Sig. = 0.01 <α = 0.05, then H0 is rejected or self-efficacy factor influences students' mathematics learning outcomes. Furthermore, to find out which level/category, the researchers compare the marginal average. It is found that the average of self-efficacy is high (72.9063) more than the low efficacy average (68.0053). Therefore, it can be concluded that students' learning outcomes with high self-efficacy are better than students with low self-efficacy. Fifth, the data show that there is no interaction between the main factors (learning method, gender, motivation, and self-efficacy) towards the dependent variable, (learning outcomes). These results are relevant to the hypothesis results above where only factor D (self-efficacy) that has an effect on learning outcomes. The further analysis will be presented in this following description.

4.1 First Hypothesis

Based on Table 5 on learning method factors, H0 is accepted because the value of Sig> α, or 0.514> 0.05. It means that there is no significant difference in student learning outcomes between jigsaw cooperative learning methods and conventional methods. This result is supported by the Essays study on 2003. The results do not show the effectiveness of jigsaw method specifically. Jigsaw is only explained as one of many cooperative learning strategies that have demonstrated effectiveness, but it has weaknesses for students in general education and in special education. The implementation of jigsaw consists of some limitations. This relates to the teacher. The teachers' research shows that students knew jigsaw method, but in the implementation, they missed an important step to teach the material they were experts to other members of their group [24]. Therefore, the success of jigsaw depends on the teachers' ability in explaining how to apply the approach correctly or vice versa. It happens because cooperative learning is based on a constructivist approach that requires the use of experience-based activities. This finding is different from Azmin (2016) that Jigsaw is beneficial for developing social skills. However, it was emphasized that, despite the positive findings obtained from this study, jigsaw method is only one of many cooperative learning methods and it is not a perfect teaching method [25]. This finding has theoretical and practical implications that the effectiveness of jigsaw cooperative learning methods specifically and cooperative learning methods generally are influenced by several factors, including the teachers' readiness in managing learning situations that support the learning process.

4.2 Second Hypothesis

The second hypothesis is related to gender factors. Based on table 5, there is no difference in student learning outcomes between male and female students because the value of Sig> α, or 0.980> 0.05 or H0 is accepted. This result is supported by previous studies that there was no significant difference between male and female in mathematics [26], there was no statistically significant difference between students' science learning outcomes based on gender differences [27], there were no significant differences in learning results between male and female students even though the influence of culture is interesting to be studied further due to the assumption that male students are considered superior [28] while female students are superior in motivation, ability, performance, and self-management [29]. Glory's finding (2017) also shows that gender has a significant influence on interest but it does not have a significant influence on integrated science learning outcomes for students [30]. This result is different from Samuelsson's finding that compared to female, male students believe that mathematics is important [31]. In general, these findings have theoretical and practical implications for teachers to generate other factors related to gender and learning outcome.

4.3 Third Hypothesis

Based on table 5, there is no difference between the learning outcomes of students who have high and low motivation because the value of Sig> α, or 0.051> 0.05, so H0 is accepted. This result is different from Tella (2007). She says that students with high motivation have better academic performance than the students with low motivation [32]. In addition, the findings of Zamsir and Fajrin (2015) show that students' learning motivation has a positive influence on mathematics learning outcomes of junior high school students with 10% contribution [33]. While Ozen (2017) shows that motivation has a low positive effect on student outcomes [34].

Therefore, this research finding shows different results from the theory and results of previous studies. The differences in individual motivation above can be explained in relation to their mathematics teacher, that the intrinsic motivation in learning mathematics can be

developed by considering the stimulation, control, and interest factors [35]. It implies that there are other variables or factors that can influence students learning motivation development, including math competition, parents, books, teachers at school [36]. Due to avoid the anxiety in completing mathematical tasks, [35] the students with high anxiety cannot develop their motivation. Therefore, the teacher must be patient, encourage, and support them based on their individual learning style. This is assumed that the motivation will have a positive effect on students 'mathematics learning outcomes based on the teacher's role in developing students' intrinsic motivation through appropriate instructional design.

4.4 Fourth Hypothesis

Based on table 5, there are differences in learning outcomes between students with high and low self-efficacy because the value of Sig $<\alpha$, or $0.01 < 0.05$, then H0 is rejected. This is relevant to the previous research result that self-efficacy has high correlation to the value of mathematical outcomes [37], [38], [39]. However, other studies show that there is no significant difference between self-efficacy and mathematics learning outcomes in male and female students [26]. It implies that there are practical implications for teachers to focus on increasing self-efficacy related to mathematics learning outcomes [40] [41] through emphasizing students' self-confidence to succeed in mathematics outcomes [26] because self-efficacy is positively related to mathematics learning outcomes [38].

4.5 Fifth Hypothesis

The fifth hypothesis states that there is an interaction between learning methods, gender, motivation, and self-efficacy towards learning outcomes. In general, this hypothesis is not proven because it is influenced by the results of hypotheses 1-3 where the main factors (learning methods, gender, and motivation) do not give different effects on student learning outcomes, especially in mathematics subjects. There is only self-efficacy that has a different effect on learning outcomes, but learning method and self-efficacy factors do not have correlation to learning outcomes. This result is relevant to the findings that jigsaw has no effect on self-efficacy perception [42]; there is no interaction between learning strategies (jigsaw and conventional) and learning motivation (high and low) [43]; there is no correlation between self-efficacy and learning outcomes in both male and female students [44]; there is no significant differences between gender differences and outcomes motivation [45]. Amedu (2015) shows that there is a significant difference between learning outcomes average based on gender by using Jigsaw [46]; Jigsaw has a significant influence on self-efficacy and learning motivation [47], and cooperative learning method is more effective than traditional method related to students achievement and attitude [48]. However, this evidence is not sufficient to support the interaction between main factors and dependent variable in this study based on the assumptions and explanations before. Therefore, this finding is different from the fifth hypothesis. It is assumed that this result is different from other researchers' result that will give theoretical and practical contribution.

5 CONCLUSION

This study aims to examine the use of 4 factors factorial design (learning methods, gender, motivation, and self-efficacy) on independent variables (learning outcomes) through experimental design. There are five hypotheses proposed to determine the effect of 4 factors interaction on dependent variable. The results of data analysis by using SPSS-assisted variant analysis show that there is no significant effect between learning method factors (first

hypothesis), gender (second hypothesis), and motivation (third hypothesis) on mathematics learning outcomes. Only the fourth hypothesis (self-efficacy) is proven to give influences on learning outcomes in mathematics. This result gives influences on the fifth hypothesis, that there is no interaction between the main factors on the dependent variable. Empirically, this result is different from other researchers result because of other factors and variables that give influence on students' outcomes. The researchers cannot control those factors and variables. In general, the teacher's role factors related to skills in designing effective learning by considering students characteristics and the subject becomes one of important variable to be further studied. The development of teacher professionalism has to focus on the subject and teachers opportunity to continue learning by mixing the real experience using different curriculum and real assessment.

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