

THE INFLUENCE OF MATHEMATICAL'S REASONING ABILITY AND GENDER DIFFERENCE TOWARDS MATHEMATICAL CONCEPTUAL UNDERSTANDING

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Abstract. This research was an ex-post facto which was used to determine the influence of mathematical reasoning ability and gender for understanding mathematics' concepts. The population in this research was all senior high school students at North Luwu regency. The sample of this research are students in classes of IX A and IX B in SMA Negeri 2 Masamba and students in classes of IX A and IX B of SMA Negeri 1 Bone-bone. The technique of sampling was two stage random sampling. The technique of collecting data was giving two tests. The first test was used for measuring student's mathematical's reasoning ability and the second one was used for measuring student's understanding of mathematics' concepts. The data were analyzed using inferential statistics. Furthermore, the finding suggests that mathematical's reasoning ability and gender together influence mathematical concepts's understanding of th students..

Keywords: Influence of Gender, Mathematical Reasoning's Ability, Mathematical Conceptual Understanding

INTRODUCTION

One of the abilities in mathematics learning is reasoning ability. It is one of basic competences of mathematics besides understanding, communication, and problem solving. There are plenty of researches related to reasoning ability in mathematics which consider it important for making argument to defend the argumentation of students as well as to support their solutions (Alibert & Thomas, 1991; Francisco & Maher, 2005; Maher, 1995, 2005; Yackel & Hanna, 2003). Schoenfeld (1992), for example, points out that a focus on rote mechanical skills leads to bad performance in problem solving. Lesh and Zawojeskij (2007) discuss how emphasising on lowlevel skills does not give the students the abilities needed for mathematical modelling or problem solving, neither to draw upon interdisciplinary knowledge.

Another aspect which attracts the interest of the author is gender difference. Some studies show that there is a difference in learning achievement of students which is influenced by gender differences. Female almost always has lower achievement than male. Furthermore, in Boaler (1994) she reviewed a small-scaled piece of research and her findings suggest that contexts in some instances affect boys and girls differently. It is more likely that boys perform better than girls if the context in a

task includes real world variables that should not be used nor taken into account to reach a solution. Boaler (1994) further discusses how this ignoring of the real world may be a reason to girls' disinterest in mathematics.

What makes the present research different to the previous studies is that it attempts to seek the influence of mathematical reasoning ability and gender difference towards mathematical conceptual understanding which is also the research question of this study. Therefore, some constructing theories are reviewed to support the method parts. Mathematical reasoning that includes the ability to think logically and systematically is the highest of mathematical cognitive.

Meanwhile, trivially, gender, as referred by several literatures, is the difference between men and women which is viewed from socio-cultural construction. Furthermore, concerning the restriction of mathematical conceptual understanding in this study, it refers to the indicators issued by the government in the form of the competencies which must be acquired by students in the curriculum education unit (KTSP, 2006), i.e.

1. Restating a concept,
2. Classifying objects according their properties,
3. Giving examples and non-examples of a concept,
4. Presenting concepts in various forms of mathematical representations,
5. Developing the requirements necessary or sufficient condition of a concept,
6. Applying a specific procedure or operation,
7. Applying the concept or problem-solving algorithm.

PROBLEM STATEMENTS

1. Do mathematical reasoning ability and gender separately influence the mathematical conceptual understanding of senior high school student?
2. Do mathematical reasoning ability and gender together influence the mathematical conceptual understanding of senior high school?

RESEARCH METHOD

The research variables in this study are reasoning ability (X_1) as well as gender difference (X_2) as the independent variables besides mathematical conceptual understanding (Y) as the dependent variable. The research itself is an ex-Post Facto research, which aims to determine whether variable of gender differences and variable of mathematical reasoning skills have effect on the mathematical conceptual understanding. The research design is illustrated in the figure 1:

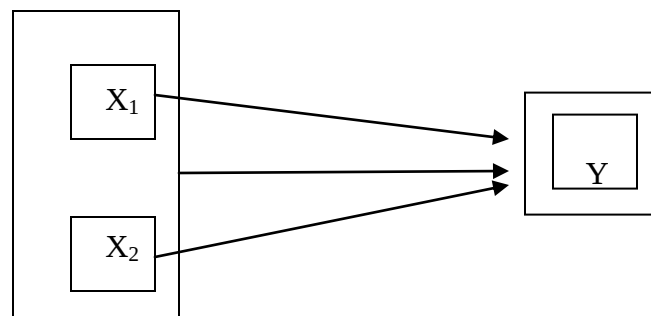


Figure 1. Design Correlation of Research Variable

Descriptions:

X_1 : Score of mathematical reasoning ability

X_2 : Gender differences, which is defined

$$X_2 = \begin{cases} 1; & \text{for male} \\ 0; & \text{for female} \end{cases}$$

Y : Score of mathematical conceptual understanding

The population in this study is all senior high school students in Luwu Utara regency, one of regencies in South Sulawesi province. The sampling technique used in this study is two stage random sampling. Two stage-random is a sampling technique by combining cluster random sampling and simple random sampling which was undertaken by the following consecutive steps:

1. Identifying the existing state high schools.
2. Randomly selecting an existing state high schools respectively located in the capital, which are as many as two schools, and outside the capital, which are as many as twelve schools.
3. Selecting two different classes from each selected school

Eventually the samples are the students of class IXA and IXB in SMA Negeri 2 Masamba and those of Class IXA and IXB, in SMA Negeri 1 Bone-bone. The instruments for data collection used in this study were mathematical reasoning test and mathematical conceptual understanding test which have been made and validated theoretically by a university's reliable testing centre and practically by the author and some colleagues. The data were analyzed using inferential statistical analysis. Multiple regression analysis was used to measure the effect of mathematical reasoning ability and gender towards the understanding of mathematical conceptual. The formula of multiple linear regression analysis at the level of significance 95% ($\alpha=0,05$) is

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$$

with the estimated function:

$$\hat{y} = b_0 + b_1 X_1 + b_2 X_2$$

Where β_i is the parameter of regression ($i = 0, 1, 2$), b_i is the regression estimator ($i = 0, 1, 2$), and ε is the error of regression. Through the analysis of linear regression with SPSS 20.0, the output will show the coefficients regression, the results of the F test and t test were used to test the hypothesis. The F-test result is used to see if there is a second effect of the independent variables together. The results of t-test are used to see the effect of each independent variable on the dependent variable.

RESULTS AND DISCUSSION

All of the tests were administered to the students and result in the scores of mathematical reasoning ability of both male and female students and those of mathematical understanding which are presented in the following tables.

Table 1. The Statistical Score of Mathematical Reasoning Ability

Statistics	Statistical Value
Number of sample	131
Maximum score	100,00
Minimum score	13,33
Ideal score	100
Range	86,67
Mean	59,59
Median	60,00
Modus	66,67
Deviation standard	18,02
Varians	324,62
Skewness	-0,469
Kurtosis	0,87

Table 2. The Statistical Scores of Mathematical Reasoning Ability of Male Students

Statistics	Statistical Value
Number of sample	36
Maximum score	100,00
Minimum score	13,33
Ideal score	100
Range	86,67
Mean	60,37
Median	60,00
Modus	60,00
Deviation standard	18,65
Varians	347,79
Skewness	-0,218
Kurtosis	0,223

Tabel 3. The Statistical Scores of Mathematical Reasoning Ability of Female Students

Statistics	Statistical Value
Number of sample	95
Maximum score	100,00
Minimum score	13,33
Ideal score	100
Range	86,67
Mean	59,29
Median	60,00
Modus	66,67
Deviation standard	17,86
Variances	319,12
Skewness	-0,583
Kurtosis	0,081

Table 4. The Statistical Scores of Mathematical Conceptual Understanding

Statistics	Statistical Value
Number of sample	131
Maximum score	100,00
Minimum score	33,33
Ideal score	100
Range	66,67
Mean	69,93
Median	72,22
Modus	72,22
Deviation standard	15,39
Variances	236,88
Skewness	-0,209
Kurtosis	-0,851

Testing the Hypothesis 1

Hypothesis : mathematical reasoning ability influences the mathematical conceptual understanding of students in senior high school in North Luwu regency.

In statistical testing, the hypothesis is formulated as follows:

$$H_0 : \beta_1 = 0 \text{ vs } H_1 : \beta_1 > 0$$

- H_0 : There is no influence of mathematical reasoning ability towards mathematical conceptual.
 H_1 : There is an influence of mathematical reasoning ability towards mathematical conceptual understanding.

Based on the regression analysis result, we get $t_{statistic} (12,849) > t_{table} (1,979)$ and significant value (0,000) which is less than $\alpha = 0,05$. Thus, H_0 is rejected implying H_1 is accepted

Testing the Hypothesis 2

Hypothesis : gender difference influences mathematical conceptual understanding of senior high school students in North Luwu regency.

In statistical testing, the hypothesis is formulated as follows:

$$H_0 : \beta_2 = 0 \text{ vs } H_1 : \beta_2 > 0$$

H_0 : There is no influence of gender difference toward mathematical conceptual understanding

H_1 : There is an influence of gender differences towards mathematical conceptual understanding.

Based on the regression analysis result, it is obtained that $t_{statistic} (0,277) < t_{table} (1,979)$ and significant value (0,782) which is greater than $\alpha = 0,05$. Thus, H_0 is accepted implying H_1 is rejected.

Testing the Hypothesis 3

Hypothesis : mathematical reasoning ability and gender differences together influence mathematical conceptual understanding of senior high school students in North Luwu regency.

In statistical testing, the hypothesis is formulated as follows:

$$H_0 : \beta_1 = \beta_2 = 0 \text{ vs } H_1 : \text{at least one of } \beta_1 \neq 0 \text{ or } \beta_2 \neq 0$$

H_0 : There is no influence of mathematical reasoning ability and gender difference towards mathematical conceptual understanding

H_1 : There is an influence of mathematical reasoning ability and gender difference to mathematical conceptual understanding

Based on regression analysis's result, we got $F_{statistic} (82,739) > F_{table} (3,067)$ and significant value (0,000) is smaller than $\alpha = 0,05$. Thus, H_0 is rejected. The multiple linear regression equation Y (mathematical conceptual understanding) of X_1 and X_2 (mathematical reasoning ability and gender difference) is $Y = 31,585 + 0,641X_1 + 0,556X_2$. The regression equation Y of X_1 and X_2 indicates that each increasing of one unit of X_1 affect 0,641 unit increase of Y. Likewise, each increasing of one unit of X_2 affect 0,556 unit increase of Y. It shows that there is relationship between X_1 and X_2 to Y. From the result, we also obtain the value of β for mathematical reasoning ability, i.e. 0,750 which indicates that there is contribution about 75,0% of mathematical reasoning ability to mathematical conceptual understanding while the remaining about 25,0% is influenced by other variables. Furthermore, the value of β for gender difference is 0,016 indicating that there is contribution about 1,6% of gender difference to mathematical conceptual understanding while the remaining about 98,4% is influenced by other variables.

CONCLUSION AND SUGGESTION

From the derived results, several conclusions can be drawn as follows:

1. The mathematical reasoning abilities of the students influence their mathematical conceptual understanding
2. Gender difference does not influence mathematical conceptual understanding of the students.
3. The mathematical reasoning ability and gender difference together influence mathematical conceptual understanding of the students

From the findings of this study, it can be suggested for further research to elaborate the results by undertaking the study in more numbers of samples and in different location.

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