The Effectiveness of Innovative Learning on Mathematical Problem-Solving Ability: Quasi-Experimental

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Abstract

Quasi-experimental research or quasi-experimental research is an innovation from true experimenters, including difficult research in the fields of education and social. Although this research is difficult to do, many researchers are also interested in using a quasi-experimental design in conducting research, especially in the field of mathematics. The high interest of researchers in this study is due to the fact that quasi-experimental research is most suitable to be applied in research in the field of mathematics education which is the subject of instructional research by educators and students. Quasi-experiments are used to make it easier to control due to non-functioning due to the control group as an external variable that also has an effect. The study conducted in this study used a literature review, broadly speaking, research data collection was based on observations of related research journal articles that had been carried out by other researchers before. Quasi-experimental studies as a research vehicle that aims to examine the application of quantitative research in testing students’ problem-solving abilities. Researchers need more accurate methods to be applied, theoretical studies and analysis results can be concluded that quasi-experimental research can be used as an alternative to problem solving in problem-based mathematics learning. Based on the analysis of the researcher’s interest, it can be seen that in fact the researcher uses a test instrument to see the effect of solving students’ mathematical problems by applying the random sampling technique.

Keywords: Quasi Experiment, Mathematical Problem Solving, Quantitative

INTRODUCTION

Quasi-experimental research as a psychological research which includes applying qualitative methods, quantitative methods and mixed methods. Then, the qualitative method is based on the influence of the independent variable the non-experimental method with the experimental method. The non-experimental method is a method that does not need independent variables. According to Ningrum, Erlin, & dkk (2017) said that said that experimental methods can be in the form of inference, including manipulating independent variables and controlling external variables (extrinsic variables) by measuring their effect on the dependent variable. The experimental method is divided into three forms, is (1) quasi-experimental, (2) single experiment, and (3) randomized experiment.

Mathematical material is always connected with various ideas or methods that are abstract in nature through simple material to have a very high level of complexity. Thus, mathematical material will be arranged systematically based on certain concepts, no steps or stages should be missed at all.
According to Noviza, Nelvi, & dkk (2017) said that learning mathematics should be applied with a clear design and must be in accordance with the abilities of students, so that the material being taught and being taught is carried out properly. Students' abilities can be seen to increase if learning outcomes appear to improve after the treatment. For this reason, comprehensive implementation steps are needed in building students' thinking about the mathematics material that will be taught through certain research methods. The development of the times also affects the implementation of mathematics learning, such as changes in the way of thinking, changes in treatment in learning towards the use of teaching methods and strategies (Indriyani & dkk, 2017).

Nurhaliza & dkk (2020) said that learning is a form of interactive process between students and teachers to share information. Based on the law of the Republic of Indonesia Number 20 of 2003 about the National Education System in article 1 (20) it is specifies that: "learning is a process of interaction between students and educators and learning resources in a learning environment". Then, Suhendri & Mardalena (2015) said that kita perlu melihat adanya solusi-solusi jitu dalam mengatasi problematika pendidikan yang terjadi. we need to see the best solution in overcoming educational problems that occur. One solution is through the use of varied and effective learning methods to adapt to the subject matter, by seeking appropriate learning methods that can provide a stimulus for the mindset to be more interactive in learning activities. Therefore, the independence of students will be increasingly formed. Students will try to learn the material through books and other sources. The appropriate learning method to overcome each student's problem is problem solving learning method. This method trains students to be able to analyze and identify a problem and be able to provide the right solution and can even communicate through writing and orally. Training students' thinking, communication and creativity in solving math problems is very important for students (Isnaniah, 2017); (Imamuddin, 2018); (Isnaniah, 2018). Students' problem solving ability is one of the goals of learning mathematics (Imamuddin, 2019).

Students are an important component in the learning process, researchers are required to be able to look at the strengths and weaknesses of students including effective ways to determine methods, strategies and models that will be used in increasing student capacities (Indriyani & dkk, 2017). Appropriate learning related to problem solving learning methods and the use of quasi-experimental research can be seen from several sources that have been quoted by the author, such as the following reference sources: (Indriyani & dkk, 2017); (Suhendri & Mardalena, 2015); (Effendi, 2012); (Wahyuni & dkk, 2018); (Nurhaliza & dkk, 2020); (Artika & Karso, 2019); (Fitriani, 2016); (Aprianti & Kesumawati, 2019); (Masamah & Ulfia, 2017); (Nurdalihah & dkk, 2021); (Fadillah & Ahmad, 2016); (Fariha & Mutia, 2013); (Fariha M. , 2013); (Lubis & dkk, 2020); (Ningrum d. , 2017); (Jatisunda & M. Gilar, 2017). With simultaneous steps through the analysis of research problems and the tendency of researchers to use research methods so that conclusions can be drawn on the form of applying a quasi-experimental design. Therefore, the quasi-experimental method is a solution for mathematics researchers in studying students' problems in understanding mathematical problems which essentially have variables that are difficult to control.

METHOD

The research applied is based on a literature study that describes the use of quasi-experiments in a student's mathematical problem solving research. This study refers to several articles in various randomly selected journals. The articles obtained were obtained from the internet google scholar. Based on the literature review used at the time of data collection, the researcher assumes that quasi-experimental research is often applied in the world of education and will always be reflective of classroom research that observes students and teachers. The data taken are in the form of trends in method development and also the dominant research instruments applied. Applications in the field are usually in testing data and samples are carried out pre-test and post-test for data collection that are applied by researchers in the field. Therefore, this study only shows the extent of the benefits of the quasi-experimental method in solving student problems.

Ketika peneliti menggunakan penelitian metode eksperimen, menurut (Winarni & Endang, 2011) The researcher must pay attention to the experimental conditions, manipulate the stimulus and then
be equipped with observing the impact of the treatment. Experimental research is a study to
determine learning outcomes due to different treatment of two classes, is the experimental class
and the control class using a pre-test and then a post-test after applied the treatment and later the
research results will be compared. Sugiyono (2014) quasi eksperimental design has a control group,
but does not fully work fully in controlling the external variables that affect the implementation of
the experiment. The independent variable is the main key in this study.

RESULTS AND DISCUSSIONS

Result

Quasi-experimental research is a quantitative research in which the researcher manipulates one
or more independent variables and controls other variables relevant to the research conducted or
commonly called the dependent variable. The purpose of quasi-experimental research is to determine
whether the causal relationship / cause of the independent variables is good for two or more variables.
The requirement of experimental research is the existence of a control variable as a form of
independent variable. Research can also be done by observation, careful observation of the control
variable which is also a manipulation of the independent variable.

The history of the development of quasi-experimental or quasi-experimental methods was first
pioneered by Campbell (1957). The history of quasi-experiments can be seen in detail at Hastjarjo
(2014) and also a book Shadish & dkk (2002) the title is “Experimental and Quasi-Experimental
Designs for Generalized Causal Inferences.” Buku Shadish & dkk (2002) use the word
“Experimental” to demonstrate a quasi-experimental design draft “Quasi-Experimental Design”. The
two experimental designs will be used to reach causal conclusions/inferences that can be linked
together (Hastjarjo, 2019). Experiments can also be interpreted as tests, namely tests that do not need
to show the cause or can also be described as experiments or direct manipulation (Cook & Campbell,
1979).

Quasi-experimental as an option that has treatments that affect manipulation in each
experimental unit but does not use random assignment to create comparisons in order to conclude
changes in treatment even interpreted as experimental or intentional manipulation (Cook & Campbell,
1979). Some of the differences between quasi-experiments and real experiments are if true
experiments are used to test the causality obtained from the occurrence of the relationship. Whereas
in quasi-experimental testing is carried out without full control in it (Salkind, 2006); (Levi & Ellis,
2011). However, this research is not completely without control over the object of research in a quasi-
experimental, but what is meant is that the research does not have absolute control over the object of
research.

<table>
<thead>
<tr>
<th>No</th>
<th>Researcher and Year</th>
<th>Research Result</th>
</tr>
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<tbody>
<tr>
<td>1.</td>
<td>Suhendri and Mardalena, 2015</td>
<td>Based on the test results, it was found that there was no interaction relationship between problem solving learning methods and independent learning on learning outcomes.</td>
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<tr>
<td>2.</td>
<td>Artika and Karso, 2019</td>
<td>The use of the TAPPS method will be better implemented than the usual troubleshooting. The TAPPS method has an effect on positive attitudes.</td>
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<tr>
<td>3.</td>
<td>Effendi, 2012</td>
<td>Based on the research, it shows that there is a significant interaction between early ability learning and guided discovery.</td>
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<tr>
<td>4.</td>
<td>Fitriani, 2016</td>
<td>Shows a significant influence between problem solving abilities and students’ mathematical self-confidence.</td>
</tr>
</tbody>
</table>
5. Nurhaliza, I.R & Maryam, I. 2020. Based on the research findings, it can be seen that the problem solving ability of students using the MMP learning model is better than problem solving learning.

6. Wahyuni, Tri., dkk. 2018. There is a difference between students' mathematics learning outcomes using the PBL model and the PBI model on the SPLDV material.

7. Aprianti., & Kesumawati, N. 2019. One conclusion based on the disposition of students there are differences in students' mathematical problem solving abilities.

8. Masamah, Ulfa. 2017. It was found that there was a mutual learning interaction that influenced the improvement of mathematical reflective thinking skills on students' initial abilities.


10. Anita Indriyani, dkk. 2017. The use of the JUCAMA model can improve students' mathematics learning achievement better than the PBL.

11. Fadillah Ahmad. 2016. Using a nonequivalent control group design type. There is a significant difference in students' mathematical creative thinking ability

12. Fariha, Mutia. 2013 There is an increase in students' mathematical critical thinking skills with the PBL approach which is better than conventional students' mathematical critical thinking skills.

13. Lubis, A. Naashir M. Tuah, dkk. 2020. There is a significant difference between PBL ability and realistic mathematics learning.

14. Ningrum, Erlin Kusuma, dkk. 2017. There is no difference in students' mathematical problem solving abilities using TAI.

15. Jatisunda, M. Gilar. 2017. Based on the findings of the researcher, there is a positive effect of using the constructivism approach on students' mathematical problem solving abilities in the circle material.

16. Yuliasari, Evi. 2017. Shows that students' mathematical problem solving abilities by learning the PBL model from the GDL model.

17. Putra, Fredi Ganda. 2017. Using the Hands on Activity assisted model has better mathematical problem solving abilities than contextual and conventional learning.

**Discussion**

Based on the many findings related to quasi-experimental research, it is an experiment where the situation in which the smallest experimental unit is assigned to the experimental group is non-random assignment. When conducting research investigations, attention must be paid to the placement and timing of the research. Based on the many findings based on quasi-experimental research investigations to see students' success in analyzing problem solving. The research was conducted as a preparation characterized by an active dynamic movement in achieving instructive goals in education.

The use of research in a quasi-experimental group is as follows: first, the experimental group is given treatment by applying the learning procedures to be carried out. The effectiveness test and the control class were given treatment using the learning method implemented. Second, the group will be given post-test. After doing the treatment or application of certain methods. Then the results of the final test of the experimental group
and the control group were compared with the factual speculation hypothesis test, and if the post-test results were found to be higher, it was concluded that the treatment given was successful. If the pre-test value is higher than the post-test, it can be concluded that the treatment given is not effective.

The use of quasi-experimental has its own characteristics as follows: a) the sample is non random, b) the group is given treatment, and c) the group is manipulated. While the instruments used by the journal articles above in their research can be seen in the following graph:

![Fig. 1 Instruments used](image)

Referring to the diagram above, the researcher concludes that the researcher’s interest in the application of quasi-experimental design makes more use of the instrument using guided questions testing on the test by 63%. While those with the least interest used guided discovery and observation of 4%, then 8% of document retrieval, while the questionnaire was 21%. Variations in the use of this instrument are based on the needs and convenience of researchers in implementing quasi-experimental designs.

Some of the category choices included in the quasi-experimental design are as follows: a) pre-test - post-test design using a nonequivalent control group design), b) time series design with control group and c) counterbalance design. While the trend of sampling carried out by researchers in their research can be seen in the following pie chart:

![Fig. 2 Sampling in conducting research](image)
Based on the diagram above, the researcher concludes that the interest of the researchers in the application of quasi-experimental design utilizes the 44% random sampling technique. While those with the least interest were using purposive random sampling technique of 5%, then sampling and multitage sampling were 6%, while the 11% sample and also couster had 28% interest. Variations in the use of this technique are based on the needs and convenience of researchers in the application of quasi-experimental designs.

**CONCLUSIONS AND SUGGESTIONS**

**Conclusions**

Based on the literature review, it can be concluded that experimental research is very optimal in solving students' mathematical problems. This is evidenced by the many studies that often use quasi-experimental research in actualizing their research. Experimental research can be used as an alternative in mathematics research, especially in learning mathematics with problem-based topics where the subject is teachers and students who are difficult to control. The results of the analysis show that the interest of the researchers can be seen in generally using tests of 63% of the various existing research instruments in testing students’ mathematical problem solving. Besides that, researchers are more dominant using random sampling technique which reaches as much as 44%.

**Suggestions**

Based on the results of this study, it is hoped that educational researchers, especially researchers in the field of mathematics education, will further optimize and develop experimental research, especially the use of quasi-experiments.

**REFERENCES**


