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EFFECTIVENESS OF PROBLEM BASED LEARNING MODELS LEARNING (PBL) WITH THE HELP OF GEOGEBRA ON NUMERATION ABILITY AND MOTIVATION LEARNING MATHEMATICS FOR JUNIOR HIGH SCHOOL STUDENTS

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ABSTRACT

This research aims to find out the numeracy abilities and motivation of students who use GeoGebra-assisted Problem Based Learning are better than students who use conventional learning. This research uses an experimental method with a Pretest-Posttest Control Group Design type of research and a quantitative approach, data collection techniques including tests, questionnaires and documentation. The material taught in this research is quadratic functions. The results of the research show that: 1) the pretest initial abilities of the experimental class and control class using the Mann-Whitney test obtained Asymp.sig values. (2-tailed) is 0.654 > 0.05, meaning is accepted; 2) posttest with the Mann-Whitney U test, the Asymp value was obtained sig. (2-tailed) is 0.000 < 0.05, meaning is rejected; 3) the average percentage results of the mathematics learning motivation questionnaire, the experimental class was 82% with solid criteria, while in the control class it was 69% with vital criteria. So it is concluded that the numeracy abilities and motivation to learn mathematics of students who are given the Problem Based Learning learning model assisted by GeoGebra are better than conventional learning.$H_0 H_0$

***Keywords**: Problem Based Learning, GeoGebra, Numeracy Ability, Learning Motivation*

INTRODUCTION

Mathematics as a global science is also the foundation of the development of modern technology has a significant role in various fields of science and advances human thinking. This is supported by opinion Yusri (2018), which states that mathematics is one of the sciences that is the basis of various other sciences that can develop the ability to systematically, rigorously, creatively, critically, and reason to solve problems in everyday life. Therefore, Mathematics lessons need to be given to all students from elementary school to college.

There are many skills in math, one of the most essential being numeracy ability. Numeration can be interpreted as the ability of students to formulate, apply and interpret mathematical content, discuss and use mathematical facts, concepts, procedures and principles to explain a phenomenon (Manasikana, 2022). Numeracy ability indicators are (1) using various numbers and symbols related to basic mathematics to solve problems in various contexts of everyday life, (2) analyzing information displayed in various forms (graphs, tables, charts, diagrams and so on), (3) interpreting the results of the analysis to predict and make decisions (Baharuddin *et al.*, 2021). Good numeracy skills are essential for everyone. In this increasingly advanced and complex age, strong numeracy skills are needed in areas such as science, technology, business, and finance. Good numeracy skills are also crucial for developing analytical thinking and making the right decisions in everyday life.

Unfortunately, many students and even adults face difficulties in mastering numeracy skills. Research Hartatik supports this, that students' numeracy skills are still low because of students' inability to master numbers and symbols related to mathematics to solve contextual problems. Students often find mathematics difficult because they do not understand the concepts and applications of this learning, so students' numeracy skills are lacking (N. Ayuningtyas &; Sukriyah, 2020). Lack of understanding of basic mathematical concepts often makes students have difficulty in

understanding basic calculation operations, numbers, numbers, and solving mathematical problems, thus hindering the development of students' numeracy skills.

Mathematics learning in the classroom still uses conventional learning models. Students are only taught to memorize and use standard formulas and procedures that teachers use. However, curriculum 13 demands active participation of students during the learning process. As a result, mathematics learning must not only teach memorizable formulas or concepts but must also provide lessons that help students solve math problems, which will improve students' numeracy skills (Silviana &; Mardiani, 2021). Improving students' numeracy skills is a challenge that must be addressed. To improve students' overall numeracy skills, a practical, contextual, and attention-grabbing learning approach is needed to improve students' numeracy skills.

Another thing that is no less important than numeracy ability is student learning motivation. In the learning process, motivation is an essential element for student success (Caesarani *et al*., 2022). Learning motivation is needed to foster student interest in the lessons taught by the teacher. Learning motivation is the primary provision to achieve learning goals (Handayani *et al.*, 2020). To achieve this, students must have their learning motivation (Subagio *et al.*, 2021). However, in reality students continue to believe that mathematics is complicated or even afraid to learn. Difficulties in learning mathematics make students feel lazy to learn mathematics. This shows that students do not have the desire or motivation of students to learn is still low (Noviarti *et al.*, 2020).

According to Subagio *et al.*, (2021)Learning motivation is defined as the desire to move, express, and focus one's characteristics to learn. Motivation plays a vital role in the learning process, as it allows us to measure the success of the learning process and how well students absorb the information provided. The indicators of motivation according to Hendriana *et al.*, (2017) are as follows: 1) confident in using mathematics, 2) flexible in doing mathematical work, 3) willingness to leave other obligations or tasks, 4) perseverance in doing mathematics, 5) able to maintain opinions, 6) persistent and tenacious in doing tasks.

Several factors, including lack of understanding of concepts, lack of problem-solving skills, and lack of motivation for mathematics subjects cause the low numeracy ability and motivation to learn mathematics students. One way teachers can solve this problem is by changing math learning from old habits to innovative, effective, and engaging learning. In this case, the researcher applies a learning model *Problem Based Learning* (PBL) during the learning process in class. In addition, researchers also use GeoGebra learning media where the learning process is designed so that students can learn interactively (Ayuningtyas *et al*., 2020).

According to Fadlurrohman *et al.,* (2022), GeoGebra provides a wide range of features that support and are very suitable for conveying mathematical concepts. GeoGebra can function as a learning medium that can provide visual experiences to students in interacting with mathematical objects. This can encourage learning motivation because it can clarify and facilitate the understanding of abstract mathematical objects into concrete.

Hotimah (2020), states that *Problem Based Learning* (PBL) is a problem-motivated learning model. This type of learning encourages students to think critically, collaborate in groups, solve problems, and use learning resources well. The model also pays attention to how students actively participate in solving problems (Ariyani &; Kristin, 2021). Because students are not only given lessons in the same direction as is done with conventional learning methods.

Steps *Problem Based Learning* (PBL) media-assisted mathematics learning based on process standards according to Puspitasari & Abd.Basir (2022) consists of five steps, namely: (1) Orienting students to problems, (2) Organizing students to learn, (3) Guiding individual and group investigations, (4) Developing and presenting work, (5) Analyzing and evaluating the problem-solving process.

Based on the description above, in this study it is expected that using the *GeoGebra-assisted Problem Based Learning* (PBL) learning model can increase students' numeracy skills and motivation to learn mathematics.

RESEARCH METHODS

The type of research used in this study is quantitative research with experimental methods. The form of design used is *Pretest-Posttest Control Group Design.*

RESULTS AND DISCUSSION

1. Numeration Ability

Table 1. Result Test the hypothesis *Pretest*

	Numeration *Pretest* Results
Mann-Whitney U	558.500
Wilcoxon W	1188.500
Z	-.449
Asymp. Sig. (2-tailed)	.654

Based on the table above, the value of *Asymp.sig is known. (2-tailed)* is 0.654 > 0.05, meaning H_0 accepted. So it can be concluded that there is no significant difference between the initial numeracy ability of experimental class students and the initial numeracy ability of control class students.

Table 2. Hypothesis Test Results *Posttest*

	Numeration *Pretest* Results
Mann-Whitney U	271.500
Wilcoxon W	901.500
Z	-3.906
Asymp. Sig. (2-tailed)	.000

Based on the calculation results of the table above, it is known the value of Asymp. sig. (2-tailed) is 0.000 < 0.05, meaning H_0 rejected. So it can be concluded that the numeracy ability of students given the *Problem Based Learning (PBL)* learning model with the help of GeoGebra is significantly better than conventional learning.

Before being given treatment, researchers provide tests to measure initial abilities to make it easier for researchers to analyze differences in students' nuemeration abilities. Furthermore, after the two classes were given different treatments, researchers evaluated the test to find out which grade students had better numeracy skills as the final data. This study found that the numeracy ability of experimental class students was better than that of the control class. This is due to differences in action or treatment, where the experimental class uses the *Problem Based Learning* (PBL) model with the help of GeoGebra while the control class uses conventional learning.

The main characteristic of *the Problem Based Learning* (PBL) model is the 5 main steps that are carried out during the learning process, namely the steps of orienting students to problems, organizing students, guiding individual or group investigations, developing and presenting work, and analyzing and evaluating the problem-solving process.

At the stage of student orientation to the problem, the researcher introduces students to what students will solve problems during learning. In addition, researchers also motivate students to be actively involved in solving problems. At this stage, students learn to hone their skills in analyzing a problem.

Picture 1. Orient Students On Issue

The second stage is organizing students, that is, researchers organize students in learning tasks, according to the problems to be solved by students. Students work together in solving problems in LKPD by using GeoGebra as a tool. The use of geogebra can invite students to analyze the information displayed by the geogebra application in the form of graphs, facilitate the investigation of function problems and invite students to illustrate function graphs into LKPD. So, his numeracy skills are more honed. In addition, students who understand better will help each other group members who do not understand the material.

Picture 2. Student Helping Group Members Aid Each Other

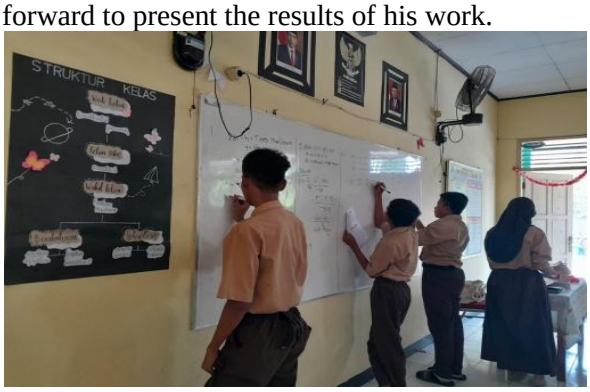
The third stage is to guide individual and group investigations, i.e. researchers assist students in gathering information from various sources, students are given questions that make them think about a problem and the type of information needed to solve the problem. During the discussion, the researcher goes around observing student activities and acts as a motivator

and facilitator, guiding and directing students if there are difficulties.

Picture 3. Teachers Guide Group Inquiry

Based on the facts found in the field when starting group discussions, it can be seen that several groups still need direction and motivation from teachers to find solutions to problems in LKPD. In line with the opinions of Syafiq (2022), which indicates that the learning model *Problem Based Learning* (PBL) requires the ability to motivate group work effectively. After using GeoGebra, students can start answering questions on LKPD. GeoGebra helps students to find the intersection points of the x and y axes, the axis of symmetry, and the coordinates of the cusp of a function through graphic images on GeoGebra. So that students are able to determine the steps to draw graphs of quadratic functions.

The fourth stage is to develop and present the work, that is, each group representative comes forward to present the results of his work.



Picture 4. Student Presenting the Results of Group Discussions

The last stage is to analyze and evaluate the problem-solving process, namely research to analyze and evaluate whether the problem solving done by students is correct or not. This step helps all groups to understand more about solving the problem presented based on the other group's explanation. This is also so that students understand when research delivers corrections and reinforcements at the end of learning.

Picture 5. Teacher Analyze and evaluate the results of student discussions

Based on the stages described above, it can be seen that the model *Problem Based Learning* (PBL) can improve students' numeracy skills. In line with opinion Wibowo *et al.,* (2022), which shows that the numeracy ability of students who get the PBL learning model is better than students who get conventional learning. Application of learning models *Problem Based Learning* (PBL) with the help of GeoGebra has an impact on increasing students' numeracy skills. Therefore, the learning model *Problem Based Learning* (PBL) with the help of GeoGebra can be used as an alternative model and media in mathematics learning because it has been proven to be better in improving students' numeracy skills than conventional learning, especially on quadratic function material.

2. Motivation to Learn Mathematics

Table 3. Result Average percentage of motivation to learn mathematics in experimental and control classes

Class	**Average percentage**	**Criterion**
Experiment	82 %	Very Powerful
Control	69 %	Strong

Next is seen from table 27. That the average result of the percentage of motivation to learn mathematics as a whole shows that the experimental class has a percentage of 82% with solid criteria. While in the control class, the percentage of motivation to learn mathematics was 69% with solid criteria. This means that it can be concluded that the motivation to learn mathematics of experimental class students is better than that of the control class.

With a high percentage of motivation to learn mathematics experimental class students, it means that students give a positive response to the models and learning media used by researchers. Learning model *Problem Based Learning* (PBL)

with the help of GeoGebra in the learning process provides a more authentic and more concrete experience by displaying graphs of quadratic functions clearly, in detail, and accurately compared to conventional learning. While using GeoGebra media is able to display directly the graph of the desired quadratic function without having to use manual methods that may still have errors in calculations. That is one of the student activities using GeoGebra that makes students curious in trying to learn quadratic function material with the help of Geogebra learning media. As according to Suratman *et al.,* (2019), that the usefulness of learning media for students is one of which learning will be more interesting so that it can foster learning motivation, and learning materials will have a more explicit meaning so that they can be understood by students and achieve the desired learning outcomes. In addition, teaching methods will be more varied and students do not feel bored.

Direct observation is also carried out by researchers, during the learning process researchers one of the approaches made by researchers directly is giving *Reward*. This is done so that students feel motivated by prizes or awards from researchers for the learning success they have achieved. Supported by opinions Rini (2022), *Reward* As a learning method it will be ideal and strategic when used in accordance with the principles of learning to stimulate learning in order to develop the potential of students.

Based on the explanation above, the *Problem Based Learning* (PBL) learning model with the help of GeoGebra can be used as an alternative model and media in mathematics learning because it has been proven to be better in increasing student mathematics learning motivation than conventional learning, especially on quadratic function material.

CONCLUSION

Based on the results of research that has been carried out, it can be concluded that:

1. There is no difference in the initial numeracy ability of experimental and control class students.
2. The numeracy ability of students who are given *Problem Based Learning* (PBL) model learning with the help of GeoGebra is better than students who are given conventional learning.
3. The motivation to learn mathematics of students who are given *Problem Based Learning* (PBL) model learning with the help of GeoGebra is better than students who are given conventional learning.

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