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Influence of Problem Based Learning Modelsand Gender to Ability Student Mathematic Communication

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Abstract

This study aims to determine how the effect of problem-based learning models and gender on students' mathematical communication skills. By using data sources, namely primary data sources and secondary data, the primary data sources in this study were data that contained the research title, and secondary data in this study were supporting books related to the research title. The method used is the literature study. The results of this study indicate that the problem-based learning model has an influence on mathematical communication because each step in learning can support the development of students 'mathematical communication skills, the gender-based learning model has an influence on students' mathematical communication skills , but between female and male students different abilities.

Keywords
learning model; problem based; gender; mathematical communication skills

I. Introduction

Education has an important role in the life of the nation. The progress and retreat of a nation-building process in all fields is largely determined by the level of education of the nation itself. An education is said to be of quality if the educational process takes place effectively and produces individuals or human resources that are beneficial to society and national development. Education is the only place for activities that can be viewed and should function to create high quality human resources. Quality human resources are characterized by human resources who have reliable abilities in adapting to face changing times that are increasingly fast and have the ability to master Science and Technology (IPTEK). So important is education for human life, because education can affect the development of human life. One of the most important educations in human life is mathematics education.

Mathematics with its various roles makes it a very important science, and one of the roles of mathematics is as a thinking tool to deliver students to understand the mathematical concepts that are being studied. A science that is based on analysis in drawing conclusions according to the students' specific communication skills.Mathematics is one of the subjects taught at every level of education at elementary, junior high, high school and university levels, the science that underlies the development of scientific and technological advances, so that mathematics is seen as a structured and integrated science, the knowledge of patterns and relationships, and science, about how to think about making sense of the world around you. The importance of mathematics can be seen from the objectives of mathematics subjects in primary and secondary education at the Ministry of National Education (Shadiq, 2014: 11), namely: 1) understanding mathematical concepts, explaining the relationship between concepts or algorithms, in a flexible, accurate, efficient and precise manner, in problem solving , 2) use reasoning on patterns

and properties, perform mathematical manipulations in making generalizations, compile evidence or explain mathematical ideas and statements,

Based on the objectives of mathematics, one of the roles of mathematics is to prepare students to be able to face changes or challenges in life and in an ever-developing world. In addition, students are also expected to be able to use mathematics and think and communicate mathematically in everyday life, and in studying various sciences which emphasize structuring reasoning and forming students' self-confidence and skills in applying mathematics.

One of the competencies that is the goal of learning mathematics is that the aspect of mathematical communication skills is one of the components that must be possessed by students. Clark (Silvianti, 2016: 722) states that mathematical communication has an important role in learning mathematics. This is because communication can play a role as: (1) a tool to exploit mathematical ideas and help students 'ability to see the various relationships of mathematical material, (2) a tool to measure the growth of understanding and reflect on students' understanding of mathematics, (3) a tool to organize and consolidate students' mathematical thinking, and (4) tools for constructing mathematical knowledge, developing problem solving, increasing reasoning, fostering self-confidence, and increasing social skills.

Mathematical communication skills are one of the important abilities in learning mathematics, including if the communication process is well established it can help students build their understanding of mathematical ideas and make them easier to understand. When students are challenged to think about mathematics and communicate it to other people / students, orally or in writing, they are indirectly required to make mathematical ideas more structured and convincing, so that the ideas become easier to understand, especially by themselves. Meanwhile, according to Baroody's opinion (in Umar, 2012: 2), learning must be able to help students communicate mathematical ideas through five aspects of communication, namely representing, listening, reading, discussing and writing. Furthermore, it is stated that there are at least two important reasons why communication in mathematics learning needs to be developed among students. First, mathematics as language, meaning that mathematics is not just a tool to aid thinking, a tool to find patterns, solve problems or draw conclusions, but mathematics is also "an invaluable tool for communicating a variety of ideas clearly, precisely, and succinctly. ”Second, mathematics learning as social activity, which means as a social activity in learning mathematics, as a vehicle for interaction between students, as well as a means of communication between teachers and students.

The ability to communicate in mathematics is an ability that can include and contain various opportunities to communicate in form.

1. Reflects real objects, pictures, or mathematical ideas;
2. Modeling situations or problems using oral, written, concrete, graphical, and algebraic methods;
3. Using reading, writing, and research skills to interpret and evaluate mathematical ideas, symbols, terms, and information;
4. Respond to a statement / problem in the form of a convincing argument.

Students' mathematical communication skills play an important role and need to be improved in learning. However, the facts in the field currently show that students' mathematics learning outcomes are still low, not yet showing satisfactory results. This is in line with the results of observations made by Gani (2015: 338), namely: 1) The learning model used by teachers in teaching and learning activities has not varied, is still dominated

by teachers so that students tend to get bored, 2) student interest in the learning process is still low This can be seen when the learning process is taking place there are still many who do not pay attention, 3) students are less active and involved in the teaching and learning process which is marked by students rarely asking the teacher, 4) learning outcomes are not optimal, marked by low daily test scores for mathematics. Another factor that causes students' low mathematical communication skills is influenced by learning that seems mediocre, that's all, there is no variation in the learning process, and a lack of student curiosity in learning. Brooks (in Ansari, 2009: 2) named such learning as ordinary learning, because the classroom atmosphere is still dominated by teachers and the focus of learning is on low-level skills. This ordinary learning emphasizes memorization, practice doing questions or drills by repeating procedures and using more specific formulas or algorithms. There are at least two consequences. First, students are less active and learning patterns do not instill concepts so that they do not invite critical attitudes (Sumarmo: 2000). Second, If students are given a different question from the practice questions, they are confused because they don't know where to start, causing the process of solving student answers to be still monotonous because students are only limited to memorizing what the teacher gives when solving the questions. Mettes (in Ansari, 2009: 3)

One of the efforts that can be made to overcome these problems is by applying problem-based learning. Problem-based learning can be applied to mathematics learning to improve mathematical communication skills.Mistakes in using the model can hinder the achievement of the desired educational goals even it can affect especially students' mathematical communication. Of the several learning models, there is a learning model that can trigger an increase in students' mathematical communication in solving math problems so that the process of solving the students becomes more systematic, namely the Problem Based Learning Model (PBM).

According to Wena (2009: 91) problem-based learning is learning that exposes students to practical problems as a foothold in learning or in other words students learn through problems. Problem-based learning is an effective approach to high-order thinking. This learning helps students to process information that has been so in their minds and compile their own knowledge about the social world and its surroundings. This learning is suitable for developing basic and complex knowledge (Trianto, 2010: 92).

Apart from the learning model factor, gender differences can also affect communication skills, because psychologically men and women have many differences. As Wijaya, Sujadi and Riyadi's (2016) research results show that: (1) male students: (a) can express, demonstrate, and convey their mathematical ideas visually, understand and interpret their mathematical ideas in written or visual form others, able to convey mathematical terms, notations, and their structure, able to make connections between their ideas and situations in written form, (b) able to express, demonstrate, convey, understand, interpret, and evaluate mathematical ideas; can use mathematical terms, notations and structures; able to convey their ideas using mathematical terms, mathematical notation and its structure; able to convey ideas and the relationship between situation models in oral form. (2) female students: have the same abilities as male students, but they can evaluate their mathematical ideas in writing or in a visual form in mathematical written communication. According to Nugraha and Pujiastuti (2019) the results of the study show that the mathematical communication skills of female students are higher than male students' mathematical communication skills. This is shown both in its entirety and in certain aspects. In the aspect of drawing and mathematical expression, female students 'mathematical communication skills are higher than male students' mathematical communication skills. Meanwhile, in the writing aspect, male students' mathematical

communication skills are higher than female students. For female students, the drawing aspect was higher than the mathematical expression aspect and the writing aspect, while for male students the writing aspect was higher than the drawing and mathematical expression aspects.

From the results of the above studies, differences indicate that it is necessary to reveal whether there is an interaction between the learning model and the gender of students (male and female) on problem solving abilities and students 'mathematical dispositions as a variable that affects students' mathematical abilities.

II. Review of Literatures

2.1 Mathematical Communication Skills

Communication in mathematics or mathematical communication is both physical and mental activity in listening, reading, writing, speaking, reflecting on and demonstrating and using language and symbols to communicate mathematical ideas. In NCTM, several indicators of mathematical communication include expressing mathematical ideas orally and in writing, formulating mathematical definitions and expressing generalizations found through observations, and reflecting and explaining thoughts about mathematical ideas and their relationships.

A broader understanding of mathematical communication put forward by Romberg and Chair (in Gordah: 2013: 228), namely: connecting real objects, pictures, and diagrams into mathematical ideas; explain ideas, situations and mathematical relations orally or in writing with real objects, pictures, graphics and algebra; express everyday events in language or mathematical symbols; listening, discussing, and writing about mathematics; reading with the understanding of a written mathematical presentation, making conjectures, constructing arguments, formulating definitions and generalizations; explain and make questions about mathematics that have been learned. Mathematics as a basic science is one of the subjects that play an important role. (Rambe, 2020).

If we look at some of the opinions above, it can be concluded that mathematical communication skills include two things, namely the ability of students to use mathematics as a communication tool (mathematical language), and the ability to communicate the mathematics that is learned. Mathematics is a universal science. Mathematics is also seen as the queen of science (Irhamna, 2020). Broadly speaking, it can be concluded that mathematical communication consists of oral and written communication. In this study, based on the descriptions that have been put forward, the ability of mathematical communication according to experts can be grouped into three, namely: 1) Written Text, which is to provide answers in your own language, model situations or problems using written, concrete, graphical and algebra, explain and create questions about mathematics that have been studied, listen to, discuss and write about mathematics, make conjectures, construct arguments and generalizations; 2) Drawing, which is reflecting real objects, pictures and diagrams into mathematical ideas; 3) Mathematical Expression, which expresses mathematical concepts by expressing everyday events in mathematical language or symbols.

According to Baroody (in Marzuki, 2012: 20) there are five aspects included in communication skills, the five aspects in question are:

1. Present; which includes showing back an idea or problem in a new form, for example translating a problem into concrete form with a chart or picture, presenting a problem or problem into a mathematical model in the form of a diagram, mathematical equation or inequality, graph, table, or a number of simple sentences.

2. Listening. In the learning process that involves discussion, the listening aspect is one very important aspect. In this process, the ability of students to provide opinions or comments is closely related to the ability to listen to the main topics or essential concepts being discussed. The importance of listening critically can also encourage students to think about answers to questions while listening.
3. Reading (Reading). In reading mathematics, Bell argues that the cause of students' difficulties in learning mathematics is the general weakness of reading ability and reading disability in particular. Because mathematics is a science whose language is conditional on symbols and terms.
4. Discussing. Discussion activities are a means for someone to be able to express and reflect on his thoughts. Baroody (2009: 20) describes some of the advantages of class discussion, including: Can accelerate understanding of learning material and proficiency in using strategies, helps students construct mathematical understanding, informs that mathematicians usually do not solve problems individually, but build ideas together other experts in a team, and help students analyze and solve problems wisely.
5. Writing, is an activity that is carried out consciously to express and reflect thoughts.

Observing the communication aspects above, in communicating students involve the five senses of the eye, ear, mouth. Besides that, it also involves thoughts and feelings. In learning, the teacher should always develop aspects of communication in learning. Mathematical communication is a series of mathematics learning activities that can be measured through metematic communication indicators, in this case Aryan (in Marzuki 2012: 22) explains that the indicators of mathematical communication in learning mathematics at each level of education are as follows:

1) Mathematical communication for elementary school students is a) connecting real objects, pictures, and diagrams into mathematical ideas, b) explaining mathematical ideas, situations and relations, orally or in writing, with real objects, pictures, graphics, and algebra, c) express everyday events in language or mathematical symbols, d) listen to, discuss and write about mathematics.
2) Mathematical communication for junior high school students is a) expressing mathematical problems using real objects, pictures into language or mathematical symbols, b) interpreting images into mathematical models, c) writing information from statements into mathematical language, and d) discussing ideas, make conjectures, construct arguments, formulate definitions, and generalizations,
3) Mathematical communication for students at the SMA / MA level is: a) compiling reflections and making clarifications about mathematical ideas, b) compiling a formulation of mathematical definitions and making generalizations from existing findings through investigation, c) expressing ideas oral and written mathematics, d) reading with the understanding of a written mathematics presentation, e) explaining and making questions about the mathematics that has been learned.

The explanation above states that one form of mathematical communication is reading mathematics. Reading mathematics has an important role in learning mathematics. Reading activities encourage students to learn meaning actively. The term reading is defined as a series of skills to compile the essence of information from a text. This means that the reader not only draws meaning from the text but also uses his knowledge, interests, values, and feelings to develop meaning. The ability to express mathematical ideas from a text, both in spoken and written form is an important part of mathematical communication standards that every student needs to have. Because, a reader is said to understand the text in a meaningful way if he is able to convey ideas in the text correctly in his own language.

Therefore, to check whether students have the ability to read mathematical texts in a meaningful way, it can be estimated through the students' ability to convey orally or rewrite mathematical ideas in their own language and understanding. Mathematical communication skills in this study are written mathematical communication skills which can be seen from: (1) stating daily life problems into mathematical symbols or language, (2) interpreting images into a mathematical model, (3) writing information from statements into math language. To check whether students have the ability to read mathematical texts meaningfully, it can be estimated through the ability of students to convey orally or rewrite mathematical ideas in their own language and understanding. Mathematical communication skills in this study are written mathematical communication skills which can be seen from: (1) stating daily life problems into mathematical symbols or language, (2) interpreting images into a mathematical model, (3) writing information from statements into math language. To check whether students have the ability to read mathematical texts meaningfully, it can be estimated through the ability of students to convey orally or rewrite mathematical ideas in their own language and understanding. Mathematical communication skills in this study are written mathematical communication skills which can be seen from: (1) stating daily life problems into mathematical symbols or language, (2) interpreting images into a mathematical model, (3) writing information from statements into math language.

2.2 Problem Based Learning

Many criticisms are aimed at the way teachers teach that are still using the old way, namely too emphasizing the mastery of concepts and information alone. Giving a number of concepts and information to students can be of little use or even not at all useful, if it is only presented by the teacher to students in one direction (teacher centered).

The reality in the field, students are only guided to memorize concepts and do not use these concepts when they encounter problems in everyday life that are still related to concepts that have been memorized by students. Even students are less able to determine the problems and formulation of these problems. This phenomenon is very disappointing for educators, especially in mathematics. From the description above, another problem arises, namely how to find the best way to convey the various concepts being taught, so that students can use and remember these concepts longer. Besides that, this concept can also solve problems that occur in real life.

2.3 Advantages and Disadvantages of Problem Based Learning

Problem-based learning is considered to have various advantages and disadvantages. According to Nata (2009: 250), the advantages and disadvantages of problem-based learning are as follows:

a. Advantages of Problem Based Learning
   1) Can make education in schools relevant to life, especially with the world of work;
   2) Can accustom students to face and solve problems skillfully, which they can then use when facing real problems in society later;
   3) Can stimulate the development of the ability to think creatively and thoroughly, because in the learning process, students carry out many mental processes by highlighting problems from various aspects.

b. Disadvantages of Problem Based Learning
   1) There are often difficulties in finding problems that match the thinking level of the students;
   2) Often takes more time than using conventional methods;

According to Adliani (2020) in each learning effort is emphasized more on mastery of concepts so that students have a good basic stock to achieve other basic abilities such as reasoning, communication, connection and problem solving.Often experiences difficulty in changing learning habits from initially learning by listening, recording and memorizing information conveyed by the teacher, to learning by searching for data, analyzing, constructing hypotheses, and solving them themselves.

III. Research Methods

In this study, the authors used a type of literature study research, namely a series of activities relating to the library data collection method, Mahmud (2011: 31). According to Abdul Rahman Sholeh, (2005: 63) literature studies research is research that uses information data by placing existing facilities in libraries, such as books, articles, research journals, documents and others, or pure literature study research. related to the object of research.

Furthermore, the research technique used in thesis writing is literature study, namely by researching and understanding books, documents or other written sources that are relevant and support research on the effect of problem-based learning models. Arikunto (2010,: 201) explains that documentation comes from the word document which means written goods. Then Sukardi (2004,: 34) explains the kinds of documents or literature sources including journals, research reports, scientific magazines, newspapers, relevant books, seminar results, unpublished scientific articles, resource persons, decrees and so on.

Thus researchers in this method analyze based on textual studies in the literature on the effect of problem-based learning models and gender on students' mathematical communication skills. After getting the results of the analysis the final step is drawing conclusions.

IV. Discussion

4.1 Influence Problem Based Learning Model Against Students' Mathematical Communication Ability

This study is to determine the effect of problem-based learning models on students' mathematical communication skills. After analyzing various sources such as books, articles, journals and previous research, we can see that there is an effect of problem-based learning models on mathematical communication skills. such as research conducted by Anggi Oktaviarrini (2015) which says that Problem-based learning is an alternative that can improve students' mathematical communication skills. This is because of each step in the learning can support the development of students' mathematical communication skills. Advice that can be given to educators in an effort to improve mathematical communication skills, it is recommended to using problem-based learning models in learning mathematics in the classroom.

4.2 Influence Learning Model Based on Gender Against Students' Mathematical Communication Ability

This study is to determine the effect of the gender-based learning model on students 'mathematical communication skills, after analyzing various sources such as books, articles, journals and previous research, we can see that there is an effect of gender-based learning models on students' mathematical abilities, however. There are differences in

ability levels between men and women, such as the results of a study conducted by Umi Babys (2020) which concluded that From this study, the mathematics communication skills of female students were higher than the mathematics communication skills of male students by 58.71% or a difference of 17.42%. Female students' mathematical communication skills in all indicators have higher scores than male students. Female students are more thorough, careful and patient in solving math problems so that they are able to communicate mathematical ideas either with pictures, diagrams or symbols and have a better mathematical representation than male students. Based on the results of this study, it is suggested that the teacher strive to improve mathematics communication skills by paying attention to gender and the use of learning methods that increase male and female student interest and motivation.

V. Conclusions

This study aims to determine the effect of problem-based learning and gender on students' mathematical communication skills. Based on the research results, the following conclusions can be drawn:

1. Problem-based learning model has an influence on mathematical communication skills because of each step in the learning can support the development of students' mathematical communication skills.
2. Gender-based learning models have an influence on students' mathematical communication skills, however, female and male students have different levels of ability.

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