Mathematics Communication Ability in Mathematics Learning in Pandemic Times

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Abstract. The pandemic period that has lasted for one year has made the face of education in this country experience significant changes, one of which is the learning process carried out by distance learning through an online system by utilizing various available platforms. This makes changes in various cognitive abilities of students, including students' mathematical communication skills. Mathematical communication skills in learning mathematics are very necessary. This is because mathematical communication can explain and organize the thinking skills possessed by students, both orally and in writing. A student who has good communication skills can provide the right response between students and other students through the media used in learning. The purpose of this paper is to present the understanding of mathematical communication skills with the scope of two things, namely the ability of students to use mathematics as a communication tool (mathematical language), and the ability of students to communicate the mathematics learned as the content of the message that must be conveyed. How and why communication is important to build a mathematical community through open communication channels in the classroom, especially during a pandemic.

Key words: mathematical communication; problem solving; pandemic; distance learning.

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INTRODUCTION

It's been one year, the education process in Indonesia and other countries in the world has changed. This is due to the COVID-19 (Corona Virus Disease) pandemic that has attacked many countries in the world. Covid-19, according to the WHO (World Health Organization) report on December 31, 2019, was alerted to the emergence of pneumonia cases of unknown etiology detected in the city of Wuhan, China.[1] Within days, Chinese health authorities identified 44 more cases. A novel coronavirus (COVID-19) was then isolated from the patient. Epidemiological links are thought to be made with exposure at a seafood market in Wuhan city. (WHO). The latest data shows that the number of positive patients in Indonesia until June 2021 has reached more than 2 million more patients with the addition of 21,000 people. (https://covid19.go.id/peta-sebaran).

As a result of the increasing spread of the virus, the Indonesian government has taken a policy in the field of education to carry out the learning process from home using existing platforms, learning is carried out online (in a network). This online learning is set by the government aimed at all levels of education from Kindergarten to tertiary institutions.[2] The choice of alternative use of digital platforms is due to the development of the industrial world which has reached the industrial revolution 4.0 with the development of the digital world. The current development of the industrial revolution strongly supports the implementation of online learning from home, because online learning is learning that is able to fold time and distance with internet-based digital assistance that is able to support learning to be carried out without any physical interaction between educators and students who only interact in cyberspace.[3]

Online learning applies to all subjects, including mathematics. Mathematics learning that applies at all levels of education Mathematics is one of the subjects taught at various levels of education starting from kindergarten to college, this is because of the importance of mathematics to be able to solve problems in everyday life. Life problems that can be seen in everyday human activities are often related to mathematics such as the building construction process, the goods production process, the buying and selling process, reading the clock, calculating land area, and others.

The content standards (CS) and graduate competency standards (GCS) articles 16 and 17 of PP No. 19 of 2005 state that mathematics learning aims to make students have the following abilities[4]:

1. Understand mathematical concepts, explain the relationship between concepts and apply concepts or algorithms, flexibly, accurately, efficiently, and precisely, in problem solving.
2. Using reasoning on patterns and traits, performing mathematical manipulations in making generalizations, compiling proofs, or explaining mathematical ideas and statements.
3. Solving problems which include the ability to understand problems, design mathematical models, complete models to interpret the solutions obtained.
4. Communicating ideas with symbols, tables, diagrams, or other media to clarify the situation or problem.
5. Having the nature of appreciating the usefulness of mathematics in life, namely having curiosity, attention, and interest in learning mathematics, as well as a tenacious and confident attitude in problem solving.

One of the objectives of learning mathematics according to articles 16 and 17 of PP No. 19 of 2005 is to communicate ideas with symbols, tables, diagrams, or other media to clarify the situation or problem. In learning mathematics, mathematical communication both orally and in writing is very important in addition to understanding concepts, reasoning, problem solving, proof, and mathematical representation.[5]

Learning must be able to help students communicate mathematical ideas through five aspects of communication, namely; 1) representing, 2) listening, 3) reading, 4) discussing and 5) writing. Furthermore, 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 thinking tool (a tool to aid thinking), a tool for finding patterns, solving problems or drawing conclusions, but mathematics is also an invaluable tool for communicating a variety of ideas clearly, precisely, and succinctly. Second, mathematics learning as social activity: that is, as a social activity in learning mathematics, as a vehicle for interaction between students, and as a communication tool between teachers and students. In this case mathematical communication is an important requirement for communicating various ideas into language mathematics, Baroody (1993).[5] Mathematical communication is needed in mathematics education, because it is the basis of mathematical solution/problem solving (Greenes, 1996).[6]

Therefore, mathematical communication skills as a social activity in which there are communication activities (talking and speaking) as well as a tool that helps in thinking (writing) are recommended by experts to continue to be developed among students. However, currently, during the pandemic, obstacles were found in developing students' mathematical communication, at least according to observations in several schools, namely; 1) the internet network is still not evenly distributed, 2) the economic conditions of students are not the same, so that online learning makes students unable to study well, 3) the learning media used are not adequate and meet the needs in the mathematics learning process, 4) learning tends to assignments without any explanation, and 5) difficulties in controlling students' ability to understand the content of the material being taught.

Based on the above, students' mathematical communication skills are important and needed in learning mathematics. Student mathematical communication is the student's ability to communicate the ideas that he thinks and has in an effort to find and provide solutions in solving a problem he faces or a problem that is given by his teacher, so that efforts will arise to actively participate in discussions, and be able to take responsibility each solution put forward before the others.

The mathematical communication skills possessed by students vary, this makes mathematics learning carried out online during the pandemic, causing students to feel more difficult and unprepared for implementation. Moreover, if students already have an image / picture of mathematics that seems to be a scourge, it will make students difficult to learn it. Therefore, the study in this paper will present the understanding of mathematical communication skills, as well as how and why communication is important to build a mathematical community through open communication channels in the classroom, especially during a pandemic.

METHODS

This research is a qualitative descriptive study, with the aim of obtaining answers related to opinions, responses, perceptions, or descriptions of words. Descriptive research chosen is a literature study which is a study of the results of

a literature search. The method of data collection by observation. The data is taken from literature review/ article searches that discuss mathematical communication and also studies on distance learning mathematics during the pandemic. As stated that the data collection technique is a literature study, refer to the technique by conducting a review study of books, literatures, notes, and reports that have to do with the problem being solved.

RESULT AND DISCUSSION

Basically, mathematics is an important symbol language and must be learned by every student. Students who study mathematics must have the ability to communicate using mathematical symbols. The importance of mastering mathematical communication skills is in line with the objectives of teaching and learning mathematics, among others: students can communicate ideas using mathematical symbols, tables, diagrams, or other media to explain situations or problems.[6]

Someone who has mathematical communication skills will be able to state that mathematics is universal, an attribute that can be understood by people who study mathematics. Because every mathematical symbol has a definite meaning and is agreed upon by everyone. For example, the integer symbol 2, arithmetic operations x, +, -, algebraic symbols >, and {…} are understood by students who study mathematics. So in this case someone who studies mathematics will be able to communicate mathematically so that he can explain the ideas he has to communicate mathematically. In addition, someone who has mathematical communication skills will be able to formulate a mathematical definition (concept) to then create and represent his idea. in the form of pictures, diagrams, symbols or models, so as to clarify what is being conveyed/communicated orally or in writing.[7]

There are two important reasons why communication is one of the focuses in learning mathematics; 1) mathematics is basically a language for mathematics itself. Mathematics is not only a thinking tool that helps us to find patterns, solve problems and draw conclusions, but also a tool to communicate our thoughts about various ideas clearly, precisely and concisely. In fact, mathematics is considered a universal language with unique symbols and structures. Everyone in the world can use it to communicate mathematical information even if their native language is different; 2) learning and teaching mathematics is a social activity that involves at least two parties, namely teachers and students. In the process of learning and teaching, it is very important to express those thoughts and ideas to others through language. Basically this exchange of experiences and ideas is a process of teaching and learning. Of course, communicating with peers is very important for the development of communication skills so that you can learn to think like a mathematician and successfully solve completely new problems.

Mathematics learning during the pandemic makes students lose their enthusiasm for learning because the interaction between students and teachers tends to be minimal, and this causes an imbalance and imperfection of information obtained by students in learning mathematics. To deal with this, learning media is needed. This is because learning media is a technology/ means that can be used to carry messages conveyed so that they can be well received by students as recipients of messages.

Pugalee (2001) suggests improving students' mathematical communication skills so that students are motivated to get used to giving relevant reasons for their answers or statements, and to comment on other opinions so that students are able to understand the mathematical concepts that are learned meaningfully. In this case, mathematical communication can make a person more honed his abilities because someone who likes to communicate, will read a lot about anything (literacy), so that by improving students' mathematical communication skills, students will read more, understand, create pictures/ patterns.[8] looking for a way out/ solution to the problem and finally can solve or simplify the problem at hand. Because before someone communicates, he will first read, then write and then talk/communicate the ideas he has.

Furthermore, Kist (Clark, 2005) states that in general, effective communication skills must be possessed by students in all subjects and not only in mathematics.[8] Likewise in everyday life in society, someone who has good communication skills tends to be able to work together and has the opportunity to become a successful person. The key to a person's success in life is his ability to communicate, either orally or in writing. One's communication in written form will burn the spirit of the reader, while communication in oral form will burn the spirit of the listener even better. So, students' mathematical communication skills must be possessed so that students can build and convey their ideas.

Mathematical communication needs to be the focus of attention in learning mathematics, because through communication, students can organize and consolidate their mathematical thinking (NCTM, 2000a), and students can explore mathematical ideas (NCTM, 2000b). In addition, according to Atkins (1999) verbal mathematical communication (mathematical conversation) is "a tool for measuring growth in understanding, allow participants to learn about the mathematical constructions from others, and give participants opportunities to reflect on their own mathematical understandings."[9] Awareness of the importance of paying attention to students' ability to communicate using mathematics learned at school needs to be grown, because one of the functions of mathematics lessons is as a way of communicating ideas practically, systematically, and efficiently. Or in Baroody's (1993) terms: “an invaluable tool for communicating a variety of ideas clearly, precisely, and succintly.”

There are at least 2 important reasons that make communication in mathematics learning the focus of attention, namely (1) mathematics as language; Mathematics is not just a tool to aid thinking (a tool to aid thinking), a tool to find patterns, or solve problems, but mathematics is also "an invaluable tool for communicating a variety of ideas clearly, precisely, and succintly," and (2) mathematics learning as social activity; as a social activity, in learning mathematics, interaction between students, as well as teacher-student communication is an important part of "nurturing children's mathematical potential". Baroody (1993). Even according to Cai (1996) "communication is considered as the means by which teachers and students can share the process of learning, understanding, and doing mathematics."[6]

Meanwhile, to measure students' mathematical communication skills in learning mathematics, it can be done by giving description questions that can reveal mathematical communication skills. Some of the questions that can be used include exploratory, transfer, elaborative, and applicative questions. The following are examples of story questions to measure mathematical communication skills in aspects of writing, drawing, and mathematical expressions.

Question: Seven years ago, my father's age was 6 times Budi's age. In the next four years, 2 times the age of the father is equal to 5 times the age of Budi plus 9 years.[6]

1. Make a mathematical model of the problem!
2. How old is your father now?
3. How did you get it? Explain your answer!

This question measures aspects of mathematical expression and writing which are indicators of mathematical communication skills. So that this question can be used to measure mathematical communication skills. Students' skills in solving these problems by making mathematical models will describe aspects of mathematical expressions. The ability of students to work on problems in their own way and in their own language is an illustration of the writing aspect. Scoring in measuring mathematical communication skills usually uses a holistic rubric.

The teacher's role in creating a mathematics community in the classroom is very strategic, in the sense that the portion of the teacher's role as a "teacher" must be proportional to other roles as a facilitator, participant or even as a friend in class, so that teachers can accelerate the improvement of mathematical communication and student reasoning by provide math assignments in various variations without feeling forced from students. This is also due to the support from the teacher in the process of learning mathematics to be effective and efficient, so that the mathematics community that has been built in the classroom makes students feel free to express their ideas and thoughts.

During the pandemic, in online learning, students' mathematics learning is assisted by parents at home, but not all parents understand the content and are able to operate devices/smartphones, so it is important to note that in this case communication between parents and teachers is needed. Teachers can minimize the level of difficulty in using gadgets for parents who have complaints about the operation of gadgets. Teachers can provide student work through short messages to parents and help children to complete them with the mathematical communication skills possessed by students. So that learning mathematics during the pandemic by utilizing various existing platforms can develop students' mathematical communication skills.

Likewise, in dealing with broader and more complex contextual problems (go beyond), students must write down the results of their thoughts before being communicated and discussed further. If this is done well, it will be seen that the creation of a mathematics community in the classroom will be

accommodated. This means that student activities need to be conditioned so that they can interact with each other, discuss, negotiate, and collaborate. In these situations, students have the opportunity to work, think and communicate using mathematics.

In the end, the ability to communicate carefully, precisely, systematically and efficiently which is "trained" through mathematics lessons, is expected to become a habit that students have in their daily lives. This is actually one of the important contributions of mathematical communication. Therefore, based on the description above, it is hoped that educators can develop students' mathematical communication skills, not only occurring in the classroom, but allowing it to occur outside the classroom.

Mathematical communication skills consist of, 1) oral communication and written communication. Oral communication such as: discussion and explaining. Written communication such as: expressing mathematical ideas through pictures/graphs, tables, equations, or in the students' own language. 2) Indicators of mathematical communication skills: Writing (written text), which explains ideas or solutions to a problem or picture using their own language. drawing (drawing), which explains ideas or solutions to mathematical problems in the form of pictures. Mathematical expression, which states problems or everyday events in the language of mathematical models. 3) essay questions can be used to measure mathematical communication skills.

CONCLUSIONS

Mathematical communication is one of the basic skills that need to be improved as well as other basic abilities, such as reasoning skills, mathematical understanding abilities, problem solving skills, mathematical communication skills and connections, and mathematical representation abilities. The choice to take advantage of the method of delivering mathematics material during a pandemic requires consideration of certain factors in supporting learning, because not all effective methods are applied to all mathematics learning materials, so in this case the creativity of mathematics teachers is needed in conveying mathematics material so that students can then use mathematics as a tool. communication (mathematical language), and students' ability to communicate the mathematics learned as the content of the message that must be conveyed can build a mathematical community through open communication channels in the classroom, especially during the pandemic.

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