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Analysis of Sociomathematical Norms in Mathematics Learning at 113 Junior High School

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ABSTRACT

This study aims to describe the sociomathematical norms that are owned by students when learning mathematics in class. The subjects of this study were students of class VII-A Jakarta 113 Junior High School. The research method used is the descriptive qualitative method. This research uses a sociomathematical norms questionnaire and interview. Based on the results of the study, 9 students had very good sociomathematical norms categories with a total percentage of indicators of 81% and 14 students had good sociomathematical norms categories with a total percentage of indicators of 72%. The results showed that very good sociomathematical norms owned by students would affect the high results obtained by students in mathematics learning and good sociomathematical norms would affect the moderate and low results obtained by students in learning mathematics

Keywords: Norm, Sociomathematics, Mathematics Learning

ABSTRACT

Penelitian ini bertujuan untuk mendeskripsikan norma sosiomatematik yang dimiliki siswa saat pembelajaran matematika di kelas. Subjek penelitian ini adalah siswa kelas VII-A SMP Negeri 113 Jakarta. Metode penelitian yang digunakan adalah metode kualitatif deskriptif. Penelitian ini menggunakan kuesioner norma sosiomatematik dan wawancara. Berdasarkan hasil penelitian, 9 siswa memiliki kategori norma sosiomatematik sangat baik dengan total persentase indikator 81% dan 14 siswa memiliki kategori norma sosiomatematik baik dengan total persentase indikator 72%. Hasil penelitian menunjukkan bahwa norma sosiomatematik yang sangat baik yang dimiliki siswa akan mempengaruhi tinggi hasil yang diperoleh siswa dalam pembelajaran matematika dan norma sosiomatematik yang baik akan mempengaruhi sedang dan rendahnya hasil yang diperoleh siswa dalam pembelajaran matematika.

Kata Kunci: Norma, Sosiomatematika, Pembelajaran Matematika

Introduction

The learning process is expected to be one of the sources of student exploration in developing knowledge and the formation of attitudes and beliefs in students (Anderson & Stillman, 2013). The teaching and learning process must lead to good interaction between students and teachers. Social interaction between students, the knowledge gained will expand through an exchange of opinions in communication (Edvardsson et al., 2011; Widodo et al., 2019). Social interaction is a relationship between two or more individuals (De Jaegher et al., 2010; Fischer & Reuber, 2011). This can occur when the behavior of one individual influences, changes or improves the behavior of another

individual or vice versa. Social interaction cannot just happen but it also requires the use of norms in the mathematics learning process.

Norms are patterns of order that are mutually agreed upon as a result of student interaction in class to achieve a common goal (Kadir, 2008; Widodo et al., 2020). Norms that occur in everyday life are called social norms, while the norms that occur when learning mathematics are known as sociomathematic norms (Widodo et al., 2019). The sociomathematic norms that occur in each class are different because the characteristics carried by each student are not the same (Widodo & Purnami, 2018). So it can be said how important the role of teachers and students is in building sociomathematic norms. The difference between social norms and sociomatematic norms is that students and teachers are expected to justify that their mathematical statement is a social norm and that justification must be based on the properties of mathematical objects is a sociomatematic norm (Partanen, 2011; Partanen & Kaasila, 2015). Sociomathematics is related to the relationship between mathematics and humans in social life which can be seen in Figure 1 (Wedege, 2010).

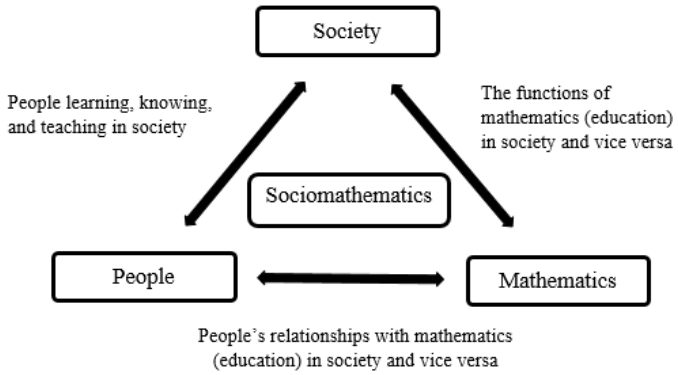

Figure 1. Sociomathematics as a subject field

Based on Figure 1 it can be said that a sociomathematic study contains three things, there are: (a) People's relationships with mathematics (education) in society and vice versa.; (b)The functions of mathematics (education) in society and vice versa, and; (c) People learning, knowing, and teaching in society.

Norms used in the classroom can increase students' responsibility when building their knowledge and understanding of mathematics (Fukawa-Connelly, 2012). In particular, there are two sociomatematic norms (Lopez & Allal, 2007; Widodo et al., 2019). First, sociomathematic norms are related to the problem-solving process. These norms focus on expectations of how problem-solving should be done. For example, learners try a variety of problem-solving strategies and verify resolution results. Second, sociomathematic norms related to participation in joint activities for problem-solving. This norm focuses on the ideal form of social interaction which is expected to support productive completion activities.

Previous research specifically states that sociomathematics norms are related to mathematical argumentation, namely how students carry out the process of interaction and negotiation to understand mathematical concepts (Moutsios-rentzos et al., 2019; Rogers & Kosko, 2019; Schwaighofer et al., 2017). Other than sociomathematic norms are closely related to negotiations on what is called problem-solving procedures, such as what is acceptable, regarding the formulation of effective procedures (Putri et al., 2015; Widodo et al., 2019, 2020; Widodo & Purnami, 2018).

Sociomathematic norms are formed based on the values of mathematics and mathematics learning in the classroom, namely responsibility, hope, cooperation, discipline, freedom of opinion, respect for opinions, and mutual agreement (Indriani & Ardiani, 2019; Ryu, 2011). The interaction process has two important indicators, namely mathematical communication skills and social skills used

by students to achieve mutual understanding and agreement (Genlott & Grönlund, 2016; Gresham et al., 2011; Rofiq et al., 2017).

Research on sociomatematic norms has been carried out including the development of sociomatematic norms by utilizing students' local potential (Kadir, 2008); aspects that affect sociomathematics norm (Widodo et al., 2020; Yackel & Cobb, 1996); the relationship of sociomatematica norm with learning media (Widodo et al., 2019); the formation of sociomathematica norms in cooperative learning(Partanen & Kaasila, 2015; Widodo & Purnami, 2018); how sociomathematic norms can construct students' mathematical understanding (Rizkianto, 2013); sociomathematic norms can lead to teacher and student beliefs to seek mathematical solutions (Kang & Kim, 2016); implementation of character values and sociomathematic norms in mathematics learning (Stephan, 2020); profile of sociomathematic norms in PMRI learning (Putri et al., 2015).

In this regard, this research is related to the study of Sociomatematic Norms in Mathematics Learning at SMP 113. For this reason, the purpose of this study to describe the sociomathematic norms that students have when learning mathematics in class.

Method

The method in this research is the descriptive qualitative method. The subjects in this study were students of class VII-A at 113 Junior High School. Collecting data in this study using questionnaires and interviews. The questionnaire filling was carried out first to 23 students. Furthermore, the interviews were conducted with 6 students based on the questionnaire results criteria high, medium, and low. The questionnaire given to students refers to aspects of sociomatematic norms such as experience of mathematics, explanation of mathematics, mathematical difference, mathematical communication, mathematics effectiveness, and mathematical insight (Biza et al., 2015; Kang & Kim, 2016; Widodo et al., 2020; Yackel & Cobb, 1996), more details can be seen in Table 1.

Table 1. Sociomatematical Norms Indicators

Indicators	Description
Experience of Mathematics	Students contribute carefully, efficiently, and actively in learning mathematics
Explanation of Mathematics	Students can understand, accept, and explain solutions or arguments systematically.
Mathematical Difference	Students can identify, assess, and compare the similarities and differences in ideas among various solutions.
Mathematical Communication	Students can listen, understand, ask questions, and make understanding to base communication in learning.
Mathematics Effectiveness	Students can find and explain problem-solving solutions that are the most effective or easiest to apply.
Mathematical Insight	Students can interact in-depth when discussing a given mathematical topic.

Data obtained from questionnaires and interviews are then carried out checking the validity of the data to find out whether the data obtained can be justified (Creswell, 2012). Checking the validity of the data used was the triangulation of sources and techniques (Miles et al., 2013).

Result and Discussion

Table 2. Results of the Sociomatematical Norms Questionnaire

Category	Interval	Frequency
Very Good	$75\% < P \leq 100\ \%$	9
Good	$50\% < P \leq 75\%$	14
Passably	$25\% < P \leq 50\%$	0

Category	Interval	Frequency
Poorly	P ≤ 25%	0

Based on Table 2 it can be said that the sociomathematic norms that students have are in two categories, namely very good and good. 9 students have a very good sociomathematic norm category and 14 students have a good sociomathematic norm category.

Research Subjects Who Have a Very Good Category of Sociomathematical Norms

On the first indicator, with a score of 12% of the research subjects can find solutions to problems with or without the teacher and always learn when given assignments by the teacher. This is by previous research conducted which states that interaction in discussions is used so that the problem assignments presented by the teacher can be resolved properly and the solutions obtained can be accepted by all students (Kadir, 2008).

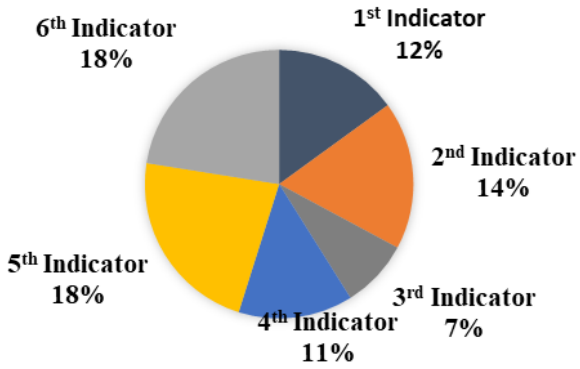

Figure 2. Percentage of Sociomathematical Norm Indicators

Based on the second indicator, with a score of 14%, research subjects can focus when the teacher explains the material, understands the solution given by the teacher, is confident when presenting the results obtained, and can draw conclusions from other friends' arguments. The results of previous show the same results, namely, students believe in learning mathematics if they pay attention to the explanation given by the teacher (Kang & Kim, 2016).

Based on the third indicator, with a score of 7%, the subject can accept other friends' arguments during the discussion process and can provide arguments for questions in the form of pictures, stories, or problems given by the teacher. In line with previous research show that a learning process will be more effective and efficient if learners communicate ideas to one another through social interaction (Rizkianto, 2013).

Based on the fourth indicator, with a score of 11%, the research subject always asks the teacher when there is the material that is not understood, likes discussions when learning because it can exchange arguments, and can explain solutions to solutions with straightforward arguments. The same results were obtained in previous research which revealed that students can convey their ideas to each other in clear and understandable language very well (Putri et al., 2015).

Based on the fifth indicator, with a score of 18%, the research subject always tries to use the fastest and easiest way to solve math problems so that answers become more practical, able to conclude learning mathematics, can compare solutions to real objects, and always double-check the solutions that have been done. The results of this study are in line with the previous that students need to have manipulative or visual material to solve problems and clarify problem solving (Yackel & Cobb, 1996).

Based on the sixth indicator, with a score of 18%, the research subjects felt that their knowledge was increased by the presence of group discussions, were able to understand mathematical formulas, used several reading sources when studying at home, better understood the material using learning media, and had ideas when solving math problems. Mathematics learning held in schools should always be innovative and can be linked to various events that occur in everyday life, which provide opportunities for students to use math applications and seek experiences about mathematics.

Based on the description of each indicator, it can be concluded that research subjects who have sociomathematic norms are very well able to carry out mathematics learning activities by the indicators of sociomathematic norms that can contribute to learning mathematics, understand explanations of solutions or arguments, can identify similarities and differences in solving solutions, be able to ask questions and explain the solutions obtained, be able to find effective and easy solutions, and students can interact to discuss mathematics material such as solving formulas and learning media. So it can be said that the sociomathematic norms that students have are very good by the high results obtained by students during the mathematics learning process.

Research Subjects Who Have a Good Sociomathematical Norm Category

In the first indicator, with a score of 12%, research subjects can find solutions to problems with or without the teacher and always learn when given assignments by the teacher. Based on previous research, it was revealed that in the process of negotiating sociomatematic norms, students in the class actively build beliefs that allow them to become more independent in mathematics (Yackel & Cobb, 1996).

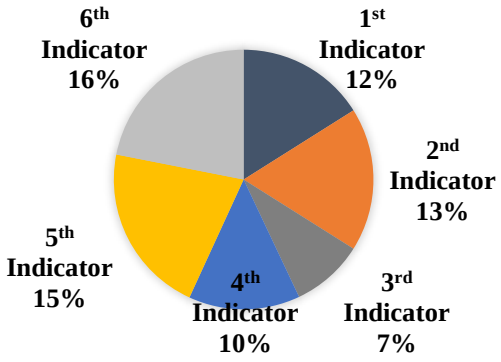

Figure 3. Percentage of Sociomatematic Norm Indicators

Based on the second indicator, with a score of 13%, research subjects can focus on when the teacher explains the material, understands the solution given by the teacher, is confident when presenting the results obtained, and can draw conclusions from other friends' arguments. The results of this study indicate that sociomatematic norms appear in student activities to solve problems, clarify their mathematical understanding, and explain solutions..

Based on the third indicator, with a score of 7%, the research subject can accept other friends' arguments when the discussion process takes place and can provide arguments about pictures, stories, or problems given by the teacher. This shows that students accept diversity, learn, help, use mistakes as opportunities to rethink, collaborate, compare strategies, and respect each other's friends.

Based on the fourth indicator, with a score of 10%, the research subject sometimes asks the teacher when there is a material that is not understood, likes discussions when learning because it can exchange arguments, and finds it difficult when explaining solutions to solutions with straightforward arguments. This shows that the questions asked by students in a discussion are a form of curiosity.

Students are encouraged to demonstrate the value of peer-to-peer solutions by asking questions about the problem-solving process.

Based on the fifth indicator, with a score of 15%, research subjects sometimes find the fastest and easiest way to solve math problems so that answers become more practical, can conclude learning mathematics, can compare solutions to real objects, and always check the solutions that have been done. Students believe in determining certain methods to be effective solutions to mathematical problems related to students' ability to simplify numbers or those solutions that will be used in the problem-solving process.

Based on the sixth indicator, with a score of 16%, the research subjects felt that their knowledge was increased by the presence of group discussions, found it difficult to understand mathematical formulas, used several reading sources when studying at home, understood material using learning media, and had ideas when solving math problems. This show that of develop sociomathematic norms, teachers must design learning in such a way that there is student interest in learning and encourages discussion to interact.

Based on the description of each indicator, it can be concluded that research subjects who have good sociomathematic norms can carry out mathematics learning activities by the indicators of sociomathematic norms that can contribute to learning mathematics, understand explanations of solutions or arguments, can identify similarities and differences in solving solutions, are less able to ask questions and explain the solutions obtained, sometimes finding solutions that are effective and easy, and students are less able to interact to discuss mathematics material such as solving formulas and learning media. So it is said that a good sociomathematic norm will correspond to the moderate and low results obtained by students during the mathematics learning process.

Conclusion

Sociomathematic norms are related to the relationship between individuals, mathematics, and society that emphasize students' beliefs and understandings which can be raised during the interaction process during the discussion of learning mathematics. It is very good that the sociomathematic norms that students have will affect the high results obtained in mathematics learning and good sociomathematic norms will affect the moderate and low results obtained by students in mathematics learning.

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