

# ANALYSIS OF MATHEMATICAL CONNECTION SKILLS USING REALISTIC MATHEMATICAL EDUCATION

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Article History	Abstract. Connection ability is the ability to associate between topics in
Received: 05-08-2021	This research aims to find out the ability of mathematical connections by using
D. 1.1	the realistic mathematical education of the concept of Social Arithmetic in class
Revision: 27-08-2021	with the selection of subjects based on the results of interviews. The main
Accepted: 13-09-2021	instrument in the study was the researchers themselves. Instruments for
Published: 20-10-2021	<ul> <li>discovering mathematical connection skills are tests and interviews. Data collection techniques with observation guidelines, tests, interviews, and documentation. Data analysis used is qualitative analysis i.e. data collection, presentation of data, and withdrawal of conclusions. The results of the analysis showed that subjects included students who had the ability of mathematical connections that met 4 indicators of mathematical connections, namely recognizing the equivalent representation of the same concept, recognizing the relationship of a mathematical procedure of a representation to an equivalent representation procedure, using and assessing the relationship between topics with other disciplines, using mathematics in everyday life.</li> <li>Keywords: Mathematical Connections, Realistic Mathematics Education, Social Arithmetic</li> </ul>
	<ul> <li>Abstrak. Kemampuan koneksi merupakan kemampuan mengaitkan antar topik dalam matematika, mengaitkan matematika dalam ilmu lain, dan dengan kehidupan sehari-hari. Penelitian ini bertujuan untuk mengetahui kemampuan koneksi matematika dengan menggunakan pendekatan matematika realistik konsep Aritmatika Sosial di kelas VII SMP Negeri 209 Jakarta. Jenis penelitian adalah deskriptif kualitatif dengan pemilihan subjek didasari pada hasil wawancara. Instrumen utama dalam penelitian ini yaitu peneliti sendiri. Instrumen untuk menemukan kemampuan koneksi matematika yaitu tes dan wawancara. Teknik pengumpulan data dengan pedoman observasi, tes, wawancara, dan dokumentasi. Analisis data yang digunakan adalah analisis kualitatif yaitu pengumpulan data, penyajian data, dan penarikan kesimpulan. Hasil analisis menunjukkan bahwa subjek termasuk siswa yang memiliki kemampuan koneksi matematika yang memenuhi 4 (empat) indikator koneksi matematika yakni mengenali representasi ekuivalen dari konsep yang sama, mengenali hubungan prosedur matematika suatu representasi ke prosedur representasi yang ekuivalen, menggunakan dan menilai kaitan antar topik dengan disiplin ilmu lain, menggunakan matematika dalam kehidupan seharihari.</li> <li>Kata Kunci: Koneksi Matematika, Pendekatan Matematika Realistik, Aritmetika Sosial</li> </ul>

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#### **INTRODUCTION**

Mathematics education as the basis of the development of science and technology has an important role in ushering human thinking on the logic of thinking (Eslinger & Kent, 2018), so that mathematics is not only seen as a science but more than that, mathematics is a means of scientific thinking and a means to study the nature of science (Kamsurya, 2020). Mathematics is the science of numbers and the operational procedures used in solving problems regarding numbers (Purpura & Napoli, 2015). In essence, mathematics means we learn the idea of hierarchically arranged concepts and deductive reasoning (Hudoyo, 1998). In order for students to understand and understand the concept (structure) of mathematics should be taught in a pure concept sequence, continued with the concept of notation and ended with an applied concept. In addition, to be able to learn well the structure of mathematics, the representation (model) begins with concrete objects that are diverse (Simanjuntak, 1993). Learning mathematics must be gradual and sequential so that students better understand the concepts he learns (Hudoyo, 2009).

Various efforts to improve the quality of math learning have been widely done, both by the government and by various parties who care about school math learning. These efforts include: (1) teacher management, (2) teacher education qualifications, (3) curriculum renewal, (4) implementation of new learning models or methods, (5) research on students' difficulties and mistakes in learning mathematics. But these efforts have not achieved optimal results, due to various obstacles in the field. As a result, until now the quality of mathematics learning in Indonesia is still low (Kamsurya, 2020).

In general, the problem of learning mathematics is seen in Soedjadi (2014) explanation which states that for quite a long time we are all immersed in math learning that for many people feels foreign, formal, and only playing numbers or symbols that are difficult and meaningless (Jordaan et al., 2017), not even a few who feel scared to face math lessons. To overcome such learning problems, innovation is needed in the field of mathematical learning. One of the results of innovation in the field of mathematics learning is the Ability to Connect Mathematics by using realistic mathematics education.

Most students have difficulty applying mathematics to real life situations (Kamsurya & Saputri, 2020; Laurens, 2018). Another factor that causes difficulty in mathematics for students is because math learning is less meaningful. Soedjadi suggested that in order for learning to be meaningful, classroom learning needs to associate children's real-life experiences with mathematical ideas. Teachers in classroom learning do not associate with

schemes that students have had and students are less given the opportunity to reinvent and construct their own mathematical ideas. Van den Heuvel-Panhuizen & Drijvers, (2014) if children learn mathematics separately from their daily experiences then children will quickly forget and can not apply mathematics.

Math learning in the classroom should be emphasized on the interrelationship between mathematical concepts and everyday children's experiences (Riyanto et al., 2019). In addition, it is necessary to reapply mathematical concepts that children have in everyday life or in other fields. One of the mathematical learning oriented to the mathematics of everyday experience is the realistic mathematical education (Kamsurya, 2019).

One of the mathematical materials taught in class VII junior high school is Social Arithmetic material. The considerations on which the material is chosen as the material taught in this study are: (1) based on the results of discussions with several math teachers obtained information that Social Arithmetic material is still a material that is somewhat difficult to understand by students, (2) many problems in everyday life related to this material, and (3) in general teachers dominate the teaching and learning system in the classroom, For this reason, a realistic mathematical education is applied. The application of RME in schools is expected to increase students' understanding and mastery of the material, because realistic mathematics learning provides students with the opportunity to rediscover and reconstruct mathematical concepts, so that students have a good understanding of those mathematical concepts. Thus, realistic mathematics learning is expected to make a major contribution to student understanding (Yetim Karaca & Özkaya, 2017). This research aims to find out the ability of mathematical connections by using realistic mathematical education by using Social Arithmetic materials in class VII of SMP Negeri 209 Jakarta.

## **METHOD**

This type of research is qualitative descriptive. Qualitative research is research that results in discoveries that cannot be achieved using statistical procedures or by quantification (Ghoni & Almanshur, 2012). The study subjects were students of class VII of SMP Negeri 209 Jakarta with a total of 22 students and the data source taken was 1 student taken based on his mastery level i.e. very good value students. Classroom teachers, math teachers and peers were interviewed in relation to the subject used. The main instruments in this study are researchers and instruments to find out the ability of mathematical connections of students, namely tests of mathematical connection ability, interviews, and documentation. Data is enabled using field records, interviews, and documentation.

The data analysis technique used in this study is qualitative data analysis, following the concept developed by Miles and Huberman, namely data reduction, data display, and conclusion drawing (Sugiyono, 2014). In order for the data obtained in this research process to be valid and appropriate, the validity of the data is carried out by means of extension of observations, peer checks, and chechk members (Creswell & Creswell, 2018).

## **RESULTS AND DISCUSSION**

#### **Subject Interview Results**

The results of interviews with research subjects on the problems used in the test process and additional problems used in the interview process can be known that the subject in his learning reflects the ability of mathematical connections. The ability of the student's mathematical connections in each indicator is as follows.

 Recognizing the equivalent representation of the same concept is the ability to recognize or solve problems of the same concept. This indicator is owned by the subject, because in the learning process the subject is able to solve similar problems from the same concept given by the teacher. In addition, from the interview process the subject is able to solve the problem of the same concept as in the following work image.

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Figure 1. Solution of the problem by subject using way 1



Figure 2. Solution of the problem by subject using means 2

2. Recognizing the relationship of a mathematical procedure to an equivalent representation procedure is an ability to decipher or explain the relationship of solving a given problem

or problem and has the nature of ability to abstract into a simpler context. This indicator is owned by the subject in this study, it is in line with the following interview excerpts.

- R : Let's explain, where did you get the answer?
- SFL : It is known from the matter that the motorcycle costs Rp. 12,000.00.00, the motorcycle is sold at a price of Rp. 6,000,000.00. Means seeking the percentage of the loss by way of 6,000,000.00 divided by 12,000.00.00 and multiplied by 10%. Then the result obtained is 50%. Thus the percentage of losses is 50%.
- 3. Using and assessing the interrelationships between mathematical topics and interrelationships outside of mathematics is an ability to apply and assess the relationship between mathematical concepts and other concepts. This indicator is owned by the subject in this study
- 4. Using mathematics in everyday life is an ability to use or apply the skills or knowledge gained in solving various problems that occur in the surrounding environment. The ability to use mathematics is owned by the subject in this research because the subject is able to use the concepts possessed in the problem solving process.

## **Peer Interview Results**

The results of peer interviews in general provide an overview of the condition of the subject in classroom learning activities. According to colleagues, the subject meets 4 indicators of mathematical connection ability in the process of learning mathematics in the classroom as well as in everyday life. This is evidenced by the subject being able to solve the problem of the exercise in the same context, deciphering and explaining the problem of the exercise that is abstract so that it is easy to understand, able to use the relationship between mathematics, and can use mathematics in everyday life, such as calculating the profits they get from selling. In general, the thought process as well as the activities carried out by SFL subjects according to peers can be concluded that the subject includes students who have mathematical abilities. This is in line with the opinions expressed by colleagues in the following interview excerpts:

- R : When given about training, the shape of the problem is similar to the example of the problem given by the teacher at that time. Can the SFL get it done?
- TS : yes, he can solve that. Because at that time, the matter was done together and he gave me an explanation, so that I could also solve the problem.
- R : What about the other problem when told to finish another way and you come forward to finish it in front of the class?

- TS : On that, it was actually the answer from the SFL and me who came forward in front of the class to write it down. Because, the teacher said that the SFL jaman who had to do the problem.
- R : Is that really the answer from the SFL?
- TS : Yes, because in completing training we usually work together, only when asked to finish in other ways, and I don't understand so the SFL does it. I looked at the way the settlement was made by the SFL.

## Interview Results with a Math Teacher

Based on the results of interviews with subject teachers, subjects in their learning activities can solve problems that have an equivalent context, and can connect and use the relationship between contests in mathematics and non-mathematical contexts. As a result, it facilitates the process of solving problems and can apply that knowledge into the real world or in everyday life. According to the teacher, the subject in the learning process is able to reflect attitudes or meet indicators of mathematical connections. This right corresponds to the following interview excerpt.

- R : In solving various problems given by you in the learning process in the classroom, is SFL able to solve the problem well?
- T : I honestly need to admit that the SFL is different to its other friends. SFL is a smart student, as I myself once tested it. At that time, I gave an example of a problem whose difficulty level was quite difficult and required a high level of thinking, but so calmly he solved the problem in a land-based manner so that the problem could be answered. While his other friends can not solve the problem well, because it is very abstract.
- R : Why did you say that?
- T : Yes, because he has more knowledge in studying mathematics. SFL is able to connect abstract problems into simple forms, and vice versa. In solving the problem he can connect the concept with the real world so that the problem can be solved.

The results of interviews conducted on the study subjects obtained data that, the subject can solve the test problems used in the interview process well. All the test questions can be solved again by the researcher, and the subject can explain the answers written to the researcher directly, the goal is to find out that how the subject can use the interrelationships of the equivalent representation of the same concept and use the interrelationships between those concepts in the process of solving the problem. The learning process that takes place, the subject can express his opinion both in answering questions from teachers and to ask questions. Based on the results of interviews conducted on the subject it is known that the subject includes intelligent people, and can use the relationship between concepts in the process of solving problems or training questions given by teachers in the classroom and in solving problems whose difficulty levels are quite high. Based on the results of interviews conducted with colleagues it can be known that the subjects in the learning process include intelligent students. This is seen in his daily life in participating in learning activities In addition, according to colleagues, the subject meets 4 indicators of mathematical connection ability in the math learning process in the classroom and in everyday life. This is evidenced by the subject being able to solve the problem of the exercise in the same context, decipher and explain the problem of the exercise that is abstract so that it is easy to understand, able to use the interrelationships between mathematics, and can use mathematics in everyday life, such as calculating the amount of profit they get from trading. In general, the thought process and activities carried out by SFL subjects can be concluded that the subject includes students who have mathematical abilities.

In addition, according to the direct narrative of the math teacher that SFL in the learning process has more ability compared to his other friends. This is especially evident from the process of solving problems carried out by SFL, namely in solving problems that are very difficult, and can connect abstract mathematical problems into a simpler form in mathematics, using the relationship between problems and the real world and using the ability to solve problems into everyday life.

Judging from the various activities that the subject of SFL, as conveyed by the teacher of mathematics subjects, the subject has the ability to connect mathematically because it can solve problems that are similar to the level of difficulty that is more than his friends, able to decipher and explain the interconnectedness of problems that are abstract into real-life contexts, assess the interrelationship of problems into real-world applications and use their mathematical understanding into life.

The results of research on the connection ability of students of class VII of SMP Negeri 209 Jakarta using the Realistic Mathematical education are known that SFL subjects have connection skills. By looking at the results of solving problems by SFL, it can be concluded that learning using a realistic mathematical education makes it easier for students to understand the mathematical material has connection skills. SFL subjects have the ability to connect between topics, the ability to relate to other sciences, and the ability to relate to everyday life.

#### CONCLUSION

Based on the results of the study it can be concluded that the ability of mathematical connections is owned by the subject, as well as fulfilling 4 mathematical connection indicators used in this study. The correctness of the mathematical connection indicator in

each indicator is able to recognize the equivalent representation of the same concept of the equivalent representation, recognize the relationship of mathematical procedures as representations to other representation procedures, use the interrelationships between mathematical topics that he has learned into other contexts, and use his ability and understanding of mathematics in everyday life.

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