Analysis of elementary student’s mathematical connection and communication ability

I Pertiwi*, and Wahyudin

1Departemen Pendidikan Dasar, Sekolah Pascasarjana, Universitas Pendidikan Indonesia, Jl. Dr.Setiabudhi No.229 Bandung 40154, Indonesia
2Departemen Pendidikan Matematika, Universitas Pendidikan Indonesia, Jl. Dr.Setiabudhi No.229 Bandung, 40154, Indonesia

*Corresponding author’s email: indahpertiwi05@upi.edu

Abstract. This study is based on the importance of elementary students’ mathematical connection and communication. The aim of this study was to find out the students’ ability to apply mathematical concepts on problems that arise in each learning. The study design used was descriptive qualitative. The samples in this study were 22 fourth grade students of an elementary school in Subang. This study uses mathematical connection ability tests instrument and a mathematical communication ability test instrument. The results obtained that students in answering the mathematical connection ability tests and mathematical communication test still low. Some students difficult and confuse when answering test because students do not understand the purpose of the question. Based on these problems, learning will be further developed so that mathematical connection and mathematical communication ability can be improved again.

1. Introduction

NCTM [1] States that mathematics is not a collection of separate topics and abilities, even though in reality mathematics is often partitioned and taught in several branches. Mathematics is an integrated science. The tendency of Mathematics to learn in the classroom is simply to record, read, write without observing the problems that exist in the surrounding environment so that it is trained to solve problems of daily living and convey ideas both verbally and in writing to elementary students related to the concept of Mathematics.

NCTM [1] states that are five basic mathematical abilities which standard processes namely problem solving, reasoning and proof, communication, connections and representation. All basic mathematical abilities are expected to be possessed by students to achieve the expected mathematics learning goals. From these five abilities, connection and communication are important things for students to have in order to be able to connect and communicate their understanding both verbally and in writing.

Understanding mathematical concepts, explaining the inter-concept linkages and applying concepts or algorithms flexibly, accurately, efficiently, and precisely in solving problems [2]. In the formulation of these objectives, mathematical connection ability becomes very important because it will help mastery of understanding concepts that are meaningful and help solve problem solving tasks through inter-conceptual connections between mathematics and between mathematical concepts and other disciplinary concepts. Likewise this mathematical connection will help students in compiling
mathematical models that also illustrate the interrelationships between concepts and or data on a problem or situation given.

The indicators of mathematical connection abilities as follows [3]: a) Finding relationships of various representations of concepts and procedures, b) Understanding relationships between mathematical topics, c) Applying mathematics in other fields of study or daily life, d) Understanding equivalent representations of a concept, e) Finding relationships of one procedure with other procedures in equivalent representation, f) Applying relationships between mathematical topics, and between mathematical topics with topics outside of mathematics. How to convey mathematical connection capabilities, namely by mathematical communication. Mathematical communication skills are the ability to convey mathematical ideas/ideas, both orally and in writing and the ability to understand and accept other people's mathematical ideas, ideas carefully, analytically, critically, and evaluatively to sharpen understanding [3].

Components of mathematics learning objectives include [2]: being able to communicate ideas with symbols, tables, diagrams, or mathematical expressions to clarify the situation or problem, and have an attitude of appreciating the usefulness of mathematics in life, curiosity, attention, and interest in learning mathematics, and attitudes, and confident in problem solving.

Indicators of mathematical communication skills [3,4,5] include: Linking real objects, images, and diagrams into mathematical ideas. Explain ideas, situations, and mathematical relations verbally or in writing, with real objects, images, graphics, and algebra. Express daily events in the language of mathematics. Listening, discussion and writing about mathematics. Read with an understanding of a written mathematical representation. Arrange math questions that are relevant to the problem situation. Make conjectures, compile arguments, formulate definitions and generalizations. From some expert opinions above, students are expected to be able to master indicators of mathematical connection ability and indicators of mathematical communication skills of elementary school students to facilitate mathematics learning.

2. Method
This research was conducted in 22 fourth grade students of elementary school in the city of Subang. The purpose of this study was to determine the level of mastery of mathematical connection skills and mathematical communication skills of students in learning elementary school mathematics. This research was conducted using a mathematical connection ability test instrument and a test of mathematical communication skills. The test instrument includes fourth grade math material in elementary school. This study uses descriptive qualitative research.

The test instruments provided were in the form of connection ability test instruments and communication skills tests described as follows:

| No | Physical Connection Capability Indicator | Mathematical Material Content | Question |
|----|----------------------------------------|-------------------------------|----------|
| 1  | Understand the relationship between mathematical topics | Build a Simple Room | 1) Determine the following rectangle 5cm 7cm What is the circumference of the rectangle above? |
| 2  | Applying mathematics in other fields of study or everyday life | Build a Simple Room | 2) In a house there is a wooden frame in the shape of a wall, with a base of 40cm and a height of 10cm. What is the width of the parallelogram? |
Table 1 shows indicators in the ability of mathematical connections with material around rectangles and wide spaces along with the problem.

![Image](image.png)

| No | Physical Connection Capability Indicator | Mathematical Material Content | Question |
|----|------------------------------------------|-------------------------------|----------|
| 1. | Connecting real objects, connecting images, and connecting diagrams into mathematical ideas | Build a Simple Room | 1) Calculate the area of the following triangle! |
|    |                                           |                               | ![Image](image.png) |
| 2. | Express daily stories in the language of mathematics | Build a Simple Room | 2) Mr. Darman has a triangular garden with 5m, 7m and 9m sides. What is the circumference of Mr. Darman's garden? |

3. Result and Discussion

Figure Findings and analysis of answers

In the answer to question number 1 the results of the answers are quite diverse. The first answer can be seen from the following picture. In the problem number 1, students were asked to calculate the circumference of the rectangle. However, most students answer only add up and answer the circumference of the rectangle is 12 cm. Figure 1 is an example of answers made by students in terms of mathematical connection skills.

![Image](image.png)

1) Determine the following rectangle

5cm

7cm

What is the circumference of the rectangle above?

**Student answer:**

The circumference of the square = 5 + 7 = 12 cm

The right answer for the circumference of the square with the base length is 7cm, and side length is 5cm is as below.

Around the rectangle

= (2 x base length) + (2 x side length)

= (2 x 7) + (2 x 5)

= 14 cm + 10 cm = 24 cm, so the circumference of the rectangle is 24 cm.

From students' answers it can be concluded that there is still a lack of understanding of mathematical connection skills.
Question:
In a house there is a wooden frame in the shape of a wall, with a base of 40cm and a height of 10cm. What is the width of the parallelogram?

Student answer:
The square of parallelogram = base x height
= 40 cm x 10 cm
= 400 cm

Figure 2. Example of Student Answers in solving connection number 2

In the question in Figure 2, there are still some students who answer right and wrong. Figure 2 above is the correct answer.

Question:
Calculate the area of the following triangle!

6cm
8cm

Student answer:
The square of triangle = 6 cm + 4 cm + 8 cm
= 18 cm

Figure 3. Example of Student Answers in solving the problem of mathematical communication no. 1

Figure 3 questions from the answer students are asked to calculate the circumference of the triangle. Almost all students answer incorrectly. Even though the problem is asked to calculate the area of a triangle, not counting the circumference of the triangle. From this it can be seen that students do not communicate well.

Question:
Mr. Darman has a triangular garden with 5m, 7m and 9m sides. What is the circumference of Mr. Darman's garden?

Student answer:
The circumference of Mr. Darman’s garden= sum of the triangle side
= 5m + 7m + 9m
= 21m

Figure 4. Example of Student Answers in Solving Question 2 of Mathematical Communication Skills

Figure 4 answers to Problem number 2, only a few students answer correctly, including the answer above is the correct answer.
4. Conclusion
Based on the results of the analysis, the results of this study indicate that students' ability to solve math problems is still experiencing difficulties. The number of students who do not understand the purpose of the questions given so that they have not met the expected indicators. Most of the students are still many who do not understand the purpose of the question, so it becomes confusing when answering questions.

Student errors related to connection skills and communication skills, namely mistakes that are often made by students are answering questions that are not in accordance with existing formulas or procedures and there are always student mistakes that often occur, namely in understanding the basic understanding of a simple building wake up, and how to determine the area of a building.

The results of this initial study are expected to provide information to the school. The importance of mathematical connection skills and mathematical communication skills. To overcome the low mathematical connection skills and mathematical communication skills of students, it is better if further research can innovate in mathematics learning such as using innovative and creative learning approaches or models.

5. References
[1] National Council of Teachers of Mathematics editor 2000 Principles and standards for school mathematics. National Council of Teachers of
[2] Hendriana H & Soemarmo U 2017 Penilaian Pembelajaran Matematika edisi revisi Bandung Refika Aditama
[3] Rohendi D2012 Developing e-learning based on animation content for improving mathematical connection abilities in high school students. International Journal of Computer Science Issues (IJCSI) 941.
[4] Latif S 2017 Mathematical Connection Ability In Solving Mathematics Problem Based on Initial Abilities of Students At SMPN 10 Bulukumba Daya Matematis: Jurnal Inovasi Pendidikan Matematika 42 p. 207-17.
[5] Cheng YL Mix KS 2014 Spatial training improves children's mathematics ability Journal of Cognition and Development 151 p. 2-11.

Acknowledgments
The author expresses his gratitude to all respondents of this study namely 4th grade elementary school students and fourth grade teachers who are willing to spend time so that this research can be carried out well and run smoothly.