Analysis of Mathematical Connection Ability of PGSD Undergraduate Students for Geometric Shapes Content

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Abstract. Mathematics is a science that provides the ability to think logically and mathematically. The ability to think logically and mathematically is reflected in mathematical connection. Students of Elementary School Teacher Education Program (S1 PGSD) are prospective teachers who will teach mathematics in elementary schools, and will have the obligation to provide students with mathematical connection ability. Therefore, undergraduate students of S1 PGSD need to have mathematical connection ability as basic skills for teaching mathematics. This study aims to analyze the mathematical connection abilities of PGSD undergraduate students for Geometric Shapes content. The research questions are as follows: (1) what is the mathematical connection ability possessed by PGSD undergraduate students for geometric shapes content, (2) what mathematical connection skills are still low in PGSD undergraduate students for geometric shapes content, (3) what mathematical connection skills do PGSD undergraduate students already have at high category for geometric shapes content. The study applied a quantitative descriptive method, with the research subjects totaling 30 students of fourth semester who were taking Geometry and Measurement courses. Data collection techniques using multiple choice tests totaling 30 items. The conclusion is that the average mathematical connection ability of S1 PGSD students reached 62.49% in the sufficient category. The mathematical connection ability which shows is still low is the indicator of mathematical connection ability with other fields/sciences is 40.00%, and the ability shows high category is connection ability between topics in mathematics.

Keywords: mathematical connection ability, geometric shapes content

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INTRODUCTION

In essence, mathematics is a structured and systematic science, concepts and principles in mathematics are interrelated with one another. Interrelated concepts are not only between concepts in mathematics, but mathematical concepts are also related to other disciplines, and mathematical concepts are related to real life. The implication of this essence, in learning mathematics students must have adequate mathematical connection skills in order to be able to connect between concepts in mathematics and relate them to other sciences, as well as connect mathematical concepts to real life. As stated by Mhlolo, M.K. (2012) that educational standards all over the world recommend that teachers enable pupils to recognise and to make connections among relatable mathematical ideas.

Mathematical connection ability is the ability needed to be able to solve problems. Hafiz, et al (2016)also said thah the ability of mathematical connections is one of the mathematical forces that must be developed in the learning of mathematics in schools. Fauzi 2015 said that the ability of a mathematical connection is required to relate to various ideas or mathematical ideas accepted by students.Therefore the ability to connect mathematics is very important and must be a goal that must be achieved in learning mathematics at every level of education. This is supported by the statement of National Council Of Teachers Of Mathematics (NCTM) "To help students build a disposition to use connections in solving mathematical problems, rather than seeing mathematics as a set of disconnected, isolated concepts and skills"(NCTM,2000)..The Elementary School Teacher Education Program (S1 PGSD) is a higher education institution that prepares prospective elementary school teachers and when they serve as teachers they will teach mathematics in elementary schools. Regarding the urgency of mathematical connection skills, PGSD students must have strong provisions in mathematical connection abilities. The ability of mathematical connections that are owned will have an impact on providing provision of

mathematical connection abilities to elementary students. Without having a mathematical connection, students have to learn and remember too many separate mathematical concepts and procedure. If students are able to link mathematical ideas, then their understanding of mathematics will be deeper and more comprehensive, because they are able to understand the interrelationships between mathematical ideas, contextual relationships between mathematical topics, and the relationship between mathematical concepts and everyday life experiences.

Previous research has found several learning approaches and models that are proven to be able to train and improve mathematical connection skills, including research by Kusaeri, Pardi, and Quddus (2019) through the application of culture-based learning, Menanti, H, Sinaga, B, and Hasratuddin (2018) through the development of mathematics learning tools, Hasbi,M. et al. (2019) by applying the Realistic Mathematics Approach. Other findings (Nding, S and Nendi, F (2018) prove that mathematical connection ability contributes significantly to mathematics learning achievement and reaches 21.9%. The results of this study indicate that students' mathematics learning achievement is influenced by their mathematical connection abilities. In accordance with the results of research by Latif, S and Akib (2016) that high initial ability of mathematical connections contributes to the ability of high school students to complete problem solving tests in mathematics. Along with the demands of 21st century skills that each individual is expected to have high-order thinking skills, the mathematical connection ability is part of the high-order thinking skills that need to be provided to students from the elementary school level. In fact mathematics has become a compulsory subject in the curriculum since elementary school in Indonesia.

Based on the urgency of mathematical connection skills that must be possessed by students from the elementary school level, PGSD undergraduate students as prospective teachers are important to have mathematical connection skills as a provision for the ability to teach mathematics in elementary schools. Therefore, this research aims to describe the mathematical connection abilities of S1PGSD students at the Indonesian education university Cibiru Campus. By knowing the results of the analysis of the mathematical connection abilities of S1PGSD students, it is hoped that they will become a basis for consideration for improving the learning process for mathematics courses so that they can provide provision for the mathematical connection abilities of prospective elementary school teacher students.

METHOD

In accordance with the research objective, which is to describe students' mathematical connection abilities with data obtained sourced from the results of mathematical connection ability tests, the research approach applied is a quantitative descriptive approach. The reason for choosing the quantitative descriptive method in this study was because the descriptive method has the main characteristics of describing phenomena. In this study, the aim was to describe the phenomenon of the mathematical connection abilities possessed by PGSD undergraduate students in geometric shapes content.

The research subjects consisted of 30 4th semester students who were taking Geometry and Measurement learning courses in elementary school and were the class taught by the researcher. Data collection techniques used test questions that test the ability of mathematical connections according to the indicators set. The number of test questions consisting of 30 questions is made proportionally according to indicators of mathematical connection ability. The research steps involved six stages of activity, namely: (1) analysis of indicators of mathematical connection ability, (2) compiling instrument grids, (3) instrument testing, (4) data collection, (5) data analysis, (6) drawing conclusions.

To find out the mathematical connection abilities of elementary school teacher candidates, in this study the mathematical connection indicators are described in the following four indicators.

1. The ability to connect between topics in mathematics.
2. Connectivity connects conceptual and procedural knowledge.
3. The ability to connect using mathematical concepts in life activities.

4. The ability to connect using mathematical concepts in other fields/sciences.

Based on these four indicators, test questions totaling 30 items were developed in the form of multiple choices, and the scope of the content was limited to geometric shapes, with details of the items as shown in the following table.

Table 1 Details of Mathematical Connection Test Questions

No	Indicators of Connection Mathematical	Number of Test Questions
1	The ability to connect between topics in mathematics.	8
2	Connection capabilities link conceptual and procedural knowledge.	7
3	The ability to connect using mathematical concepts in life activities.	8
4	The ability to connect using mathematical concepts in other fields/sciences.	7
Total test questions		30

Testing the validity of the instrument is done through the analysis of items or test instrument items from the test results of test items. Item analysis, namely correlating the score of each question item with the total score which is the sum of each item score. In the analysis of this item, the Pearson Moment correlation formula is used to determine the correlation. The steps taken in the validity test using SPSS version 17, from the results of the calculation analysis then the correlation coefficient of item scores to the total score is determined whether the minimum correlation coefficient reaches 0.3 or not. If the correlation coefficient is less than 0.3, the instrument items are not used. Of the 30 test items analyzed, the correlation coefficient reached 0.3. Thus 30 items entirely used to collect data.

The reliability test used the Split Half Technique which was then analyzed using the Spearman Brown formula. Based on the calculation results, the number shows 0.930 as the correlation coefficient; this shows that the instrument items are valid because the calculated numbers obtained are greater than 0.6. An instrument is declared reliable if the reliability coefficient is at least 0.6 (Sugiyono, 2012).

In this study the data analysis technique used is descriptive statistics using the percentage formula. Descriptive statistics are statistics that are used to analyze data by describing or describing the data that has been collected as it is without intending to make general conclusions or generalizations. The formula used is as follows.

$$DP = \frac{F}{N} \text{x } 100\%$$

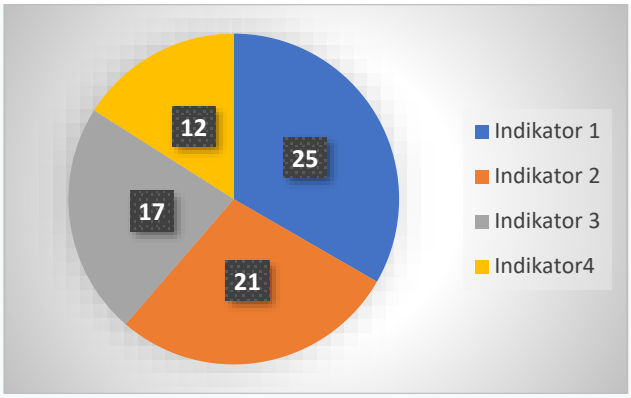
DP = Descriptive Percentage
F = Empirical score (score obtained)
N = Ideal Score for each question item
To find out the level or category of the percentage, then the score obtained in % is converted to the criteria table (Riduan, 2004).

Table 2. Percentage Descriptive Analysis Criteria

No	Percentage (%)	Category
1.	75%-100%	well
2.	50%-74%	enough
3.	25%-49%	Not enough
4.	1%-24%	Very less

RESULTS

The results of data analysis from the results of the student's mathematical connection test are shown in graph 1 below.



Graph 1. Number of Students Who Answered Connection Questions Correctly

In graph 3 above it can be described that the mathematical connection ability for indicator 1 is the ability to connect between topics in mathematics, out of 30 students who were able to answer 30 questions correctly totaled 25 people. As for the second indicator, namely the ability to connect conceptual and procedural knowledge that is able to answer 30 questions correctly, a total of 21 students. Mathematical concepts in other fields/sciences students who were able to answer correctly totaled 12 people.

Table 3 Description of the Percentage of Mathematical Connection Ability

No	Connection Ability	Number of Research Subjects	Number of Subjects Answered Correctly	%	Description (category)
1.	The ability to connect between topics in mathematics.	30	25	83,33	well
2.	Connection capabilities link conceptual and procedural knowledge.	30	21	70,00	enough
3.	The ability to connect using mathematical concepts in life activities.	30	17	56,66	enough
4.	The ability to connect using mathematical concepts in other fields/sciences.	30	12	40,00	less
Average mathematical connection ability				62,49	enough

Research question 1: what is the mathematical connection ability possessed by PGSD undergraduate students for geometric shapes content?
The table above shows that in general, 4th semester PGSD undergraduate students have mathematical connection skills, especially in geometric shapes content, the average count is 62.49%, which is in the sufficient category.

Research question 2: what mathematical connection skills are still low in PGSD undergraduate students for geometric shapes content?
Of the four indicators of mathematical connection ability, PGSD undergraduate students have sufficient connection ability for the second and third mathematical connection ability indicators

however they still have low ability in connection using mathematical concepts in other fields/sciences which reaches 40.00%.

Research question 3: what mathematical connection skills do PGSD undergraduate students already have at high category for geometric shapes content?

The high mathematical connection ability possessed by PGSD undergraduate students for geometric shapes content is a mathematical connection ability between topics in mathematics of 83.33% in the high category.

DISCUSSION

In general, 4th semester PGSD undergraduate students have mathematical connection skills, especially in geometry materials, the average count is 62.49% in the sufficient category. This finding is different from the findings of research conducted by Suhandri and Nurdin, E (2017) which found that students of UIN Sultan Syarif Kasim Riau have high mathematical connection abilities. This difference is thought to be based on basic knowledge of mathematics between PGSD students and UIN Syarif Kasim Riau students. In addition to the results of Suhandri and Nurdin's research, the mathematical connection analysis focused on calculus material, while this research focused on geometric shapes content which is more applicable in everyday life.

PGSD students are prospective teachers who should have mathematical connection skills, because when carrying out their duties the teacher has the obligation to guide and train elementary school students to have mathematical connection abilities. This statement is supported by Ndiung and Nendi (2018) who state "Content of mathematics knowledge is important to be possessed by teacher in order to run mathematics instruction in creating joyful learning atmosphere." It can be said that it is so important for prospective teachers to have mathematical connection skills. However, based on the results of the mathematical connection ability test, PGSD students have not optimally mastered the four indicators of mathematical connection. This finding is in accordance with the opinion of Hafiz, et al (2017) that the lack of mathematical connection ability is caused by many things, one of which is because students are unable to connect the mathematical ideas that have been taught and the mathematical ideas that have just been learned.

The high mathematical connection ability possessed by PGSD UPI Cibiru undergraduate students for geometry material is a mathematical connection ability between topics in mathematics of 83.33% in the high category. This finding is different from the results of Yuniawatika's research (2018) which concluded that the mathematical ability between mathematical ideas is in the moderate category. This high ability of mathematical connections between mathematical topics, shows the mathematical literacy of PGSD students, especially semester 4, can be used as a basis for strengthening and improving the ability of mathematical connections which is still low, namely the ability of mathematical connections with other fields/sciences. Of the four indicators of mathematical connection ability, students PGSD Undergraduate Program has sufficient connection ability for the second and third mathematical connection ability indicators however, it still has a low ability in connection using mathematical concepts in other fields/sciences which reaches 40.00%.

With the results of this analysis, PGSD students must continue to be given the opportunity to practice solving problems related to mathematical connection skills, such as the ability to connect between mathematical topics, the ability to link conceptual and procedural knowledge, the ability to connect using mathematical concepts in life activities, the ability to connect using mathematical concepts in other disciplines, in order to become trained in dealing with, studying, and solving problems that require mathematical connection skills. Mathematical Connection Ability does not just appear in students, but needs to be developed (Dewi, N.R and Masrukan, 2018). Siregar and Edy Surya (2017) also emphasized that with mathematical connection skills, students' abilities in mathematics are expected to be broader. In addition, mathematical connection abilities can also improve students' cognitive abilities such as remembering, understanding, applying environmental concepts and so on. To be able to improve mathematical connection skills Sirait proposes based on the results of his research (2017) that by connecting mathematical concepts with other scientific concepts or everyday life, making mathematics

learning more meaningful and students' mathematical connection abilities are better. It is further said that a realistic context can help students acquire clear knowledge and skills because students have the opportunity to practice and learn directly, in other words a realistic mathematics education (RME) approach can help students see how mathematical ideas are interrelated. understanding the interrelationships of mathematical ideas, students value mathematics and do not consider mathematics a difficult subject. Thus, with the results of the analysis of the mathematical connection abilities of PGSD undergraduate students in this study, it is the basis for the consideration that learning Geometry and Measurement courses in SD needs to develop an approach , strategies, and learning methods that provide opportunities for students to practice solving problems, connecting mathematical ideas with procedures and other concepts both between topics in mathematics and with other sciences and facts in everyday life.

CONCLUSION

The conclusion is that the average mathematical connection ability of S1 PGSD students reached 62.49% in the sufficient category. The mathematical connection ability which shows is still low is the indicator of mathematical connection ability with other fields/sciences is 40.00%, and the ability shows high category is connection ability between topics in mathematics.

The results of the analysis of the mathematical connection abilities of PGSD undergraduate students in this study became the basis for the consideration that learning the Geometry and Measurement course in SD needs to develop approaches, strategies, and learning methods that provide opportunities for students to practice solving problems, linking mathematical ideas with other procedures and concepts. both in internal mathematics and with other sciences and facts in everyday life. In addition to applying approaches, strategies and learning methods, Muchayat (2011) said that to increase the effectiveness of learning mathematics, it is necessary to support the understanding of the teacher, students, the learning material being taught and also the interaction between the teacher and students and learning aids which play an important role in the learning process. Sanjaya (2010) states that "through a mature and careful planning process, the teacher is able to correctly predict the success to be achieved, and the learning process can be directed and regulated by the teacher.

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