

Analysis of Mathematical Connection Ability to Students' Learning Motivation in Advanced Mathematics Courses

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ABSTRACT

This study aims to learn how the students' mathematical connections are and discover the influence of the mathematical connections on students' motivation in advanced mathematics learning. The population of this research is the second-semester students of a state university in Yogyakarta, and the subject is 84 students. The instrument used was the question sheets on the mathematical connection ability on advanced mathematics materials, the questionnaire instrument, and the interview guidelines related to learning motivation. The data analysis used was the descriptive statistics analysis. The results of this study indicate that (1) the students' mathematical connection ability was low, (2) the influence of connection abilities on motivation was very low.

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1. INTRODUCTION

Education is a place in the establishment of human resources, which are expected to develop every potential possessed by students in the cognitive, affective and psychomotor fields through a process commonly referred to as the learning process (Wijaya, Dewi, Fauziah, & Afrilianto, 2018). The learning process can also be carried out outside the classroom as non-formal or informal education which has the same role in shaping the nation's personality, especially for university students majoring in elementary school teacher education.

Learning Mathematics is a scientific discipline related to the process of thinking in reasoning. Learning mathematics is a science that is carried out to obtain concepts by thinking rationally and sensibly (Isrok'atun, 2018). Mathematics is related to a structured thinking process, so it becomes a problem if someone studies mathematics but does not understand the previous mathematical concepts resulting in the assumption that mathematics is difficult (Surya, Zulfah, Astuti, Marta, & Wijaya, 2020). Meanwhile, basically, the concept of mathematics is a very important thing in everyday life, especially in the world of education. In everyday life we often apply mathematical concepts, without even realizing it is a mathematical concepts. For example, when someone is doing the chairman election of in an organization. The data from the election has counted the application of mathematical concepts in

everyday life, but not everyone comprehends that what he does is the application of mathematics in everyday life.

Students' mathematical connection ability is an ability to connect or link mathematical material in everyday life that is felt by students directly. Zuyyina et al. (2018) said that mathematical connection ability is the ability of students to be able to connect the concepts, principles or procedures contained in mathematics with mathematics itself, related to other fields of science and everyday life.

The usual contextual approach to learning done by the teacher created quite good students' mathematical connection abilities. This is in line with research conducted by Ulya, Irawati & Maulana (2016), which suggests that the conventional approach is significantly better than conventional learning in improving students' mathematical connection abilities with a significance level of $= 0.05$. From the study, it is concluded that the learning, which is usually done by teachers who use a conventional approach, they can make students' abilities increase or students can understand them better (Aritonang, 2018).

The research conducted by Setiawarni (2019) stated that mathematical connection skills could be increased if learning is associated with everyday life. This is in line with research conducted by Nurfalah, Irawati & Isrok'atun (2017), which suggests that a contextual approach with "Unique Boy" media significantly affects connection ability. The increasing level reached 0.19 based on the results of the average score. This is because the contextual approach provides learning that facilitates students to relate the material or knowledge they have with everyday life. {Formatting Citation} states that students have learning motivation if they pay close attention to the lesson and read the material so that students can understand the learning content.

The purpose of this study is to find out students' mathematical connections, ability and students' motivation in learning advanced mathematics. The motivation of this research is to improve the current advanced mathematics learning system because as is known now, the learning is done through distance or online learning (Hilmiatussadiah, 2020).

The results of this research are reinforced by the results of research by Dewi et al. (2019) and Wijaya et al. (2020). Unfortunately, in reality, learning mathematics is considered the most difficult to understand. Moreover, the Elementary School Teacher Education (ESTE) students themselves did not all come from the Mathematics and Natural Sciences department when they were in high school but from various majors, so it was difficult for students to solve story problems, let alone work on Higher Order Thinking Skill (HOTS) questions. Students' problem-solving skills were also still lacking in learning mathematics. Furthermore, learning is carried out remotely, causing new problems such as network conditions in their respective areas, learning support devices, and human resources. Therefore, learning motivation will be adjusted to the environment around students, and the resulting learning outcomes will be very different from before because the learning environment among students is different.

The concept of learning mathematics in everyday life makes mathematics studied in formal education starting from the elementary school level to the college level. From every level of education, basic mathematical competencies can be used as guidelines for developing the ability to connect mathematics learning in everyday life. The targeted mathematical abilities in the mathematics curriculum are mathematical understanding, mathematical problem solving, mathematical reasoning, mathematical connections and mathematical communication (Kenedi, Hendri, Ladiva, & Nelliarti, 2018). In this opinion, the ability of mathematical connections is very important to be developed so that a person is able to find a good relationship between mathematical concepts, everyday life and other fields that make learning more meaningful. Through the ability of mathematical connections, the concepts that have been previously studied are not forgotten and left as a separate part of the concepts that have not been studied, where the concepts that have been studied will become basic knowledge in understanding other concepts.

Motivation is one of the supporting tools to generate enthusiasm for study and able to help a more effective learning process. Meanwhile, according to Yanti (2019), motivation has an important role in

learning. If the motivation is low, the learning potential will also decrease. Motivation is a psychological impulse that is carried out to get an action in achieving the goals that have been set (Fauzia, 2017). Research conducted by Kaharuddin (2020) states that motivation is the basic impulse that moves a person to enter a process and is able to maintain their behaviour to reach their goal.

Motivation can also reflect the behavioural characteristics of students, and how they have a stable interest while carrying out learning activities (Juliya, 2021). When the learning process takes place, there is an interaction between lecturers and students that allows lecturers to recognize the types of characteristics and potentials possessed by students (Putri, 2017). Motivation plays an important role in strengthening students' ability to solve problems. Students must have determination, optimism, and think about the future in order to achieve learning goals (Handayani, 2020). So it can be concluded that motivation and learning are an inseparable combination because, through proper learning motivation, students can explore deeper knowledge. Andriani & Rasto (2019) state that students can do better in the learning process if they are motivated and will learn wholeheartedly without being burdened. Therefore, this study analyzes the mathematical connection ability to students' learning motivation. Every ESTE student should have mathematical connection skills because in teaching mathematics to elementary school students, the materials should be linked in a concrete context, or the learning is associated with objects in students' everyday life.

2. METHODS

The research method used is descriptive quantitative research with a survey design. With the sample that will be used in this study, namely students majoring in Elementary School Teacher Education in the second semester of Class G as many as 42 students and as many as 42 students, the samples used in this study were 84 students from a State University In Yogyakarta.

This research is a quantitative descriptive study with a survey design (Cross-Sectional Survey Design), which can explain the conditions and practices in learning based on the facts that occur in the field (Setiawan, 2018). This research was conducted from March to June 2021 at Ahmad Dahlan University. The population in this study were students majoring in Elementary School Teacher Education at Ahmad Dahlan University in the second semester. The samples used in this study were 84 students from Ahmad Dahlan University, consisting of 42 students from Class G, and another 42 students from Class H.

To measure the effect of students' mathematical connection abilities on motivation and learning outcomes, the instruments used were in the form of descriptions of questions and questionnaires related to students' mathematical connections in advanced mathematics. The research instrument itself is a tool used to collect research data, so that a problem that has been formulated can be solved based on the data that has been gained including the types of test and non-test instruments (Azwar, 2020). The instruments used were test questions, questionnaires, and interview guideline. The test questions were used to measure students' mathematical connection ability based on the materials that have been given in advanced mathematics courses, questionnaires and interview guidelines were used to measure student learning motivation. The instrument reliability is calculated by the alpha coefficient formula. According to Azwar (2020), the alpha coefficient is described as follows:

Table 1. Coefficient Alpha

Range	Category
0,600 - 0,800	Very high
0,400 - 0,600	Hihgh
0,200 - 0,400	Low
0,000 - 0,200	Very low

Data analysis was carried out in this study by using descriptive analysis. It was done by describing the data obtained in accordance with the research indicators. In this study, two data processing techniques were used, namely quantitative data processing and qualitative data processing. Quantitative data processing is the processing of data expressed in the form of numbers, such as when processing the results of students' abilities in mathematical connections in advanced mathematics learning, the values obtained by students and the results of distributing questionnaires will also be processed quantitatively. While qualitative data processing is in the form of description. It was used in processing the data from the results of mathematical connection abilities, the results of questionnaires and interviews. The data obtained will be explained descriptively.

3. FINDINGS AND DISCUSSION

3.1. Findings

The description of Students' Mathematic Connection Ability

The student's mathematical connection is an ability possessed by a person to solve a challenge by connecting a mathematical concept with everyday life. Mathematical connection ability is also an ability that aims to enable students to develop higher-order thinking skills. According to (Isnaeni, Ansori, Akbar, & Bernard, 2018), there are several indicators that are included in mathematical connections, namely looking for correlation as representations of concepts with procedures, understanding the relationships among mathematical topics itself, using mathematics in other fields in everyday life, equivalent understanding representations of the same concept, looking for connections from one procedure to another, and in equivalent representation, using connections among mathematical topics itself and between mathematical topics and other topics.

Learning outcomes are an evaluation action that can reveal aspects of the thinking process, aspects of values or attitudes, and aspects of skills within students. It means the learning outcomes could reveal the depiction of student achievement holistically after going through the learning process (Raharjo, 2021). Therefore, the learning outcomes obtained by each student are shown from an interaction of acts of learning and are usually indicated by the test scores obtained by each student. Learning outcomes are also closely related to the abilities possessed by each student at the end of learning. The learning outcomes of each student will definitely be very different from one another because the learning outcomes depend on the understanding possessed by students in the learning process.

The descriptive statistical analysis of the data shows the results of students' abilities in mathematical connections by first grouping them according to the type or level of ability of each class and adjusted the indicators of mathematical connections. In this study, the results of the mathematical connection diagnostic test given to students consisted of ten questions. Diagnostic tests can determine the mathematical connection ability possessed by each student. Completion of each question is an acceptance of the challenge for students to be skilled in solving problems. Students need to be able to master the knowledge, attitudes and skills in the learning process. In this case, being able to complete a challenge is not easy. It was done by using reasoning or from the lowest level to the highest level of thinking. As for the mathematical connection abilities of the second-semester students of Ahmad Dahlan University in advanced mathematics courses, different results were obtained for each material presented. It could be seen in the following table:

Table 2. Results of Students' Mathematic Connection Ability in Advanced Mathematics Courses

Indicator	No	Symmetry	1st transformation	2nd transformation	1st probability	2nd probability	Maximum Score
1	1	2,98	4,76	8,33	10,71	6,55	1
	4	1,79	0,00	0,00	1,79	0,00	1
2	2	1,79	0,00	0,00	4,76	2,38	1
	3	13,69	11,90	11,90	16,07	12,50	1
3	7	17,86	20,83	19,05	20,83	17,26	2
4	8	10,12	7,14	3,57	7,14	5,95	1
	9	1,79	0,00	0,00	1,79	0,00	1
5	10	2,98	4,76	8,33	8,93	6,55	5
6	5	19,05	20,83	19,05	20,83	19,05	1
	6	4,17	1,19	5,36	5,36	5,95	1

Based on table 1, it is found that students have more dominant and equally superior mathematical connection abilities, namely the ability to use mathematics in other fields of study in everyday life and to use connections among mathematical topics and between mathematics topics and other topics on 1st transformation material as much as 20.83%, the 2nd transformation, and the 1st probability, but on the material of symmetry and the 2nd probability the dominant indicator is using connections among math topics and between math topics and other topics. Overall, the most superior indicators for each learning material are using connections among math topics and between math topics and other topics.

Most students are able to understand a problem, and some students are able to solve problems well. So that most students can answer the question correctly. This is in accordance with the opinion of Kenedi et al. (2018), who stated that mathematical connection is a skill that must be built and learned because good mathematical connection skills will help students to be able to know the correlation of various concepts in mathematics and apply mathematics in everyday life. It is also in line with Bunga, N & Isroka'atun (2018), who stated that mathematical connection abilities could be increased if the learning is related to students' daily life. By linking the lesson to the daily life experienced by students, students will easily understand the material.

In linking the events of everyday life, students need to find the connection as things that are seen as real (representations), understand the relationship between mathematical topics, use mathematical understanding in everyday life, understand what is seen as comparable (equivalent) with the same reality, looking for ways to relate one event to another in life in a comparable way (equivalent representation), and using the connection between mathematical topics or with other topics. Students are said to have been able to relate the event if they can solve related questions well and write down answers correctly and comprehensively. Most students are able to understand the questions, but students have a wrong perception of what is being asked in the questions. Some students are not able to try to understand the question, let alone answer it. However, most students are already able to understand the question even though in writing the answer, many students have a wrong perception of what is being asked on the question.

As stated by Sertiawarni (2019), students' mathematical connection abilities are categorized as low, by meeting two indicators of achieved mathematical connections. Meanwhile, the students' mathematical connection ability which is categorized as moderate is by fulfilling the three indicators of mathematical connection ability that are achieved. And students' mathematical connection abilities can be categorized as high if they meet at least four indicators of achieved mathematical connection abilities.

Learning Motivation

Motivation is the overall drive within students that will ensure the continuity of student learning activities and provide direction to their learning activities so that the desired goals of students can be achieved. According to Maulanal (2019), motivation is divided into two types, namely motivation that comes from within a person (intrinsic motivation) and motivation that comes from outside one's self (extrinsic motivation).

To measure student learning motivation in this study, the indicators by Suharni & Purwanti (2019) was used as a guide. There are 8 indicators used, including (1) activity duration, (2) activity frequency, (3) persistence in activities, (4) perseverance, tenacity and ability to face obstacles and difficulties, (5) dedication and sacrifice to achieve goals, (6) level of aspirations to be achieved with the carried out activities, (7) achievements or outputs achieved from the carried out activities and (8) direction of attitude towards the target of the activity. Of the 8 indicators, 20 statements were made in the form of a closed questionnaire given to 84 students. The data processing for the questionnaire is done using the percentage technique based on the answers from students according to each indicator of learning motivation and the average is drawn from the whole answers to get the interval of student motivation. The results of the motivation questionnaire obtained in this study are as follows:

Table 3. Motivational Questionnaire Results

Indicators	Questions	Score%
Duration	Mathematic lessons were very long (-)	58%
	I learn Math for 3 hours every day at home (+)	33%
Frequency	I can't solve a Math problem (-)	15%
	I often do Math practice outside of the classroom (+)	23%
Persistency	I do the Math assignment as instructed by the lecturer (+)	34%
	I always do the Math assignment correctly (+)	8%
	I'm happy when I get a math assignment (+)	3%
	I always do the assignments given by the lecturer myself (+)	21%
Perseverance, and Tenacity	I always cheat when I have assignments (+)	8%
	I ask the lecturer or friends if there is material that I don't understand (-)	33%
	I never ask the lecturer even if I don't get the materials (-)	68%
Dedication and Sacrifices	I dare to solve the problems if the lecturer asked (+)	9%
	I always save my money to buy Mathematic coursebook (+)	3%
	I never buy Mathematic coursebook (-)	52%
Aspiration	I'm not confident to think that Mathematic has lots of benefits for me (+)	3%
	By keep learning Mathematic, I could understand other subjects easier (-)	10%
Achievement	I get compliments because of my good grades in Math (+)	9%

Direction of Attitude	I diligently learn Math, but I'm not getting higher rank in the classroom (-)	55%
	I follow Math lessons wholeheartedly(+)	33%
	I can't follow Math lessons wholeheartedly (-)	72%

Based on table 3 regarding the results of learning motivation obtained by students during learning, it can be concluded that the average of the motivation obtained is 28% or is in the low category. This can be caused due to online learning, where the network constraints most students. So that when learning takes place, students do not take part in learning as a whole. Even at the time of learning, most students did not activate the camera and there was no response from the student when they're being called.

3.2. Discussion

Learning motivation acts as a driving force in a person as a whole which can generate intentions to encourage students to carry out learning activities so that they are able to achieve their desired goals (Cahyani, 2020). According to Tokan & Imakulata (2019), learning motivation is one of the factors for the good learning outcomes, because it makes students tend to get learning outcomes which in accordance with learning objectives.

In fact, most students do not like learning mathematics, unfortunately, students' motivation to learn is very low. Especially now that learning is done virtually which is not directly seen by every student when learning is carried out, even most students do not turn on the camera when doing the learning process. There are still students who must be given a stimulus first in order to follow the lesson well. At this time, learning is carried out virtually, which is one of the causes of lack of motivation to learn in students. Students may have high learning motivation if they are active in the learning process by paying attention to the presentation and have high enthusiasm in participating in the learning process, and able to apply the learning both for themselves and by sharing it with others.

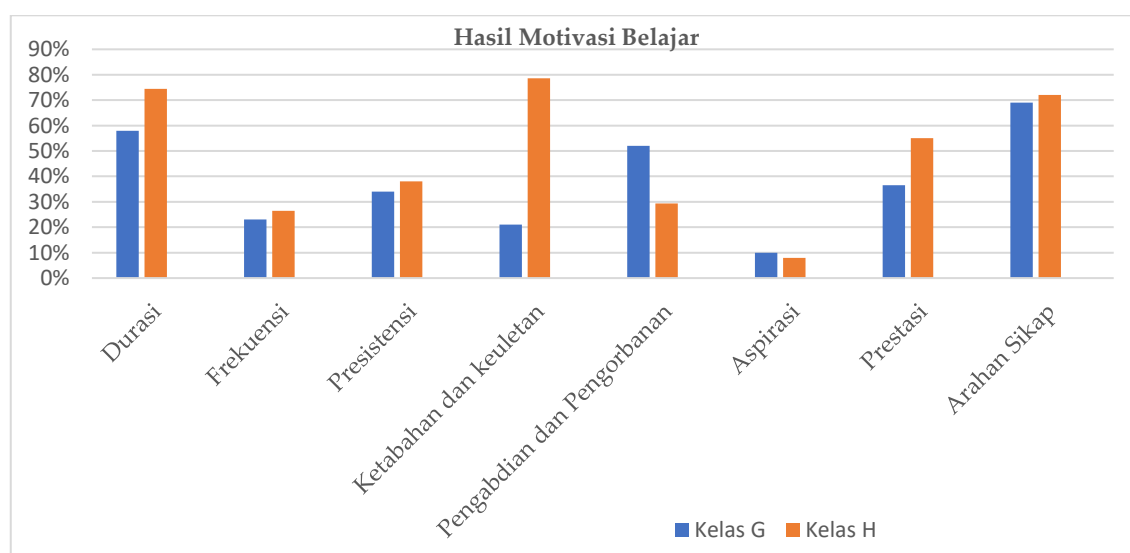


Figure 1. Motivation Result during the Research

Based on the graph above, the average learning motivation obtained by students is 42.93 in the low category. So it can be concluded that students' mathematical connection abilities have not been embedded so that the motivation obtained in learning advanced mathematics is still low.

Thus it can be concluded that the learning motivation of each student is different because it depends on the students themselves and the environment around them. Motivation should involve processes that provide energy, and direction and maintain behaviour to be able to follow the learning process well (Suharni & Purwanti, 2019). The opinion of Mc Donald in Putri & Kurnia (2017) stated that motivation is a change in energy in a person's personality which is characterized by the emergence of affective (feelings) and reactions to achieve goals. Thus the emergence of motivation is marked by a change in a person's that can be realized or not. Therefore, motivation plays an important role in students carrying out the learning process so that students can solve the problems given in the courses. Furthermore, students must also have a strong enthusiasm and a sense of optimism that they can achieve learning goals well. Therefore, it can be concluded that learning motivation is a combination of motivational and learning components that are closely related to each other and cannot be separated so that with the existence of learning motivation students can understand the courses well.

This is reinforced by the results of interviews conducted with students who stated that "mathematic is difficult to learn because it is difficult to understand the formula and difficult to remember it". From this opinion, it could be happen because mathematics is abstract learning. Meanwhile, for someone to understand something, they need to learn using concrete objects or things, therefore the ability to connect mathematically plays an important role in growing motivation to learn in a person because of the ability to connect mathematically in studying Mathematics is associated with everyday life, among the math topics as well or with other topics, even always associated with concrete objects so that students can understand mathematics easily. Thus learning motivation can grow if someone understands how to learn. Therefore by having mathematic connection ability, the learning motivation will grow because learning using mathematical connections is closely related to one's daily life. Furthermore, if learning is connected with various things around us or other topics, then learning Math will be easy to understand. It will be considered no longer difficult to learn and to understand the formula. Therefore, learning mathematics, which is connected to various things, is necessary to achieve the learning objectives properly, especially in learning mathematics.

4. CONCLUSION

Based on the findings and discussion on the effect of mathematical connection ability on motivation and learning outcomes of the 2nd-semester ESTE students of Ahmad Dahlan University, it can be concluded that students' mathematical connection abilities in advanced mathematics courses that have been carried out towards the 84-second semester students obtained average results of 20.83% which categorized as low. It can be said that most students still have difficulties and misperceptions with what is being asked in the questions. Because learning is done virtually, most second semester students have difficulty understanding the materials caused by several factors such as being constrained by the internet network, do not turn on the camera in learning process, no answer while being asked by the lecturer, motivation from within students themselves and the environment around them. Therefore, in the virtual learning process, it must be properly prepared so that it can attract the attention of students in the learning process and the objectives in learning can be achieved properly. Most students don't even turn on the camera when learning is being carried out, and there are still students who must be given a stimulus first in order to follow the lesson well. At this time, learning is carried out virtually, which is one of the causes of students' lack of motivation to learn. Students can be said to have learning motivation if they are active in the learning process by paying attention during the presentation time, have high enthusiasm in participating in the learning process, and can apply the learning both for themselves and by sharing with others. The average motivation generated during the learning takes place is 42.93% which is still in the low category. In this study, the students' mathematical connection abilities obtained were low, so the motivation was also low, in which the mathematical connection

abilities were related to the learning motivation. Thus, learning motivation on students' mathematical connections is still in the low category.

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