Mathematical internal connection ability based on personality types of sensing and intuiting

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Abstract. Learning mathematics is related to the connection ability. The mathematical connection ability is needed by the students to connect each mathematical topic, the other learning subjects and daily problems. The personality types of sensing and intuiting is the ability to process information. Every student has a different in receiving and processing information. It is cause by personality type, which makes the mathematical internal connection ability of student different. The aim of the study is to describe student’s mathematical internal connection ability based on personality types of sensing and intuiting. This research used the qualitative method. Subject in this study were four students of class VII in Junior High School which selected using purposive sampling. The results obtained that the student with intuiting type has more mathematical internal connection ability than the student with sensing type. Based the result of the research, it can conclude that the student who can connect each concept in same topic in mathematics may not have the ability to connect each concept on the other topics. Most of the students were only implementing the formula taught at school. Students did not try to explore a concept to the other topic in mathematics.

1. Introduction
Mathematical connection ability is an essential part that must be emphasized at every grade of education. Every student must have and develop the ability of mathematical connection, because learn mathematics at school, one topic can relate to the other topics in mathematics. One of five basic mathematical competency standards developed from NCTM is the mathematical connection ability [1]. In Bruner’s theory, the student must understand the relationship of concepts in mathematics because mathematical concepts are related [2]. The ability of mathematical connection contained in objectives of the curriculum mathematics learning in Indonesia, among others, understanding mathematical concepts, explaining the interrelationships of concepts and applying concepts accurately, precisely, and efficiently in problem-solving [3]. It means that student who understands well the relationship between mathematical concepts, so understanding these concepts is more durable and able to apply the concepts to other problems or situations. Without good mathematical connection ability, a student is just remembering and memorizing a formula. Thus, it may be difficult when he is studying a new concept in mathematics.

Mathematical connection ability can be categorized into four aspects, namely: (a) inter connection of mathematical topics that link between concepts or principles in the same topic, (b) connections between
mathematical topics that link material in a particular topic to material in other topics, (c) the connection between matter and science other than mathematics, and (d) connection with daily life [4]. In other words, the aspect of connection is not only a concept in the same topic but also connection with other subjects and daily life problems. The classification of mathematical connection abilities related to internal connections includes the connections between mathematical topics, while the external connections include the connections with other subjects or connections with daily life [1]. Therefore, the ability of mathematical connections is the interrelationship between ideas, concepts, mathematical theorem in some topic or other topics and the relationship of mathematical content with the content of other fields of study or everyday problems.

The result of the research shows the low level of mathematical connection ability possessed by the students, the average percentage of mathematical connection ability of junior high school students is only 34% [2]. Meanwhile, the other research [5] shows that the level of mathematical connection ability of students to connect mathematics and daily life obtained a percentage of 51.11% and the relationship between objects with mathematical concepts obtained a percentages of 17.78%. It happened because the students tend to remember and memorize a formula, so they feel difficult when trying a new problem with the same formula. Memorizing knowledge in no way provides a useful for exist ideas [6]. Because the level of mathematical connection ability of student to understand relationship between objects with mathematical concepts is low so this research focuses in mathematical internal connection ability.

Every student has different mathematical connection ability, because they receive and process information differently, that are sensing and intuiting [7]. The structure of personality is formed by the functions of psychologies. MBTI (Myers-Briggs Type Indicator) identifies how people have choices to receive information that is focused on personality types of sensing and intuiting [8]. Sensing or intuiting relates to the tendency of someone to receive and process information, whether through possibility or premonition. The sensing tends to see the tangible, practical facts of experience and life, whereas the intuiting tends to see the possibilities, relationships, and meaning of experience [10]. The person who is easier to receive and process information through the senses is usually careful with the facts but hard to try finding the meaning behind the facts. Meanwhile, the intuiting person can quickly find the meaning of facts, but sometimes inaccurately and erroneously [9].

The problem in this study is how the student’s mathematical internal connection ability is to understand the relationship between concept in the same topic and other topic based on personality types of sensing and intuiting. The aim of the study is to describe student’s mathematical internal connection ability based on personality types of sensing and intuiting.

2. Methods
This research used a descriptive qualitative method and it was conducted in Grade VII students of State Junior High School 16 Surakarta in the academic year of 2019/2020. The subject was selected by using purposive sampling so that the researchers can choose the individuals to be the research subjects and understand the focused phenomena of the research [11]. It involved a total of 4 students representing sensing and intuiting personalities.

The data were collected by using the instruments of mathematical internal connection test and personality classification questionnaire. The mathematical connection test used a description test containing questions related to the mathematical internal connection indicator. The mathematical internal connection test was conducted to find out the students' mathematical connection ability in linking concepts within topics and between topics in mathematics. Furthermore, it used a personality classification questionnaire developed by Myers-Briggs. The questionnaire was designed in the form of checklist enabling the subjects to choose one of two alternative responses that fit with their character. After they selected the appropriate responses, then the responses were calculated and grouped based on the personality types.

The validity of the data used the triangulation method. The triangulation method emphasizes the use of different data collection methods for the same data [12]. The collected data were analysed by using data reduction, data presentation, and conclusion. Data reduction was selecting, focusing, and simplifying the data obtained. The data presentation was processing information in the form of narration and the result of data reduction was to conclude.
3. Result and Discussion
The test is conducted to determine the mathematics connection ability, but this research is focused on mathematical internal connection ability. The mathematical internal connection ability consists of 2 questions using 2 indicators, namely (1) interconnection of mathematical topics that link between concepts in the same topic, and (2) connection between mathematical topics that link material in particular topic to material in other topics. Based on the indicators of mathematical internal connection ability, the valid data were obtained from students’ mathematical internal connection ability. The valid data of the mathematical internal connection ability with sensing and intuiting personality are presented in Table 1 below.

Table 1. Data ability students’ mathematical internal connection that is valid with the type of personality sensing and intuiting.

| No | Indicator of Mathematical Internal Connection Ability | Question | Sensing Personality Type | Intuiting Personality Type |
|----|--------------------------------------------------------|----------|--------------------------|---------------------------|
| 1. | To solve problem in inter connection of mathematical topics that between concepts in the same topic. | How much the angle of number 3? | Students record the same information that can be obtained and then solve problem same as what was recorded. | Students record information in their language and solve problem with their own ideas. |
|    | ![Diagram](image1.png)                                  |          |                          |                           |
| 2. | To know connections between mathematical topics that link material in a particular topic to material in other topics. | How much the difference between x and y? | Students try hard to link something that is interrelated. | Students use imagination to link things that are interconnected. |
|    | ![Diagram](image2.png)                                  |          |                          |                           |

Based on Table 1, students with sensing personality are different from students with intuiting personality types in solving mathematical problems in the same topics. The students with sensing personality wrote exactly what they have been taught, while intuiting students answered with their own language. It happens because sensing personality is an impersonator and relating to procedural knowledge [13]. In the second indicator, students with intuiting personality are easy to connect something because they have a good imagination skill.

Mathematical connection test that carried out at the class VII at the senior high school in Surakarta were 30 students. The result obtained from 4 subjects who will be analysed mathematical internal connection ability based on personality types of sensing and intuiting. Some of the students’ answers can be analysed as follows. The result of the students’ mathematical internal connection tests based on the sensing and intuiting personalities of each subject is presented below.
Figure 1 shows that student with sensing personality wrote coherently what he knew and the problems being asked without changing the mathematical symbols and wrote down the units of degrees completely. This means that student recognize ideas of mathematical in the same topic. The student also use the relationship of mathematical ideas in the same topic, it’s seen that student can connect same concepts to the material of line and angles. However, in the last step the student is less able to identify mathematical concepts between the same topics so as to produce a relationship with each other as a whole. It can be seen that student forgot that the overall angle of triangle is $180^\circ$, but in problem solving the student actually reduce the results of previous solutions. It indicates that the student can define and work on a given problem based on what has been exemplified before, but he finds it difficult in determining the solution of the problem because he is unable to link the concepts between mathematical topics.

Figure 2. Student’s answer with intuiting personality for first indicator
The result of the student with intuiting personality shows that the student can recognize the relationship between concepts on one topic and write the links. Based on Figure 2, although the student was not careful in writing degrees, he could use mathematical concepts to solve problems and convert them into mathematical symbols. It indicates that the student with intuiting personality can define the link of concepts using conceptual relations with the appropriate procedures.

![Figure 2](image)

**Figure 3.** Student’s answer with sensing personality for second indicator

The result of the student with sensing personality for the indicator between mathematical topics can be seen in Figure 3. This figure shows that student are not able to recognize mathematical ideas between concepts in certain topics with other topics, it can be seen that student stop at the equation and do not continue to look for the value of y. in addition, the student is not able to use the relationship between mathematical ideas between concepts in certain topics and other topics. At this stage the student did not find the value of y, the student was looking for nor could the student cannot find determine the value of x. This indicates that student has difficulty identifying mathematical concepts between concepts in certain topics and other topics so that student do not result in a comprehensive relationship with each other and cannot solve a problem.

![Figure 3](image)

**Figure 4.** Student’s answer with intuiting personality for second indicator
In contrast to the result of the student with sensing personality, the student with intuiting personality could define and use mathematical concepts well. Based on Figure 4, the student is able to recognize mathematical ideas between concepts in certain topics with other topics, because student is able to determine the value of $y$ correctly. The student is also able to use the relation of mathematical ideas between concepts in certain topics with other topics. At this stage, even though there are calculation errors, student is able to use algebra in the material of lines and angles. It can be seen that student can determine the value of $x$ they are looking for. The student also understand the purpose of the problem, which is to find the difference between $x$ and $y$. This indicated that student is able to identify mathematical concepts between concepts in certain topics with other topics so as to result in a comprehensive relationship with each other and can solve problems.

Based on the analysis above, it can be said that the students’ mathematical internal connections ability is affected by the personality types. Students with intuiting personality are better at linking concepts to the same mathematical topic. Likewise on the problems that require the ability to link a concept of a certain topic with other topics in mathematics. In the other hand, the students with sensing personality have difficulty to connect different mathematical topics, but on the same topic they can answer in accordance with the notes provided. In line with the research which stated that students with sensing personality have moderate mathematical connection ability as they tend to focus on the procedure of the material in the question and it is in line with the character of personality sensing, namely relates to procedural knowledge [14]. Although the students of sensing personality type like to record the same information and use procedural knowledge in solving problems but it does not guarantee that these students have procedural abilities in solving problems correctly [13].

4. Conclusion
Based on the research, it can be concluded that the students’ mathematical internal connection ability are well. Both of students with sensing or intuiting understand the relationship between mathematical concepts in same topic, even though sensing personalities are not as well as intuiting personalities. Students with intuiting personalities understand the relationship between mathematical concepts with another topic, in contrast to the students with sensing personality who have not been able to connect the mathematical concept in topic with other topics. The process of receiving and processing the information is important for students, because if students catch the wrong information, they will connect something wrong continuously. Therefore, it is important to know the personality of students to improve mathematical internal connection ability.

5. References
[1] NCTM 2000 *Principles and Standards for School Mathematics* (United State of America: NCTM)
[2] Saminanto and Kartono 2015 Analysis of Mathematical Connection Ability in Linier Equation with One Variable Based on Connectivity Theroy *International Journal of Education and Research* 3 259-270
[3] Hendriana, Rohaeti, and Sumarmo 2018 *Hard Skill dan Soft Skill Matematika Siswa* (Bandung: PT Refika Aditama)
[4] Kitsantas A 2002 Test Preparation and Performance: A Self-Regulatory Analysis *Journal of Experimental Education* 4 231-240
[5] Nenta D S and Edy S 2017 Analysis of Students’ Junior High School Mathematical Connection Ability *International Journal of Science Basic and Applied Research* 33 309-320
[6] Walle J A 2008 *Matematika Sekolah Dasar dan Menengah: Pengembangan Pengajaran* (Jakarta: Erlangga)
[7] Sukmana A 2012 Berpikir Intutif dan Implikasinya pada Pembelajaran Matematika *Prosiding Seminar Nasional Pendidikan Matematika* 1 39-60
[8] Zaman S dan Sandi I A 2009 *Myers-Briggs Type Indicator* (Jakarta: Visimedia)
[9] Baron R dan Elizabeth W 2007 *Mengenal 9 Kepribadian Manusia dengan Lebih Asyik* (Jakarta: Serambi Ilmu Semesta)
[10] Felder and Dietz 2002 The Effect of Personality Type on Engineering Student Performance and *Attitudes Journal of Engineering Education* 9 2
Acknowledgments

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