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Mathematical Connection Ability viewed from Cognitive Style and Gender in the CONINCON Learning (*Constructivism, Integrative & Contextual*)

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Abstrak

Students have different characteristics both in gender and cognitive style. This difference also has an impact on students' mathematical abilities, especially mathematical connection abilities. Mathematical concepts are related to each other. Mathematical connection skills can help students to link between mathematical concepts so that students do not learn them separately. The purpose of this study is to describe the ability of students' mathematical connections in terms of cognitive and gender styles in the CONINCON learning model. This research is a mixed-method type sequential exploratory research, which is a sequential combination of qualitative to quantitative. The population of this study was all students of class VIII of SMP Negeri 18 Semarang. The subject of this research is class VIII D as the experimental class using the CONINCON learning model and class VIII C as the control class. Taking research subjects based on reflective & impulsive cognitive style categories and male & female. The results showed that the results of mathematical connection ability in terms of cognitive and gender styles varied. This is shown from the 8 students studied, namely 2 students in the reflective male category, 2 students in the reflective female category, 2 impulsive male students, and 2 impulsive female students.

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INTRODUCTION

Mathematical connection ability is the ability to connect between mathematical topics, mathematical topics with other sciences, and mathematical topics with real-life (Nugraheni & Junaedi, 2019). Most students have difficulty understanding the purpose of a given problem and are not careful in their mathematical calculations (Mulbar *et al*., 2017). Based on the results of the 2018 PISA survey in mathematics, Indonesia is ranked 74th out of 79 countries. Indonesia is under the International average score with a score of 379. While the International average score is 489 (PISA, 2018). This shows that the ability of HOTS mathematics in Indonesia is still low.

The reason for the decline in the quality standard of mathematics education is due to the lack of ability to connect with other fields, the environment, and only conceptual teaching methods (Arthur *et al*., 2017). Students should often be presented with questions about the ability of mathematical connections (Ayu *et al*., 2016). The reason of the low mathematical connections according to some studies is the lack of mastering the mathematical prerequisite material and the material being studied (Afifah, 2017), students are not accustomed to learning to use the concept of mathematical connections (Karyanto & Mampouw, 2018), learning that is less building students' mathematical connection skills (Supriyadi *et al*., 2017), and students are less invited to construct, while the teacher does not associate mathematical concepts with other material and the surrounding environment (Saminanto *et al*., 2018).

Mathematical connection ability is one of the abilities that students must achieve from the elementary level to class XII. The many concepts in mathematics make connection skills important to apply so that mathematics is not understood separately (Widiana *et al*., 2017). NCTM (2000) said that the ability of mathematical connections is the ability of students to associate events in everyday life with other subject matter and link between concepts in mathematics. The indicators are (1) connecting between mathematical topics; (2) connecting mathematical topics with other subjects; and (3) connecting mathematical topics to daily life.

Every concept is interconnected with other concepts in mathematical connections. students in connecting ideas are also different. In order to understand how students learn, one of them is cognitive styles (Prihastanto & Fitriyani, 2017). Individual differences affect learning outcomes namely gender and cognitive style (Yaman *et al*., 2015). Cognitive style means the methods preferred in the process of getting information to respond to a task (Mulbar *et al*., 2017). Likewise what Warli (2010) said that cognitive style is an individual characteristic in thinking, remembering, organizing, and solving a problem.

According to Abdurrahman (1999), the cognitive style category of great concern in children's learning difficulties is reflective and impulsive cognitive style. According to Jerome Kagan, children who are quick to solve problems, but are not careful so answers tend to be wrong are called impulsive cognitive styles. While children who are slow in solving problems, but careful, so the answers tend to be called reflective cognitive style (Putri *et al*., 2017). This cognitive style focuses on the level of accuracy. The measuring device uses MFFT (*Matching Familiar Figures Test*) which was developed by Warli.

Besides cognitive style, other individual differences are gender, age, and education level (Lin *et al*., 2018). According to Communion, the term gender refers to the economic, social, political, and cultural fields related to men and women (Hodiyanto, 2017). Gender can influence someone in solving a problem (Pratiwi, 2015). Gender is a distinguishing factor in thinking and determining the solutions to the problems taken (Nur & Palobo, 2018). Gender in this study is only limited to gender identity, namely men and women.

The demands of the times require students to have high-level thinking skills. Teachers play a high role in changing the learning process (Ernawati, 2016). One ability that can connect mathematics with other fields of science and real life is the ability of mathematical connections. Therefore the need for learning models that can develop students' mathematical connection skills. In this study using the CONINCON learning model.

According to Saminanto *et al*. (2018), the CONINCON learning model is a learning model that is based on the approaches of constructivist, integrative, and contextual. CONINCON was taken from *Constructivistic* (CON), *Integrative* (IN), and

Contextual (CON). This learning model is based on indicators of mathematical connections, namely connections between mathematical topics, mathematical connections with other sciences, and mathematical connections with real life. The CONINCON learning model is a learning model that implements the approaches of constructivist, integrative, and contextual to foster mathematical connection skills. This model has five phases, namely, construct construction phase, construct phase, integrative phase, contextual phase, and reflection phase.

The purpose of this study is to describe the ability of students' mathematical connections in terms of cognitive and gender styles in the CONINCON learning model.

METHOD

The research method used in this study is a mixed-method with a merger of qualitative and quantitative research (Creswell, 2012). *The mixed-method* used is *sequential exploratory* which is mixed research which is more inclined to the qualitative process. The study began with a qualitative phase with the collection and analysis of qualitative data, then continued with a quantitative phase (Creswell, 2014).

This research was conducted at SMP N 18 Semarang in May until June with a population of eighth-grade students even semester 2018/2019 academic year. A population of 8 classes was chosen randomly so that the subjects of class VIII D were obtained as an experimental class using CONINCON learning and class VIII C as a control class.

The selection of research subjects used the MFFT (*Matching Familiar Figure Test*) instrument developed by Warli. That way, students will get reflective and impulsive cognitive styles. The instrument of MFFT can be shown with the main image and several varied images. There is only one picture from several varied images that are the same as the main image (Ardani, 2017).

The way to work on MFFT is that students choose one picture from several different images, which are the same as the main picture. The observed variables are the number of errors and the average time of the first image selection. The total number of test items is 13. The variables that are considered in the test are the time (t) used every time the answer and frequency (f) answer until it is correct. Every time a child answers, the time from the first picture is displayed and the frequency of answers until the answer is correct. The results of the time and frequency response data are used to measure reflective and impulsive cognitive styles (Warli, 2009).

The research subjects were chosen based on the categories of impulsive & reflective cognitive styles and male & female gender. The criteria are (1) reflective students are taken from the reflective student group with the longest and most careful record of time (most correct) in answering questions and (2) impulsive students taken from the group of impulsive students whose time is the shortest but the least accurate (most wrong) in answering questions. This is so that the selected students are truly reflective or impulsive student categories (Mahendra & Mulyono, 2016).

The research subjects obtained were 8 students from 36 students of class VIII as an experimental class. Research subjects of 8 students are 2 male students who have reflective cognitive style, 2 female students who have reflective cognitive style, 2 male students who have impulsive cognitive style, and 2 female students who have impulsive cognitive style.

Data collection techniques in this study are tests, interviews, observations, and documentation. The instruments used in this study were students 'mathematical connection ability tests, MFFT, interview guidelines for students' mathematical connection abilities, and observation sheets during learning. Interviews are used to strengthen the initial assumptions on the results of the analysis of students' material connection abilities tests. Analysis of the data used in this study is the analysis of qualitative and quantitative data. Qualitative data analysis according to Huberman (2007) in the form of data collection, data reduction, data presentation, and conclusion drawing. While quantitative data analysis is the normality test, homogeneity test, average completeness test, and classical completeness test.

RESULT AND DISCUSSION

The purpose of quantitative research is to determine the completeness of students' mathematical connection abilities in CONINCON learning. Before

that, a normality test and a homogeneity test were carried out. The normality test obtained is sig. = 0,2 > 0,05, then H_0 is accepted, meaning that the mathematical connection ability data of students is normally distributed. The homogeneity test obtained is sig. = 0,167 > 0,05, then H_0 is accepted, meaning that students' mathematical connection ability data have the same variance.

Quantitative analysis used in this study is the average completeness test and classical completeness test. The average completeness test uses the help of SPSS *one Sample t-Test*, which aims to determine students' mathematical connection skills in CONINCON learning. The average completeness test obtained using SPSS *one Sample t-Test* is sig. 0,000 < 0,05, then H_0 is rejected, meaning that the average mathematical connection ability of students taught with the CONINCON learning achieves completeness. While the classical completeness test using the proportion test, obtained from z_{hitung} is 2,69 > z_{tabel} is 1,64 with a 5% degree of confidence 5%, H_0 is rejected, meaning that the classical completeness of students' mathematical connection ability in the CONINCON learning reaches 75%.

The Purpose of qualitative analysis in this study is to describe the ability of students' mathematical connections in terms of cognitive style and gender. Early qualitative research was conducted to determine students' cognitive styles. Cognitive style tests using MFFT were conducted in class VIII D as an experimental class at SMP N 18 Semarang. This test is done before the learning activity. The cognitive style results obtained from MFFT grade VIII D students are presented in Table 1 as follows:

Table 1. Results of Cognitive Style MFFT Classification

No.	Student Category	Total students	Percentage
1	Fast-Accurate	6	16.67
2	Reflective	14	38.89
3	Impulsive	16	44.44
4	Slow-Inaccurate	0	0

Based on Table 1, it shows that the number of students is fast-accurate namely 6 students (16.67%), the number of reflective students is 14 students (38.89%), the number of impulsive students is 16 students (44.44%), while the number of students slow-inaccurate namely 0 (0%) which means there are no students in the slow-inaccurate category. This shows that students who have more reflective and impulsive cognitive styles than fast-accurate and slow-inaccurate. So, according to the focus of the study, the subject taken is the cognitive style of reflective - impulsive.

After obtaining the reflective & impulsive cognitive style data in class VIII D with the number of students 36, then grouped again based on the criteria of the cognitive style of reflective & impulsive and male & female gender. Reflective cognitive style students were chosen by 2 male students and 2 female students who were the slowest or most needed a long time to solve the problem but they were the most care so that the solutions obtained tended to be correct. While the impulsive students were chosen by 2 male students and 2 female students who were the fastest or needed the least amount of time to solve the problem but they were the least careful so that the solutions obtained tended to be wrong. The grouping of cognitive style and gender measurement results can be seen in detail in Tables 2 and 3 as follows:

Table 2. Results Grouping Reflective Subject and Gender

No	Reflective Subject	Gender	Average	
			Time	Frequency
1	D-07	Male	53.01	2
	D-30		45.44	2.07
2	D-05	Female	74.68	1.69
	D-32		45.58	1.46

Table 3. Results from Grouping Impulsive Subject and Gender

No	Impulsive subject	Gender	Average	
			Time	Frequency
1	D-12	Male	8.68	4
	D-13		13.09	2.76
2	D-02	Female	12.36	3.15
	D-24		19.74	2.92

Based on Tables 2 and 3 obtained 2 male reflective subjects, 2 female reflective subjects, 2 male impulsive subjects, and 2 female impulsive subjects. In addition to using the results of cognitive style data, this analysis uses interviews to strengthen the initial assumptions of the results of the analysis of students' mathematical connection abilities. The detailed description is as follows:

Mathematical Connection Ability of Reflective Male Students

Based on the measurement of cognitive style, 14 students, both male, and female, were found in the reflective category. After that, it is grouped again into 2 male students who are the slowest or most need a long time in solving problems but he is most careful so that the solutions obtained tend to be correct.

Analysis based on the cognitive style and gender of students, then associated with students' answers in solving problems in the matter of mathematical connection skills. This analysis of guideline is based on indicators of mathematical connection ability. The mathematical connection ability of reflective male students in this category is almost the same. Reflective male students still need to concentrate on understanding story problems, lack of thoroughness, and long working time, because they need to recall other material. If students do not know the formula to be used, then use trial and error. Students are less mathematical in solving story problems. Students tend to answer questions directly without formulas.

Reflective male students D-12 only reach the first indicator, namely connections between mathematical topics. Whereas the second and third indicators namely the connection of mathematical topics with other subjects and real-life have not been reached. Reflective male students D-30 achieves the first and second indicators, namely indicators of connections between mathematical topics and connections of mathematical topics with other subjects. While the third indicator has not yet been reached, namely the mathematical connection with real life. In accordance with the results of Mahendra & Mulyono's research (2016) that reflective students have deep thoughts so it requires a relatively long time to solve mathematical connection ability questions.

Mathematical Connection Ability of Reflective Female Students

This category is almost the same as the previous category, the difference is in the gender of women. The mathematical connection ability of the two reflective female students in this category can be said to be the same. Reflective female students can write answers in full, whether known, asked, or completed answers. It's just that there are formulas that are not written in the answer sheet and also conclusions, but during the interview can answer and give reasons precisely.

All indicators of mathematical connection ability in reflective female students D-05 and D-32 have been achieved, namely indicators of connections between mathematical topics, connections of mathematical topics with other subjects, and connections of mathematical topics with real life. In accordance with the results of several studies, namely Nurhayati and Subekti (2017) that women are superior in accuracy and thought equality. Then according to Nasriadi (2018) that reflective students must go through deep reflection, then reflective individuals are more likely to give a reaction or response that is accurate and precise.

Mathematical Connection Ability of Impulsive Male Students

Based on the results of cognitive style measurements obtained 16 students both male and female with the impulsive category. The data are grouped again into 2 students that are the fastest or most require the least amount of time in solving problems but they are the least accurate so that the solutions obtained tend to be wrong.

The mathematical connection ability of the two impulsive male students is almost similar. Students in this category do not understand mathematics material and material other than mathematics thoroughly. Students are not careful in understanding the problem of the story, even though the answer is correct, but can not explain the results of work. Some calculations when doing are also often wrong, so the results are wrong. Students work on problems too quickly, so there are steps that are missed and wrong writing, both formula writing and answers. Students tend to count quickly without many descriptions and rarely use formulas. There are no conclusions on all answers but

can explain correctly at the interview. Therefore, this category of student accuracy is still lacking.

In this category, indicators of mathematical connection capability are only partially achieved. Impulsive male students D-12 only reach connection indicators between mathematical topics. Whereas mathematical connections with other subjects and real-life have not been reached. Impulsive male students D-13 has achieved indicators of connections between mathematical topics and mathematical topics with other subjects, while mathematical connections with real-life have not been reached. Although the achievement indicators of the mathematical connection are the same as those of reflective male students, the level of accuracy and problem-solving steps is better for reflective male students. In accordance with the results of several studies, namely Mahendra & Mulyono (2016), that impulsive students are less thorough in the process of working on problems and lack mastering mathematical connection indicators. Likewise, according to Nasriadi (2018) that impulsive students, require a relatively short time in working on problems so that the accuracy and accuracy of the responses tend to be less.

Mathematical Connection Ability of Impulsive Female Students

This category results from the grouping of 16 impulsive students who are selected according to predetermined criteria. The mathematical connection abilities of these impulsive female students have two very different analyzes. Impulsive female students D-02 is not careful in understanding many things, namely: mathematical calculation problems, units, there are missed work steps, formulas that are not in accordance with the command of the problem and understanding of the story problem. Students can write conclusions correctly, even if the results are wrong. This is consistent with Setiawan's (2016) statement that impulsive cognitive style is an individual characteristic that reflects how the individual uses a faster time in solving problems but many of the answers produced are wrong.

While impulsive female students, D-24 can work on problems systematically and with the right answers. Students can tell how to do the problem well at the interview. Students are a bit inaccurate when writing known and asked questions as well as units in story problems and skip one step in problem-solving. However, it can be explained precisely in the interview. The level of accuracy is among the highest compared to other impulsive students. Likewise, the value of the results of tests of mathematical connection ability. This is consistent with the results of the research by Nurhayati and Subekti (2017) that women are superior in accuracy and thought equality.

Impulsive female students D-02 has not reached all indicators of mathematical connection ability, both indicators of connections between mathematical topics, connections of mathematical topics with other subjects, and connections of mathematical topics with real life. Otherwise, impulsive female students D-24 can achieve all indicators of mathematical connection ability, namely indicators of connections between mathematical topics, the connection of mathematical topics with other subjects, and connections of mathematical topics in real life. The differences are quite far from the two subjects because the measurement results of the cognitive style of subject D-24 are in the category of fast-accurate. So, the cognitive style is impulsive, but it is almost close to the fast-accurate category. The difference between the two students in this category is consistent with Singer *et al.* (2017) that intellectual abilities, previous experiences, habits, and personality traits, influence the development of cognitive style. Cognitive style can change or develop with the environment.

CONCLUSION

Based on research that has been done, there are findings from impulsive female subject categories. Impulsive female students were taken by two subjects, but the results of the analysis were different. The first impulsive female student did not reach all indicators of mathematical connections, namely indicators of connections between mathematical topics, connections of mathematical topics with other subjects, and connections of mathematical topics in real life. Otherwise, the second impulsive female student has achieved all indicators of mathematical connections, both indicators of connections between mathematical topics, connections of mathematical topics with other subjects, and connections of mathematical topics in real life. It means the measurement of cognitive style is in the category of

fast-accurate. This means that the processing time is fast and the answer tends to be correct but there are a number of steps that are missed due to lack of accuracy. The working frequency is above average, so it tends to be wrong but not too much. The second impulsive female student is categorized as impulsive cognitive style because when measuring cognitive style, the time is below average or can be said to be fast and the working frequency is above average or can be said to tend to be a lot wrong. So, the cognitive style is impulsive, but it is almost close to the fast-accurate category.

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