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THE MATHEMATIC CONNECTION ABILITY OF PRE-SERVICE TEACHER DURING ONLINE LEARNING ACCORDING TO THEIR LEARNING STYLE

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Abstract

Mathematic connection is one of the basic abilities someone must have in order to learn mathematics successfully. Mathematic connection helps someone to understand the function of mathematics, improving mathematic concept, determining the correlation among mathematic concepts, and identifying the application of mathematic in the surrounding environment. The most common issue occur regarding this case is that the mathematic connection ability of mathematic pedagogy students are considerably low that finally result to low learning outcome. Moreover, mathematic learning is conducted online during the COVID-19 pandemic. Not every lecturer is capable to conduct an online learning properly. As the result, it becomes harder for the students to learn mathematics, let alone finding mathematic connection. This study aims at describing the mathematic connection ability among the mathematic pre-service teacher during online and offline learning, comparing the ability between the students who undergo online and offline learning, and creating the visualizations of mathematic connection ability of mathematic pedagogy students who undergo online learning based on their learning style. This study implements *mixed methods* with *explanatory sequential design*. The technique and data collecting instrument are conducted in two ways, those are quantitative and qualitative data collection techniques. For the quantitative data (mathematic connection ability), it is measured through test, while the qualitative data is acquired using questionnaire and descriptive qualitative according to the category of mathematic connection ability. The findings obtained are the mathematic connection ability of the students. The findings presents that the mathematic connection ability of students in online learning are better than those in offline learning (expository). Students with the tendency of having more than one learning style are better than those who only prefer one type of learning style (visual, auditory, kinaesthetic).

Keywords – Mathematic connection, Learning style, Covid-19, Online learning, Pre-service teacher

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1. Introduction

Mathematic connection is one of the basic abilities of basic mathematics (NCTM, 2000) that everyone, including college students, should have. Mathematic connection ability could help students to contextualize the benefit of mathematics, and help to fix the concept and determine the connection among mathematic concept (Hendriana, Slamet & Sumarmo, 2014). Mathematic connection ability allows students to generate connection of ideas that could help them to solve problems. Besides, mathematic connection also helps them to recall the skill and concepts in order to use them accurately when facing a certain situation that requires problem solving. Additionally, it also helps the students to develop their perspective in viewing mathematics as an integrated or inseparable part among one and another (NCTM, 2000).

Mathematic connection ability could also help in identifying the relationship between the representation of concept and procedure, understanding mathematic topics, and improving the ability to apply mathematic concept in other field of science or in the daily life basis. Based on the explanation above, mathematic connection ability does not only function to find the correlation among mathematic concepts, but also to apply it on to various fields of science and to the real life situation. According to the National Council of Teacher of Mathematics (NCTM, 2000), the indicators of mathematic ability are: 1) acknowledge and apply the connection among mathematic ideas. In this case, the connections could help students to apply all the concepts that they have learnt on to the new context that they will learn by connecting one concept to the others. That way, they could recall the previous concept so that they will perceive those new concepts as the extension of the previous concept. 2) understanding the correlation among the mathematic ideas to construct a wholesome interrelated concept. At this stage, students are able to identify similar mathematic structure in every different mathematic setting. Therefore, their comprehension on the correlation among one concept to another becomes better. 3) acknowledge and apply mathematics on to the real life. The external contexts of mathematics, in this stage, deals with the connection between mathematics and real life, so it is expected that students are able to connect the events in the daily life situation (real life) into mathematical model. Students' ability in identifying the connection between real life and mathematics is considered substantial, since it would help them in understanding the topics within mathematics. They could also turn daily life problems into mathematical model. This allows students to be aware of the functions of mathematics. In other words, it can be concluded that mathematic connection ability are the ability of students in finding the correlation among the representation of a concept and 3 procedures, those are: 1) the understanding on the correlation among mathematic topics, 2). The ability to applying mathematics into other fields of science and 3) the ability of students to apply mathematics into the daily life basis.

Mathematic connection also helps someone to solve mathematic problem creatively (Eli, Mohr-Schroeder & Lee, 2013). As the result, there is a chance that someone with a good mathematic connection ability is also creative at the same time. Creative is classified as the highest level of ability according to the recent Bloom Taxonomy (Stanny, 2016). Creative is also included as one of the main components in the 21st century education (Sternberg, 2005, 2012; Navarrete, 2013; Tindowen, Bassig & Cagurangan, 2017; Kawuryan, Sri-Hastuti & Supartinah, 2018; Suryandari, Fatimah, Sajidan, Rahardjo & Prasetyo, 2018).

In fact, not every student has good mathematic connection ability. As the consequence, their ability in identifying the connection among mathematic concepts, mathematics and other subject, as well as mathematics and daily life events is considerably low. It surely then affects students' learning outcome in mathematics. This statement is proved by Indonesia's rank for Mathematics subject in Programme Internationale for Student Assessment (PISA) issued by Organisation for Economic Co-operation and Development (OECD). The result of PISA for Indonesia in 2015 was indeed improved, yet still classified as below average, the mathematic score was 386 when the OECD average was 490. That is why Indonesia was placed 64 out of 72 countries (Kementerian Pendidikan dan Kebudayaan, 2016). It is also supported by the result of PISA 2018, Indonesia was ranked lower than in 2015. For literacy, Indonesia was ranked 74, mathematics ranked 73 with the average score of 379 and 71% of Indonesian students are considered below the minimum competence for mathematic subject (Kementerian Pendidikan dan Kebudayaan,

2019). This result showed that the result of PISA Indonesia is far behind other countries and ought to be improved (Kementerian Pendidikan dan Kebudayaan, 2016; Zulkarnain, 2013; Istiandar, Wardono & Mulyono, 2015; Wardono, Waluya & Candra, 2016).

The study conducted by Apipah and Kartono (2017) presented that, commonly, the students' mathematic ability is still low. And the low mathematic ability affects the quality of learning and finally leads to low learning outcome. The findings from the study by Ainurriqiyah (2015) found that students could hardly find the connection between the concept that they have learnt and the concept that they are about to learn. This condition makes it difficult for them to solve problems that require several concepts to solve. The difficulties that the students faced is influenced by learning style. Someone's learning style determines how that student could absorb information through his/her senses. A study by Richardo, Mardiyana & Sari (2014) stated that different learning style causes different ability in problem solving. Learning style is the method used by someone to focus and grasp new information (Sengodan & Iksan, 2012). The mathematic connection ability is different in each person depending on the learning style (Apipah, & Kartono, 2017). Boström (2011) stated that teacher who acknowledge students' learning style are more oriented on the improvement process as well as the learning outcome, the teacher is also more flexible to changes that allow students to learn better. Teacher could select the most appropriate learning model in order to optimize the learning outcome (Riau & Junaedi, 2016).

Learning style is also one of the internal factors that is influential to mathematic learning outcome. Learning style is the belief, habit, and views that influence how an individual prefer their learning environment to be (Weng, Ho, Yang & Weng, 2019). Learning style is the easiest method an individual has to absorb, control, and manage the information received throughout the learning process (Bire, Geradus & Bire, 2014; Rijal & Bachtiar, 2015). Learning style is the cognitive and affective characteristic, also psychological behavior of an individual on how the person understand something, interact, and respond to the learning environment. It is something that is unique to the person and relatively stable (Manolis, Burns, Assudani & Chinta, 2013; Kolb & Martin, 2017). Learning style also refers to how a student makes use of the learning situation to process information and synthesize that into something new (Cassidy, 2004; Zoghi et al., 2010). It may also concerns with the approach to process information during the learning situation (Weng et al., 2019). Based on the arguments above, it can be defined that learning style is the way an individual makes use of a learning situation in order to receive and manage new information well as the means to improve the existing knowledge or to obtain a new knowledge.

Students' learning style will affect their learning outcome (Cassidy, 2004; Norman, 2009). Therefore, the teacher shall know the learners' learning style in order to adjust the preparation for the learning activities (Manolis et al, 2013; Weng et al., 2019). It is supported by the opinion from Fletcher, Potts and Ballinger (2008) that the teacher's ability in identifying students' preference on learning style would help to determine the right learning method to ensure the success of the outcome. However, one's learning style is not always permanent, but it follows the cognitive development and learning experience (Turesky & Gallagher, 2011). The appropriate learning style is the students' key of success in learning (Bire et al., 2014; Amin, & Suardiman, 2016).

Students who are aware of their learning style, they are able to absorb and manage information that would ease them to obtain good learning outcome. Therefore, during the learning activities, it is necessary to assist and direct students to identify the learning style that match to their needs, so that the learning objective can be achieved effectively. This theory does not only apply to students at schools but also in the university. It is important to know their learning style in order to learn well.

Such matter in regards to mathematic connection ability is basically not solely caused by learning style, but also about how they learn. COVID-19 pandemic itself has become the challenge in conducting a fun learning activity. It inhibits teachers to plan and implement learning activity which prove the learners opportunities to become critical and creative in an interactive way since it is supposed to be conducted online. This sudden change on the learning method makes it difficult for teachers to plan and implement learning activities that meet the expectations. Delivering the lesson normally is hard, let alone conducting

learning activities that involves learner's creativity. Not all teachers are technology-aware. Hence it is difficult for them to hold an online class. It makes learners find the lesson to be boring. One of the solutions to this issue is providing the facilities for online learning which are feasible for teachers to use for learning activities.

Online learning is a learning in the network or known as SPADA (Sistem Pembelajaran Daring) that is the interpretation from the Online Learning Style, (Chaeruman, Wibawa & Syahrial, 2018). Online learning is a program that aims to improve the access of the students upon the high-qualified education through the blended learning application (Watson, 2008). With that, the concept of online learning is developed based on the concept blended learning. Blended learning is the learning which combines the face-to-face learning and the online learning and seeing the advantages of both, not only a mere mix (Bonk & Graham, 2006). There are two requirements of the learning activities that can be done using the blended learning, those are the synchronous activity (learning activity between the lecturer and students done in the same time, the face to face on and the virtual one). The second is the asynchronous (independent learning activity by the participant that is done anytime, anywhere and is not limited by time with the lecturer). Both of these activities must be prepared well so that both of them can strengthen the learning process for the students (Bonk & Graham, 2006) that has the implication to the learning result of the students to be able to prepared and conduct the online learning well, it needs the mastery skill of technology, pedagogy, and content or known as TPACK (Wahyudi, Winanto & Relmasira, 2015).

2. Methodology

2.1. Research Goal

This research aimed to describe the mathematic connection skill of the students of teaching major in the online and offline learning, comparing the mathematic connection skill between the students of education major who gained the learning through online and offline method, also to give description on how the mathematic connection skill in the online learning seen from the perspective of learning style.

2.2. Sample and Data Collection

The population in research is the students of Islamic Elementary Education (Pendidikan Guru Madrasah Ibtidaiyah) major of IAIN Surakarta of year 2019. To see the mathematic connection skill whether the online or the offline learning one, then two classes are chosen randomly from three parallel classes available. The sampling technique for the quantitative research is the simple random sampling. For the qualitative data, the sampling technique used is the non-probability sampling, that is the purposive sampling technique by taking one sample for every category of mathematic connection skill according to the learning style. The technique and instrument of data collecting are categorized into two, qualitative and quantitative data collection. Quantitative data (mathematic connection skill) is measured by test. The instrument used is test questions according to the aspect of mathematic connection according to National Council of Teacher of Mathematics (2000). The test is conducted twice in every class, before (pre-test) and after (post-test) learning. The second test is administered to identify the influence of the both learning activities. The qualitative data is gained using the technique of questionnaire and descriptive qualitative according to the category of mathematic connection skill. Aspects from the questions framework of learning style is adopted and developed from the aspects and questions framework made by DePorter, Reardon and Singer-Nourie (2014) and Knoll, Orani, Skeel & Van Horn (2017). The exercise questions used to measure the skill of the mathematic connection in the form of essay test questions. The exercise questions used are already gone through validity and reliability test with the correlation coefficient of 0.4973 (valid) and Cronbach's Alpha score of 0.853 (very reliable).

2.3. Data Analysis

This research is a mixed method with the explanatory sequential design that applies the data collection for quantitative and qualitative data in sequence (Creswell, 2012; Giddings, 2006). The first step is collecting and analysing the quantitative data to gain the description of the mathematic connection skill, as well as

testing the effectiveness of the application of online learning. The second step is collecting and analysing the qualitative data to gain the description and mapping on the mathematic connection skill according to the learning style of the students. This data is used to strengthen the quantitative data about the effectiveness of online learning upon the improvement on the mathematic connection skill so that it can show how the online learning is done according to the learning style of the students. The quantitative analysis on this research is done to find out the comparison on the mathematic connection skill on the students who get the online as well as offline learning. The result of score on the mathematic connection skill is made in a form of: Category of Mathematic connection skill (KKM). Category of Mathematic connection skill (KKM) is divided into three categories, those are KKM 3 (High), KKM 2 (Medium), KKM 1 (Low). The analysis of qualitative data is done according to the steps from Miles and Huberman (1994), Creswell (2012) those are data reduction, presentation, and conclusion drawing.

3. Findings/Results

The mathematic connection skill of the students from the study program of Madrasah Ibtidaiyah Education of IAIN of Surakarta from both classes can be observed in the following Table 1 and 2.

The mathematic connection skill is divided into three category, those are High, Medium, and Low. The categorization of the mathematic connection skill is done in gaining deeper data. The rule used in the Fraenkel and Wallen rule (2009) is that almost every scores in the normal distribution on the average level, subtracted by three times of the standard deviation and the average is added by three times of the standard deviation. Based on that, to filter the score data of the mathematic connection skill into three categories, the rule used is the same as the one in Table 3.

Class	N	Minimum	Maximum	Mean	Std. Deviation
Online Model	35	40	100	84.00	15.1
Expository	36	40	100	74.00	17.2

Table 1. The Mathematic connection skill of Both Classes

Class	Category	Types of Connection		
		Mat 1	Mat 2	Mat 3
Online Model	Minimum Score	5	10	10
	Maximum Score	30	35	35
	Average	26.80	31.71	29.28
	%	89,33	90.61	83.65
Expository	Minimum Score	10	10	10
	Maximum Score	30	35	35
	Average	21.38	23.61	27.91
	%	71.26	67.26	79.76

*Note. Mat.1 = Connection between topics; Mat.2 = Connection to other subjects; Mat.3 = Connections to daily life

Table 2. Mathematic connection skill of the Students from the Type of Connections

Category	Symbol	Minimum Score Limit
High	KKM 3	$\chi > \bar{\chi} + SD$
Medium	KKM 2	$\bar{\chi} - SD \leq \chi \leq \bar{\chi} + SD$
Low	KKM 1	$\chi < \bar{\chi} - SD$

Note: χ : Score of the Mathematic connection Skill; $\bar{\chi}$: Average Score of the Mathematic connection Skill; SD: standard deviation of the Mathematic connection Skill

Table 3. Criteria for the Categorization of the Mathematic connection skill

Based on the minimum score limit motioned on Table 3, the details of the distribution of the students according to the category of mathematic connection skills is gained and presented in Table 4, 5 and 6.

Criteria	Symbol	Total Students	
		Online Model	Expository
High	KKM 3	10	7
Medium	KKM 2	22	18
Low	KKM 1	3	11
Total		35	36

Table 4. Total of Students Based on the Category of Minimum Score

Criteria	Symbol	Total Students			
		Online Model		Expository	
		M	F	M	F
High	KKM 3	1	9	3	4
Medium	KKM 2	7	15	5	13
Low	KKM 1	0	3	4	7
Total		35		36	

Table 5. Total of Distribution of Students Based on Gender

Class	Category	Type of Connection		
		Mat 1	Mat 2	Mat 3
Online Model	High	29	18	10
	Medium	4	16	22
	Low	2	1	3
Expository	High	13	8	17
	Medium	7	20	11
	Low	16	8	8

*Note. Mat.1 = Connection between topics, Mat.2 = Connection to other Subjects; Mat.3= Connection with Daily Life

Table 6. Mathematic Connection Skill According to the Type of Mathematic connection

Class	N	Learning Style*			
		A	V	K	L
Online Model	35	14	5	7	9
Expository	36	5	8	12	11

*Note. A = Auditory; V = Visual; K = Kinaesthetic; L = Aside from Visual Auditory and Kinaesthetic

Table 7. Number of Students on Both Classes According to Learning Style

Class	Category	Learning Style			
		A	V	K	L
Online Model	Minimum Score	40	45	50	65
	Maximum Score	100	100	85	100
	Average	86.42	81.00	78.87	86.11
Expository	Minimum Score	40	50	40	45
	Maximum Score	95	100	95	100
	Average	76.00	75.62	73.33	65.90

Table 8. Mathematic connection of Students based on Learning Style

Class	Category	Learning Style			
		A	V	K	L
Online Model	High	2	1	0	5
	Medium	11	3	6	4
	Low	1	1	1	0
Expository	High	1	2	3	2
	Medium	3	5	5	5
	Low	2	1	3	4

Table 9. Mathematic connection Skill of the Students According to the Learning Style

3.1. Comparison Test on the Initial Mathematic Connection Skill of Both Classes

Before both classes are taught using Online and Expository Model, the testing is done upon the Initial mathematic connection skill of both classes. The test used is comparison test on the average using the T-test. The result of the comparison test from both classes can be observed on the Table 10.

Class	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Online Model	35	65	95	82.1429	6.7315	45.314
Expository Model	36	70	95	80.5556	8.3133	69.111

Table 10. Initial Mathematic connection Skill

3.2. The Result of Comparison Test on the Average of Initial Skill of Online Class and Expository Class

The Hypotheses are formulated as follow:

$H_0: \mu_1 = \mu_2$: The mathematic connection skill of the students of online class and expository class is equal

$H_1: \mu_1 \neq \mu_2$: The mathematic connection skill of the students of online class and expository class is not equal

Based on the result of T-test with the help of the SPSS version 23, it is gained that the t count is 0.8869. The value of t table for $dk = n_1 + n_2 = 71$, with the degree of error taken is $\alpha = 5\%$ that is 2.01. It is gained that $t_{count} (0.8869) < t_{table} (2.000)$, so that H_0 is accepted. Thus, it can be concluded that the mathematic connection skill of the students in Online Class and Expository Class is equal.

3.3. Result of Comparison Test on the Average Score of Final Skill in Online and Offline (Expository) Classes

After both classes received the education using the different model, all students from both classes were given the post-test to see the impact of both models. The steps done is the pre-requisite tests, the normality and homogeneity test that is followed by the comparison test with the T-test.

3.4. Normality Test of the Mathematic Connection Skill of the Students in Online Class

The hypotheses are formulated as follow:

$H_0: \mu_1 = \mu_2$: The mathematic connection skill of the students in online class came from a normally distributed population

$H_1: \mu_1 \neq \mu_2$: The mathematic connection skill of the students in online class came from a non-normally distributed population

It gained, from Lillifors, the highest score of the calculation result is 0.1152 meanwhile Lillifors table for $n = 36$, with the degree of error taken is $\alpha = 5\%$ is 0.1495. So, the $L_{O_{count}} (0.1152) < L_{O_{table}} (0.1495)$, because the $L_{O_{count}}$ is smaller than the $L_{O_{table}}$, than H_0 is accepted. So that it can be concluded that

the mathematic connection skill of the students in offline (expository) class came from a population with normal distribution.

3.5. The Homogeneity Test of the Mathematic Connection on Online and Offline (Expository) Class

The hypotheses are formulated as follow:

$H_0: \mu_1 = \mu_2$: *The mathematic connection of the students in Offline (Expository) class came from the homogeneous population*

$H_1: \mu_1 \neq \mu_2$: *The mathematic connection of the students in Offline (Expository) class came from the non-homogeneous population*

It gained from the F count 1.293 meanwhile from the F table. For the dk numerator of $71 - 1 = 70$ and the dk denominator of $35 - 1 = 34$ with the degree of error of 5%, then the F table = 1.67. Hence, it can be concluded that the mathematic connection of online and offline (expository) class are from the homogeneous samples.

After the prerequisite test fulfilled, the next step is the comparison test on the mathematic connection skill from both classes seen from the learning style. The result of the measurement of mathematic connection skill of both classes and the result of comparison test of the mathematic connection skill of both classes can be observed in the Table 11 and 12.

Learning Model	Source of Variance	Learning Style			
		Auditory	Visual	Kinesthetic	Others
Online Model	Σ	1230	425	550	775
	\bar{X}	87.86	85	78.57	86.111
	S	15.26	19.07	15.36	9.93
	S ²	135.71	364	236.71	98.76
Offline (Expository) Model	Σ	380	605	880	725
	\bar{X}	76	75.62	73.33	65.90
	S	20.33	15.06	18.05	15.62
	S ²	434	227.62	326.33	244.54

Table 11. Analysis of Variance in Learning Style of Both Classes

The comparison test on the mathematic connection of students who received the education from the online and offline (expository) class.

The Hypotheses are formulated as follow:

$H_0: \mu_1 = \mu_2$: *The mathematic connection skill of online and offline (expository) class is equal*

$H_1: \mu_1 \neq \mu_2$: *The mathematic connection skill of online and offline (expository) class is not equal*

It gained that the t count of 3,653 and the t table for the dk = $(35 + 36) - 2 = 69$ with the degree of error 5% is 2.000. So that the $t_{\text{count}} (3.653) > t_{\text{table}} (2.000)$ then the H_0 is refused and H_1 is accepted. It means that there are differences of mathematic connection skill of students who received learning from online and offline (expository) class.

The comparison test on the mathematic connection of students who received the education from the online and offline (expository) class with the learning style of **Auditory**

The hypotheses are formulated as follow:

$H_0: \mu_1 = \mu_2$: *The mathematic connection skill of online and offline (expository) class with the Auditory learning style is equal*

$H_1: \mu_1 \neq \mu_2$: *The mathematic connection skill of online and offline (expository) class with the Auditory learning style is not equal*

It gained that the t count of 1.492 and the t table for the $dk = (14 + 5) - 2 = 17$ with the degree of error 5% is 2.110. So that the $t_{count} (1.492) < t_{table} (2.110)$ then the H_0 is accepted and H_1 is refused. It means there are no differences of mathematic connection skill on students who received learning from online and offline (expository) class, with the **Learning Style of Auditory**.

The comparison test on the mathematic connection of students who received the education from the online and offline (expository) class with the learning style of **Visual**

The hypotheses are formulated as follow:

$H_0: \mu_1 = \mu_2$: *The mathematic connection skill of online and offline (expository) class with the Visual learning style is equal*

$H_1: \mu_1 \neq \mu_2$: *The mathematic connection skill of online and offline (expository) class with the Visual learning style is not equal*

It gained that the t count of 1.086 and the t table for the $dk = (5 + 8) - 2 = 11$ with the degree of error 5% is 2.201. So that the $t_{count} (1.086) < t_{table} (2.101)$ then the H_0 is accepted and H_1 is refused. It means there are no differences of mathematic connection skill on students who received learning from online and offline (expository) class, with the **Learning Style of Visual**.

The comparison test on the mathematic connection of students who received the education from the online and offline (expository) class with the learning style of **Kinesthetic**

The hypotheses are formulated as follow:

$H_0: \mu_1 = \mu_2$: *The mathematic connection skill of online and offline (expository) class with the Kinaesthetic learning style is equal*

$H_1: \mu_1 \neq \mu_2$: *The mathematic connection skill of online and offline (expository) class with the Kinaesthetic learning style is not equal*

It gained that the t count of 0.699 and the t table for the $dk = (7 + 12) - 2 = 17$ with the degree of error 5% is 2.110. So that the $t_{count} (0.699) < t_{table} (2.110)$ then the H_0 is accepted and H_1 is refused. It means there are no differences of mathematic connection skill on students who received learning from online and offline (expository) class, with the **Learning Style of Kinaesthetic**.

The comparison test on the mathematic connection of students who received the education from the online and offline (expository) class with the learning style of **Others**.

The hypotheses are formulated as follow:

$H_0: \mu_1 = \mu_2$: *The mathematic connection skill of online and offline (expository) class with the Others learning style is equal*

$H_1: \mu_1 \neq \mu_2$: *The mathematic connection skill of online and offline (expository) class with the Others learning style is not equal*

It gained that the t count of 3.187 and the t table for the $dk = (9 + 11) - 2 = 18$ with the degree of error 5% is 2.101. So that the $t_{count} (3.187) > t_{table} (2.101)$ then the H_0 is refused and H_1 is accepted. It means there are no differences of mathematic connection skill on students who received learning from online and offline (expository) class, with the **Learning Style of Others**.

Learning Style	T _{count}	t _{table}	Decision from test
Online and Offline Class	3,653	2.000	Ho refused
Auditory	1,492	2.110	Ho accepted
Visual	1,086	2.201	Ho accepted
Kinaesthetic	0,699	2.110	Ho accepted
Others	3,187	2.101	Ho refused

Table 12. Comparison Test on the Mathematic connection on Online and Offline Class

4. Discussion and Conclusion

Based on the analysis result from the data that are done, it is gained that the students who received the learning from online class has a better mathematic connection skill compared to the students that received the learning from the offline (expository) class. This happened because the facility of online learning gives opportunities to students to access a wider learning facilities and is not limited by time. This is according to Watson (2008) who mentioned that online learning can increase the access to learning facility at maximum level. The activities that keep on giving the learning opportunities for the students in conducting and making creative product is what suspected to give the optimal learning experience for the students. This condition is according to the research of Amabile (2012), where the students become creative individuals, if they get the opportunity to do some creative activities, there are conditioned creative process, as well as supported by the supportive learning environment. Besides, the online learning concept that is done also adopted the principle of blended learning that combines the face to face learning and online learning by looking at the advantages of both (Bonk & Graham, 2006). The online learning activity that is presented in blended learning form gives the chance for synchronous activities (learning activities between the lecturer and students done in the same time whether on direct face to face or virtually). Besides, it will also provide the asynchronous activities (the independent learning activity by the students that can be done anytime, anywhere and is not limited by the time with the teacher). This gives the chance for the students to learn anytime and anywhere.

Also, the learning activities of the students in solving mathematics problem is also supported by the learning environment that allow the growth of creativity. There are also chances for every group of students to present their result in the online class (synchronous), so that it pushes other students to create better result, better than the other students (Soh, 2017; Amabile, 2012). The very positive learning environment here stimulate the students and their team to keep on improving their creation. This is according to Tsai, Horng, Liu, Hu and Chung (2015), that the positive learning environment will make the students become motivated and creative in making something useful. This is also according to the mathematics learning paradigm of today, where mathematics are close to human, mathematics are part of the human culture (Hersh, 1997; Siswono, 2010) and is the part of social reality (Hers, 1997; Zevenbergen, Dole & Wright, 2004). This is also in line with the research of Wahyudi, Winanto and Relmasira (2015), the attractive and correct learning as well as using a contextual problem is able to motivate the students to learn mathematics and able to solve the problem of mathematics. This is what ease the students in finding the relationship between mathematics concept existed in the question and also improving their concept about mathematics in their surrounding environment. The learning patterns that continuous like this will improve the mathematic connection skill of the students.

Based on the learning style of the students of education major that become the sample of this research, it can be gained that the online learning is effective and significant for the students with “others” learning style (aside from auditory, visual and kinaesthetic). The in depth analysis result through interview gained that students with “others” learning style apparently has the tendency to have more than one learning styles (combination between auditory with visual, auditory with kinaesthetic, visual and kinaesthetic and even the tendency to have all three). Students with the tendency to have more than one learning styles have relatively different way of learning with the students that only have one tendency of learning style. The students with such learning style feel that it is easier to learn with the learning facility provided online. They are more creative in making the connection between concepts and relating the mathematical concept

with the surrounding. Besides, the chance to make creative creation as the result of connecting the mathematics concept in a creative way. This condition is according to the result of the research from Amabile (2012), Wahyudi, Waluya, Suyitno and Isnarto (2020) and Wahyudi, Waluya, Suyitno and Isnarto (2021), where the students will be a creative individual if they are given the chance in acting creative, the is a conditioned creative process. Also, support with the learning environment that support their process in improving the ability in thinking mathematically creative in solving problem. This is also according to the argument of Rogers (1982) and the result of study by Ramdhani, Wimbari and Susetyo, (2018), where the psychological security and freedom (psychotherapy) for students will motivate and stimulate the creativity for the students in making some creative works.

The expected result of the research is the mathematic connection skill of the students with the online learning model is better from the mathematic connection skill of the students with the offline (expository) learning model. The students with the tendency of more than one learning style (others) have the better mathematic connection skill compared to the one with only one tendency of learning style (visual, auditory, kinaesthetic).

5. Suggestions

Based on this research, then it is suggested that every educators need to see the learning style of their students before developing the learning so that the students can learn more optimally. The mathematic connection skill can be developed by online learning that gives the learning experience with the contexts of surrounding environment of the students. This will ease the students in connecting mathematics concepts as well as connecting the mathematics concepts with the environment around them because the problem used is contextual problem exist in their surrounding environments.

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