Al-Ishlah: Jurnal Pendidikan
Vol.15, 4 (December, 2023), pp. 4553-4567
ISSN: 2087-9490 EISSN: 2597-940X, DOI: 10.35445/alishlah.v15i4.3154

Mathematical Connection Ability Profile of Junior High School Students of Comparative Materials

Syifa Maharani Priharvian[1], Tasya Alma Qolbi[2], Sintha Sih Dewanti[3]

[1] Universitas Islam Negeri Sunan Kalijaga, Yogyakarta, Indonesia; syifapriharviann@gmail.com
[2] Universitas Islam Negeri Sunan Kalijaga, Yogyakarta, Indonesia; qolbitasya@gmail.com
[3] Universitas Islam Negeri Sunan Kalijaga, Yogyakarta, Indonesia; sintha.dewanti@uin-suka.ac.id

ARTICLE INFO

Keywords:

mathematical connection;
comparison;
daily life;
discipline;
other sciences

Article history:

Received 2022-12-19
Revised 2023-03-10
Accepted 2023-10-30

ABSTRACT

Mathematical connection ability is needed because it relates to students' problem-solving abilities. This research was conducted to determine the ability of junior high school students' mathematical connections based on the region in the comparative material. This study uses the Manova test, which begins with quantitative research and continues with qualitative research. A sample of 251 students was taken using a cluster random sampling technique in one of the provinces in Indonesia with the most immigrants aiming to pursue education at various levels. The test instrument in this study was used to measure the ability of mathematical connections between mathematical ideas, mathematical connections with everyday life, and mathematical connections with other disciplines. The results of the Manova test show that the school environment affects students' mathematical connection abilities. In different areas, students have their own advantages in each mathematical connection indicator. So, it is suggested that schools pay attention to the learning methods used to suit students to improve students' mathematical connection abilities.

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Corresponding Author:
Sintha Sih Dewanti
Universitas Islam Negeri Sunan Kalijaga, Yogyakarta, Indonesia; sintha.dewanti@uin-suka.ac.id

1. INTRODUCTION

Mathematics is a compulsory subject at all levels of school. Concepts in learning mathematics are related to one another, so when students learn a concept, they must also learn other concepts (Aledya, 2019; Radiusman, 2020). In line with Bruner's theory that in mathematics, all the concepts in it will be interconnected. This situation is referred to as a mathematical connection, which connects one concept to another. Mathematical connections can also be interpreted as one of the few abilities in mathematics that is considered important. This is in accordance with the statement of NCTM (2000) in his book entitled *Principles and Standards of School Mathematics* that students must have five mathematical abilities, namely the ability to communicate mathematically, the ability to reason mathematically, the ability to connect mathematically, the ability to represent, the ability to solve problems.

According to Coxford (Mandur et al., 2020), students will be considered to have good mathematical connection skills if these students can fulfill the three indicators of mathematical connection, namely mathematical connections between topics in mathematics, mathematical connections with other disciplines, and connections with everyday life. In addition, NCTM (2000) reveals the following three aspects as a reference that students' mathematical connection abilities are considered good, namely being able to know and know the relationships between mathematical topics and understanding the relationships of these topics so that mathematics can unite into a coherent whole and apply mathematical topics to things in their lives including in other fields. Based on these two opinions, it can be concluded that the indicators of mathematical connection ability are the ability to connect mathematically to ideas in mathematics, the ability to make connections in everyday life, and the ability to make connections to other people's disciplines.

The literature review identified that the study of mathematical connections has three orientations. (García-García, 2021) : mathematical connections that focus on certain mathematical concepts and use specific tasks that lead to mathematical concepts (García-garcía & Dolores-flores, 2019); study the mathematical relationships between different representations; Studying beliefs related to the use of mathematical connections in school situations (Sutihat & Pujiastuti, 2019). Based on some of these references, further research is needed on the ability of mathematical connections in schools. Therefore, the researcher raised the topic of mathematical connection ability in junior high school in comparison material.

Mathematical connection ability is important for students to deal with various mathematical problems. One of the subjects in class VII semester 2 that can explore mathematical connection skills is comparative material. Comparison is two or more similar quantities in a simple form. Comparative materials can be used to compare an object with other objects. The size of the object in question is in the form of length, speed, mass, time, and so on (Irawati & Setyadi, 2021). Comparative material is one of the materials in mathematics that is often used in everyday life (Agnesti & Amelia, 2021; Dewi & Nuraeni, 2022; Sari, 2020). One of the applications of comparative material in everyday life is in buying and selling activities or in cooking activities in giving measurements (Sulistyawati et al., 2021). Even though this material is often used in everyday life, it is undeniable that there are still some students who have difficulty understanding this material (Jumiati, 2020). In comparison material, there are two sub-chapters, namely value comparison and value comparison. The nature of comparison is a comparison between two or more quantities where a variable increases in size, then other variables also increase in size or vice versa. The comparative feature of value reversal is two or more variables where if one variable increases, the other variable decreases or vice versa (Kriswinarso et al., 2021).

Based on this background, mathematical connection skills are very important for every student which aims to make it easier for students to deal with mathematical problems (Damayanti et al., 2020; Prasetyo et al., 2018). One of the materials that can explore the ability of mathematical connections is comparative material. In comparative material, students are required to understand the problems that exist in the questions, usually, there are two or more objects to be compared. With this background, the researcher is interested in investigating the ability of mathematical connections with the material taken, namely comparative material.

Basically, students must have good mathematical connection skills in learning mathematics because they can measure success in understanding mathematical concepts. The process of understanding students' mathematical thinking can be done through explanations, strategies, and mathematical behavior, which will be far more complex than the way teachers think about mathematical concepts and learning mathematics (Zelenina, 2021). Thus, learning evaluation becomes important and will further affect student learning outcomes. Therefore, it is necessary to investigate the ability of mathematical connections through material comparison.

With some of the descriptions above, it is necessary to conduct research to investigate the ability of mathematical connections in comparative material. This study aims to determine whether there are differences in mathematical connection abilities. Therefore, researchers will also investigate what factors affect the ability of mathematical connections. Recognizing the importance of mathematical connection skills to solve problems in mathematics, the sample material used is comparative material.

Thus, this study aims to determine the mathematical connection ability of junior high school students in comparative material.

2. METHODS

The types of research conducted in this study are quantitative research and descriptive research with a qualitative approach. Qualitative research is an approach to understand and find out more about the things to be discussed using the selected research instrument so that data can be obtained in the form of written reports (Creswell, 2008). According to Kenedi (2019), descriptive research is research that collects and exposes all existing facts. Quantitative research is related to the measurement of linkages and the differences between each indicator of mathematical connection ability. The necessary data can be obtained by conducting tests and analysis of students' answers that have been adjusted to the indicators of mathematical ability. This research was conducted in the even semester of the 2021/2022 school year. This research was conducted with the hope that it could become the basis for further research on students' mathematical connections to comparative materials.

The subjects in this study were selected using the random sampling technique of regional clusters. The random sampling cluster technique is a sampling technique using clusters or not individually (Sugiyono, 2012). The random sampling cluster technique is suitable for use in too many research populations so that groups can be taken between existing populations. In this study, it used regional clusters so that the data obtained from the study could be used to identify mathematical connection capabilities from different regions. The chosen area is one of the provinces in Indonesia where most of the immigrants aim to study at various levels. This study was conducted in three regions in the province: the city area, the west of the city, and the east. In the city area with characteristics as a superior school, 86 students were taken as research subjects, while in the western area of the city with the characteristics of schools located in the village, 84 students were taken as research subjects, and in the eastern area of the city with characteristics as superior schools located in the village, 81 students were taken as research subjects.

Table 1. The number of students used as research samples

Place	School	Gender		Subject
		Male	Female	
West	School A	31	50	81
Central	School B	40	46	86
East	School C	38	46	84

Data collection is carried out through the results of learning evaluation using tests that have been tested for validity by 5 people consisting of 2 lecturers and 3 mathematics teachers. After validation, a difficulty index test is carried out, as well as the reliability of the test instrument.

Table 2. The results of data analysis of student answers are obtained

Analysis	Indicators		
	Mathematical relationships in connecting between mathematical ideas	**Mathematical connections in everyday life**	**Mathematical relationship with other disciplines**
Percentage	84,26%	58,65%	44,79%
Difficulty Level	0.84 (Easy)	0.59 (medium)	0.45 (medium)
Reliability		0.45 (Medium reliability)	
Discrimination Power	0.38 (Enough)	0.64 (Good)	0.72 (Very Good)
Validity	Valid (Low)	Valid (Very High)	Valid (Very High)
Maximum Score	4	9	7
Mean	3,37	5,28	3,14

The test consists of 3 essay questions with indicators that correspond to the ability of mathematical connection. Students are given 90 minutes to complete the test with the supervision of the researcher and the help of the teacher concerned. To get maximum results, researchers do not allow using any tools and check class conditions so that research subjects are more comfortable in the process of taking the test (Moustakas, 1994). The descriptive method used in this study was to analyse the students' test answers. Analysis of student answers using assessments adjusted to the scoring rubric that has been prepared to determine students' mathematical connections to comparative materials (Kenedi, 2019). Sugiyono (2017) said that this data analysis technique uses techniques, including: data collection, data reduction, data presentation, and drawing conclusions. Data collection is carried out by testing grade VII students who have learned comparative material so that data can be obtained optimally. After collecting data, data reduction is carried out by observing and assessing students' answers to the tests that have been given. The data obtained is then presented as clearly as possible so that conclusions can be drawn for the research carried out. According to Romiyansah, Karim, & Mawaddah, (2020) that the percentage of students' mathematical connection ability used includes:

Table 3. Intervals for classifying mathematical connections

Percentage of Mathematical Connection Ability	Group
$0 < x < 50\%$	Low
$50\% < x < 70\%$	Keep
$70\% < x < 90\%$	Tall
$90\% < x < 100\%$	Very High

3. FINDINGS AND DISCUSSION

After the test instrument is tested on students, a further analysis is carried out so that several things will be discussed in this article, namely the percentage of students' mathematical connection ability in each school and the mistakes that students often make on each indicator. In addition to these two things, through interviews with teachers, factors that affect the ability of mathematical connections in each school and the efforts that teachers have made in each school to improve mathematical connection capabilities.

Based on the results of the analysis of mathematical connection ability test instruments on the comparison material tested in each school, the following results were obtained:

Table 4. Results of the analysis of the mathematical relations of the three schools

School	Mathematical relationships in connecting between mathematical ideas	Mathematical connections in everyday life	Mathematical relationship with other disciplines
School A	88,3%	49,2%	52,4%
School B	86,6%	57,4%	38%
School C	76,8%	69%	44,4%

Based on the findings, it was determined that all schools had a high degree of mathematical connection ability in the first indicator, which focuses on the interrelation between different topics in mathematics. Regarding the integration of mathematics into everyday life, School B and C demonstrate a reasonable level of proficiency, whereas School A exhibits a lower level of proficiency. School A demonstrates a moderate amount of mathematical links with other fields, whereas School B and C have a low level of such connections. The subsequent data represents the quantity of pupils categorised by their level of proficiency in each indicator:

Table 5. Analysis of the number of students at each mathematical connection ability

	Mathematical relationships in connecting between mathematical ideas				Mathematical connections in everyday life				Mathematical relationship with other disciplines			
	Low	Keep	High	Very High	Low	Keep	High	Very High	Low	Keep	hIGH	Very High
School A	13 (10,53%)	0 (0%)	5 (4,05%)	62 (50,22%)	44 (35,64%)	6 (4,68%)	26 (21,06%)	5 (4,05%)	38 (30,78%)	6 (4,86%)	8 (6,48%)	29 (23,49%)
School B	17 (14,62%)	0 (0%)	3 (2,58%)	65 (55,9%)	28 (24,08%)	31 (26,66%)	11 (9,4%)	16 (13,76%)	62 (53,32%)	3 (2,58%)	10 (8,6%)	11 (9,46%)
School C	23 (19,32%)	0 (0%)	6 (5,04%)	55 (46,2%)	17 (14,28%)	17 (14,28%)	33 (27,72%)	17 (14,28%)	38 (31,92%)	12 (10,08%)	34 (28,56%)	0 (0%)

According to the above results, on the mathematical connection ability indicators of mathematics topics, no student has moderate ability, on average, each school has very high ability with School B with the criteria of excellent schools in the city having the highest number of students. Meanwhile, in the indicator of the connection of mathematics with daily life, the school that has the most low-ability students is School A with the criteria of superior schools in the village. Meanwhile, in the indicator of mathematical connection ability with other sciences, students in School C with school criteria in the village do not have students with very high abilities. When the three schools were combined, it was found that the indicators of mathematical connection ability with mathematical topics had the highest percentage compared to other indicators. Here is a graph of the ability of mathematical connections between schools:

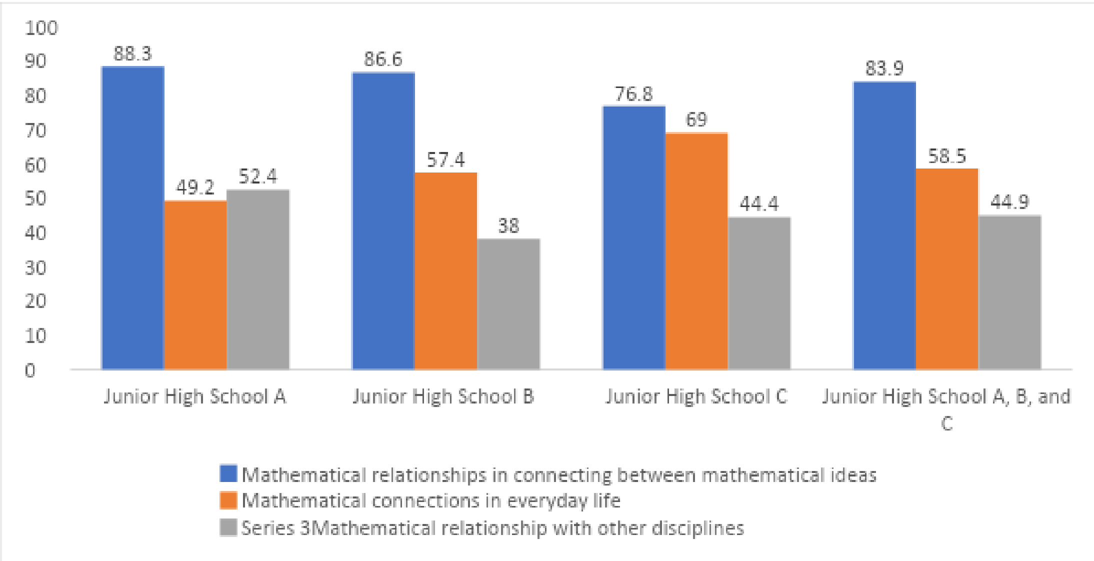

Figure 1. Mathematic Connection Chart

Table 6. Test the normality of mathematical connections

One-Sample Kolmogorov-Smirnov Test

		A	B	C
N		81	86	84
Normal Parameters[a,b]	Mean	58.3951	56.4535	61.9643
	Std. Deviation	26.50268	22.73720	23.31060
Most Extreme Differences	Absolute	.106	.126	.126
	Positive	.102	.073	.098
	Negative	-.106	-.126	-.126
Kolmogorov-Smirnov Z		.951	1.165	1.152
Asymp. Sig. (2-tailed)		.326	.132	.141

a. Test distribution is Normal.

b. Calculated from data.

Testing the normality of students' mathematical connection data using the Kolmogorov-Smirnov test with a significance level of α = 0.05. Based on the table, it is known that the significant value of asymp. Sig.(2-tailed) School A 0.326, School B 0.132, and School C 0.141 which have a value greater than 0.05. In accordance with the basis of decision-making in the kolmogorov-Smirnov normality test, it can be concluded that the data are normally distributed. Thus, the assumptions or requirements of normality are met.

Table 7. Multivariate test of mathematical connection

Multivariate Tests[d]

Effect		Value	F	Hypothesis df	Error df	Sig.	Noncent. Parameter	Observed Power
Intercept	Pillai's Trace	.903	762.481[a]	3.000	246.000	.000	2287.444	1.000
	Wilks' Lambda	.097	762.481[a]	3.000	246.000	.000	2287.444	1.000
	Hotelling's Trace	9.299	762.481[a]	3.000	246.000	.000	2287.444	1.000
	Roy's Largest Root	9.299	762.481[a]	3.000	246.000	.000	2287.444	1.000
school	Pillai's Trace	.157	7.024	6.000	494.000	.000	42.145	1.000
	Wilks' Lambda	.846	7.149[a]	6.000	492.000	.000	42.896	1.000
	Hotelling's Trace	.178	7.274	6.000	490.000	.000	43.641	1.000
	Roy's Largest Root	.153	12.595[c]	3.000	247.000	.000	37.784	1.000

a. Exact statistic
b. Computed using alpha = .05
c. The statistic is an upper bound on F that yields a lower bound on the significance level.
d. Design: Intercept + school

One part of a multivariate test is to test together the effect of each factor on the dependent group, which is important in manova analysis. This factor has a major effect. In multivariate tests showing F values for Pillai's Trace, Wilks' Lambda, Hotelling Trace, Roy's Largest root has a value of sig= 0.000<0.05 (significant), which means that there is an influence of schools on indicators of mathematical connections to mathematical concepts, daily life, and with other sciences.

Table 8. Descriptive Statistics of mathematical connections

Descriptive Statistics

	school	Mean	Std. Deviation	N
Mathematicalideas	A	3.5802	1.09389	81
	B	3.4651	1.07043	86
	C	3.0714	1.44611	84
	Total	3.3705	1.23052	251
everydaylife	A	4.4321	3.11825	81
	B	5.1628	2.54771	86
	C	6.2143	2.71129	84
	Total	5.2789	2.87922	251
otherdisciplines	A	3.6667	2.95381	81
	B	2.6628	2.29890	86
	C	3.1071	2.40490	84
	Total	3.1355	2.58410	251

From the results above, the mathematical idea indicator obtained the mean in School A is 3.5802, while in School B it has a mean of 3.4651 with 86 students and in School C it has a mean of 3.0714 with 84 students. In mathematics indicators in daily life in School A has a mean of 4.4321, School B has a mean of 5.1628, and SMP School C has a mean of 6.2143. While in mathematical indicators in other sciences in School A has a mean of 3.6667, School B has a mean of 2.6628, and School C has a mean of 3.1071.

Table 9. Inter-subject effect test of mathematical connection

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power[b]
Corrected Model	mathematicalideas	11.847[a]	2	5.923	4.006	.019	8.012	.713
	everydaylife	132.738[c]	2	66.369	8.485	.000	16.971	.965
	otherdisciplines	42.138[d]	2	21.069	3.211	.042	6.422	.610

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power[b]
Intercept	mathematicalideas	2852.681	1	2852.681	1929.300	.000	1929.300	1.000
	everydaylife	6966.040	1	6966.040	890.623	.000	890.623	1.000
	otherdisciplines	2481.982	1	2481.982	378.263	.000	378.263	1.000
school	mathematicalideas	11.847	2	5.923	4.006	.019	8.012	.713
	everydaylife	132.738	2	66.369	8.485	.000	16.971	.965
	otherdisciplines	42.138	2	21.069	3.211	.042	6.422	.610
Error	mathematicalideas	366.695	248	1.479				
	everydaylife	1939.740	248	7.822				
	otherdisciplines	1627.257	248	6.562				
Total	mathematicalideas	3230.000	251					
	everydaylife	9067.000	251					
	otherdisciplines	4137.000	251					
Corrected Total	mathematicalideas	378.542	250					
	everydaylife	2072.478	250					
	otherdisciplines	1669.394	250					

The above results show the relationship between the ability of mathematical connections with the indicator of mathematical ideas (Y1) resulting in the value of F = 4.006 with a significance of 0.019. The significance value is smaller than the predetermined significance level of 0.05 (0.031 < 0.05). Then for everyday life (Y2) produces a value of F = 8.485 with a significance of 0.00. The significance value is smaller than the predetermined significance level of 0.00 < 0.05. Then for the connection of mathematics with other science indicators (Y3) a value of F = 3.211 and a signification value of 0.042 is obtained which is smaller than the specified signification level of 0.042<0.05. So it can be concluded that there are differences in indicators of mathematical connection with mathematical concepts (Y1), everyday life (Y2), and with other sciences (Y3). With different P values, it was found that schools have an influence on indicators of mathematical connection ability in everyday life, the ability of mathematical connections to mathematical ideas and mathematical connections to other sciences.

Table 10. Leenge's Test of Equality of Errors Variance of mathematical connections

Levene's Test of Equality of Error Variances[a]

	F	df1	df2	Sig.
mathematicalideas	9.209	2	248	.000
everydaylife	9.180	2	248	.000
otherdisciplines	11.613	2	248	.000

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + school

The Leevene test is used to check the homogeneity of a data with a signification level of $\alpha = 0.05$. In the Leevene test, if the signification value > 0.05, the data can be said to be the same. In the results of the Leevene test, it was found that each indicator had a signification value of less than 0.05, so at the next stage of the analysis it must use Games-Howel as the data observed in the Post-Hoc test.

Table 11. Some Comparisons of Mathematical Connections

Multiple Comparisons

Dependent Variable		(I) school	(J) school	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
mathematicalideas	Bonferroni	A	B	.1151	.18828	1.000	-.3387	.5689
			C	.5088*	.18936	.023	.0524	.9652
		B	A	-.1151	.18828	1.000	-.5689	.3387
			C	.3937	.18654	.107	-.0559	.8433
		C	A	-.5088*	.18936	.023	-.9652	-.0524
			B	-.3937	.18654	.107	-.8433	.0559
	Games-Howell	A	B	.1151	.16762	.771	-.2813	.5116
			C	.5088*	.19917	.031	.0375	.9802
		B	A	-.1151	.16762	.771	-.5116	.2813
			C	.3937	.19550	.112	-.0690	.8564
		C	A	-.5088*	.19917	.031	-.9802	-.0375
			B	-.3937	.19550	.112	-.8564	.0690
everydaylife	Bonferroni	A	B	-.7307	.43302	.278	-1.7744	.3130
			C	-1.7822*	.43552	.000	-2.8319	-.7324
		B	A	.7307	.43302	.278	-.3130	1.7744
			C	-1.0515*	.42902	.045	-2.0856	-.0174
		C	A	1.7822*	.43552	.000	.7324	2.8319
			B	1.0515*	.42902	.045	.0174	2.0856
	Games-Howell	A	B	-.7307	.44217	.227	-1.7771	.3157
			C	-1.7822*	.45558	.000	-2.8601	-.7043
		B	A	.7307	.44217	.227	-.3157	1.7771
			C	-1.0515*	.40372	.027	-2.0062	-.0968
		C	A	1.7822*	.45558	.000	.7043	2.8601
			B	1.0515*	.40372	.027	.0968	2.0062

Dependent Variable		(I) school	(J) school	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
otherdisciplines	Bonferroni	A	B	1.0039*	.39661	.036	.0479	1.9598
			C	.5595	.39890	.486	-.4020	1.5210
		B	A	-1.0039*	.39661	.036	-1.9598	-.0479
			C	-.4444	.39295	.778	-1.3915	.5028
		C	A	-.5595	.39890	.486	-1.5210	.4020
			B	.4444	.39295	.778	-.5028	1.3915
	Games-Howell	A	B	1.0039*	.41130	.042	.0303	1.9774
			C	.5595	.42020	.380	-.4349	1.5540
		B	A	-1.0039*	.41130	.042	-1.9774	-.0303
			C	-.4444	.36098	.437	-1.2980	.4093
		C	A	-.5595	.42020	.380	-1.5540	.4349
			B	.4444	.36098	.437	-.4093	1.2980

Based on observed means.

The error term is Mean Square(Error) = 6.562.

*. The mean difference is significant at the .05 level.

The observed Post-Hoc test is Games-Howell because the data used are not the same. Post-Hoc test results will be said to be significant if the significance value > 0.05. From the results above, it was found that the indicator of mathematical ability with mathematical ideas of School A has differences with School C because the significance value of School A to School C is 0.031<0.05. Then in the indicator of mathematical ability with daily life, School A has a difference with School C with a significance value of 0.000<0.05 and School B has a difference with School C with a significance value of 0.027<0.05. Meanwhile, in the indicator of the ability to connect mathematically with other sciences, School A has a difference from School B with a significance value of 0.042<0.05.

Based on the results of multivariate inferential analysis, it was found that schools with different characteristics have an influence on students' mathematical connection ability. This conclusion can be attributed to the results of the Post-Hoc test which states that there are differences between schools in each indicator of mathematical connection ability. In addition to characteristics by region, characteristics based on the level of school excellence are also a consideration in determining the influence of schools on mathematical connections. The level of school excellence can be influenced by student achievement both academic and non-academic. In academic achievement, students' understanding of learning is strongly influenced by the methods used by teachers in delivering material (Manalu et al., 2020; Sodik et al., 2019; Yuliana & Widyasari, 2022). According to Raharjo, I (2021), the most influential factor in students' understanding of learning and the abilities that students have are internal factors and only a small part of external factors. Internal factors in students include student interest, student enthusiasm for learning, students' cognitive abilities, and other things that come from within the student. Meanwhile, external factors that affect the student's learning process are social backgrounds such as family, friends, and the community environment that interacts with students.

The learning method in the comparison material used in schools in rural areas with superior characteristics is a problem-based method. This method is used with the hope that students are accustomed to thinking critically to solve problems in comparison material using concepts they have learned before. The problem-based learning method is a suitable method used to improve mathematical connection skills if the problem is associated with other disciplines and students' daily lives (Basuki, 2019). This is in accordance with several studies that say that problem-based learning methods are suitable for improving students' mathematical connection abilities (Abidin, 2020). Unfortunately, teachers at School A rarely associate problem-based learning with daily life so that students are less able to connect mathematics learning with daily life. Based on the graph, it can be seen that School A has the highest mathematical connection ability on the mathematical connection indicator with mathematical ideas and the lowest ability on the mathematical connection indicator with everyday life. In addition to the methods used by the teacher, this ability of mathematical connection can be influenced by internal and external factors. One of the most influential internal factors in middle school A students is the student's lack of interest in mathematics. This is in line with Unarti's research (2022) that mathematical connection ability is influenced by student interest in learning. Student interest in learning can decrease due to a lack of variety in the learning process.This is due to the lack of variety in the learning process. In School A, teachers are only fixated on using whiteboards and package books as learning media that cause students to feel bored in the learning process. Then the most influential external factor in most students in School A is the scope of friendship. Most of the students in School A have the same scope of friendship so the thinking they have is less developed.

In schools in villages with non-school characteristics, mathematics teachers often use a contextual approach to comparative materials in the hope that students will more easily understand the material when relating the material learned to everyday life. The contextual approach has several important components, namely constructivism, modelling, inquiry, questioning, learning society, authentic judgement, and reflection (Ramdani, 2018). The use of a contextual approach is a suitable approach in improving students' mathematical connection ability because it makes students get mathematical concepts independently so that they can understand the usefulness and origin of the concepts they find (Simbolon, 2019; Sodik et al., 2019; Yuliana & Widyasari, 2022). This is in line with the research of Fitriana and Putri (2020) which says that a contextual approach will improve students' mathematical connection ability. Low student interest and student motivation make it a little difficult for teachers to practise contextual approaches. In chart 1 it can be seen that School C has the ability of mathematical connections which in each indicator does not have a large difference. This condition can be influenced by the contextual methods and approaches that teachers use. The contextual approach used requires students to look for mathematical concepts with the knowledge that students already have and students' experiences in their daily lives. In addition to contextual methods, there are internal factors of students that affect students' mathematical connection ability. The internal factors that most influence students in School C are students' interest in learning, student learning motivation, and students' cognitive abilities which make students take a little longer to develop science than students in general. This is related to influential external factors , namely family factors that are considered unable to guide students in learning at home.

Schools with excellent characteristics in the city area have a very comfortable learning environment. In the process of learning comparative material, the teacher will remind students of the material previously studied. After doing this, the teacher will enter the Lead in phase by forming heterogeneous groups and then asking students questions to explore the experience or knowledge they already have as a basis for learning comparative material. The second phase is the Reconstruction phase by providing learning materials to students and assigning tasks as a process in developing new understanding. The last phase used is the Productional phase by presenting the results of the work with the aim of adapting what students understand to the actual mathematical concepts. These three phases are phases of the C-MID (Cooperative-Meaningful Instructional Design) learning method. That way, the teacher hopes that students can understand the mathematical material well and understand that all concepts in mathematics are related to each other. This method has an influence on students' mathematical connection ability if the assignment and delivery of material from the teacher can be entangled with daily life and also other disciplines (Purnama & Fadli, 2020). However, the application of C-MID in schools in this area of the city does not link the material of mathematics with other disciplines and also daily life. This has an effect on the mathematical connection ability of students in school, which is proven by the calculation results shown in Graph 1, which show that the ability to make mathematical connections with other mathematical ideas has a higher percentage than the other two indicators of mathematical connection ability.

Village-area schools with superior characteristics and city-area schools with superior characteristics have similarities in two indicators, namely indicators of the ability to connect mathematically with mathematical ideas and mathematical connections with daily life which are the result of the Post-Hoc test. In city schools with excellent characteristics, the internal factors that most influence the ability of mathematical connections are the lack of enthusiasm for student learning and also the interest in learning students. This can be seen from the response of students when the maths teacher enters the classroom and the enthusiasm of the students when learning takes place. In addition to these internal factors, external factors also greatly affect the student's mathematical connection ability, especially student environmental factors. Students' desire to keep up with the times makes students less focused on their academic abilities but racing to pursue their social status.

After analysing the mathematical connection ability in each school, a combined analysis of the mathematical connection ability of the three schools that have different characteristics is needed. According to chart 1, the indicator of mathematical connection with other disciplines is an indicator of mathematical connection that has the highest percentage among other indicators. This is because the three schools use a learning method that begins with the teacher's action to remind students of the material that has been studied before along with reminding the material and then with the material to be studied. While the indicator that has the lowest percentage is the indicator of mathematical connection with other disciplines. This can be because teachers do not understand the relationship between mathematics and other disciplines so that teachers are less able to apply this indicator to learning.

Based on research, it can be seen that the mathematical connection ability of each student with the achievement of mathematical connection aspects has different results in each school. From these results, the category of students with low, medium, high, and very high abilities was obtained. Overall, it is only at the first level that students in each school are at medium ability. As for the results on other indicators, students in each school have low and moderate connection ability. With the view that the ability of mathematical connection is an important ability because it has similarities with other systematic and structured sciences which contain things related to one another, students at every level of education must have this ability (Manalu et al., 2020).

In reality, School A, School B, and School C have low indicators of students' mathematical connection ability. Low ability will make it difficult for students to interpret mathematics and foster interest in mathematics because they already think mathematics is difficult. That way, the low ability of mathematical connections will have an impact on the student's learning process and also their learning outcomes. Therefore, efforts are needed from teachers to create learning that can later develop students' mathematical connection skills.

4. CONCLUSION

Profile of Middle School Students' Mathematical Connection Ability in Comparative Material by investigating the mathematical connection ability that there are differences in the mathematical connection ability of the three schools. From the results of data analysis from three schools with different characteristics, it was found that schools with superior status did not guarantee students' mathematical connection abilities. Mathematical connections cannot develop by themselves, therefore, assistance from the school is needed to improve mathematical connection skills. In learning in the classroom, the teacher needs to train and familiarize students with relating concepts in mathematics and those outside mathematics. Mathematics teachers need to use various strategies to be able to build students' mathematical connections in learning mathematics in the classroom. Further research on mathematical connections can be developed by paying attention to student learning styles, what methods are appropriate to use, or lower educational levels and the types of mathematical problems used.

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