Students' Mathematical Connection Ability viewed from Self-Efficacy in Statistics

Kasih Ayu Dian Antariksa[*], Kartono, & Sukestiyarno

Postgraduate School of Mathematics Education, Universitas Negeri Semarang, Indonesia

Abstract: This research is a qualitative research. The purpose of this study is to describe students' mathematical connection abilities in terms of self-efficacy. Data collection techniques in qualitative research include (1) questionnaires, (2) interviews, and (3) documentation of students' work as supporting data for analysis. Data analysis in qualitative research includes data reduction, data presentation, and drawing conclusions. From this study it can be concluded that students with high self-efficacy are able to relate the 3 indicators of mathematical connection ability well, which means students with high self-efficacy will also have high mathematical connection ability. Students with moderate self-efficacy are only able to connect 2 indicators of mathematical connection ability well because students tend not to because these students lack understanding of the concepts being taught and students with low self-efficacy are only able to relate 1 indicator of mathematical connection ability well because students are less able connecting mathematical concepts. Likewise, student self-efficacy is still in the low category, this is because students still seem hesitant in working on a problem.

Keywords: mathematical connection ability, self-efficacy, junior high school students.

Abstrak: *Penelitian ini merupakan penelitian kualitatif. Tujuan dari penelitian ini adalah untuk mendeksripsikan kemampuan koneksi matematis siswa ditinjau dari self-efficacy. Teknik pengumpulan data dalam penelitian kualitatif meliputi (1) angket, (2) wawancara, dan (3) dokumentasi hasil karya siswa sebagai data pendukung analisis. Analisis data dalam penelitian kualitatif meliputi reduksi data, penyajian data, dan penarikan kesimpulan. Dari penelitian ini dapat disimpulkan bahwa siswa dengan self-efficacy tinggi mampu menghubungkan 3 indikator kemampuan koneksi matematis dengan baik yang artinya siswa dengan self-efficacy tinggi maka kemampuan koneksi matematisnya akan tinggi pula. Siswa dengan self-efficacy sedang hanya mampu menghubungkan 2 indikator kemampuan koneksi matematis dengan baik karena siswa cenderung tidak karena siswa tersebut kurang dalam memahami konsep yang diajarkan dan siswa dengan self-efficacy rendah hanya mampu menghubungkan 1 indikator kemampuan koneksi matematis dengan baik karena siswa kurang mampu menghubungkan konsep-konsep matematis. Begitu pun dengan self-efficacy siswa masih ada dalam kategori rendah, hal ini dikarenakan siswa masih terkesan ragu-ragu dalam mengerjakan suatu soal.*

Kata kunci: *kemampuan koneksi matematis, efikasi diri, siswa SMP.*

▪ **INTRODUCTION**

Mathematics plays an important role in the development of science and technology as a tool for solving various problems in other fields of science. This is in accordance with one of the goals of learning mathematics in schools (Kemendikbud, 2013), namely understanding mathematical concepts, explaining the interrelationships between concepts, and applying concepts or algorithms in a flexible, accurate, efficient, and precise way in solving problems.

Mathematical connection ability is a student's ability to connect mathematical topics, connect mathematics with mathematics itself and with other sciences, and connect mathematics with real life or everyday life (Nugraheni & Junaedi, 2019). Even

though mathematics has benefits for other fields of study as well as for everyday life, there are still many opinions from some students who consider it that mathematics is a lesson the hard one. This can affect the character of students who feel unsure of their ability to learn mathematics and even solve problems in everyday life using the application of mathematics. As a result, this can have a negative impact on students' affective, among other things, it can cause anxiety, fear, and worry from lack of confidence in one's own abilities (Jelatu, 2018).

Self-efficacy is defined as a person's belief about his own ability to produce achievements that affect events in real life. According to Firmansyah and Fauzi (Nuryaninim, 2012) self-efficacy helps a person in making choices, their efforts to move forward, the persistence and struggle they show in facing difficulties, and the level of anxiety or calm they experience when maintaining the tasks they face. including life. they. Students with low self-efficacy in doing certain tasks will tend to avoid tasks that they consider difficult and cannot be completed. Conversely, students who have high self-efficacy will continue to try to complete the task no matter how difficult the task is. The existence of high self-efficacy in mathematics lessons encourages students to be diligent and try to really pay attention and look for learning strategies to learn and do math assignments (Sunaryo, 2017). According to research conducted by Soleymani & Rekabdar (2016: 16) which aims to determine the relationship between self-efficacy, achievement and attitudes towards mathematics which concludes that there is no relationship between attitudes towards mathematics learning achievement. There is a positive relationship between self-efficacy in mathematics and mathematics achievement. The results show that there is a positive relationship between self-efficacy and math achievement. Therefore, high self-efficacy has a positive impact on math achievement. Conversely, low self-efficacy has a negative impact on student achievement.

Self-efficacy also has three variations in various dimensions and has implications for one's work. Bandura (1997) stated that a person's self-efficacy measurement refers to three dimensions, namely Magnitude, Strength, and Generality. The magnitude dimension is how students can overcome their learning difficulties which include: (a) Optimistic outlook in doing lessons and assignments; (b) How much interest in the lessons and assignments; (c) Develop capabilities and achievements; (d) Seeing a difficult task as a challenge; (e) Study according to a set schedule; (f) Act selectively in achieving its goals. The strength dimension, namely how high the students' confidence in overcoming their learning difficulties, which includes: (a) The effort made can improve achievement well; (b) Commitment in completing the assigned tasks; (c) Believe and know the advantages possessed; (d) Persistence in completing tasks; (e) Have positive goals in doing various things; (f) Having good motivation towards himself for self-development. The generality dimension, which indicates whether self-efficacy beliefs will take place in a particular domain or apply in a variety of activities and situations which include: (a) Responding to different situations well and thinking positively; (b) Making past experience a way to achieve success; (c) Likes to seek new situations; (d) Can deal with any situation effectively; (e) Trying new challenges (Hendriana, Rohaeti & Sumarmo: 2017).

Self-efficacy indicators were further developed in questionnaire statements. Measuring a person's self-efficacy is carried out using an efficacy scale in the form of a

perception scale because it refers to perceptions of individual abilities. In a person's self-efficacy measurement standard, several items are presented that describe task demands at different levels, and that person will assess or assess the strength of his belief in his ability to complete the required task or activity (Bandura, 1977). Bandura (1977) explains the differences in the characteristics of people who have high and low self-efficacy. People who have low self-efficacy have the following characteristics: (1) stay away from tasks they consider difficult, (2) stop quickly when they encounter difficulties, (3) have low aspirations and poor commitment to the goals they have chosen , (4) focusing on the bad consequences he will face from failure, and (5) tending to reduce his efforts because he is slow to improve the circumstances of the failures experienced and is easy to experience stress, which negatively affects learning. Meanwhile, people who have high self-efficacy have the following characteristics: (1) want to approach difficult tasks as challenges to be completed, (2) set goals and commit to these tasks, (3) have high efforts , (4) have strategic thinking, (5) think that failures are experienced due to less than optimal effort so that higher efforts are needed in dealing with difficulties, (6) quickly improve after failure and are not easily stressed. The existence of high self-efficacy towards mathematics lessons encourages students to be diligent and try really hard to pay attention and look for learning strategies to learn and do math tasks. The difficulties encountered in learning mathematics did not make him despair. It is this perseverance and effort that can make a positive contribution to the mathematics learning achievements achieved by students at school (Sunaryo, 2017).

Based on this, the connection with mathematical connection ability is that self-efficacy has a function to assess students' success in solving mathematical connection ability questions, because with self-efficacy students are trained to be confident in their abilities, dare to face challenges, not easily give up in solving problems, can know his own weaknesses and shortcomings, then indirectly this treatment can change the habits of students so they are not embarrassed to ask questions, dare to express opinions, can cooperate with others, dare if asked by the teacher to come forward, with this indirectly can hone students' mathematical connection skills (Adni, Nurfauziah, Rohaeti. 2018).

▪ **METHOD**

This research is qualitative research. Qualitative research is used to analyze students' mathematical connection abilities based on self-efficacy (Moleong, 2010). Qualitative research design in this study uses grounded theory design. Grounded theory is a research strategy in which the researcher generates a general and abstract theory of a particular process, action or interaction derived from the views of the participants (Creswell, 2016). This research was conducted at SMP Negeri 39 Semarang. The population in this study were all students of class VIII. In qualitative research, the selection of subjects was carried out using a purposive sampling technique, with 6 experimental class students, namely class VIII F, selected based on their mathematical connection abilities with high, medium, and low self-efficacy.

Data collection techniques in qualitative research include (1) questionnaires, (2) interviews, and (3) documentation of students' work as supporting data for analysis. Sugiyono (2013) mentions data analysis in qualitative research including data reduction, data presentation, and drawing conclusions. The reduction in this case is to analyze the results of the mathematical connection ability test. Then the mathematical connection

ability is reviewed from self-efficacy. The data reduction stage begins with the selection of research subjects based on the results of questionnaires and student self-efficacy interviews. Next, two students were selected for each self-efficacy category. In qualitative research data presentation is usually done in the form of brief descriptions, charts, relationships between categories, flowcharts, and the like. In this case Miles and Huberman in Sugiyono (2015) state that to present data in qualitative research is with narrative text. In this study, data on students' mathematical connection abilities in terms of self-efficacy are presented in the form of tables, brief descriptions, and photographs of student work. Generating conclusions in qualitative research are expected to be new findings that have never existed before. These findings can be in the form of a description or description of an object that was previously still dim so that upon examination it becomes clear. In this study, the conclusion is in the form of a description of students' mathematical connection abilities in terms of self-efficacy.
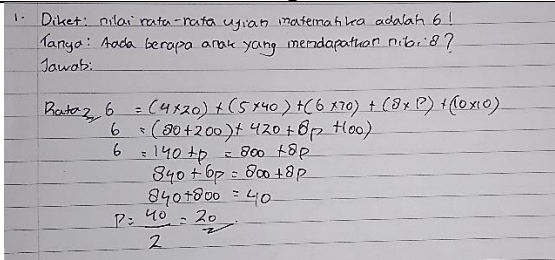
▪ **RESULT AND DISSCUSSION**

The results and discussion of this research are that in the experimental class, it was found that there were several students with high, medium and low self-efficacy categories. For further analysis, 6 subjects were taken in the category of students with high self-efficacy, 2 students with moderate self-efficacy and 2 students with low self-efficacy.

Description of Students' Mathematical Connection Ability with High Self-Efficacy
a.   Subject no. F-16

Table 1. Results of the f-16 subject's mathematical connection ability test

Indicators	Description
1. Connections between mathematical topics	
	Subject F-16 wrote down known, asked in the problem. Although still not complete. So it can be seen that the F-16 subject uses the average concept in calculating the number of children who get a score of 8.
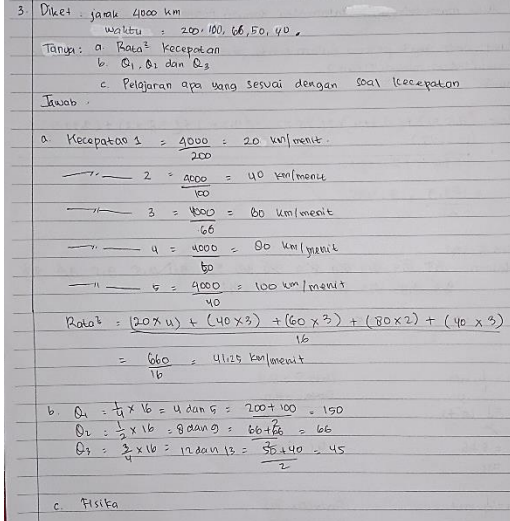
2. Connection with disciplines (other fields of study)	
	In question number 3, subject F-16 wrote it was known, it was asked in full. But it doesn't include the speed formula, it just writes the numbers. Subject F-16 was able to use the speed formula to find the average runner.
3. Connection with the real world (everyday life)	
	From figure above, Subject F-16 does not write down what is known and what is asked. F-16 subjects can work on questions related to everyday life. This can be seen from F-16's correct answer.
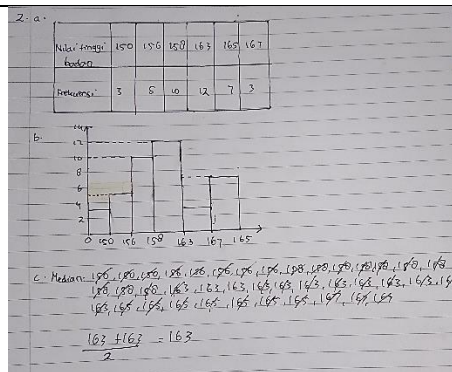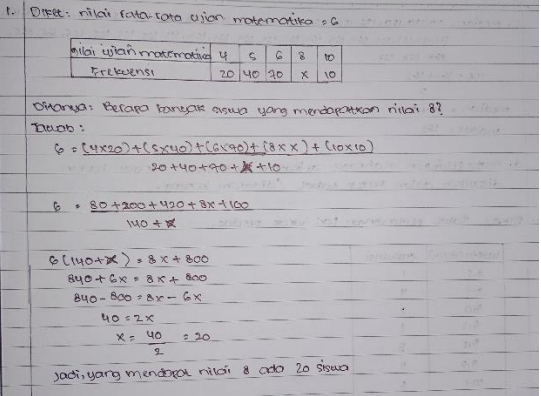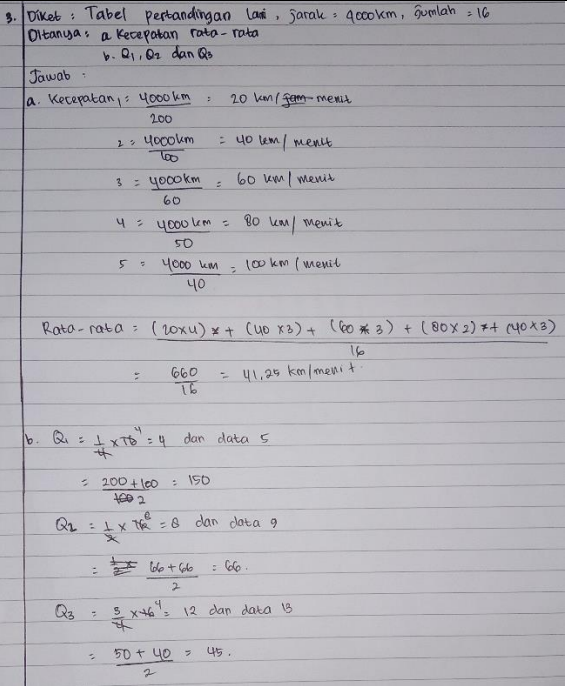
The results of the written test, interview test and triangulation obtained results on subject F-16. It can be concluded: (1) F-16 subjects are able to connect between mathematics topics. This can be seen from the answers that are coherent, can mention what is known, what is asked. (2) F-16 courses are able to connect with scientific disciplines (other fields of study). It can be seen that subject F-16 was able to find the average speed by first finding the speed of each runner. (3) subject F-16 was able to connect with the real world (daily life), seen in the sequence of answers to question number 3 even though subject F-16 did not write down what was known and what was asked.

b.   Subject no F-28

Table 2. Results of subject f-28's mathematical connection ability test

Indicators	Description
1. Connections between mathematical topics	Subject F-28 wrote down what was known, asked in the questions in full. Then it can be seen that subject F-28 uses the concept of average in calculating the number of children who get a score of 8.
2. Connection with disciplines (other fields of study)	Subject F-28 already understood question number 3, proven by writing down known, asked in full. But it doesn't include the speed formula, it just writes the numbers.

3. Connection with the real world (everyday life)
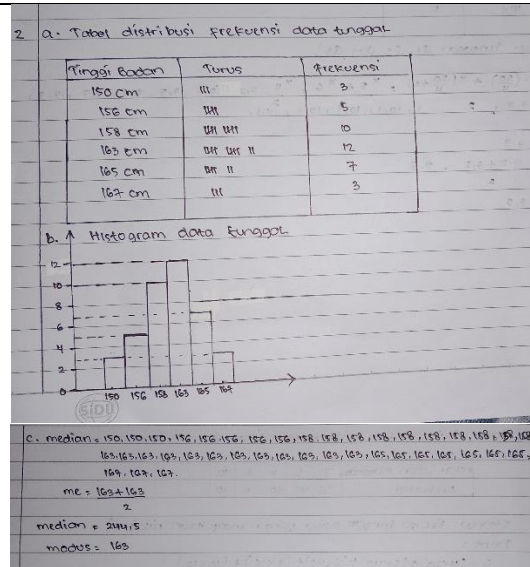
From the figure above, Subject F-28 does not write down what is known and what is asked. F-28 subjects can work on questions related to everyday life. This can be seen from F-28's answers which were correct but there were still calculation errors to find the median.
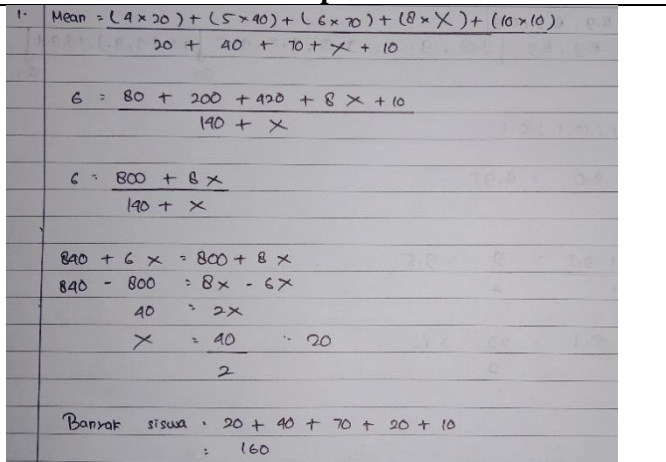
The results of the written tests, interviews and triangulation in subject F-28 can be concluded: (1) subject F-28 is able to make connections between mathematics topics. This can be seen from the complete flow of answers, can mention what is known, what is asked. (2) F-28 courses are able to connect with scientific disciplines (other fields of study). It can be seen that subject F-28 was able to find the average speed by first finding the speed of each runner. (3) the F-28 subject is able to connect with the real world (daily life), seen in the sequence of answers to question number 3.

The results of the description of the ability to connect mathematically with high self-efficacy show that Subject F-16 and Subject F-28 are able to connect 3 indicators of mathematical connection. This means that students with high self-efficacy also because they are not only capable but able to connect what they see with previous concepts. The results of the written tests, interviews and triangulation in subject F-28 can be concluded: (1) subject F-28 is able to make connections between mathematics topics. This can be seen from the complete flow of answers, can mention what is known, what is asked. (2) F-28 courses are able to connect with scientific disciplines (other fields of study). It can be seen that subject F-28 was able to find the average speed by first finding the speed of each runner. (3) the F-28 subject is able to connect with the real world (daily life), seen in the sequence of answers to question number 3.
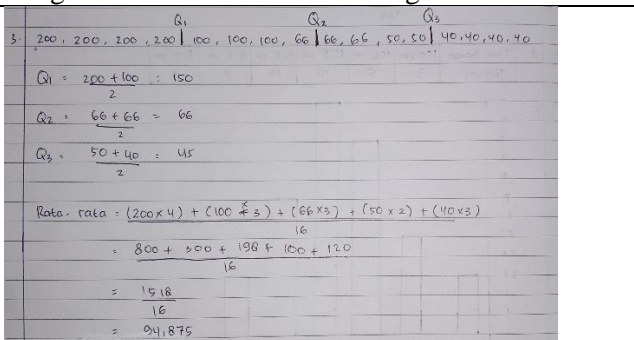
Description of Mathematical Connection Capability with Moderate Self-Efficacy
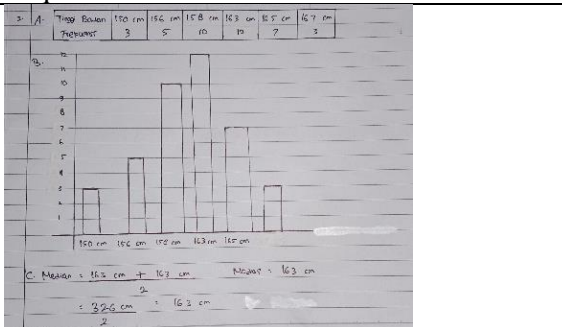a.   Subject no. F-02

Table 3. Results of subject f-02's mathematical connection ability test

Indicators	Description
1. Connections between mathematical topics	Subject F-02 did not write down known, asked. So it can be seen that subject F-02 uses the average concept in calculating the number of children who get a score of 8.
2. Connection with disciplines (other fields of study)	Subject F-02 slightly understood what was meant in question number 3, but was still not quite right in answering the questions.
3. Koneksi dengan dunia nyata (kehidupan sehari-hari)	From figure above Subject F-02 does not write down what is known and what is asked. Subject F-02 can work on questions related to everyday life. This can be seen from F-02's correct answer.
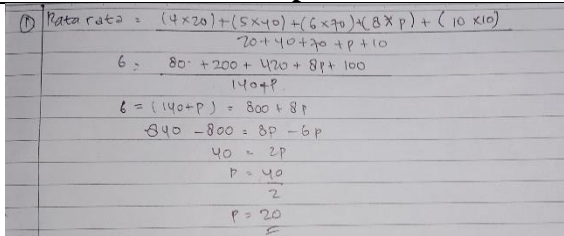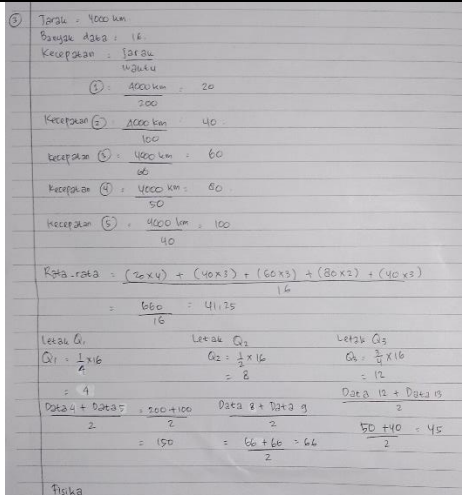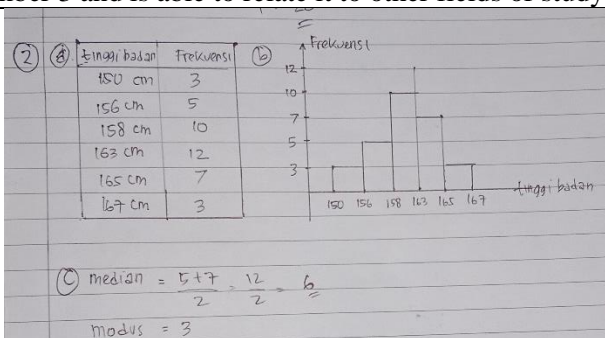
b.   Subject no. F-08

Table 4. Results of subject f-08's mathematical connection ability test

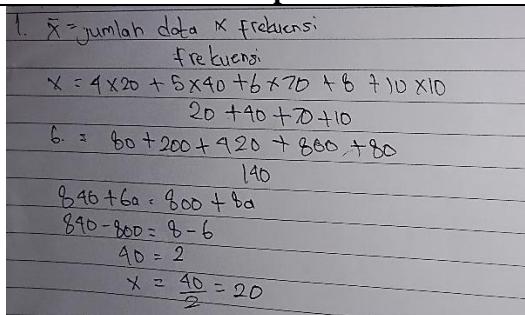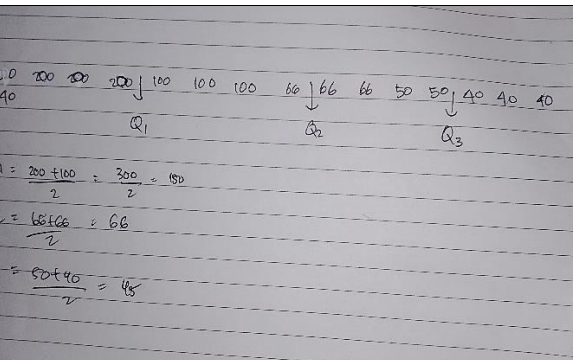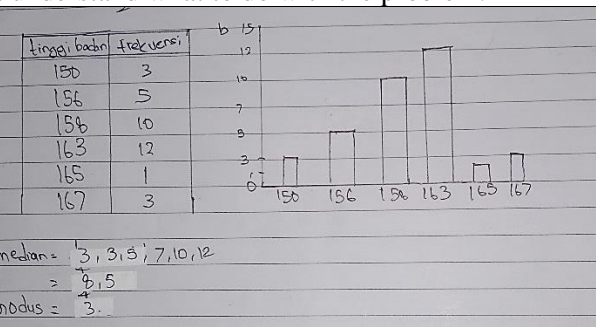| Indicators	Description
1. Connections between mathematical topics	
	Subject F-08 did not write down known, asked. So it can be seen that subject F-08 uses the average concept in calculating the number of children who get a score of 8.
2. Connection with disciplines (other fields of study)	
	Subject F-08 understands what is meant in question number 3 and is able to relate it to other fields of study.
3. Connection with the real world (everyday life)	
	Subject F-08 did not write down what was known and what was asked. Subject F-08 could not work on the questions because there were still wrong answers for the median and mode.

The results of written tests, interviews, and triangulation on F-08 subjects can be concluded: (1) F-08 subjects are able to connect between mathematics topics, (2) F-08 subjects are able to connect with (other) scientific disciplines. field of study). It can be seen that subject F-08 was able to find the average speed by first finding the speed of

each runner. (3) subject F-08 is less able to connect with the real world (daily life), it seems that there are still answers that are not quite right. From the results of the description above, subjects F-02 and F-08 have moderate self-efficacy, of the 3 indicators of mathematical connection, only 2 indicators are able to be fulfilled. This is because students do not understand the concept of the problem, students tend to do it only by looking at the problem in general and not analyzing it first (Adni et al., 2018).

Description of Mathematical Connection Capability With Low Self-Efficacy
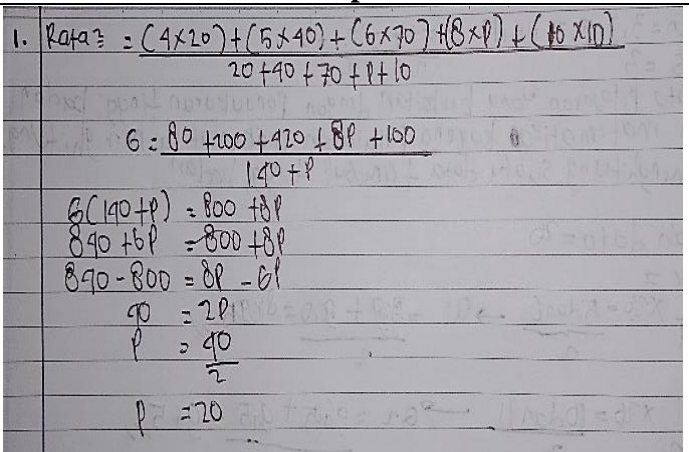a.   Subject no. F-11

Table 5. Results of the F-11 subject's mathematical connection ability test

Indicators	Description
1. Connections between mathematical topics	 Subject F-11 did not write down what was known, asked in full. Subject F-11 was also incomplete in writing answers.
2. Connection with disciplines (other fields of study)	 Subject F-11 only wrote down the data he described, but did not understand what to do with the problem.
3. Connection with the real world (everyday life)	 From figure above, Subject F-11 does not write down what is known and what is asked. F-11 subjects are able to work on questions related to everyday life.

The results of written tests, interviews and triangulation on F-11 subjects can be concluded: (1) F-11 subjects are less able to connect between mathematical topics, and in doing so are also incomplete. (2) F-11 subjects are less able to connect with scientific disciplines (other fields of study). It can be seen that subject F-28 was able to find the average speed by first finding the speed of each runner. (3) F-11 subjects are able to connect with the real world (everyday life).
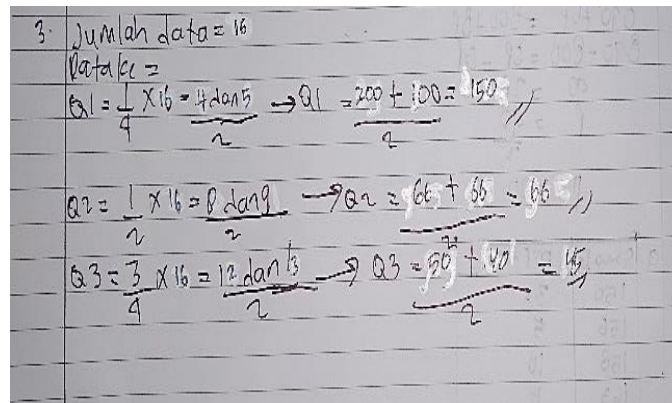
b.   Subject no. F-29

Table 6. Results of subject f-29's mathematical connection ability test

Indicators	Description
1. Connections between mathematical topics	Subject F-29 did not write down what was known, asked in full. It can be seen that subject F-29 uses the average concept to solve the problem.
2. Connection with disciplines (other fields of study)	Subject F-29 only wrote down the data in the questions, but did not understand what to do in the questions.

3. Connection with the real world (everyday life)	

From the picture above, Subject F-29 does not write down what is known and what is asked. F-29 subjects are less able to work on questions related to everyday life.

The results of the written tests, interviews and triangulation on the F-29 subject can be concluded: (1) the F-29 subject is able to connect between mathematical topics, and the process is also incomplete. (2) F-29 subjects are less able to connect with scientific disciplines (other fields of study), (3) F-29 subjects are less able to connect with the real world (everyday life).
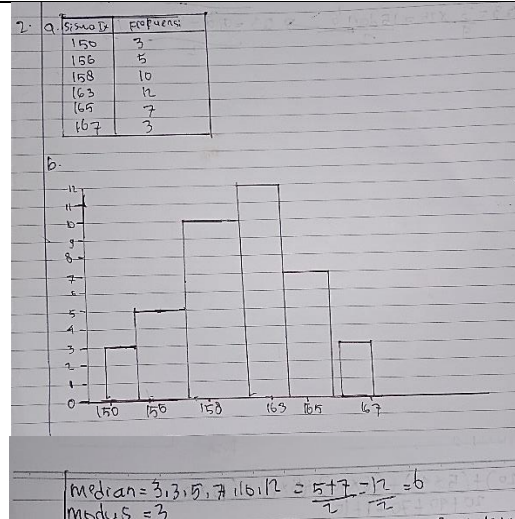
From the results of the description of low mathematical connection ability in subjects F-11 and F-29, it was found that students were only able to fulfill 1 indicator out of 3 indicators of mathematical connection ability. Mathematical connection ability in terms of student self-efficacy is an indicator that is not fulfilled due to the lack of conceptualization of a material. And students still see that material in mathematics is a separate thing. This opinion is reinforced by research from Minarti & Nurfauziah (2016) that there is no relationship between mathematical connection ability and self-efficacy. Besides that, students are less able to relate mathematical concepts. Likewise with student self-efficacy is still in the low category, this is because students still seem hesitant in working on a problem.

▪ **CONCLUSION**

From this study it can be concluded that students with high self-efficacy are able to relate the 3 indicators of mathematical connection ability well, which means students with high self-efficacy will also have high mathematical connection ability. Students with moderate self-efficacy are only able to connect 2 indicators of mathematical connection ability well because students tend not to because these students lack understanding of the concepts being taught and students with low self-efficacy are only

able to connect 1 indicator of mathematical connection ability well because students are less able connecting mathematical concepts. Likewise with student self-efficacy is still in the low category, this is because students still seem hesitant in working on a problem. Students in completing each statement given, on average students are afraid of being wrong to work on questions, and students feel unsure that these students can work on the questions given, there is even one student who says that he sometimes understands the material presented by the teacher in class, but when they go home or get to the student's house they can forget to work on questions of the same type.

▪ **REFERENCES**

Adni, D. N., Nurfauziah, P., & Rohaeti, E. E. (2018). *Ananlisis Kemampuan Koneksi Matematis Siswa SMP Ditinjau Dari Self Efficacy Siswa* [An Analysis of the Mathematical Connection Ability of Junior High School Students in View of Students' Self Efficacy]. *JPMI : Jurnal Pembelajaran Matematika Inovatif*, Vol. 1, No. 5, September 2018.

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. Psychological Review, No. 84: 191-215.

Bandura, A. (1997). Self-efficacy the exercise of control. New York: W. H. Freeman and Company.

Hendriana, H., Rohaeti, E. E., & Sumarmo, U. (2017). Hard skills dan soft skills matematik siswa. *Bandung: Refika Aditama*.

Jelatu., & Silfanus. 2018. *Scaffolding dalam pembelajaran matematika : guru sebagai fasilitator* [Scaffolding in mathematics learning: teachers as facilitators] Prosiding Seminar Nasional Pendidikan Matematika II 2018 HOTS Matematika & Tren Penelitian Pendidikan MIPA.

Kemendikbud. (2013). *Peraturan menteri pendidikan dan kebudayaan republik indonesia no. 65 tahun 2013 tentang standar proses pendidikan dasar dan menengah* [Regulation of the minister of education and culture of the republic of indonesia no. 65 of 2013 concerning process standards for elementary and secondary education]. Jakarta: Kemendikbud.

Kenedy, Ary Kiswanto., dkk. (2018). *Kemampuan Koneksi Matematis Siswa Sekolah Dasar Dalam Memecahkan Masalah Matematika* [Mathematical Connection Ability of Elementary School Students in Solving Mathematical Problems]. *Jurnal Numerac, Vol5, No. 2, hlm. 226-235.*

Moleong, L. J. (2010). *Metodologi penelitian kualitatif.* Bandung: Remaja Rosdakarya.

Minarti, E. D., & Nurfauziah, P. (2016). *Pendekatan konstruktivisme dengan model pembelajaran generatif guna meningkatkan kemampuan komunikasi dan koneksi matematis serta self efficacy mahasiswa calon guru di kota cimahi* [Constructivism approach with generative learning models to improve

communication skills and mathematical connections and self efficacy of prospective teacher students in cimahi city]. P2M STKIP Siliwangi, 3(2), 68–83.

Nugraheni, M., & Junaedi, I. (2019). The mathematics connection ability of 8th grade students in terms of cultural capital in brain-based learning. *Unnes Journal of Mathematics Education, 8(2)*, 128-134.

Nuryaninim. (2012). *Self-efficacy matematika*. online : http://www.slideshare.net/Interest_Matematika_2011/self-efficacy-matematis. (17 Januari 2022).

Soleymani, B., & Rekabdar, G. 2016. Between math self-efficacy and mathematics achievement with control of math attitude. International Journal of Mathematics, 6(1): 16–19.

Sugiyono. 2013. *Metode Penelitian Pendidikan.* Bandung : Alfabeta.

Sugiyono. 2015. *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, dan RND*. Bandung : Alfabeta.

Sunaryo, Yoni. (2017). *Pengukuran self-efficacy siswa dalam pembelajaran matematika di mts n 2 ciamis* [Measurement of student self-efficacy in learning mathematics at mts n 2 ciamis]. *Jurnal Teori dan Riset Matematika (TEOREMA). Vol. 1 No. 2. Hal 39-44.*