EDUMATSAINS
JURNAL PENDIDIKAN MATEMATIKA DAN SAINS
E-ISSN:2527-7235
Volume 9 Issue. 1, July, 2024, pp 51-61
http://ejournal.uki.ac.id/index.php/edumatsains

Analysis of Number Sense Ability in View of Student Learning Independence

Anggun Badu Kusuma[1*], Fira Nur Setiyana[2]

[1,2]Department of Mathematics Education FKIP Universitas Muhammadiyah Purwokerto

e-mail: ***anggun.badu@gmail.com**, **firanur224@gmail.com**

Article Info

Article history:
Received : June 21, 2024
Revised : July 17, 2024
Accepted : July 24, 2024
Available online : July 31, 2024

https://doi.org/10.33541/edumatsains.v9i1.6003

Abstract

Number sense is an important skill for mastering number concepts. This research aims to analyze number sense abilities in terms of student learning independence. This research includes qualitative descriptive research. The research subjects were class VII students of SMP Negeri 1 Kebasen Banyumas. Data was collected through learning independence questionnaires, number sense ability tests, and interviews. Students were divided into three groups based on their learning independence questionnaire scores: high, medium, and low. A purposive sampling strategy was used to identify research subjects. The research results show that students with high learning independence are able to fulfill all number sense indicators. The abilities mastered are demonstrating the ability to compare the size and size of a fractional number problem to be sorted, the meaning of arithmetic operations on fractions, the use of arithmetic operations on fractions, the ability to calculate accurately (correctly) in a conceptually efficient time, choose an efficient calculation strategy, and the results obtained are logical. Students with moderate learning independence are able to master five of the six number sense indicators. Students with low learning independence are only able to fulfill two of the six number sense indicators. Students with low learning independence are only able to fulfill two of the six indicators, namely understanding of the meaning of arithmetic operations on fractions and demonstrating the ability to calculate accurately (correctly) in a conceptually efficient time.

Keywords: Number Sense Ability, Fractions Material, Learning Autonomy

1. Introduction

Number Sense is the ability possessed by an individual to master and understand numbers and their operations (Amirulloh & Budiarto, 2013). Number sense is generally seen as a conceptual understanding of numbers with the aim of solving a problem without being stuck with certain procedures or algorithms (Bobis, 1991). Using this understanding will produce mathematical evaluations and various useful strategies (Reys & Yang, 1998).

Number sense abilities will develop over time from the experience and knowledge that students have. However, each person's responsiveness in learning and solving math problems is different. There are several factors that need to be considered to achieve the ability to solve a problem, including self-confidence (Saputra et al., 2023), learning motivation (Siregar et al., 2023), teacher performance (Puspanaja et al., 2024), anxiety mathematics (Lasdianto et al., 2023), and learning independence (Salsabila et al., 2023).

Learning independence is an important aspect because it can influence student learning outcomes. Success in the learning process is closely related to learning independence, because the higher the learning independence, the better the foundation for student-centered learning (Sandi, 2012). This is because independent learning is an individual process with the initiative or without the help of others in determining activities in the learning process such as formulating learning goals, learning resources, learning needs and controlling the learning process (Sundayana, 2018).

Research on students' number sense abilities reveals various factors that can influence their learning independence. Mariana et al. (2020) found that students with a field-independent cognitive style tend to have a higher number sense, so teaching strategies must be in line with students' cognitive styles. Mohamed & Johnny (2010) emphasize the importance of understanding numbers in everyday life and identify the need for students to improve their understanding of numbers. Santos et al. (2022) highlighted the influence of innate mathematical characteristics and self-efficacy on number sense competence, stating that building self-efficacy is very important to improve number sense skills. Pramestie Wulandari et al., (2021) classified junior high school students' number sense abilities in the low category, indicating the need for targeted interventions to improve these skills. These studies collectively underscore the importance of understanding students' cognitive styles, self-efficacy, and innate mathematical characteristics in developing their number sense abilities and learning independence.

Fractional number material is found in class VII SMP/MTs semester 1 with the first basic competency standard, namely understanding the properties of number counting operations and their use in problem solving. Fractional numbers have also been taught at the SD/MI level, but in reality, there are still SMP/MTs students who have not mastered them well. Fractions are an important topic as a basis for studying algebra and others, but there are still many students who do not understand them (Yulianingsih et al., 2018). One of the causes is the difference in the process of completing calculation operations (Sutiarso, 2019). Difficulty in understanding the concept of fractions and the process of solving them is also due to not being able to understand the material correctly (Kania, 2018).

These conditions make it very important to conduct research on the relationship between student learning independence and students' number sense abilities. This research provides an analysis of number sense abilities when viewed from student learning independence. With this research, it can be seen whether independent learning has an impact on students' number sense abilities. The results

of this research can be used as a reference for what steps teachers should take if they find students with varying levels of learning independence. This research can be used as a basis for teachers to design good learning tools to maximize students' number sense.

2. Methods

This research was carried out in class VII of SMP Negeri 1 Kebasen Banyumas. The research subject was class VII G. The research carried out was qualitative research with a descriptive approach and purposive sampling technique. The instruments used are Questionnaires, Number Sense Ability Tests, Interviews, and Documentation. Instrument validation is carried out by content validation, which is carried out by experts related to number sense and independent learning. The questionnaire used is in the form of a Likert scale consisting of 30 questions containing indicators of learning independence. This questionnaire aims to group students into three categories, namely low, medium and high independence categories. The categorization criteria based on the results of the student learning independence questionnaire are in Table 1 below:

Table 1. Categorization Criteria Based on the Learning Independence Questionnaire

Category	Criteria
Height	$x > 96{,}06$
Medium	$76{,}37 \leq x \leq 96{,}06$
Low	$x < 76{,}37$

The number sense ability test consists of three questions. The preparation of the questions is based on indicators of number sense ability. The grid of number sense ability test questions is according to Table 2 below:

Table 2. Number Sense Ability Test Question Grid

No	Ability Indicator Number Sense	Question Item Number
1	Demonstrates the ability to compare the size and size of a fractional number problem to be sorted	1b, 2b, 3b
2	Demonstrate an understanding of the meaning of arithmetic operations on fractions	1b, 2b, 3a
3	Demonstrate an understanding of the use of arithmetic operations on fractions	1a, 2a, 3a
4	Demonstrate the ability to calculate accurately (correctly) in a conceptually efficient time	1c, 2c, 3a
5	Choose an efficient calculation strategy	1a, 2a, 3b
6	Demonstrate understanding that the results obtained are logical	1c, 2c, 3b

The data analysis stages consist of data reduction, data presentation, and data triangulation. The data processing process in data reduction is carried out by summarizing, sorting and selecting to focus on important things, as well as selecting things that are not needed. The data obtained was based on the results of questionnaires, tests and interviews conducted with 9 students who were grouped into each category of learning independence. The reduced data will provide a clearer

picture of the results of students' number sense ability tests on fraction material in terms of learning independence. After the data has been reduced, the next step is to present the data. The researcher presented the data by presenting questionnaires, test results and interviews in narrative form. This presentation will illustrate students' number sense abilities and independent learning. This aims to make it easier to understand the results of research conducted with existing data and plan what to do. Triangulation of the data used is by using triangulation techniques. This aims to test the validity of the data and check or compare the data that has been obtained and determine the consistency of students' answers seen from the various data used.

3. Result and Discussion

Based on the results of the questionnaire obtained, the number of students in the high learning independence category was 6 students, 21 students in the moderate learning independence category, and 6 students in the low learning independence category. Researchers chose 9 respondents consisting of 3 students in the high learning independence category, 3 students in the moderate learning independence category, and 3 students in the low learning independence category. The consideration given in selecting students is students who have good communication skills. To obtain students with good communication skills, discussions were held with mathematics teachers at the school. With this discussion, recommendations for the names of students with good communication skills were obtained. Apart from communication skills, the main thing in selecting students is based on the results of the learning independence questionnaire. After obtaining the average and grouping it according to Table 1, the next step is to have the three best questionnaire scores in each category. Student respondent data is according to Table 3 below:

Table 3. Student Respondent Data Based on Learning Independence Questionnaire Scores

No	Name	Score	Student Group	Student Code
1	SZT	111		KBT 1
2	NNA	104	Hight	KBT 2
3	MSP	102		KBT 3
4	ANA	95		KBS 1
5	VRL	92	Moderate	KBS 2
6	LDR	90		KBS 3
7	RS	76		KBR 1
8	AR	74	Low	KBR 2
9	PH	73		KBR 3

Table 3 shows the students who were respondents selected based on their learning independence questionnaire scores. KBT, KBS, KBS are codes for student identity. In sequence, KBT is the code for students in the High Learning Independence category, KBS is the code for students in the moderate Learning Independence category, and KBR is the code for students in the Low Learning Independence category.

3.1. Higher Learning Category

Students with high learning independence are able to understand the questions well. Students write down and are able to fully explain the results of their answers. In questions that contain indicators of the ability to compare whether a problem is bigger or smaller, students are able to write down the order in which they are asked. This is as seen in Figure 1. Apart from that, during the interview, students were also able to provide an explanation of the solution according to the answer that was written and carried out clearly. In questions that contain indicators showing understanding of the meaning of arithmetic operations on fractions, students are able to understand the use of operations in answering questions. So that students are able to explain how to use written operations clearly. In questions that contain indicators showing understanding of the use of arithmetic operations on fractions, students are able to solve problems involving more than one arithmetic operation. This is made clear when students are able to provide reasons for using these arithmetic operations.

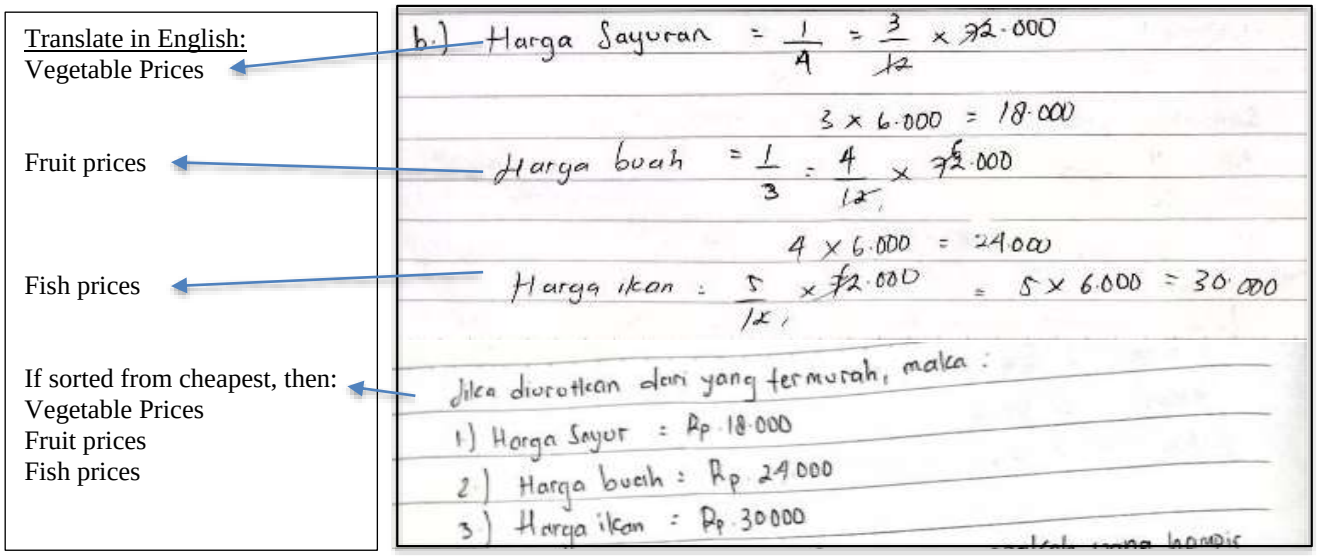


Figure 1. Examples of student work with high learning independence

In questions that contain indicators showing the ability to calculate accurately (correctly) in a conceptually efficient time, students are able to write answers correctly and the work is completed within the specified time limit. This can be monitored in the conditions in the field when researchers conduct research, that students answer the results within the specified time limit. Students also explained that the results were obtained within the specified time limit and the answers written were calculated correctly. In questions that contain indicators that have various efficient solution strategies, students use several solution strategies in answering a question. Regarding this, students can provide explanations for the strategies used and students are able to provide reasons for using these strategies. Finally, on questions that contain indicators showing understanding that the results obtained are logical, students provide arguments for answers by writing sentences that can be accepted as logical or make sense. Researchers also understand and understand the meaning of the sentences written in the answers.

Based on the description above, researchers can conclude that students with high learning independence are able to fulfill all number sense indicators. This is in line with (Kor et al., 2018), which states that students with high abilities and achievements have the sense and all the skills needed to solve fraction problems.

3.2. Medium Learning Category

Students with moderate learning independence are able to understand the questions well by writing down and fully explaining the results of the answers they have worked on on questions that contain indicators showing the ability to compare the size and size of a fractional number problem that will be sorted. Students are able to write down information on each question and the order in which they are asked for each item containing indicators well and during the interview they are able to provide a clearly written explanation of how to solve it. In questions that contain indicators showing understanding of the meaning of arithmetic operations on fractions, students are able to understand the use of operations in answering questions. So that students are able to explain how to use written operations clearly. Students in the moderate learning independence category on questions that contain indicators show understanding of the use of arithmetic operations on fractions, there is a student who is not able to understand the question well so that the student does not understand that the solution can involve more than one arithmetic operation in question number 1a. The student was able to provide reasons for this. Apart from a student who does not understand well, students who are in independent learning are able to understand and solve problems involving more than one arithmetic operation. So that you can provide reasons for using these arithmetic operations.

In questions that contain indicators showing the ability to calculate accurately (correctly) in a conceptually efficient time, students are able to write answers correctly and the work is completed within the specified time limit. This can be monitored in the conditions in the field when researchers conduct research, that students answer the results within the specified time limit. Students can also explain that when writing the answer, the student finished the work within the specified time limit and wrote the answer correctly. Students in the medium learning independence category on questions that contain indicators choose efficient calculation strategies, are able to use several solution strategies in answering a question. Regarding this, students can provide explanations for the strategies used and students are able to provide reasons for using these strategies. A student in this indicator does not appear to have several solving strategies on only one of the questions containing this indicator, namely number 1a. Finally, on questions that contain indicators showing understanding that the results obtained are logical, students provide arguments for answers by writing sentences that can be accepted as logical or make sense. Researchers can also understand sentences written by students.
Based on the description above, the researcher can conclude that even though there were two students who experienced errors in understanding and working on the indicators, they showed an understanding of the use of inter-operations for calculating fractions for question 1a and choosing

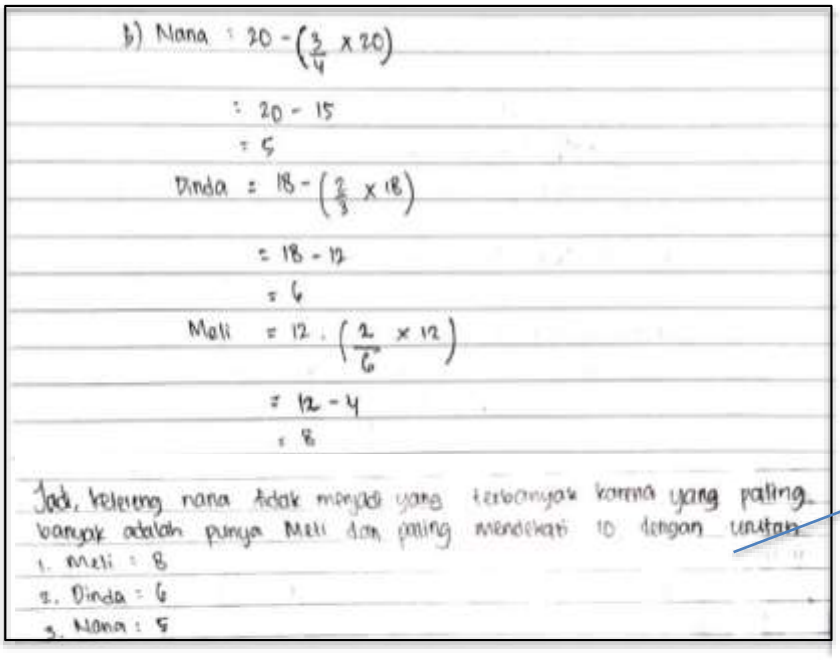
an efficient calculation strategy for question 1a. This is in line with the results of research by (Ekawati, 2013), which states that students with moderate mathematical abilities are able to name the characteristics of arithmetic operations but do not have sensitivity to the characteristics and properties of these operations to be able to solve the problems given and cannot use the concepts. concepts flexibly in problem solving. However, the majority of students in the moderate learning independence category can be said to be able to fulfill all number sense indicators.

3.3. Low Learning Category

Students with low learning independence have not been able to understand questions well in questions that contain indicators showing the ability to compare the size and size of a fractional number problem that will be sorted. So that students do not write information on most of the questions and the order asked in each question item that contains indicators, except that students in this category are only able to write down the order information only in question item number 1b, but there is one student with an answer that is not yet perfect and when Student interviews are able to provide a clearly written explanation of how to solve them. In questions containing indicators showing understanding of the meaning of arithmetic operations on fractions, students were able to understand the use of operations in answering questions, except for two students who were not able to understand the use of operations in answering question number 2b. Overall, students in this low category are considered capable of understanding, so that students are able to explain how to use written operations clearly. Students in the low learning independence category on questions containing indicators showed an understanding of the use of arithmetic operations on fractions, there were students who were able to complete questions containing these indicators, namely only number 3a and one student was only able to solve question number 2a. Apart from these students, students with low learning independence have not been able to solve problems involving more than one arithmetic operation but are able to provide reasons for the arithmetic operations used.

In questions that contain indicators showing the ability to calculate accurately (correctly) in a conceptually efficient time, students are able to write answers correctly and the work is completed within the specified time limit. There were exceptions for two students who had not been able to show calculations correctly (correctly) in a conceptually efficient time on questions number 2c and 3a. This can be monitored in conditions in the field when researchers conduct research, so that students can answer the results, some of which are still within the predetermined time limit and some which exceed the predetermined time limit. Students in this low category as a whole can demonstrate their abilities and can also provide an explanation that when writing answers, students also finish the work within the specified time limit and write the answers correctly. Students in the low learning independence category on questions that contain indicators of choosing an efficient calculation strategy are not yet able to use several solution strategies in answering a question. Regarding this, students can provide explanations for the strategies used and students are able to provide reasons for using these strategies. The work of students in this category is seen to have several solution strategies for question 3b and a student is seen to have several solution strategies

for question 2a. Finally, in questions that contain indicators showing that understanding of the results obtained is logical, students have not provided argumentative answers by writing sentences that can be accepted as logical or make sense, except that students in this category are only able to write their argument sentences in question item 3b (Figure 2). Researchers can also understand sentences written by students.



Translate in English:
So, Nana's marbles don't have the most because Meli has the most marbles and is closest to 10 in order:

Figure 2. Examples of student work with low learning independence

Based on the description above, the researcher can conclude that there are several students who are able to understand and master the indicators, showing an understanding of the meaning of arithmetic operations on fractions and demonstrating the ability to calculate accurately (correctly) in a conceptually efficient time. So, it can be said that students in the low learning independence category have not been able to fulfill all the number sense indicators. A similar statement was made by (Ekawati, 2013), in her research that students with low level mathematical abilities do not have a good understanding of numbers.

With these results, it can be seen that independent learning has an impact on number sense abilities. These results are also in accordance with research by Ivrendi (2011) which states that self-regulation of behavior has the most influence on students' number sense. Students with high learning independence have higher number sense abilities compared to students with low learning independence. Because of this condition, if a mathematics teacher finds differences in student learning independence, the teacher must carry out more careful planning. This planning mainly

concerns what and how assistance will be given to students with low learning independence because their number sense abilities are also lacking.

4. Conclusion

Based on the results of research regarding the description of students' number sense abilities in fraction material in terms of the learning independence of class VII students at SMP Negeri 1 Kebasen, it can be concluded that students who have high learning independence meet all the number sense indicators. Students who have moderate learning independence are able to master the five indicators of number sense. One indicator that is not met is the indicator of choosing an efficient calculation strategy. Students who have low learning independence are only able to fulfill two indicators, namely demonstrating an understanding of the meaning of arithmetic operations on fractions and demonstrating the ability to calculate accurately (correctly) in a conceptually efficient time.

5. Acknowledgments

Thanks are expressed to the Head of the UMP Mathematics Education Study Program who has facilitated this research. Apart from that, also to the principal of SMP Negeri 1 Kebasen who was willing to make his school a research subject.

6. References

Amirulloh, A. F., & Budiarto, M. T. (2013). Kemampuan Number Sense Siswa Kelas VII SMP dilihat dari Perbedaan Jenis Kelamin. *MATHEdunesa, Jurnal Ilmiah Pendidikan Matematika, Universitas Negeri Surabaya*, *2*(1).

Bobis, J. (1991). The Effect Of Instruction On The Development of Computational Estimation Strategies. *Mathematics Education Research Journal*, *3*(1).

Ekawati, E. (2013). Profil Kemampuan Number Sense Siswa Kelas Vii Sekolah Menengah Pertama (SMP) Dalam Memecahkan Masalah Matematika Pada Materi Bilangan Bulat. *MATHEdunesa, Jurnal Ilmiah Pendidikan Matematika, Universitas Negeri Surabaya*, *2*(1), 1–8. https://doi.org/https://doi.org/10.26740/mathedunesa.v2n1.p%25p

Ivrendi, A. (2011). Influence of Self-Regulation on the Development of Children's Number Sense. *Early Childhood Education Journal*, *39*(4), 239–247. https://doi.org/10.1007/s10643-011-0462-0

Kania, N. (2018). Alat Peraga untuk Memahami Konsep Pecahan. *Jurnal Theorems (The Original Research of Mathematic)*, *2*(2), 1–12.

Kor, L.-K., Teoh, S.-H., Binti Mohamed, S. S. E., & Singh, P. (2018). Learning to Make Sense of Fractions: Some Insights from the Malaysian Primary 4 Pupils. *International Electronic Journal of Mathematics Education*, *14*(1). https://doi.org/10.29333/iejme/3985

Lasdianto, J. R., Haerudin, & Abadi, A. P. (2023). Kemampuan Pemecahan Masalah Matematis Siswa SMP Berdasarkan Kecemasan Matematika. *Jurnal Pendidikan Matematika*, *14*(1), 88–102. https://doi.org/https://doi.org/10.36709/jpm.v14i1.17

Mariana, R., Khabibah, S., & Amin, S. M. (2020). Profile Number Sense of 5th Grade Students Subject Based on Field-Dependent and Field-Independent Cognitive Style. *International Journal for Educational and Vocational Studies*, *2*(12). https://doi.org/10.29103/ijevs.v2i12.3353

Mohamed, M., & Johnny, J. (2010). Investigating Number Sense Among Students. *Procedia - Social and Behavioral Sciences*, *8*, 317–324. https://doi.org/10.1016/j.sbspro.2010.12.044

Pramestie Wulandari, N., Ayu Apsari, R., Yulis Tyaningsih, R., Humaira Salsabila, N., & Rozi Hadiyanto, F. (2021). Number sense ability of junior high school students. *Journal of Physics: Conference Series*, *1778*(1), 012024. https://doi.org/10.1088/1742-6596/1778/1/012024

Puspanaja, D. A., Putri, I. M., & Rinaldi, A. (2024). Pengaruh Persepsi Siswa tentang Kinerja Guru terhadap Kemampuan Pemecahan Masalah Matematis. *Journal on Education*, *6*(2), 11440–11447. https://doi.org/https://doi.org/10.31004/joe.v6i2.4941

Reys, R. E., & Yang, D. C. (1998). Relationship between computational performance and number sense among sixth- and eighth-grade students in Taiwan. *Journal for Research in Mathematics Education*, *29*(2), 225–237. https://doi.org/10.2307/749900

Salsabila, T. M., Leonard, L., & Puteri, N. C. (2023). Pengaruh Kemandirian Belajar terhadap Kemampuan Pemecahan Masalah Matematis. *Journal of Instructional Development Research*, *3*(1), 9–18. https://doi.org/https://doi.org/10.61193/jidr.v3i1.34

Sandi, G. (2012). Pengaruh Blended Learning Terhadap Hasil Belajar Kimia Ditinjau Dari Kemandirian Siswa. *Jurnal Pendidikan Dan Pengajaran*, *45*(3), 241–251.

Santos, R. A., Collantes, L. M., Ibañez, E. D., Ibarra, F. P., & Pentang, J. T. (2022). Innate Mathematical Characteristics and Number Sense Competencies of Junior High School Students. *International Journal of Learning, Teaching and Educational Research*, *21*(10), 325–340. https://doi.org/10.26803/ijlter.21.10.18

Saputra, R. J., Sofyan, D., & Mardiani, D. (2023). Kemampuan pemecahan masalah matematis siswa ditinjau dari self-confidence siswa pada materi bangun ruang sisi datar. *Jurnal Inovasi Pembelajaran Matematika: PowerMathEdu*, *2*(1), 79–92. https://doi.org/10.31980/powermathedu.v2i1.2719

Siregar, A. M., Lubis, R., & Ardiana, N. (2023). Analisis Faktor-Faktor Rendahnya Kemampuan Pemecahan Masalah Matematis Siswa Ditinjau Dari Motivasi Belajar Siswa Di Kelas Vii Smp Negeri 5 Padangsidimpuan. *MathEdu (Mathematic Education Journal)*, *6*(2), 41–47. https://doi.org/https://doi.org/10.37081/mathedu.v6i2.5004

Sundayana, R. (2018). Kaitan antara Gaya Belajar, Kemandirian Belajar, dan Kemampuan Pemecahan Masalah Siswa SMP dalam Pelajaran Matematika. *Mosharafa: Jurnal Pendidikan*

Matematika, *5*(2), 75–84. https://doi.org/10.31980/mosharafa.v5i2.262

Sutiarso, S. (2019). Mengapa Sulit Menyelesaikan Soal Pecahan 2/x + 3/y = 2/3? *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *8*(3), 420–428. https://doi.org/10.24127/ajpm.v8i3.2349

Yulianingsih, A., Febrian, & Dwinata, A. (2018). Analisis Kesalahan Konsep Pecahan Pada Siswa Kelas VII A SMP Negeri 13 Satu Atap Tanjungpinang. *Jurnal Pendidian Matematika, Musharafa*, *7*(2), 199–206.