

# Misconception Analysis of Minimum Competency Assessment (AKM) Numeration of High School Students from Field Dependent Cognitive Style

Retno Wahyu Arian Sah<sup>1</sup>, Alfi Rachma Nisfi Laila<sup>2</sup>, Astri Setyawati<sup>3</sup>, Rani Darmayanti<sup>4</sup>, Dewi Nurmalitasari<sup>5</sup>

© 2023 JEMS (Jurnal Edukasi Matematika dan Sains)

This is an open access article under the CC-BY-SA license

(<https://creativecommons.org/licenses/by-sa/4.0/>) ISSN 2337-9049 (print), ISSN 2502-4671 (online)

## Abstrak:

Tujuan dari penelitian ini adalah untuk mendeskripsikan sejauh mana kesalahpahaman yang dialami siswa SMA saat mengerjakan soal-soal Kemampuan Numerik Minimum (AKM) yang dimodelkan berdasarkan gaya kognitif domain-dependent. Jumlah siswa yang dijadikan subjek dalam penelitian ini adalah siswa kelas XI-IPS-nya di kelas tiga (3). Penelitian dilaksanakan di Tawang Sari, Kecamatan Tulungagung, Kedungwal, MA Darul Hikma, Kabupaten Tulungagung, Jl KH Abu Mansur I. Penelitian dilakukan secara bilangan genap tahun ajaran 2021-2022. Metode sampling yang ditargetkan dengan tes GEFT (Group Embedded Figure Test) digunakan untuk menentukan topik penelitian dan mengklasifikasikan siswa memiliki gaya kognitif tergantung subjek atau tidak (tergantung subjek). Hasil penelitian menunjukkan bahwa siswa dikategorikan berdasarkan hasil respon tes penomoran AKM yaitu miskonsepsi rendah, sedang, dan tinggi. Jumlah soal adalah 3 soal. Item pertama digunakan untuk memastikan bahwa indikator tidak dapat mengulangi konsep. Item kedua digunakan untuk menentukan bahwa indikator gagal merumuskan konsep dengan benar dalam berbagai representasi matematis. Indeks tidak dapat menentukan rumus yang menjawab pertanyaan. Indikator tidak dapat menerapkan rumus atau algoritma untuk memecahkan masalah. Butir ketiga digunakan untuk melihat indikator ketidakmampuan menggunakan rumus atau algoritma pemecahan masalah. Hasil yang diperoleh menunjukkan bahwa siswa gaya mata pelajaran tertentu dengan kesalahpahaman rendah mendapat skor lebih tinggi dari tanggapan terhadap pertanyaan penomoran AKM daripada siswa dengan kesalahpahaman sedang dan tinggi.

**Kata Kunci:** Asesmen Kompetensi Minimum; Gaya Kognitif *Field Dependent*; Miskonsepsi; Numerasi.

## Abstract:

The purpose of this study was to describe the extent of misunderstandings experienced by high school students while tackling Minimum Numerical Ability (AKM) questions modeled on the basis of domain-dependent cognitive styles. The number of students used as subjects in the study was her XI-IPS students in class three (3). The study was conducted at Tawang Sari, Tulungagung District, Kedungwal, MA Darul Hikma, Tulungagung District, Jl KH Abu Mansur I. The study was conducted in even-numbered terms of the academic year 2021-2022. A targeted sampling method with the GEFT test (Group Embedded Figure Test) is used to determine research topics and classify students as having subject-dependent cognitive styles or not (subject-dependent). The results showed that students were categorized based on their AKM numbering test response results of low, medium, and high misconceptions. The number of questions is 3 questions. The first item is used to make sure that the indicator cannot repeat the concept. The second item is used to determine that the indicator fails to formulate the concept correctly in various mathematical representations. The index cannot determine the formula that answers the question. Indicators cannot apply formulas or algorithms to solve problems. The third item is used to see indicators of inability to use formulas or problem-solving algorithms. The results obtained show that subject-specific style students with low misunderstandings score higher from responses to AKM numbering questions than students with moderate and high misunderstandings.

**Keywords:** Minimum Competency Assessment; Field Dependent Cognitive Style; Misconceptions; Number.

---

Retno Wahyu Arian Sah, Universitas Muhammadiyah  
[retno.ariansah@gmail.com](mailto:retno.ariansah@gmail.com)

Alfi Rachma Nisfi Laila, Universitas Muhammadiyah  
[alfiraila61@gmail.com](mailto:alfiraila61@gmail.com)

Astri Setyawati, Universitas Nahdlatul Ulama Lampung  
[astridewantoro46@gmail.com](mailto:astridewantoro46@gmail.com)

Rani Darmayanti, Universitas Muhammadiyah  
[ranidarmayanti90@webmail.umm.ac.id](mailto:ranidarmayanti90@webmail.umm.ac.id)

Dewi Nurmalitasari, Universitas PGRI Wiranegara Pasuruan  
[dewinurmalitasari31@gmail.com](mailto:dewinurmalitasari31@gmail.com)

## **Introduction**

Referring to the National Council of Teachers of Mathematics (NCTM, 2000), in learning mathematics students must learn with understanding and activeness so that students gain new knowledge from experience and knowledge that has been obtained. In this case, NCTM classifies there are five standard processes in learning mathematics. These processes include mathematical problem solving (mathematical problem solving), mathematical reasoning and proof (mathematical reasoning and proof), mathematical communication (mathematical communication), mathematical connection (connection or associating a mathematical idea), and mathematical representation (mathematical interpretation). The above needs to be mastered by students as a provision for understanding in learning mathematics (Fernández et al., 2021; Partono et al., 2021; Sugianto et al., 2022).

However, the five standards of the mathematics learning process are not necessarily mastered by students. Many students find mismatches in the mastery of student concepts that still occur when learning mathematics. This is commonly called a mathematical misconception. or errors that include understanding concepts that do not run systematically, resulting in errors of judgment and calculation errors in solving a problem, (Muzangwa & Chifamba, 2012) Mathematical misconceptions make it difficult for students to learn mathematics due to the failure of students to understand the concepts that are the basis or their steps in solving mathematical problems, (Schnepper & McCoy, 2013). Even more conical, research by (Sudihartinih, 2020) which focuses on one mathematical material, the results show that the misconceptions in the cone material show the percentage of 95.6% students' inability to determine two possible simple equations, 55.3% inability to determine the description of simple parabolic equations, 43.5% inability to determine conic equations , 55.3% inability to prove the length of the rectum latus ellipse, 52.2% inability to determine simple equations when the asymptote of the hyperbola and its vertices are known, and 57.4% inability to determine the focal equation of the hyperbola when the difference between the focal radius lengths is known Can be studied that the level of students' mathematical misconceptions is still high The same thing is shown from the results of the interviews of the mathematics teacher class XI-IPS MA Darul Hikmah, Tulungagung Regency In general, students on average have not mastered the understanding of concepts and are still wrong to determine examples, so many students are found unable to answer questions listen that's right.

This study refers to the assessment that has recently been implemented in Indonesia, namely the Minimum Competency Assessment (AKM). It is necessary to have an analysis related to the level of misconceptions and detailed descriptions related to AKM, especially in the numeracy ability level (Kemdikbud, 2020). Numeration is defined as the ability to think in using mathematical knowledge in explaining events, problem solving, and decision making in everyday life (Sekaryanti et al., 2022). The cognitive level of numeracy includes the form of the level of knowledge, application, and reasoning presented in the presentation of questions in the form of Higher Thinking Order Skill (HOTS) or with in other words, students need to adapt to solving problems according to their abilities, namely thinking at a high level. Thus, the temporary assumption of student researchers will have a high level of misconception about it so that further research is needed (Darmayanti et al., 2022; Gozali et al., 2021; Ichsan et al., 2019)

Researchers examine the level of misconceptions about the AKM Numeration in terms of cognitive style which refers to the field dependent cognitive style (Witkin et al., 1977) provides an explanation that cognitive style is a characteristic of individuals in using cognitive structures and functions in learning, both thinking processes, problem solving

processes, and processes in processing information obtained. Then, (Wooldrdge & Bartolf, 2006) explained that students with field dependent cognitive style always depend on the structure of the environment, the learning process depends on experience, has a short attention span, is easy to change, likes to study the environment, chooses learning situations based on feelings and experiences, is socially oriented, less achievement oriented and less competitive. At the same time, (Witkin et al., 1977) Characteristics of field dependent cognitive style include a tendency to think globally, a tendency to accept existing structures, rational orientation, a tendency to engage in work that emphasizes social skills, a tendency to follow existing ones, tend to work with extrinsic motivation, and are more interested in reinforcement (Alphonse & Mwantimwa, 2019; Chen, 2019; Song & Bonk, 2016). Therefore, it can be concluded that students with field dependent cognitive style prioritize environmental influences (Darmayanti et al., 2023; Syaifuddin et al., 2022). Students' thinking tends to be big picture (holistic), so it is easy to follow and does not require analytical and systematic thinking. In their studies, they have a strong interest in the sciences social (Abdara, 2017; Kusumaningtyas et al., 2017; Rahmah et al., 2022; Ruskhan Fauza et al., 2022)

From the explanation above, students' mathematical misconceptions must be minimized or eliminated, and special attention must be paid to the teacher and the students themselves, because they can result in disruption of the learning process and the achievement of the learning objectives of mathematics itself. If not resolved immediately, the student will remain in storage. Therefore, researchers need to study specifically and add information related to the level of students' misconceptions in solving numeracy AKM questions in terms of the field dependent cognitive style of each student. An assessment designed to produce accurate information in improving the quality of teaching and learning which in turn will improve student learning outcomes.

## **Method**

This study uses a descriptive type of research with a qualitative approach that aims to describe misconceptions in solving AKM Numeration questions in terms of field dependent cognitive style in class XI-IPS students. The study was conducted in the even semester of the 2021/2022 academic year. The subjects taken in this study were three students consisting of: low field dependent (low misconception), medium dependent field (moderate misconception), and high dependent field (high misconception). The research subject was determined based on the purposive sampling method (technique to determine the sample). Student misconceptions in solving AKM questions Numeration is the object of this study.

The instrument in this study consisted of two, namely the Main Instrument and Supporting Instrument. The main instrument in this study was the researcher himself while the supporting instrument was three, namely the Group Embedded Figure Test (GEFT) to measure and determine the cognitive style possessed by students where students who obtained scores 0 to 11 are categorized as FD (Field Dependent), student question sheets to see the misconceptions experienced by students in answering questions and interview guidelines to strengthen students' answers.

The analysis in this study adopts the theory of (Miles, 1992), namely data reduction (reduction), data presentation (display), and drawing conclusions (calculation). In the reduction phase, the researcher selects the results of the study by correcting the results of the students' cognitive style test instruments and the results of students' mathematical misconceptions who have a field dependent cognitive style and perform high, medium, low misconceptions. Then make it as a subject in the study, presented in the form of descriptive data images based on high, medium, low levels of misconception and including the category of students with a field dependent cognitive style tendency.

Determination of cognitive style is done by giving the GEFT test or Group Embed Figure Test, which is a test consisting of 25 items (in the form of complex images) divided into 3 stages of work over a period of 20 minutes. The first part consists of 7 items, the second and third stages consist of 9 items for the scoring test. The total score is obtained from the number of correct executions of the second and third stages of the test. Test work refers to the GEFT test, the field dependent cognitive style scoring guidelines adopted from the research (Mirlanda & Pujiastuti, 2018). Researchers determine the field dependent cognitive style category based on Table 1.

Table 1. Scoring Guidelines according to the GEFT test

No	Score	Category
1	$80 \leq x \leq 100$	Tall
2	$60 \leq x < 80$	Currently
3	$0 \leq x < 60$	Low

## Result and Discussion

The Geft test was carried out to determine the students' cognitive style, presented in the following table form:

Table 2. GEFT Test Results

No	Student Name Code and Gender	Score	Category
1	RM (P)	12	Not FD (FI)
2	DN (P)	14	Not FD (FI)
3	KB (P)	10	FD
4	SH (L)	11	FD
5	AG (L)	12	FD
6	MM (L)	9	FD

Based on the data presented in the table above, it was found that 2 students were in the non-FD category, or had a Field Independent style and 4 students were in the Field Dependent style category. Then, 4 students who were in the field dependent category were used as research subjects by being given a written test. To determine the level of misconceptions in solving the AKM Numeration questions, the research subjects were given 3 AKM Numeration questions in 2021, where each item has different indicators that refer to indicators of mathematical misconceptions.

The first item is used to determine the indicators for not being able to restate the concept. The second item is used to determine the indicators for not being able to formulate concepts in various forms of mathematical representation correctly; the indicator cannot determine the formula to answer a problem; and indicators cannot apply problem solving formulas or algorithms. The third item is used to see mathematical misconceptions only on indicators cannot apply problem solving formulas or algorithms. The scores obtained are presented in the table below.

Table 3. The results of the AKM Numeration Writing Test Questions

No	Student Name Code and Gender	Score	Category
1	SH (L)	55	Low
2	KB (P)	65	Currently

3	AG (L)	75	Currently
4	MM (L)	89	Tall

Referring to the table above, it was found that 1 subject was included in the category with a low level of misconception in solving the AKM Numeration problem, 2 subjects were included in the category with the level of misconception in solving the AKM Numeration problem, 1 subject was included in the category with the level of misconception in solving the AKM Numeration question. High To describe the analysis in this study, the researcher took 3 test results that would describe the level of misconception, including:

- Field dependent students with misconceptions solve low numeracy AKM questions (subject A),
- Field dependent students with misconceptions solve the medium numeracy AKM questions (subject B, with the highest score),
- Field dependent students with misconceptions solve high numeracy AKM questions (subject

**Field dependent students with misconceptions solve low numeracy AKM questions (subject A)**

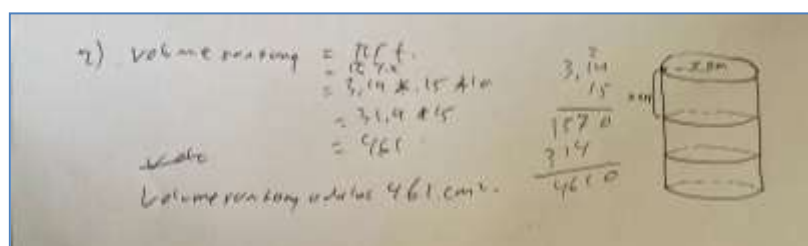
Field dependent students with misconceptions about solving low numeracy AKM questions or subject A are determined based on the results of the written test with the highest score, namely MM (L) with a score of 89. The higher the student's written test score, the lower the level of mathematical misconceptions of a student. Test results write students' misconceptions about AKM The low number for number one is shown in figure 1.



Figure 1. Subject A's answer to question number one

The first item is used to determine the indicators for not being able to restate the concept The results obtained by students are able to restate what concepts are asked in the questions in the form of tables and identify which foods can and cannot be included in Andi's mother's tiered basket which is in the form of a tube. Based on the results of interviews with students who are subject A, students do not get significant difficulties when working on question number one so that they are able to work on question number one. The indicator cannot restate the concept in question number one shows students are able to process information and solve problems presented in questions with the proper solution

Furthermore, the results of subject A's answer to question number two are shown in Figure 2.



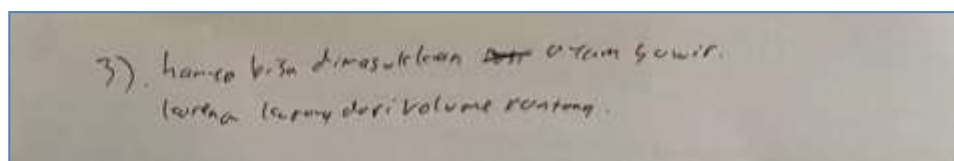
**Figure 2.** Subject A's answer to question number two

The second item is used to determine indicators for not being able to formulate concepts in various forms of mathematical representation correctly; the indicator cannot determine the formula to answer a problem; and indicators cannot apply problem solving formulas or algorithms. The results obtained by students can only answer 1 question indicator, namely representing the question in the form of an image by making a picture of a tube correctly and affixing a description of the location of the radius ( $y$ ) and the location of the height of the tube ( $x$ ). However, students have not been able to determine the formula for the volume of a cylinder (tiered basket) correctly as shown in Figure 2 above. The volume of the appropriate cylinder is  $V = \pi r^2 t$  or if it is assumed with a drawing that has been made and adjusted to the assumptions in the problem  $V = \pi y^2 x$

Indicators cannot determine formulas to answer a problem and indicators cannot apply formulas or problem solving algorithms are interrelated. If students can determine the use of the appropriate formula then there is a possibility that students can also apply formulas to answer questions correctly, regardless of the accuracy of calculations obtained, students are able to calculate accurately, it's just that the formula applied is not appropriate and it is also found that the volume unit written by the student is also not quite right, which should be  $cm^3$ . So it can be concluded that students have not been able to meet the second and third indicators in question number two.

From the results of interviews with students, in solving problem number two, students were not precise and were not careful in applying the formula and it was used because students forgot and did not have time to re-check the answer sheet before it was deposited, resulting in an error in the volume unit that was written down. Research by (Harahap et al., 2019) also shows that inaccuracy in working on the problem will cause errors in solving the problems presented.

In item number three, with the indicator not being able to apply formulas or problem solving algorithms, the results obtained that students have not succeeded in answering correctly. Conceptually, students have been able to relate concepts correctly, the student's assumption is that food that can be included in Andi's mother's stacked basket is food which has a volume smaller than or equal to the stacked basket. However, based on the results of student interviews based on the answers to item number two which turned out to be less precise in the application of the formula so that it would also affect the results of answer number 3.



**Figure 3.** Subject A's answer to question number one

### Field dependent students with misconceptions solve moderate numeracy AKM questions (subject B, with the highest score)

Field dependent students with misconceptions about solving moderate AKM numeracy questions or subject B are determined based on the results of written tests with moderate scores, namely KB (P) and AG (L) with scores of 65 and 75. Students with moderate misconception abilities, unable to restate the concept of problem solving correctly because students do not understand basic concepts, cannot represent questions in the form of

pictures correctly, in detail and neatly because students are less thorough. The results of students' written tests with misconceptions about AKM questions medium numbers for number one are shown in Figure 4

Sayur Sop	→	2300R	(tidak bisa)
Bubur Ayam	→	1900R	(bisa)
Soto Ayam	→	1.000R	(bisa)
Ayam Suir	→	2.205R	(bisa)
Masiger	→	300R	(bisa)
Masi kuning	→	2.520R	(tidak bisa)
Culai (kan.)	→	3.010R	(bisa)

**Figure 4.** Subject B's answer to question number one

The first item is used to find out the indicators for not being able to restate the concept. The results obtained by students are less thorough in restating what concepts are asked in the question in the form of tables and identifying which foods can and cannot be included in the stacked basket belonging to Andi's mother who tube-shaped. Based on the results of interviews with students who are subject B, students do not get into trouble, when working on question number one so that he is sure he is correct working on question number one. The problem presented in the problem with the correct solution, but students are less thorough in the delivery of writing answers.

Then, the results of subject B's answer to question number two are shown in Figure 5.

$$\begin{aligned}
 \text{Volume maksimal} &= \pi \times r^2 \times t \\
 &= \pi \times 16^2 \times 10 \\
 &= 2250\pi //
 \end{aligned}$$

**Figure 5.** Subject B's answer to question number two

Item number two is used to determine indicators for not being able to formulate concepts in various forms of mathematical representation correctly; the indicator cannot determine the formula to answer a problem; and indicators cannot apply formulas or problem-solving algorithms. The results obtained by students can only answer 2 question indicators, namely students can be able to formulate concepts in mathematical representations correctly and are able to determine formulas to answer a problem.

Indicators cannot determine formulas to answer a problem and indicators cannot apply formulas or problem solving algorithms are interrelated. If students can determine the use of the appropriate formula then there is a possibility that students can also apply formulas to answer questions correctly, regardless of the accuracy of calculations obtained, students are able to calculate accurately with the formula that is applied accordingly, but it is found that students have not written down the volume unit, which should exist  $\text{cm}^3$ . So it can be concluded that students have not been able to meet the third indicator in question number two.

From the results of interviews with students, in solving problem number two, students correctly applied the formula but were less thorough in writing answers because students forgot and were in a hurry so they did not re-check the answer sheet before being deposited, resulting in an error in the volume unit that was written down. This shows that students understand question number two about rectangular flat shapes, but students are less careful in processing the information contained in the questions.

In item number three, with the indicator not being able to apply formulas or problem-solving algorithms, the results obtained that students have not succeeded in answering correctly. Conceptually, students have been able to relate concepts correctly, students assume that the food that can be put into Andi's mother's stacked basket is a heavy meal range  $2000\pi$ . However, based on the results of student interviews based on answer number two which turned out to be less precise in the application of the formula so that it would also affect the results of answer number three.

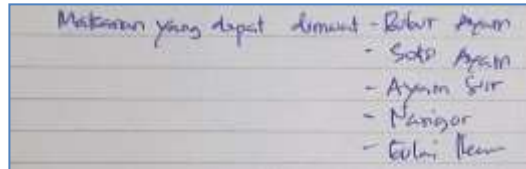


Figure 6. Subject B's answer to question number one

**Field dependent students with misconceptions solve high numeracy AKM questions (subject C)**

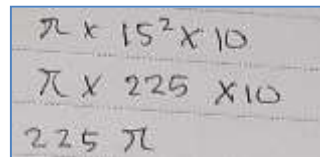
Field dependent students with misconceptions in solving high numeracy AKM questions or subject C are determined based on the results of written tests with low scores, namely SH (L) with a score of 55. Students with high misconception abilities, because students have low mathematical abilities. This is because students are unable to state rework the concept of volume and shape correctly and cannot process information by representing the questions in the form of pictures correctly and in detail. The results of the student's written test with misconceptions about the AKM question. Low numbers for number one are shown in Figure 7.

Jenis	Volume	Luas
Bubur Ayam	1500 L	-
Soto Ayam	1500 L	-
Ayam Sate	2000 L	-
Mangor	500 L	-
Makanan	2.500 L	-
Gulai Ikan	1.000 L	-

Figure 7. Subject C's answer to question number one

The first item is used to find out the indicators for not being able to restate the concept. The results obtained by students cannot restate what concepts are asked in the question and identify which foods can and cannot be included in Andi's mother's stacked basket which is in the form of a tube, so the original student give an answer with an overall answer is yes. Based on the results of interviews with students who are subject C, students look confused when answering questions. Students are said to not understand the concept if students are unable to express or re-explain a concept that has been studied previously. This is in line with research (Ningrum & Budiarto, 2016) namely students cannot understand and recall the material that has been taught during the process of delivering the material. Furthermore, the results of subject C's answer to question number two are shown in Figure 8.





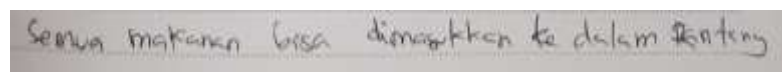
The image shows three lines of handwritten mathematical work on a grid background. The first line is  $\pi \times 15^2 \times 10$ . The second line is  $\pi \times 225 \times 10$ . The third line is  $225 \pi$ .

Figure 8. Subject C's answer to question number two

The second item is used to determine indicators for not being able to formulate concepts in various forms of mathematical representation correctly; the indicator cannot determine the formula to answer a problem; and indicators cannot apply problem solving formulas or algorithms. The results obtained by students cannot answer the question indicators, namely students cannot formulate concepts in mathematical representations correctly and are able to determine formulas to answer a problem.

From the results of interviews with students, at the completion of question number two, students did not understand the stages in working on the questions. This shows that students cannot understand, remember, process and describe the information contained in the questions. In addition, during the process of delivering material, students rarely pay attention explanation and never ask questions regarding material that has not been understood This was found by (Febriyanti & Seruni, 2015) One of the things that can support students' ability to understand the problem is the interaction or communication with the teacher.

In item number three, with the indicator not being able to apply formulas or problem-solving algorithms, the results obtained that students did not succeed in answering correctly. Conceptually, students have been able to relate concepts correctly, students assume that all food can be included in Andi's stacked basket. However, based on the results of interviews with students, it was found that students could not give reasons



The image shows a single line of handwritten text: "Semua makanan bisa dimasukkan ke dalam kantong".

Figure 9. Subject C's answer to question number one.

## Conclusion

Based on the results of the analysis described above, it can be concluded from each indicator of students' misconceptions in solving the AKM Numeration questions in terms of field dependent cognitive style. presented in questions and students can represent the problem in the form of pictures by making a picture of a tube correctly and affixing the location of the radius (y) and the location of the height of the tube (x) in detail and clearly. However, students have not been able to determine and apply the formula, as well as the correct use of the volume unit so that it also affects the answers obtained because students do not forget the formula that should be applied.

Students who have a field dependent cognitive style with mathematical misconceptions have moderate mathematical abilities Students are unable to restate the concept of volume correctly because students do not understand basic concepts, cannot represent questions in the form of pictures correctly, in detail and neatly because students are less thorough. In addition, students can remember the formula to answer the questions correctly, but there are calculation errors caused by students not being careful while answering the questions

Students who have a field dependent cognitive style with high mathematical misconceptions have low mathematical abilities Students are not able to restate the concept

of volume correctly and cannot process information by representing questions in the form of pictures correctly and in detail This is caused by students' misunderstanding of the concept of volume Students also unable to determine the formula correctly caused by students' ignorance of the concept In addition, students are also unable to apply the formula used correctly, in detail and systematically.

## Reference

- Abdara, A. (2017). Analisis Kemampuan Calon Guru Matematika Dalam Pengajuan Masalah Ditinjau dari Gaya Kognitif Field Independent dan Field Dependent. *Kreano, Jurnal Matematika Kreatif-Inovatif*, 8(1), 69–75. <https://doi.org/10.15294/kreano.v8i1.7120>
- Alphonse, S., & Mwantimwa, K. (2019). Students' use of digital learning resources: diversity, motivations and challenges. *Information and Learning Science*, 120(11–12). <https://doi.org/10.1108/ILS-06-2019-0048>
- Chen, Y. C. (2019). Effect of Mobile Augmented Reality on Learning Performance, Motivation, and Math Anxiety in a Math Course. *Journal of Educational Computing Research*, 57(7), 1695–1722. <https://doi.org/10.1177/0735633119854036>
- Darmayanti, R., Sugianto, R., & Muhammad, Y. (2022). Analysis of Students' Adaptive Reasoning Ability in Solving HOTS Problems Arithmetic Sequences and Series in Terms of Learning Style. *Numerical: Jurnal Matematika Dan Pendidikan Matematika*, 6(1).
- Darmayanti, R., Usmyatun, U., Setio, A., Sekaryanti, R., & Safitri, N. D. (2023). Application of Vygotsky Theory in High School Mathematics Learning Material Limit Functions. *Jurnal Edukasi Matematika Dan Sains*, 11(1), 39–48. <https://doi.org/10.25273/jems.v11i1.14099>
- Fernández, E. A., Samacá, L. F., & Martín, C. R. (2021). Diagnose, Analysis, and Proposal of Project Based Learning (PBL): A Case for Analog Communications Course. *Proceedings of the LACCEI International Multi-Conference for Engineering, Education and Technology, 2021-July*. <https://doi.org/10.18687/LACCEI2021.1.1.461>
- Gozali, I., Lie, A., Tamah, S. M., & Jemadi, F. (2021). HOTS questioning ability and HOTS perception of language teachers in Indonesia. *Indonesian Journal of Applied Linguistics*, 11(1). <https://doi.org/10.17509/ijal.v11i1.34583>
- Harahap, Z. I. S., Muchlis, E. E., & Maulidiya, D. (2019). Faktor – Faktor Penyebab Kesalahan Siswa Dalam Menyelesaikan Soal Matematika Tentang Luas Permukaan Kubus Dan Balok Kelas Viii Smpn 18 Kota Bengkulu. *Jurnal Penelitian Pembelajaran Matematika Sekolah (JP2MS)*, 3(3), 342–352. <https://doi.org/10.33369/jp2ms.3.3.342-352>
- Ichsan, I. Z., Sigit, D. V., Miarsyah, M., Ali, A., Arif, W. P., & Prayitno, T. A. (2019). HOTS-AEP: Higher order thinking skills from elementary to master students in environmental learning. *European Journal of Educational Research*, 8(4). <https://doi.org/10.12973/eu-er.8.4.935>
- Kemdikbud. (2020). Desain Pengembangan Soal Asesmen Kompetensi Minimum. *Desain Pengembangan AKM*, 1–125.

- Kusumaningtyas, S. I., Juniati, D., & Lukito, A. (2017). Pemecahan Masalah Generalisasi Pola Siswa Kelas VII SMP Ditinjau dari Gaya Kognitif Field Independent dan Field Dependent. *Kreano, Jurnal Matematika Kreatif-Inovatif*, 8(1), 76–84. <https://doi.org/10.15294/kreano.v8i1.6994>
- Miles, M. B. , & H. A. M. (1992). *Analisis Data Kualitatif* (UI Press). Sumber tentang Metode-Metode Baru.
- Mirlanda, E. P., & Pujiastuti, H. (2018). KEMAMPUAN PENALARAN MATEMATIS: ANALISIS BERDASARKAN GAYA KOGNITIF SISWA. *Symmetry: Pasundan Journal of Research in Mathematics Learning and Education*. <https://doi.org/10.23969/symmetry.v3i2.1252>
- Muzangwa, J., & Chifamba, P. (2012). Analysis of Errors and Misconceptions in the Learning of Calculus by Undergraduate Students. *Acta Didactica Napocensia*, 5(2).
- NCTM. (2000). *Six Principles for School Mathematics*.
- Nidia Zuraya. (2012). *KH Hisyam, Pelopor Pendidikan Modern Muhammadiyah (3-habis)*. Republika.Co.Id.
- Partono, P., Wardhani, H. N., Setyowati, N. I., Tsalitsa, A., & Putri, S. N. (2021). Strategi Meningkatkan Kompetensi 4C (Critical Thinking, Creativity, Communication, & Collaborative). *Jurnal Penelitian Ilmu Pendidikan*, 14(1), 41–52. <https://doi.org/10.21831/jpipip.v14i1.35810>
- Rahmah, K., Inganah, S., Darmayanti, R., Sugianto, R., & Ningsih, E. F. (2022). Analysis of Mathematics Problem Solving Ability of Junior High School Students Based on APOS Theory Viewed from the Type of Kolb Learning Style. *INDoMATH: Indonesia Mathematics Education*, 5(2), 109–122. <https://indomath.org/index.php/>
- Ruskhan Fauza, M., Inganah, S., Darmayanti, R., Prasetyo, B., Mariyanto, A., & Lony, A. (2022). Problem Solving Ability: Strategy Analysis of Working Backwards Based on Polya Steps for Middle School Students YALC Pasuruan. *Jurnal Edukasi Matematika Dan Sains*, 10(2), 353–363. <https://doi.org/10.25273/jems.v10i2.13338>
- Schnepper, L. C., & McCoy, L. P. (2013). Analysis of Misconceptions in High School Mathematics. *Networks: An Online Journal for Teacher Research*, 15(1), 625–625. <https://doi.org/10.4148/2470-6353.1066>
- Sekaryanti, R., Cholily, Y. M., Darmayanti, R., Rahma, K., Prasetyo, B., & Maryanto, A. (2022). Analysis of Written Mathematics Communication Skills in Solving Solo Taxonomy Assisted Problems. *Jurnal Edukasi Matematika Dan Sains*, 10(2), 395–403. <https://doi.org/10.25273/jems.v10i2.13707>
- Song, D., & Bonk, C. J. (2016). Motivational factors in self-directed informal learning from online learning resources. *Cogent Education*, 3(1). <https://doi.org/10.1080/2331186X.2016.1205838>
- Sudihartinih, E. (2020). Students' Mistakes and Misconceptions on the Subject of Conics. *International Journal of Education*, 12(2). <https://doi.org/10.17509/ije.v12i2.19130>

- Sugianto, R., Muchamad Cholily, Y., Darmayanti, R., Rahmah, K., & Hasanah, N. (2022). Development of Rainbow Mathematics Card in TGT Learning Model for Increasing Mathematics Communication Ability. *Kreano: Jurnal Matematika Kreatif-Inovatif*, 13(2), 221-234. <http://journal.unnes.ac.id/nju/index.php/kreano>
- Syaifuddin, M., Darmayanti, R., Rizki, N., Sugianto, R., & Niswatun Hasanah. (2022). High school students' mathematical representation ability: Evaluation of disposition based on mastery learning assessment model (MLAM). *Journal of Advanced Sciences and Mathematics Education*, 2(1), 1-15. <https://www.journal.foundae.com/index.php/jasme/index://creativecommons.org/licenses/by-sa/4.0/>
- Witkin, H. A., Moore, C. A., Goodenough, D., & Cox, P. W. (1977). Field-Dependent and Field-Independent Cognitive Styles and Their Educational Implications. *Review of Educational Research*, 47(1), 1-64. <https://doi.org/10.3102/00346543047001001>
- Wooldrdge, B., & Bartolf, M. H. (2006). Field dependence-field independence learning style.pdf. In *Learning Styles and Learning* (pp. 237-257).