AJST
journal.amca2012.org

AMCA JOURNAL OF SCIENCE AND TECHNOLOGY
e-ISSN 2774-8324
Vol 3, No 2, August 2023, 36-39
DOI 10.51773/ajst.v3i2/270

Analysis of students' mathematical communication ability on student learning styles

Alwi Asgafi[1], M. Saidun Anwar[1], Choirudin[1,*], Rani Darmayanti[2], and Usmiyatun[2]

[1]Universitas Ma'arif Lampung, Indonesia
[2]University of Muhammadiyah Malang, Indonesia
[*]Corresponding author: choirudin.umala@gmail.com

KEYWORDS
analysis
learning styles
mathematical communication

ABSTRACT Students' mathematical communication ability is their ability to communicate mathematical concepts orally and in writing. The inability of students to fulfill indicators of their ability to relate something that happens to mathematical ideas, in addition to the failure of students to explain concepts, situations, and mathematical relationships, is the root cause of students' low ability to communicate mathematically. This study aimed to determine the mathematical communication abilities of students whose learning styles ranged from high to low. This research is descriptive qualitative research. A qualitative approach was chosen because this study used written and oral data. Class VII students of MTs Ma'arif Roudlotut Tholibin Metro, consisting of six male students and ten female students with various learning styles, were the subjects of this study. This study used interviews, learning-style questionnaires, and tests to collect data. Sources of information were obtained from the results of surveys on learning styles, tests, and interviews acquired from students. After being seen and researched, the results show that different learning styles have different abilities in mathematical communication. Based on student learning styles, the test scores for auditory learning styles are 77, visual 65, kinesthetic 62.5, and read and write 70. Therefore, it can be concluded that compared to students who use other learning styles, students with visual learning styles have better mathematical communication abilities.

1. INTRODUCTION

Mathematics has an essential task as a representative language to recognize valid correspondence, where the goals of learning mathematics include conveying ideas or thoughts and then being able to demonstrate mathematics using complete sentences, pictures, tables, graphs, or other media that describe an event or situation (Permendikbud, 2014). The purpose of this Permendikbud is in line with the targets defined in the NCTM (Adawiyah & Rifqi, 2022; Dewi et al, 2015; Nuraeni & Luritawaty, 2016; Ulfah & Felicia, 2019), which reveals the rules of five cycles in dealing with problems, proof and thinking, connection, communication, and representation (Adawiyah & Rifqi, 2022; Cholily et al, 2023; Usmiyatun et al, 2023). Based on that explanation, it can be concluded that mathematical communication skills are needed when learning mathematics.

Mathematical communication ability is a student's expertise when communicating the main ideas of mathematics in writing or orally. Students' mathematical communication skills can be trained with learning steps at school, and one of them is learning mathematics (Asuro & Fitri, 2020; Purwati & Wuri, 2022). This can happen because of the elements of mathematics, which is the study of thinking that can further develop students' reasoning abilities. As a result, the development of mathematical communication skills relies heavily on mathematics.

According to (Adawiyah & Rifqi, 2022; Hafizha et al, 2022), a learning style is an approach that explains what students do when learning or taking steps to concentrate on different processes and ideas. Meanwhile, according to Winkel, learning style is a step or way of learning that is typical of students. Each student has a different learning style, but some have the same one. Therefore, each individual has additional expertise in capturing subject knowledge, especially mathematics. According to (Adawiyah & Rifqi, 2022; Mufidah, 2017) in their quotations, it states that according to Neil Flemming, learning styles are divided into four, namely: Aural/auditory (A), Visual (V), Kinesthetic (K), and Read and Write (R)) (Mufidah, 2017).

Research on mathematical communication skills has previously been carried out by (Wijayanti et al, 2019), which shows that learning styles are not proven to have a relationship with mathematical communication skills. Meanwhile, research conducted in this journal found a link between learning styles and students' mathematical communication skills. In addition, other studies have been conducted by (Noviyana et al, 2019), who found that learning styles influence student achievement; these results are almost the same as what was done in writing this journal. Then, the re-

search by (Musaidah et al, 2020) suggested a link between learning styles and students' mathematical communication abilities. The learning style used is VAK (visual, auditory, and kinesthetic). In contrast, the research conducted by the author uses the VARK learning style (graphic, acoustic, read and write, and kinesthetic) (Musaidah et al, 2020).

With the creation of mathematical communication skills, students are expected to be able to master communicating thoughts and also be able to accept well the opinions conveyed by others. Mathematical communication skills can help students when studying mathematics; in addition to making it easier for them to understand a concept, they can also help them associate thoughts and language with mathematical symbols. Conversely, with the variety of student learning styles, educators must also understand each student's learning style to be more precise in teaching and learning activities to achieve learning goals.

2. METHOD

This research is included in the descriptive qualitative research. The process is carried out following existing conditions and written data and drawings. Qualitative research methods continue to be evaluated. Researchers participate directly in the field in the research process and record the data found, then make a research report in a systematic and detailed manner (Adawiyah & Rifqi, 2022; Fadli, 2021; Suyitno, 2018). Purposive sampling, also known as a method of selecting data sources with specific considerations, is also used to select research subjects. This selection is based on researchers who use qualitative research methods (Novita et al, 2018; Wijayanti et al, 2019).

One of the reasons for conducting this research was to describe students' mathematical communication abilities when viewed based on learning style groupings. The ability studied is the ability of mathematical communication to write (written text). Mathematical expression (a mathematical expression) explains some things that need to be used to measure student abilities, including 1) Making mathematical models in pictures, tables, and graphs (drawing), 2) Expressing or implementing events in our daily lives in the form of language or math symbols. (a mathematical expression), Moreover, 3) Provide answers in written form in their language (written) (Adawiyah & Rifqi, 2022; Ashim et al, 2019; Sari& Pujiastuti, 2022; Usmiyatun et al, 2023).

The data collection technique was interviews with mathematics teachers and students to obtain initial data. The information obtained is based on what happened in the field; students' learning styles were known through learning style questionnaires; to measure students' mathematical communication abilities, researchers used tests, and to strengthen data, researchers used documentation. The data collection technique was interviews with mathematics teachers and students to obtain initial data. The information obtained is based on what happened in the field; students' learning styles are known through learning style questionnaires; to measure students' mathematical communication abilities, researchers use tests, and to strengthen data, researchers use documentation (Adawiyah & Rifqi, 2022; Kusumaningsih et al, 2020; Muthmainnah et al, 2019; Sugianto et al, 2023).

As Miles and Huberman explained, data reduction, data presentation, and conclusion are part of this study's analysis (Septiana et al, 2018; Utomo et al, 2023). Method triangulation is used to test the validity of the data, namely by comparing data from the results of interviews, documentation, questionnaires, and tests (Sugiyono, 2018).

TABLE 1. Learning Style Questionnaire Results

Learning Style	Mean	Percentage
Visual	75	37.5
Auditorial	67.5	31.25
Kinesthetics	66.875	25
Read/Write	64.375	6.25

TABLE 2. Mathematical Communication Ability Test Results

Learning Style	Frequency	Score
Visual	5	77
Auditorial	6	65
Kinesthetics	4	62.5
Read/Write	1	70

3. RESULTS AND DISCUSSION

The next step is to analyze the data that has been collected. Without the help of specific statistical programs such as SPSS, data processing is done manually using the Microsoft Excel application. Data is reduced and presented, and conclusions are drawn during data analysis. The data analysis was carried out in several ways, including data reduction data presentation, and conclusions were drawn. The following is an analysis of the data that has been collected.

After collecting the data, the following are the results of the learning style questionnaire: The student learning style questionnaire is based on filling in the questionnaire conducted by the students, and the following data is obtained:

Based on Table 1 from the results of a survey of 16 students, it can be explained that most students have a visual learning style with an average mark of 75 and a percentage of 37.50%, auditory with an average mark of 67.5 and a rate of 31.25%, kinesthetic with an average yield of 66.875 and speed of 25%, and read/write with a result of 64.375 and percentage of 6.25%.

Mathematical communication skills based on learning style groupings obtained the distribution of abilities as follows:

Table 2 explains the state of students' mathematical communication abilities based on group data with an overall score of 77 on visual, 65 on auditory, 62.5 on kinesthetic, and 70 on read/write.

Based on the total score obtained, students' average final mathematical communication skills score is 68.5. Based on Ngalim Purwanto's opinion, the score obtained belongs to the excellent category (Sugiyono, 2018).

Students can complete the idea indicators in written form. In addition, students can also express questions or answers to incidents or events that occur every day. Students can also give their answers in everyday language. However, the student's answers still needed to be quite right on several questions.

Students can complete the idea indicators in written form. In addition, students can also express questions or answers to events or events that occur daily and solve questions with the correct answers.

After being analyzed, it can be explained that students with a learning style in mathematical communication skills have advantages in mathematical expression (mathematical expression) and writing skills (written). Still, students with an auditory learning style must improve their ability to answer (accuracy).

Students can solve questions with good enough answers. However, students with a read-and-write learning style must improve in expressing questions or answers to everyday events. In addition, students need to improve in writing answers in their language.

After being analyzed, it can be explained that students with a learning style in mathematical communication skills have an advantage in the accuracy of answers, even though the answers seem very short. However, students with a read-and-write learning style need to improve in expressing mathematics (mathematical expression) and writing skills (written).

After being analyzed, it can be explained that students with learning styles in mathematical communication skills have advantages in mathematical expression and writing abilities and have benefits in answering abilities (accuracy of answers).

Students with a kinesthetic learning style can solve questions with pretty good answers; besides, they have advantages in writing answers in their language (written). However, students with a kinesthetic learning style must improve in expressing questions or answers to everyday events. This goes hand in hand with (Turmuzi & Kurniawan, 2021) research, which states that the recapitulation of student answers and the results of converting student scores with sequential percentages, especially in questions with indicators of reading with an understanding of a mathematical representation.

After being analyzed, it can be explained that students with learning styles in mathematical communication skills have advantages in the accuracy of answers and writing skills, even though the answers seem very short. However, students with kinesthetic learning styles need to improve in expressing mathematics (mathematical expression). This is in line with the research of (Aliffianti et al, 2022), which stated that the study results showed that the mathematical communication abilities of students with visual learning styles were sufficient. Students with auditory and kinesthetic learning styles had mathematical communication abilities in the lower class (Aliffianti et al, 2022).

After all the data has been collected and managed, the mathematical communication ability test results for class VII students at MTs are obtained. Ma'arif Roudlotut Tholibin Metro, when viewed from his learning style, data shows students with a visual learning style of 5 get an average score of 77, with a Good interpretation, students with an auditory learning style of 6 get an average score of 65, with a Good arrangement, students with a kinesthetic learning style of 4 get an average score of 62.5, with a Good interpretation. Students with a read/write learning style of 1 get an average score of 70 with a Good arrangement. The total average number of students is 68.5, which brings a Good interpretation.

Based on the mathematical communication ability test results, when viewed from their learning style, it can be concluded that students with a visual (1) learning style have advantages in mathematical expression and the ability to write in their language (written) but have deficiencies in answering questions, (2) auditory has advantages in mathematical expression and the ability to write in its language (written), but has disadvantages in answering questions, (3) Reading and writing have advantages in the accuracy of answers in answering questions but are lacking in expressing mathematics (a mathematical expression) and the ability to write in everyday language (written), (4) kinesthetic has advantages in the accuracy of answers and the ability to write in their language,

It is known based on interviews that researchers have conducted with one of MTs students. Ma'arif Roudlotut Tholibin, whose initials are SS, said that "the existing learning activities, especially mathematics, seem boring" (SS, Personal communication, 29 April 2023). Likewise, researchers' contact with other students with the initials AID also said that learning mathematics could have been more varied and exciting.

So, the visual learning style has advantages from the ability to express mathematics (a mathematical expression), write in one's language (written), and answer questions. This is in line with research (Nuraeni & Luritawaty, 2016), which states that the achievement of students' mathematical communication skills who get think-talk-write learning strategies is better than students who get conventional learning.

4. CONCLUSION

As the results and discussion obtained, it can be concluded that learning styles influence students' mathematical communication abilities. As well as the accuracy of learning styles has a positive influence on students' mathematical communication skills. The more appropriate the learning style used during the learning process, the higher the students' mathematical communication skills. According to the findings of this study, researchers believe that students' learning styles influence the level of their mathematical communication skills. Therefore, for students to improve their mathematical communication skills, they must pay attention to learning that must be designed as well as possible.

References

Adawiyah, R., & Rifqi, A. (2022). Strategies for Increasing Vocational High School Competitiveness Through Optimizing Student Competence. *E-journal.Unesa.ac.id*, 10(3), 194–212. https://ejournal.unesa.ac.id/index.php/inspiration-management-education/article/view/46668/39378

Aliffianti, TR, Kurniati, N., Humaira, N., & Turmuzi, M. (2022). Analysis of mathematical communication skills regarding the learning styles of class VIII students of SMPN 5 Kota Bima for the 2021/2022 academic year. *Griya*, 2(2), 461–475.

Ashim, M., Asikin, M., & Kharisudin, I. (2019). The Need for Mathematical Communication and Mobile Learning Setting Problem Based Learning to Improve 4C Capabilities in the Disruptive Era. *Prism*, 2, 687–697.

Asuro, N., & Fitri, I. (2020). Analysis of Mathematical Communication Ability Given the Self Concept of SMA/MA Students. *Suska Journal of Mathematics Education*. http://ejournal.uin-suska.ac.id/index.php/SJME/article/view/10031

Cholily, YM, Darmayanti, R., Lovat, T., Choirudin, Usmiyatun, & Muhammad, I. (2023). Si-GEMAS: Serious game mathematical crossword puzzle learning media for students' critical thinking abilities. *Al-Jabar*, 14(1), 165–179.

Dewi, HD, Susanto, & Lestari, NDS (2015). Development of NCTM Standard Learning Devices (National Council of Teachers of Mathematics) in Grade VII Junior High Schools (SMP) on Statistics. *Journal of Education*, *2*(3), 25–30.

Fadli, MR (2021). Understand the design of qualitative research methods. *Humanika*, *21*(1), 33–54. https://doi.org/10.21831/hum.v21i1.38075

Hafizha, D., Ananda, R., & Aprinawati, I. (2022). Analysis of Teacher Understanding of Student Learning Styles at 020 Ridan Permai Sdn. *Journal of Basic Education Review: Journal of Educational Studies and Research Results*, 8(1), 25–33. https://doi.org/10.26740/jrpd.v8n1.p25-33

Kusumaningsih, W., Setiawan, PY, & Utami, RE (2020). Profile of Middle School Students' Algebraic Thinking in Mathematical Problem Solving because of Cognitive Style and Gender. *JIPMat*. http://journal.upgris.ac.id/index.php/JIPMat/article/download/5574/pdf

Mufidah, L. (2017). Understanding Learning Styles to Increase Children's Potential. *Dignity: Journal of Women and Children*, 1(2). https://doi.org/10.21274/martabat.2017.1.2.245-260

Musaidah, E., Purnomo, D., & Setyowati, RD (2020). Analysis of Creative Thinking Ability Because of the Learning Styles of Class VIII Students of SMP Negeri 1 Sayung Year 2019/2020. *Imaginary: Journal of Mathematics and Mathematics Education*, *2*(5), 382–390. https://doi.org/10.26877/imaginer.v2i5.6520

Muthmainnah, M., Hapizah, H., & Somakim, S. (2019). The Application of Prompting Probing Strategies in Learning Mathematics Material Relations and Functions at Junior High School. *Lentera Sriwijaya: Scientific Journal of Mathematics Education*, 1(1), 27–37. https://doi.org/10.36706/jls.v1i1.9567

Novita, R., Prahmana, RCI, Fajri, N., & Putra, M. (2018). Causes of difficulty learning three-dimensional geometry. *Journal of Mathematics Education Research*, 5(1), 18. https://doi.org/10.21831/jrpm.v5i1.16836

Noviyana, IN, Dewi, NR, & ... (2019). Analysis of Students' Mathematical Communication Ability in Terms of Self-Confidence. ... National Mathematics. https://journal.unnes.ac.id/sju/index.php/prisma/article/view/29241

Nuraeni, R., & Luritawaty, IP (2016). Developing Students' Mathematical Communication Skills through the Think Talk Write Strategy. *Musharafa*, 5(2), 101–112.

Permendikbud. (2014). *Minister of Education and Culture of 2014, concerning No. 59 of the Year*.

Purwati, H., & Wuri, DE (2019). Analysis of Students' Mathematical Communication Ability with Competitive Learning Style. *Journal of Derivatives: Journal of Mathematics and Mathematics Education*, 4(2), 17–23. https://doi.org/10.31316/j.derivat.v4i2.155

Sari, SM, & Pujiastuti, H. (2020). Analysis of Students' Mathematical Communication Ability in Terms of Self-Concept. *Kreano, Journal of Creative-Innovative Mathematics*. https://journal.unnes.ac.id/nju/index.php/kreano/article/view/22717

Septiana, N., Rohmadi, M., Nasir, M., Nastiti, LR, Usmiyatun, & Riswanto. (2018). Difficulties in Teaching Integrated Science for Middle School/MTs Science Teachers in Central Kalimantan. *EduScience: Journal of Science & Mathematics Education*, 6(1), 1. https://doi.org/10.23971/eds.v6i1.716

Sugianto, R., Darmayanti, R., Wahyu Arian Sah, R., & Usmiyatun, U. (2023). Bulletin of Educational Management and Innovation Word square English learning media design assisted by the Canva application. *Bulletin of Educational Management and Innovation*, 1(1), 1–16. https://journal.rafandhapress.com/BEMI

Sugiyono. (2018). *Quantitative Qualitative Research Methods. In Quantitative Qualitative Research Methods*.

Suyitno. (2018). *Qualitative Research Methods: Concepts, Principles, and Their Operations*. Akademia Pustaka.

Turmuzi, M., & Kurniawan, E. (2021). Analysis of Students' Mathematical Communication Ability on Geometry Material Analysis of Students' Mathematical Communication Ability on Geometry Material. *JPM*, 11(1), 50–61.

Ulfah, M., & Felicia, L. (2019). Development of Mathematics Learning in the National Council of Teachers of Mathematics (NCTM) in Children. *Equality: Journal of Gender and Child Studies*, 1(2), 127. https://doi.org/10.24235/equalita.v1i2.5642

Usmiyatun, Sah, RA, & Darmayanti, R. (2023). Design Development of Audiovisual Teaching Materials for Canva Application-based Reading Skills in Early Childhood. *Caksana Journal: Early Childhood Education*, 4(1), 1–12.

Utomo, DP, Usmiyatun, & Baiduri. (2023). Analogical Thinking: An Analysis of the Problem-Solving Process Using Target-Based Example Thinking.

Wijayanti, ID, Hariastuti, RM, & Yusuf, FI (2019). Students' Mathematical Communication Ability in Terms of Learning Style. *Indiktika: Journal of Mathematics Education Innovation*, 2(1), 68–76. https://doi.org/10.31851/indiktika.v2i1.3429