Analysis of mathematical critical thinking ability in student learning style

by 6 Wardono

Submission date: 14-Apr-2023 03:25PM (UTC+0700)
Submission ID: 2064261544
File name: 6.pdf (806.35K)
Word count: 3292
Character count: 18774

Journal of Physics: Conference Series

Analysis of mathematical critical thinking ability in student learning style

Analysis of mathematical critical thinking ability in student learning style

W. R. Purwanto[1], S. B. Waluya[2], Rochmad[3] , Wardono[4]

[1] Postgraduate Mathematics Education, Universitas Negeri Semarang Indonesia
[2,3,4] Universitas Negeri Semarang, Jalan Kelud Utara III Semarang, Indonesia

Email: [1] Wahyuridlo90@gmail.com

Abstract. This article aims to analyze mathematical critical thinking skills on student learning styles. Mathematical critical thinking skills can be developed through the character of the learning styles possessed by each student in learning mathematics. Learning can be maximized by knowing the learning styles of students and continued with the learning process by means of one way communication but must go through a process of interaction that is two way communication. This research was carried out at SMP Negeri 3 Jekulo in the odd semester 2019/2020 school year using the comparative-associative explanative research method. From the research results obtained that: 1) There are differences in learning outcomes in terms of mathematics learning styles of students. 2) There are differences in mathematics learning outcomes in terms of students' mathematical critical thinking skills. 3) student learning styles do not affect students' mathematical critical thinking abilities From the results of these studies indicate that every student, both those who have auditory, visual, or kinesthetic learning styles have different mathematical critical thinking abilities.

1. Introduction

To get maximum learning outcomes, besides applying the six principles of mathematics learning in school, there is a connection between mathematical thinking as a competence in learning, especially mathematics. Mathematical concepts are arranged in a hierarchically structured, logical, and systematic manner starting from the simplest concepts to the most complex concepts that require good mathematical thinking skills to overcome them [1].

In the learning process, giving treathment is indispensable in increase the students' critical thinking skills. [2] explains that students practice ways of thinking and reasoning in drawing conclusions through the activities of inquiry, exploration, experimentation, showing similarities and differences, consistent and inconsistency.

The ability to think mathematics given treatment can be a benchmark in the success of the mathematics learning process. Mathematical thinking process is carried out by providing various contextual problems that are familiar with students' lives to be optimally solved by students in the context of mathematics learning that are interesting for students [3].

In addition to mathematical critical thinking skills, student success in learning activities is greatly influenced by the learning environment. Learning is a psychological process that takes place in active interactions between subjects and the environment and produces changes in knowledge, skills, and attitudes that are constant or permanent [4]. The environment in question is an educational environment in the form of learning activities that are tailored to student learning styles.

Learning style is a unique and consistent way in which students absorb and process the information they have obtained. According to [5] states "...students are seeing difficulties in learning because they don't know their learning styles". This indicates that students who have difficulty learning because they do not know their learning style. In line with this, [6] also stated "learning style is an important factor influencing the way students approach learning", that learning style is an important factor used in the learning process. According to [7] most students fail to understand the lesson because they do not know how to do in learning. From these statements the learning style is an important factor that influences student learning.

Learning style is very important and very decisive for anyone in carrying out their learning tasks, anyone can learn more easily, when he finds a learning style that suits him [8]. Each student has different abilities in receiving and processing information, this results in students also taking different ways to receive that information. At the reception of different information on each student affects the ability to think critically mathematically. Given these differences, each student has his own situation in interpreting mathematical problems from abstract to concrete conclusions.

On the other hand, the ability to think critically mathematically is also influenced by the learning styles of each student. In fact, learning styles have their own criteria between auditory and kinesthetic visual learning styles. This means that when the teacher conducts the learning process in front of the class with questions and answers and does the practice questions, the mathematical critical thinking ability in each learning style has different characters.

The formulation of the problem in this study include:

a) Are there differences in mathematics learning outcomes in terms of student learning styles?
b) Are there differences in mathematics learning outcomes in terms of students' mathematical critical thinking skills?
c) Does the student's learning style affect students' mathematical critical thinking skills?

2. Method

The research method used in this study is an associative explanatory survey method. This type of survey is used to find out a certain condition occurs or what influences the occurrence of a condition. Explanation level is the level of explanation, namely how the variables studied will explain the object under study through collected data [9]. Explanative survey in this study is divided into two parts, namely: 1) Comparative, which is a survey that aims to make a comparison (compare) between one variable with other similar variables, 2) Associative, ie associative survey is to explain the relationship (correlation) between variables. The population of this study was all students of class VIII odd semester of junior high school students in 3 Jekulo Kudus Regency in the academic year 2019/2020 odd semester with 185 students distributed in 7 classes. Sampling is done by taking one class at random with the consideration that each class has the same mathematical problem solving ability and obtained class VIII-C with a total of 26 students as research samples. Regarding research procedures, starting with the provision of learning style questionnaires, grouping mathematical critical thinking skills; then students are given a problem solving ability test. After problem solving ability data is collected, the data is grouped based on the tendency of student learning styles and the level of mathematical critical thinking skills (high, medium, and low). Two-way ANOVA test analysis to determine differences in problem solving abilities based on learning styles and critical thinking skills. This study aims to determine the description of student learning styles, the level of critical thinking, and the ability to solve mathematical problems and the influence of learning styles, critical thinking mathematics on the ability to solve mathematical problem solving of junior high school students in 3 Jekulo Kudus Regency.

3. Results and Discussion

After students are classified based on the tendency of learning styles and critical thinking skills, then the data of problem solving abilities are processed using the two-way ANOVA test. The description of

problem solving abilities based on learning styles and the level of student learning independence is presented in the following table:

Table 1. Problem solving abilities based on learning styles

Learning style	Mean	Std Eror	95% Confidence Interval	
			Lower Bound	Upper Bound
Auditory	75,167	2,343	70,224	80,109
Visual	69,778	2,142	65,258	74,298
Kinesthetic	80,400	1,686	76,842	83,958

Table 2. Problem solving abilities based on Critical Thinking Skills

Critical Thinking Skills	Mean	Std Eror	95% Confidence Interval	
			Lower Bound	Upper Bound
High	85,000	2,736	79,229	90,771
Medium	77,067	1,482	73,941	80,193
Low	63,278	1,801	59,479	67,077

From Table 1, it appears that the average mathematical problem solving ability is based on student learning styles namely, for Auditorial, Visual, and Kinesthetic learning styles in a row; 75,16; 69.77 and 80.40. From the results of these descriptive statistics it shows that there are differences in the average ability of problem solving based on the tendency of students' learning styles, but the difference in their problem solving abilities is not too far apart. Whereas table 2 the average mathematical problem solving ability based on students' critical thinking mathematical abilities, namely, high, medium, low respectively; 85; 77.06 and 63.27.

Next, to find out how the relationship between the research variables was carried out the two-way Anova test with the following results.

Table 3. The relationship of learning styles, students' mathematical critical thinking skills, and the ability to solve mathematical problems

Source	Type III sum Squares	df	Mean Square	F	Sig
Corrected Model	2360,649[a]	8	295,081	10,954	,000
Intercept	105873,606	1	105873,606	3930,092	,000
Style	414,009	2	207,005	7,684	,004
Skill	1500,323	2	750,161	27,846	,000
Style*Skill	118,275	4	29,569	1,098	,389
Errol	457,967	17	29,939		
Total	144308,000	26			
Corrected total	2818,615	25			

From Table 2 the following information can be obtained: learning mathematics with student learning styles, it is known that there are differences in mathematics learning outcomes based on student learning styles. This is indicated by the value of F count = 7.684 and Sig = 0.004 which is greater than α = 0.05; while to examine the relationship between mathematics learning outcomes with critical thinking skills, it is known that there are differences in mathematics learning outcomes based on critical thinking skills. This is indicated by the value of F count = 27.846 and Sig = 0.000 which is smaller than α = 0.05; furthermore, it is also known that, there is no interaction effect between students' learning styles on critical thinking skills, this is indicated by the value of F count = 1.098 and Sig = 0.389 which is greater than α = 0.05.

How to optimize students' critical thinking skills on subject matter, use of language, use logical structure of logical thinking, test the truth of science, and experience from various aspects will reward

them for becoming independent learners. As according to [10] explains that critical thinkers always go through several stages in their actions, namely formulating a problem, giving an argument, making a deduction, conducting an induction, evaluating, then making a decision and determining an action. Mathematical thinking ability is complex and requires precondition concepts and processes from the lower both in terms of material and how to learn or teach it, so that in learning it is necessary to consider mathematical tasks and supportive learning atmosphere to encourage the emergence of these mathematical thinking abilities [11].

Mathematical thinking ability is a form of accumulation of mathematical thinking concepts that indicate the development of abilities: (1) mathematical understanding; (2) mathematical problem solving; (3) mathematical reasoning; (4) mathematical connections; (5) mathematical communication [3]. It is therefore recommended that in teaching mathematics in secondary schools, critical thinking skills should be included in the teacher education curriculum so as to improve student performance in Mathematics [12].

Based on these assumptions, the concept of mathematical critical thinking ability is a process of learning mathematics that directs active students to analyze and understand abstract things concretely onfacts mathematicalso as to obtain accurate conclusions. The ability to think critically mathematically can be developed optimally by means of one way communication but must go through a process of interaction that is two way communication that is between fellow students, students and teachers, students with the environment and learning resources. In the process, learning that is carried out must be able to provide challenges for students to think in a complex manner related to the concept of the material being studied. Characteristics of students describe the background state of student understanding that influences the effectiveness of the learning process. The condition of student characteristics that should be considered by the teacher in designing the learning process that is managed in the classroom is a learning style. Learning style is a way that someone tends to choose to find and receive experience information, as well as students' habits in treating the experiences they have [13]. If someone can recognize their own learning style, then that person can manage under what conditions, where, when and how one can maximize learning [14].

Learning style refers to the way of learning used by learners. Generally, it is considered that one's learning style comes from personality variables, cognitive and psychological states of background and educational experience. The approach that is often and commonly used is a learning style based on these sensory modalities, namely: visual, auditory and kinesthetic learning styles [15]; [16] classifies learning styles based on how we absorb information easily (modality) into three types, namely auditory type, visual type, and kinesthetic type. The characteristics of each learning style are stated as follows.

Each student must have a different learning style according to the characteristics of each individual. This will also have an impact on the teacher. Here the teacher must also understand good teaching for each student so the teacher must know and understand the character of each student. For this reason, it is important for teachers to know their students' learning styles. [17] states there are several reasons why teachers' understanding of student learning styles, need to be considered in the teaching process, namely; make the process of teaching and learning dialogic. Mathematical critical thinking processes in learning styles can be observed using the IDEALS steps, namely Identify, Define, Enumerate, Analyze, List, Self-Correct [18]. Kinesthetic students can be said to have critical thinking processes better than visual and auditory students at the Enumerate, Analyze, List, and Self-Correct steps [18].

According to [19] with his research showing that students with mathematical critical thinking skills with kinesthetic learning styles are higher than students' mathematical thinking abilities that have auditory and visual learning styles. From the results of From the research results obtained that: there are differences in learning outcomes in terms of mathematics learning styles of students. There are differences in mathematics learning outcomes in terms of students' mathematical critical thinking skills. student learning styles do not affect students' mathematical critical thinking abilities. From the results of these studies indicate that every student, both those who have auditory, visual, or kinesthetic learning styles have different mathematical critical thinking abilities.

The study and discussion it can be concluded that mathematics learning is not only sufficient for the achievement of mathematical abilities, but is beginning to change to a new mindset of achieving mathematical critical thinking abilities with each learning style. Basically every student has a learning style, but not all of them develop in a balanced way but there is one that dominates according to the learning style they have. This causes students to like learning that varies according to the learning style they have. Diversity of student learning styles requires a selection ofstrategies teachingthat are suitable so that the strength of student learning styles develops well. By involving visual, auditory and kinesthetic aspects, it is expected to be able to improve mathematical critical thinking skills in mathematics learning. So more broadly with the combination of mathematical critical thinking by knowing learning styles will produce maximum quality of learning and improve high learning outcomes.

4. Conclusion

Optimizing the learning styles that are owned by students can be done several things according to the type of learning styles including: (1) Visual Students; display interesting pictures and concept maps when learning takes place, encourage students to read at a glance then after getting a general picture of the material to be studied, then enter in the details or details (2) Student Auditorial; repeating material that is considered important by using rhythm or intonation of sound, using media in the form of biology learning videos that have sound effects (3) Kinesthetic Students; design a learning model that makes students more active such as project-based learning, demonstration methods and practicum. With certain characteristics in each of the existing learning and research styles, the kinesthetic learning style has better mathematical critical thinking skills than students who have auditory and visual learning styles.

References

[1] A. Suryana, "Kemampuan Berpikir Matematis Tingkat Lanjut (Advanced Mathematical Thinking) Dalam Mata Kuliah Statistika Matematika 1," in *Seminar Nasional Pendidikan Matematika*, 2012.

[2] M. Kusumaningrum and A. A. Saefudin, "Mengoptimalkan Kemampuan Berpikir Matematika Melalui Pemecahan Masalah Matematika," in *Seminar Nasional Matematika dan Pendidikan Matematika FMIPA UNY*, 2012, p. 60.

[3] M. Fajri, "Kemampuan Berpikir Matematis Dalam Konteks Pembelajaran Abad 21 di Sekolah Dasar," 2017. [Online]. Available: https://media.neliti.com/media/publications/232878-kemampuan-berpikir-matematis-dalam-konte-d16721dd.pdf . [Accessed: 20-Sep-2019].

[4] Trianto, *Pengembangan Perangkat dalam Teori dan Praktek*. Surabaya: Prestasi Pustaka, 2009.

[5] A. Esa, M. Radzali, M. A. Misdi, and Z. Jaafar, M, "Congruency of Mind beetwen Lecture and Students in Enginering Disciplines," *Asian Soc. Sci.*, vol. 5, no. 8, pp. 68–76, 2009.

[6] S. Rahman, S. Abdullah, M, M. Yasin, R, S. Meerah, T, L. M. Halim, and S. Amir, "Student learning Style and Preferences for the Promotion of Metacognitive Development Activities in Science Class," *World Appl. Sci. J.*, vol. 14, no. 1, pp. 11–13, 2011.

[7] N. Sulhan, *Pembangunan Karakter Pada Anak: Manajemen Pembelajaran Guru Menuju Sekolah Efektif*. Surabaya: Surabaya Intelektual Club, 2010.

[8] B. J. R. Marpaung and E. Napitupulu, "Pengaruh Strategi Pembelajaran dan Gaya Belajar terhadap Hasil Belajar," *J. Teknol. Pendidik.*, vol. 7, no. 1, pp. 25–34, 2014.

[9] Sugiyono, *Metode Penelitian Kuantitatif, Kualitatif dan R&D*. Bandung: Alfabeta, 2006.

[10] W. Jufri, *Belajar dan Pembelajaran Sains*. Bandung: Rineka Cipta, 2013.

[11] Y. Sari, I. Kurniawati, and G. Pramesti, "Penerapan Pendekatan Open-Ended Dalam Pembelajaran Matematika Untuk Meningkatkan Kemampuan Berpikir Matematis Siswa Ditinjau Dari Respon Siswa," *J. Pendidik. Mat. Solusi*, vol. 1, no. 1, pp. 1–10, 2013.

[12] A. N. Chukwuyenum, "Impact of Critical thinking on Performance in Mathematics among Senior Secondary School Students in Lagos State," *IOSR J. Res. Method Educ.*, vol. 3, no. 5,

pp. 18–25, 2013.
[13] R. Sundayana, "Kaitan antara Gaya Belajar, Kemandirian Belajar, danKemampuan Pemecahan Masalah Siswa SMP dalam Pelajaran Matematika," *J. Pendidik. Mat. STKIP Garut*, vol. 8, no. 1, 2016.
[14] S. Rijal and B. S, "Hubungan antara Sikap, Kemandirian Belajar, dan Gaya Belajar dengan Hasil Belajar Kognitif Siswa," *J. BIOEDUKATIKA*, vol. 3, no. 2, pp. 15–20, 2015.
[15] M. Irham and W. N.A, *Psikologi Pendidikan Teori dan Aplikasi dalam Proses Pembelajaran*. Yogyakarta: ArRuzz Media, 2014.
[16] B. De Porter and M. Hernacki, *Quantum Learning. Membiasakan Belajar Nyaman dan Menyenangkan*. Bandung: Kaifa, 2015.
[17] Ghufron, M. Nur, and R. Risnawati, *Gaya Belajar Kajian Teoritik*. Yogyakarta: Pustaka Pelajar, 2012.
[18] Soal Cerita Matematika Berdasarkan Gaya Belajar," *J. Math Educ. Nusant.*, vol. 8, no. 1, pp. 23–30, 2015.
[19] A. Karim, "Pengaruh Gaya Belajar Dan Sikap Siswa Pada Pelajaran Matematika Terhadap Kemampuan Berpikir Kritis Matematika," *J. Form.*, vol. 4, no. 3, pp. 188–195, 2014.

Analysis of mathematical critical thinking ability in student learning style

ORIGINALITY REPORT

19%	14%	8%	6%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	elsd.ssru.ac.th Internet Source	2%
2	karyailmiah.unipasby.ac.id Internet Source	2%
3	Submitted to Simpson University Student Paper	2%
4	Submitted to Universitas Airlangga Student Paper	2%
5	Fresha Anjani, Syafika Ulfah. "Secondary students' mathematical reasoning in terms of learning styles on online learning", Jurnal Elemen, 2022 Publication	1%
6	ejournal.um-sorong.ac.id Internet Source	1%
7	Ni Wayan Suardiati Putri, I Wayan Gede Wardika. "Implementation TANDUR Learning Using GeoGebra Towards Student Learning Result Viewed from Independence Learning",	1%

	JTAM (Jurnal Teori dan Aplikasi Matematika), 2020 Publication	
8	Submitted to University of Greenwich Student Paper	1 %
9	Submitted to De La Salle University Student Paper	1 %
10	id.scribd.com Internet Source	1 %
11	nlistsp.inflibnet.ac.in Internet Source	1 %
12	eprints.ums.ac.id Internet Source	1 %
13	repo.uinsatu.ac.id Internet Source	1 %
14	www.ilkogretim-online.org Internet Source	1 %
15	I. Ketut Darma, I. Gede Made Karma, I. Made Anom Santiana. "Need analysis for developing applied mathematics textbooks based on blended learning to improve problem solving abilities at the students of polytechnic state of Bali", AIP Publishing, 2020 Publication	1 %
16	docplayer.net Internet Source	1 %

17	jurnal.unsur.ac.id Internet Source	<1 %
18	Elsa Susanti, Hartono. "Mathematical Critical Thinking and Creative Thinking Skills", Proceedings of the 2019 International Conference on Mathematics, Science and Technology Teaching and Learning - ICMSTTL 2019, 2019 Publication	<1 %
19	docobook.com Internet Source	<1 %
20	journals.iau.ir Internet Source	<1 %
21	www.fkip-unswagati.ac.id Internet Source	<1 %
22	libstore.ugent.be Internet Source	<1 %
23	Submitted to University College London Student Paper	<1 %
24	www.neliti.com Internet Source	<1 %

Exclude quotes	On	Exclude matches	< 10 words
Exclude bibliography	On		

Analysis of mathematical critical thinking ability in student learning style

GRADEMARK REPORT

FINAL GRADE

/0

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7