

Learning Analysis with ARIAS Model on Students' Critical Thinking Skills Reviewed from Learning Styles

Hamidah¹, Jaka Wijaya Kusuma^{*2}, Ilmadi³

^{1,2}Universitas Bina Bangsa, Serang Banten, Indonesia

³Universitas Pamulang, Tangerang, Indonesia

*jakawijayak@gmail.com

ABSTRACT

A person who can think critically in mathematics means having a high level of ability and is a fundamental ability that students must have to learn mathematics. The research aims to determine the influence of understanding the ARIAS model on students' critical thinking skills in terms of learning style. This type of research is quasi-experimental with a post-test nonequivalent control group design. The research population is a student majoring in mathematics education at Bina Bangsa University, then selected two classes as research subjects. The acquisition of data from mathematical critical thinking skills tests and learning style questionnaires was then processed with the ANOVA (Analysis of Variance) test. The results showed a significant difference in mathematical necessary thinking skills between students and ARIAS learning and ordinary learning and judging from students' learning styles. There was a substantial difference in mathematical critical thinking skills. Furthermore, it is known that there is an interaction between the type of learning and its learning style towards students' mathematical necessary thinking skills.

Keywords: ARIAS Learning Model, Critical Thinking, Learning Style

ABSTRAK

Seseorang yang berkemampuan untuk berpikir secara kritis dalam matematis artinya memiliki kemampuan tingkat tinggi dan merupakan kemampuan mendasar yang harus siswa miliki untuk belajar matematika. Tujuan penelitian yaitu untuk mengetahui pengaruh pembelajaran dengan model ARIAS terhadap kemampuan berpikir kritis mahasiswa ditinjau dari gaya belajar. Jenis penelitiannya yaitu penelitian kuasi eksperimen dengan desain posttest nonequivalent control group design. Populasi penelitiannya yaitu mahasiswa jurusan pendidikan matematika di Universitas Bina Bangsa, kemudian dipilih dua kelas sebagai subjek penelitian. Perolehan data dari tes kemampuan berpikir kritis matematis dan angket gaya belajar, kemudian diolah dengan uji ANOVA (Analysis of Variance). Hasil penelitian menunjukkan bahwa terdapat perbedaan yang signifikan kemampuan berpikir kritis matematis antara mahasiswa dengan pembelajaran ARIAS dan pembelajaran biasa, dan ditinjau dari gaya belajar mahasiswa terdapat perbedaan yang signifikan kemampuan berpikir kritis matematisnya. Selanjutnya diketahui terdapat interaksi antara jenis pembelajaran dengan gaya belajarnya terhadap kemampuan berpikir kritis matematis mahasiswa.

Kata kunci: Model Pembelajaran ARIAS, Berpikir Kritis, Gaya Belajar

Received : April 9, 2022

/Accepted : May 23, 2022

/Revised : April 15, 2022

/Published : May 24, 2022

Introduction

Mathematics can train students to develop a critical, systematic, logical, creative, and effective way of working together. Critical thinking skills are an important component of education and have been the passion of many instructors over the years, as they are believed to lead to higher academic performance. The importance of mathematics in the world of education makes it a necessity for students to emphasize their learning on critical thinking rather than just memorizing or manipulating formulas (D'Alessio et al., 2019; Prihatami, 2020)

The Current Indonesian curriculum emphasizes learning by inviting students to solve problems in the learning process. In problem-solving of the course, students are required to think critically instead of just memorizing or remembering simple information. Teachers are not used to

inviting students to practice critical thinking in mathematics and science (Siregar et al., 2019). Students are currently poorly trained in a state of testing, arguing to ask questions, looking for relationships, and conducting evaluations that result in the student's ability to think critically low (Primasatya & Jatmiko, 2019). This fact shifts the paradigm, and they should learn mathematics not only to get accurate numbers or answers but also to how the formation of attitudes and thinking patterns, which then impacts their ability to be more creative, critical, and logical in solving problems.

A person who can think critically about mathematics means having a high level of ability and is a fundamental ability that students must have to learn (Novtiar & Aripin, 2017; Primasatya & Jatmiko, 2018). The statement confirms that critical thinking ability is the ability to think reflectively and always based on consideration when deciding what is done (Bayuningsih et al., 2018; Dewi et al., 2019). Mathematical critical thinking skills lead students to develop a wide array of strategies from various sources and compare their findings with previous theories.

There is a relationship between a person's learning outcomes and motivation (Syafii, 2021). Learning motivation is an inevitability for optimal student self-development. The interaction between teachers and students should be a process. So it is necessary to design a learning model that can motivate students and activate them during the teaching and learning process to positively impact their abilities, especially critical thinking.

Learning with the ARIAS model results from Keller and Kopp's development in 1987 with five components in it, including assurance, relevance, interest, assessment, and satisfaction (Swastika & Narendra, 2019). This ARIAS model is made as a reference for teachers during teaching and learning activities that are packaged in such a way as to motivate students and invite students to be active during learning activities. Research results show that students show the most active attitude in the ARIAS learning process, and it is found that discipline is the most active student activity when disciplined (Kusuma & Hamidah, 2019). When discussing during learning with the ARIAS model provides a place for students to think critically about the problems given. Furthermore, the assessment component in the learning process invites students to evaluate the results of the discussion, which is one of the critical thinking processes, namely making considerations before making a decision.

Learning with the ARIAS model is packaged to motivate students during learning, and to grow a person's learning motivation must be seen from the characteristics of his learning style in receiving materials during the learning process. There are three learning styles: a person's style/characteristics in learning, including visual, auditorial, and kinesthetic (Jamulia, 2018; Mareta & Sembiring, 2020; Wawan, 2018; Willia et al., 2020). Everyone has a different learning style in understanding the information received. If the learning process matches learning characteristics, then the person will be motivated to be involved during the learning process.

Learning style is related to how a person learns and likes what he learns (Pramesti & Ratnadi, 2020). The learning style is a collaboration of how the person understands and processes all the information obtained (Mokodompit et al., 2020). The lack of harmony between the learning styles of students and teachers tends to make students depressed, bored, and unable to focus in the classroom to get less satisfactory results (Jamani et al., 2020).

The research was conducted at Bina Bangsa University, majoring in mathematics education in semester four, two classes. The purpose of the research is 1) to find out if there are significant differences in the mathematical critical thinking ability of students who learn with ARIAS with ordinary learning; 2) to know whether there are significant differences in the ability to think students mathematically. Judging from the learning style, and 3) find out whether there is an interaction between this type of learning and a significant learning style to the mathematical critical thinking ability of students?

Research Methods

The type of research is quasi-experiment, and the design is *a posttest-only control design*. The population is all students of Bina Bangsa University mathematics education with a sample of two classes from semester four consisting of two classes of 26 students each who will be given the same subject matter and tests. The test is carried out at the end of learning but is also seen in the interaction between variables. The design is illustrated as follows:

Tabel 1. Design Research

Group	Treatment		
	Y	X	O
Experiment	Y	X	O
Control	Y		O

Information:

O = postes ability to think critically mathematics

X = treatment with ARIAS model

Y = learning style

The research was conducted in the 2020/2021 teaching year, with the research process being the preparation, implementation, and analysis of data. The research instruments are postes, and learning style questionnaires. Posttest consists of 5 items of essay questions on analytical geometry materials as a tool to measure students' mathematical critical thinking skills, with a maximum score of each question item is 4. Market learning style in 27 statements, each 9 for each learning style. The questionnaire scale model used the Likert scale of answer choice is never, rarely, sometimes, often, and always will be given a score of 1, 2, 3, 4, and the highest is 5. The instrument is given to both classes then the data is analyzed with the ANOVA test.

Result and Discussions

The test results of the data obtained are student learning results as measured by postes after being given ARIAS learning for practical classes and ordinary learning for online control classes. Data is also obtained from learning style questionnaires distributed before learning begins.

Table 2. Description of Critical Thinking Test Results of Second Class Students Reviewed from Learning Styles Descriptive Statistics

Group	Gaya Belajar	Mean	Std. Deviation	N
ARIAS	Visual	15.50	1.291	4
	Auditorial	15.27	4.148	15
	Kinesthetic	21.71	2.138	7
	Total	17.04	4.395	26

Usual	Visual	17.44	2.159	16
	Auditorial	6.00	2.000	5
	Kinesthetic	14.60	3.130	5
	Total	14.69	4.994	26
Total	Visual	17.05	2.139	20
	Auditorial	12.95	5.520	20
	Kinesthetic	18.75	4.413	12
	Total	15.87	4.806	52

From table 2, the average postes score of critical thinking skills of students given ARIAS learning is 17.04, which is better than with ordinary learning 14.69. When viewed based on learning style, it is known that students with auditorial and kinesthetic learning skills are better with ARIAS learning than with ordinary learning, but not with visual learning style, where the average critical thinking ability score of ordinary grades of 17.44 is greater than the ARIAS class of 15.50. Furthermore, overall, the critical thinking ability of students with kinesthetic learning style tendencies is 18.75 better than students with visual and auditorial learning style tendencies, namely 17.05 and 12.95.

Table 3. ANOVA Test Tests of Between-Subjects Effects
Dependent Variable: Critical

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	779,558a	5	155.912	17.997	.000
Intercept	8886.528	1	8886.528	1025.799	.000
Group	226.256	1	226.256	26.117	.000
Gaya_Belajar	427.451	2	213.725	24.671	.000
Group * Gaya Belajar	235.317	2	117.659	13.582	.000
Error	398.499	46	8.663		
Total	14267.000	52			
Corrected Total	1178.058	51			

a. R Squared = ,662 (Adjusted R Squared = ,625)

Critical thinking skills analysis with ARIAS learning

In Table 3. Known sig value. The variable "Group" is $0.000 < 0.05$ or the accepted hypothesis, which means there is a difference in the mathematical critical thinking ability of students who are given ARIAS learning with ordinary. Next from Table 1. It is known that the average value of the critical thinking ability of the ARIAS class is greater than that of the ordinary group. So it was concluded significantly that the ability of students in critical thinking given ARIAS learning is better than usual.

Based on the results of the test above, I reviewed again how the facts of the learning process in the field. Online learning is a learning process that is applied not because of likes but because of the demands of the pandemic situation experienced internationally. So that students and lecturers try hard to maximize learning activities in an online way to remain optimal in honing student skills. Implementing the ARIAS learning model is one of the strategies used because this model is packed with five basic components that invite students to be active during learning activities. The ARIAS model can foster self-confidence, maintain a person's interest, and invite him to be active during the learning process and get to know the relationship between mathematical materials with the surroundings (Swastika & Narendra, 2019).

The steps in ARIAS learning are by the five stages, including assurance, relevance, interest, assessment, and satisfaction. Its implementation in learning is at the beginning of learning, starting with 1) preliminary activities, namely: a) opening lessons with greetings, attendance checks, and prayers; b) conditioning the class so that learning can take place conducive, then conveying learning goals; c) motivate and invite students to be active in learning; d) the "assurance" component is raised by sharing question sheets with difficulty in the problem of centering easy and realistic to complete or by the student's ability to bring out his confidence; e) the problem is done independently and then directly discussed. 2) The core activity is to bring up the "relevance" component: a) explain the material and its relevance to understanding the material to the needs of students. Students pay close attention to explanations; b) the material delivered is tailored to student life and provides relevant examples; c) after finishing explaining the material, as a component of "interest," students are divided into 4 groups with heterogeneous abilities (attracting interest with variations in learning). Each group is given different problems as discussion material, and each group then presents the results of the discussion both in the form of completed answers and considerations of their problems (attracting interest by allowing students to participate in learning actively); d) in the "assessment" component, that is, other groups evaluate and investigate the presentation of progressive groups and each group must provide a response; e) lecturers guide the course of group discussions well and provide directions that support the involvement of all students; f) After all groups have finished the presentation, the lecturer provides an evaluation and correction of the student's incorrect answer and explains again if something is not yet understood. 3) Closing activities: a) lecturers provide opportunities for students to summarize today's material or improve the results of discussions that have been discussed; b) provide training questions to be done individually at home; c) lecturers evaluate learning activities in general and make conclusions from the material that has been discussed; d) as a component of "satisfaction" lecturers gives awards to students who are active during learning and the best group in the form of different grades.

In the "interest" component or attracting and maintaining student interest, one way is that lecturers use GeoGebra mathematics software in delivering materials. This certainly attracts the attention of students because it is not a monotone. The material delivered is analytical geometry, so that students' imagination is more covered by learning using applications. Geometry is an easily acceptable material because it correlates very well with a person's natural cognition (Jelatu et al., 2018). Geometry contains many concepts and is used in everyday life (Maharani et al., 2019).

Then confirmed that Geogebra is an interactive mathematical device specifically on algebraic and geometric materials (Wassie & Zergaw, 2019). Learning with Geogebra can help students improve their skills, especially conceptual and operational problems, and effectively teach mathematics based on the investigation (Yorganci, 2018). During learning, lecturers monitor and direct activities with discussions and Q&A. To maintain the interest of these students, students are also invited to participate in exploring their understanding by using GeoGebra mathematics software or anything in solving the given questions.

Online learning is flexible in its implementation and can encourage the emergence of independent learning attitudes and motivation to be more active during learning activities. Furthermore, students can freely hone their critical thinking skills in solving the mathematics problems given. To the study results, in this case, online learning is not an obstacle but an ease because students have more time outside the learning hours to learn and explore and hone their skills (Firman & Rahayu, 2020).

Analysis of mathematical critical thinking skills reviewed from learning styles

In Table 3. Known sig value. The variable "Gaya_Belajar" is $0.000 < 0.05$, which means the hypothesis is accepted. So it is concluded that there are differences in students' mathematical critical thinking skills judging from their learning styles. Next is based on Table 1. The average value of postes results based on visual, auditorial, and kinesthetic learning styles was 17.05, 12.95, and 18.75. These results explain that their critical thinking skills are better in students with a kinesthetic learning style than in other learning styles.

When viewed from the facts during the learning process applied the use of mathematical applications. In this case, indirectly invite students to actively do their learning activities to find problem-solving or understand the concept given. Activities like this certainly support students with a kinesthetic learning style because these students more quickly understand the material through natural movement (Ningrat et al., 2018). Is also that this type gains knowledge from direct interaction by actively doing activities or learning (Şener & Çokçalışkan, 2018).

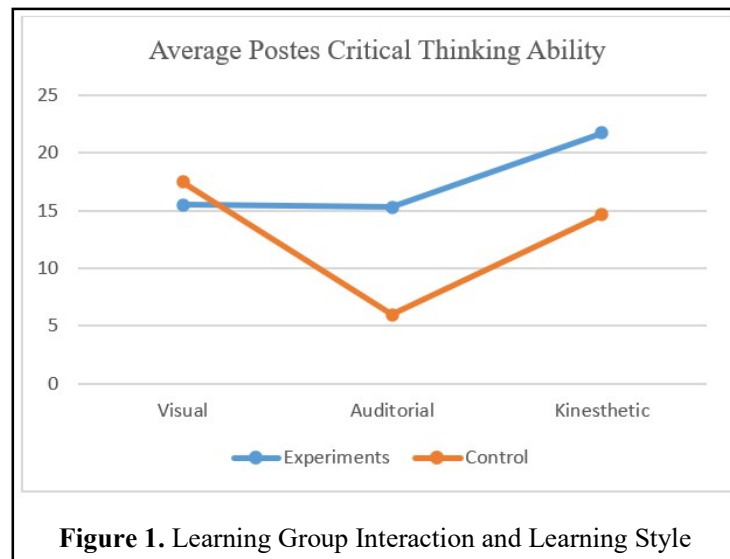
Nevertheless, the ability to think critically of students with visual learning styles is also not much different from kinesthetic. The learning process is an online ARIAS model and utilizes the GeoGebra application of geometric materials. The advantage for visual students is that the learning process carried out by lecturers during teaching is that many use images that are certainly made interesting and associated with the surroundings. Students who tend to learn with a visual style remember longer than they see and quickly understand images (Jamulia, 2018). It is further mentioned that the existence of visualisasi konsep abstrak dapat memperkuat memori plearn about konsep yang is being studied (Lengkana et al., 2020).

Not so with students who have an auditorial learning style. The test results show that the average value of student posts with this learning style is much smaller than visual and kinesthetic. Auditorial learning by listening or dialogue (Mareta & Sembiring, 2020; Ozdemir et al., 2018). This style more quickly understands the material through group discussions and direct exposure to the material. Online learning is certainly a thing that does not support the thinking ability of students with auditorial learning styles.

Interaction analysis

In Table 3. Known sig value. For the variable "Group*Gaya_Belajar" is $0.000 < 0.05$, which means that the hypothesis is accepted or, in other words, there is an interaction between the class group and the learning style in determining the student's mathematical critical thinking ability. The interaction of mathematical critical thinking ability test results between study groups (experimental classes and control classes) with learning styles (visual, auditorial, and kinesthetic) can also be seen in the figure 1.

Figure 1 shows the highest student postes score obtained by the ARIAS class group with a kinesthetic learning style of 21.71 and the lowest obtained by ordinary class students with auditorial learning styles. The results of this test are a finding that can be used as a reference for teachers in delivering materials to their students. Teachers must pay attention to the students' learning styles in delivering materials to optimize their learning outcomes.



In this study, it is known that students' critical thinking skills can be well achieved in learning the ARIAS model by students with kinesthetic learning styles. For this reason, teachers must be able to provide many activities in constructing geometry to increase knowledge of geometric concepts and improve students' critical thinking skills (Bozkurt, 2018).

Meanwhile, what needs to be considered is students with auditorial learning styles who get the lowest average of 6.00. Students with this learning style should not be given learning with ordinary models, especially with online learning and especially geometry materials. The way to overcome it is to provide learning activities with the ARIAS model or other models that can cover the needs of students with auditorial learning styles to optimize their learning outcomes. Another alternative is to utilize technology to optimize students' critical thinking skills, especially in the demands of online learning today. The technology could clarify abstract concepts through effective modeling and representation (Khalil et al., 2019).

Conclusion

This study concludes that there is a significant difference in the mathematical critical thinking ability of students who get learning with the ARIAS model with students who get ordinary learning and when viewed from their learning style. Furthermore, it is also known that there is a significant interaction between the type of learning and the learning style of students' mathematical critical thinking ability.

Acknowledgment

I am grateful to all the students who responded to this study. I also thank all those involved in the preparation of this article. Hopefully, this article can be useful in developing education in the future.

Bibliography

- Arti, N., Utami, C., & Prihatiningtyas, N. C. (2020). Hubungan Motivasi Belajar Matematika Dengan Kemampuan Numerik Siswa Pada Materi Aljabar. *JPMI (Jurnal Pendidikan Matematika Indonesia)*, 5(2), 92–99.
- Bayuningsih, A. S., Usodo, B., & Subanti, S. (2018). Critical thinking level in geometry based on self-regulated learning. *Journal of Physics: Conference Series*, 983(1), 12143.

- Bozkurt, A. (2018). Examining the accuracy and justification of geometric constructions made by pre-service teachers with dynamic geometry software and the awareness they gained throughout the process. *International Journal of Research in Education and Science*, 4(1), 304–313. <https://doi.org/10.21890/ijres.383197>
- D'Alessio, F. A., Avolio, B. E., & Charles, V. (2019). Studying the impact of critical thinking on the academic performance of executive MBA students. *Thinking Skills and Creativity*, 31, 275–283.
- Dewi, D. P., Mediyani, D., Hidayat, W., Rohaeti, E. E., & Wijaya, T. T. (2019). Analisis Kemampuan Berpikir Kritis Matematis Siswa Smp Pada Materi Lingkaran Dan Bangun Ruang Sisi Datar. *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, 2(6), 371–378.
- Firman, F., & Rahayu, S. (2020). Pembelajaran online di tengah pandemi covid-19. *Indonesian Journal of Educational Science (IJES)*, 2(2), 81–89.
- Jamani, N. A., Abdaziz, K. H., Karim, H. S. C. A., Nizar, F. A., Dzulkarnain, H. N., & Azimi, M. I. (2020). Learning Style Preferences among Pre-clinical Medical Students in a Public University in Pahang. *IMJM*, 17(2), 11–16.
- Jamulia, J. (2018). Identifying students learning style preferences at IAIN Ternate. *International Journal of Education*, 10(2), 121–129.
- Jelatu, S., Sariyasa, & Made Ardana, I. (2018). Effect of GeoGebra-aided REACT strategy on understanding of geometry concepts. *International Journal of Instruction*, 11(4), 325–336. <https://doi.org/10.12973/iji.2018.11421a>
- Khalil, M., Khalil, U., & ul Haq, Z. (2019). Geogebra as a Scaffolding Tool for Exploring Analytic Geometry Structure and Developing Mathematical Thinking of Diverse Achievers. *International Electronic Journal of Mathematics Education*, 14(2), 427–434. <https://doi.org/10.29333/iejme/5746>
- Kusuma, J. W., & Hamidah, H. (2019). Kolaborasi Model Assurance-Relevance-Interest-Assessment-Satisfaction dengan Think-Talk-Write untuk Meningkatkan Motivasi Berprestasi dan Kemampuan Berpikir Kritis Siswa. *GAUSS: Jurnal Pendidikan Matematika*, 2(2), 24. <https://doi.org/10.30656/gauss.v2i2.1777>
- Lengkana, D., Surbakti, A., & Amala, D. (2020). The Effect of Mind Mapping and Learning Style on Concepts Mastery and Students' Representation Skills. *International Conference on Progressive Education (ICOPE 2019)*, 422(Icope 2019), 110–117.
- Maharani, A., Sulaiman, H., Saifurrohman, Aminah, N., & Rosita, C. D. (2019). Analyzing the student's cognitive abilities through the thinking levels of geometry van hiele reviewed from gender perspective. *Journal of Physics: Conference Series*, 1188(1). <https://doi.org/10.1088/1742-6596/1188/1/012066>
- Mareta, W., & Sembiring, B. (2020). Pengaruh Gaya Belajar Terhadap Hasil Belajar Siswa Pada Mata Pelajaran Ekonomi Kelas X Ips Di SMA Negeri 9 Kabupaten Batanghari. *SJEE: Scientific Journals of Economic Education*, 4(1), 79–86.
- Mokodompit, D. F., Pulukadang, R. J., & Manurung, O. (2020). Profil Kreativitas Siswa Kelas VIII SMP N 1 Kalawat Dalam Penyelesaian Masalah Geometri Ditinjau Dari Gaya Belajar Matematika. *JSME (JURNAL SAINS, MATEMATIKA, DAN EDUKASI) MATEMATIKA FMIPA UNIMA*, 8(1), 23–28.
- Ningrat, S. P., Tegeh, I. M., & Sumantri, M. (2018). Kontribusi gaya belajar dan motivasi belajar terhadap hasil belajar Bahasa Indonesia. *Jurnal Ilmiah Sekolah Dasar*, 2(3), 257–265.
- Noviarti, Utami, C., & Prihatiningtyas, N. C. (2020). Hubungan Motivasi Belajar Matematika Dengan Kemampuan Numerik Siswa Pada Materi Aljabar. *Jurnal Pendidikan Matematika Indonesia*, 5(2), 92–99. <https://journal.stkipsingkawang.ac.id/index.php/JPMI/article/view/937>

- Novtiar, C., & Aripin, U. (2017). Meningkatkan kemampuan berpikir kritis matematis dan kepercayaan diri siswa SMP melalui pendekatan open ended. *Prisma*, 6(2), 119–131.
- Ozdemir, A., Alaybeyoglu, A., Mulayim, N., & Uysal, M. (2018). An Intelligent System for Determining Learning Style. *International Journal of Research in Education and Science*, 4(1), 208–214.
- Pramesti, N. M. I., & Ratnadi, N. M. D. (2020). Pengaruh Kecerdasan Emosional, Gaya Belajar Visual, Gaya Belajar Auditorial Dan Kinestetik Pada Tingkat Pemahaman Akuntansi. *E-JA e-Jurnal Akuntansi*, 30(1), 130–146. <https://doi.org/10.5897/ERR2015>
- Prihatami, E. (2020). POGIL Berpengaruh terhadap Kemampuan Berpikir Kritis Matematis? *AlphaMath: Journal of Mathematics Education*, 5(2), 15–26.
- Primasatya, N., & Jatmiko, J. (2018). Implementation of Geometry Multimedia Based on Van Hiele's Thinking Theory for Enhancing Critical Thinking Ability for Grade V Students. *International Journal of Trends in Mathematics Education Research*, 1(2), 56–59.
- Primasatya, N., & Jatmiko, J. (2019). Implementation of Geometry Multimedia Based on Van Hiele's Thinking Theory for Enhancing Critical Thinking Ability for Grade V Students. *International Journal of Trends in Mathematics Education Research*, 1(2), 56–59. <https://doi.org/10.33122/ijtmer.v1i2.40>
- Şener, S., & Çokçalışkan, A. (2018). An Investigation between Multiple Intelligences and Learning Styles. *Journal of Education and Training Studies*, 6(2), 125. <https://doi.org/10.11114/jets.v6i2.2643>
- Siregar, Y. E. Y., Rachmadtullah, R., Pohan, N., Rasmitadila, & Zulela, M. S. (2019). The impacts of science, technology, engineering, and mathematics (STEM) on critical thinking in elementary school. *Journal of Physics: Conference Series*, 1175(1). <https://doi.org/10.1088/1742-6596/1175/1/012156>
- Swastika, G. T., & Narendra, R. (2019). ARIAS learning model based on a contextual approach to increase the mathematical connection capacity. *JIPM (Jurnal Ilmiah Pendidikan Matematika)*, 7(2), 104. <https://doi.org/10.25273/jipm.v7i2.2984>
- Syafii, M. (2021). Hubungan Motivasi Belajar Matematika Siswa Terhadap Hasil Belajar Matematika Pada Materi Kalkulus dan Aljabar di Kelas XI IPA SMA. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, 5(1), 65–74. <https://doi.org/10.31004/cendekia.v5i1.275>
- Wassie, Y. A., & Zergaw, G. A. (2019). Some of the potential affordances, challenges and limitations of using GeoGebra in mathematics education. *Eurasia Journal of Mathematics, Science and Technology Education*, 15(8), em1734.
- Wawan, W. (2018). *Analisis pemahaman konseptual dan prosedural siswa dalam menyelesaikan soal Matematika berdasarkan gaya belajar*. UNIVERSITAS NEGERI MAKASSAR.
- Willia, A., Annurwanda, P., & Friantini, R. N. (2020). Proses Pemecahan Masalah Matematika Ditinjau Dari Gaya Belajar Siswa. *AlphaMath: Journal of Mathematics Education*, 6(2), 116–128.
- Yorganci, S. (2018). A study on the views of graduate students on the use of Geogebra in mathematics teaching. *European Journal of Education Studies*, 4(8).