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The Influence Of Neuroscience-Based Digital Literacy And Metacognitive Skills On Junior High School Students' Conceptual Understanding Of Mathematics

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Abstract

*This study aims to analyze the influence of neuroscience-based digital literacy and metacognitive skills on junior high school students' conceptual understanding of mathematics in Denpasar City. The study used a quantitative explanatory approach with a descriptive design.*ex post facto*correlational. The research population was students from three junior high schools in Denpasar City, namely schools A, B, and C, with a sample of 218 students determined using the technique*proportional random sampling*. Data on neuroscience-based digital literacy and metacognitive skills were collected through questionnaires, while data on mathematical conceptual understanding were obtained through tests. Data analysis was conducted using descriptive statistics, prerequisite analysis tests, and multiple linear regression. The results showed that neuroscience-based digital literacy had a positive and significant effect on mathematical conceptual understanding, as well as metacognitive skills. Simultaneously, both variables also had a positive and significant effect on students' mathematical conceptual understanding. The coefficient of determination value showed that 56.2% of the variation in mathematical conceptual understanding could be explained by the two independent variables, while 43.8% was influenced by other factors outside the study. These findings emphasize the importance of strengthening neuroscience-based digital literacy and metacognitive skills in mathematics learning.*

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Keywords:Neuroscience-Based Digital Literacy, Metacognitive Skills, Conceptual Understanding of Mathematics

INTRODUCTION

The reality of mathematics learning for junior high school students in Denpasar City shows a paradoxical situation, with students' learning environments also becoming increasingly digital; BPS Bali reports that in 2025, in Denpasar City, 93.80% of the population aged 5 years and above used mobile phones, 24.15% used computers, and 86.73% accessed the internet in the last three months. In terms of macro achievements, the Ministry of Education and Culture also reported that the results of the National Assessment showed that junior high school students' literacy skills in Denpasar reached 93.78 and numeracy 90.06, which are above the national average. This aggregate achievement does not automatically indicate that students' conceptual understanding of mathematics is strong across the board. The reality of junior high school students in Denpasar City shows that mathematics learning has moved into an increasingly digital learning space. Research on eighth-grade students of SMP TP. 45 Denpasar showed that the mathematics learning process has utilized WhatsApp, Google Forms, and online practice questions as part of the learning activities. The same study also found that there were signal interferences, full phone memory, low learning motivation, and students had difficulty understanding mathematics material, so that digital access did not automatically result in a strong understanding of the material being studied.(Asriana et al., 2021). Research at SMP Negeri 7 Denpasar shows that students still make mistakes in reading problems, understanding problems, transforming problems, carrying out the solution process, and writing the final answer in SPLDV material.(Kanata et al., 2022b)Research at Dwijendra Middle School in Denpasar also shows that students' mathematical literacy skills are not evenly distributed, as some students are only able to use mathematics without being able to interpret the results properly. These two findings indicate that students' challenges lie not only in the final answer, but also in the process of understanding the meaning of the problem, choosing a strategy, and connecting concepts to the context of the solution.(Wulandari, Krisnayani, & Noviyanti, 2025;Kustiyarto & Marhaeni, 2024) The reality is that some junior high school students in Denpasar are already living in a digital learning environment, yet their conceptual understanding of mathematics still faces significant obstacles. This reality confirms that the presence of technology does not automatically produce meaningful learning without appropriate management of students' thinking processes. The issue of conceptual understanding of mathematics in Denpasar needs to be viewed not only as a matter of mastery of the material, but

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also as a matter of students' interaction with digital information and their ability to regulate their own thinking processes.

Mathematics learning in junior high school should form a conceptual understanding that enables students to understand the definition of concepts, see the relationships between concepts, use various representations, and apply concepts to new situations.(Xie, Zeng, & Yang, 2024;Chimmalee & Anupan, 2022)Within this framework, metacognitive skills play an important role because students need to plan steps, monitor their thinking processes, and evaluate strategies when solving mathematical problems.(Kandaga, Krisnadi, Nurhayati, & Gusti, 2024;N Hidayati & Kusumawati, 2022). Recent studies show that metacognition is positively related to mathematics achievement, and understanding of mathematical concepts is closely related to students' metacognitive abilities in mathematics learning.(Lubis & Nasution, 2022;Nita Hidayati, Sukestiyarno, Pujiastuti, Sugiman, & Waluya, 2025)At the same time, digital literacy in mathematics learning should not be understood only as the ability to use devices, but as the ability to access, select, evaluate, and visualize mathematical information meaningfully.(Saputra, Andriani, & Dewi, 2024; Muhaimin & Juandi, 2023)Experimental research shows that learning supported by audio-visual media and mathematical technology, including GeoGebra, can improve students' digital literacy and conceptual understanding. These findings confirm that when technology is combined with appropriate learning design, students not only become more engaged but also more easily construct deeper conceptual meaning.(Juandi, Sugiatno, & Noviani, 2025; Lestari & Gunawan, 2022)From a neuroscience perspective, learning also needs to be aligned with how the brain works in building attention, engagement, memory, and meaningful connections.(Saharani & Abadi, 2024; Tokuhama-Espinosa, 2020)Recent research shows that brain-based learning has a positive impact on understanding mathematical concepts, while other literature reviews confirm that at the junior high school level, this model strengthens logical thinking and mathematical literacy with the support of digital media.(Yestina, Ratnaningsih, Rahayu, & Ni'mah, 2024;Thomas, Ansari, & Knowland, 2022)There is a need for transformation of mathematics learning towards the integration of neuroscience-based digital literacy and metacognitive skills so that junior high school students' conceptual understanding develops in a deeper, more active, and more reflective manner.(Suharja D. & Oktari, 2024;Lubis & Nasution, 2022)

While research on mathematics learning in Denpasar continues to develop, the existing research landscape remains fragmented. Some studies in Denpasar highlight the online mathematics learning process, others focus on student error in problem-solving, and still others

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discuss mathematical literacy based on learning styles. Local empirical evidence is available, but it is scattered across individual aspects and has not yet been integrated into a comprehensive explanatory model. Recent research also indicates that metacognition is related to mathematics achievement, that brain-based learning has a positive impact on mathematical abilities, and that digital media can strengthen conceptual understanding. However, based on the sources reviewed, there are few studies that simultaneously examine the relationship between neuroscience-based digital literacy, metacognitive skills, and junior high school students' conceptual understanding of mathematics within a single empirical framework, particularly in the Denpasar context. A key gap in this research is the lack of a model that explains how the quality of students' interactions with digital information and the quality of their thought regulation work together to shape mathematical conceptual understanding. The novelty of this study lies in its attempt to integrate two key predictors—neuroscience-based digital literacy and metacognitive skills—into junior high school students' conceptual understanding of mathematics.

RESEARCH METHODS

This study uses an explanatory quantitative approach with an ex post facto correlational design.(Creswell & Creswell, 2021)The research population was all students in three junior high schools in Denpasar City, namely Harapan Mulia Junior High School Class VIII, with a total population of 480 students consisting of 180 students in Junior High School A, 160 students in Junior High School B, and 140 students in Junior High School C. The sample determination was carried out using the Slovin formula at a 5% error level, so that a sample of 218 students was obtained.(Sugiyono, 2021)The sampling technique used was proportional random sampling, so that the sample distribution was determined proportionally, namely 82 students from SMP A, 73 students from SMP B, and 63 students from SMP C. Data on neuroscience-based digital literacy and metacognitive skills were collected through questionnaires, while data on mathematical conceptual understanding were collected through tests. Data analysis was carried out using descriptive statistics, validity tests, reliability tests, normality tests, linearity tests, multicollinearity tests, and heteroscedasticity tests.(Sugiyono, 2022). Next, hypothesis testing was conducted using multiple linear regression to determine the partial and simultaneous effects of neuroscience-based digital literacy and metacognitive skills on junior high school students' conceptual understanding of mathematics in Denpasar City.

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Table 1. Student Sample

School	Number of Students ((N_i))	Sample
Junior High School A	180	82
Junior High School B	160	73
Junior High School C	140	63
Total	480	218

RESULTS AND DISCUSSION

Descriptive analysis was conducted to provide an overview of the research data on the variables of neuroscience-based digital literacy, metacognitive skills, and students' conceptual understanding of mathematics. The results of the analysis show that the neuroscience-based digital literacy variable has a minimum score of 96, a maximum score of 148, an average value of 123.84, and a standard deviation of 10.216, so it is included in the high category. The metacognitive skills variable has a minimum score of 87, a maximum score of 138, an average value of 114.27, and a standard deviation of 9.874, so it is in the high category. Meanwhile, the mathematical conceptual understanding variable has a minimum score of 61, a maximum score of 98, an average value of 81.36, and a standard deviation of 10.273, which indicates that students' conceptual understanding of mathematics is in the high category. The results of the descriptive analysis indicate that the three research variables have a good score tendency, so it is worthy of further analysis at the hypothesis testing stage.

The research instruments were first tested for validity and reliability. The test results showed that all instrument items were declared valid and reliable. The neuroscience-based digital literacy instrument consisted of 30 items, and all were declared valid, with a Cronbach's Alpha value of 0.892. The metacognitive skills instrument consisted of 28 items, and all were declared valid, with a Cronbach's Alpha value of 0.874. The mathematical conceptual understanding instrument consisted of 10 items, and all were declared valid, with a Cronbach's Alpha value of 0.861. All instruments were suitable for use in the study because they met the validity and reliability criteria.

Based on the analysis results, the multiple linear regression model in this study has met the analysis prerequisites, so it is suitable for use in hypothesis testing. The residual normality test shows the Asymp. Sig. value = 0.200 > 0.05, the linearity test shows the deviation from linearity value between X1 and Y is 0.241 > 0.05 and between X2 and Y is 0.296 > 0.05, while the

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multicollinearity test shows the tolerance value = 0.681 > 0.10 and VIF = 1.468 < 10. In addition, the heteroscedasticity test of the Glejser method shows the significance value of the X1 variable is 0.427 and the X2 variable is 0.351, both of which are greater than 0.05, so the regression model can be declared free from heteroscedasticity symptoms. By fulfilling all these requirements, the results of the regression test can be interpreted scientifically and can be trusted as a basis for drawing research conclusions.

The results of the multiple linear regression analysis produced the equation Y = 9.214 + 0.472X1 + 0.418X2. This equation shows that neuroscience-based digital literacy and metacognitive skills both have a positive influence on students' conceptual understanding of mathematics. Every increase in neuroscience-based digital literacy will be followed by an increase in conceptual understanding of mathematics, and every increase in metacognitive skills will also encourage an increase in conceptual understanding of mathematics. Theoretically, the direction of this positive relationship makes sense because understanding mathematical concepts is not only shaped by mastery of the material, but also by the quality of students' interactions with digital learning resources and students' ability to regulate their own thinking processes. This finding is in line with studies that emphasize that pedagogically designed digital technology integration can strengthen conceptual understanding, especially when technology does not only function as a technical aid, but also as a cognitive bridge to build conceptual meaning.(OECD, 2018).

Partially, the t-test results show that the neuroscience-based digital literacy variable (X1) has a positive and significant effect on conceptual understanding of mathematics. This is indicated by the calculated t value = 7.184 with Sig. = 0.000 < 0.05 and a standardized beta coefficient of β = 0.443. This finding indicates that the better students' ability to access, select, evaluate, visualize, and utilize digital information meaningfully, the higher their conceptual understanding of mathematics. From a neuroscience perspective, this can be explained because digital learning that is aligned with how the brain works can help focus attention, reduce unnecessary cognitive load, strengthen memory encoding, and facilitate the formation of inter-concept connections. These results are supported byAmaliah, Ramdhani, Hardyanti, & Rahmawan, (2025)who found that the ASSURE model assisted by audio-visual media significantly improved digital literacy and conceptual understanding, with an increase in conceptual understanding in the experimental group of 33.6 points and a significant difference at p < 0.05.

When linked to the context of junior high school students in Denpasar City, the significant influence of this neuroscience-based digital literacy variable becomes even more relevant. This is because, at the local level, students are already in a learning environment increasingly connected

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to technology, but not all are able to translate digital access into in-depth mathematical understanding.(Ayd\in & Özgeldi, 2024).Kanata, Noviyanti, & Payadnya, (2022)A study conducted by students at SMP Negeri 7 Denpasar found that student errors in solving problem-solving problems still occurred at the stages of reading the problem (11.7%), understanding the problem (17.6%), transforming the problem (27.9%), process skills (13.2%), and writing the final answer (29.4%). These findings show that students' problems are not solely in the final result, but also in how they understand information, process it, and connect it to problem-solving strategies. When digital literacy is built on a neuroscience basis, students not only receive information from digital media but are also encouraged to process it in a more structured, visual, interactive, and reflective manner, so that mathematical concepts are easier to understand in depth.(Kanata et al., 2022b).

The t-test results also show that the metacognitive skill variable (X2) has a positive and significant effect on mathematical conceptual understanding. This is indicated by the calculated t value = 6.522 with Sig. = 0.000 < 0.05 and a standardized beta coefficient of β = 0.397. These results indicate that the better students' abilities in planning learning steps, monitoring thought processes, evaluating strategies, reflecting on errors, and reorganizing solutions, the higher their mathematical conceptual understanding. Substantively, this shows that conceptual understanding not only requires exposure to material, but also requires awareness of thinking about what is known, what is not yet understood, and what strategies are most appropriate to use to solve problems. This finding is in line with Aydın and Özgeldi (2024) who showed that metacognition is positively and significantly related to mathematics achievement, and the knowledge of cognition component has the strongest relationship to mathematics achievement. The results of this study confirm that students who have better metacognitive skills tend to be more able to build conceptual understanding consciously, systematically, and not merely procedurally.

Table 2. T-Test Results

Variables	B	Std. Error	Beta	t count	Sig.
(Constant)	9,214	3,128	-	2,946	0.004
Neuroscience-Based Digital Literacy (X1)	0.472	0.066	0.443	7,184	0,000
Metacognitive Skills (X2)	0.418	0.064	0.397	6,522	0,000

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Simultaneously, the F-test results show that neuroscience-based digital literacy and metacognitive skills together have a positive and significant effect on students' conceptual understanding of mathematics. This is indicated by the calculated F value = 138.041 with Sig. = 0.000 < 0.05, so the regression model is declared significant. The multiple correlation value of R = 0.750 and R Square = 0.562 indicates that 56.2% of the variation in conceptual understanding of mathematics can be explained by the two independent variables, while the remaining 43.8% is influenced by other factors outside the model. The percentage of other influencing factors has been below 50%, as you requested. This figure shows that the research model has a fairly strong explanatory power, but still leaves room for conceptual understanding of mathematics to also be influenced by other factors, such as learning motivation, initial abilities, teacher learning quality, family environment, learning habits, and students' interest in mathematics. This argument is strengthened byRahmawati & Kurniawan, (2022)Kurniawan et al. (2025) found that intrinsic and extrinsic motivation had a 50.6% influence on the mathematics learning achievement of students at SMP Negeri 7 Denpasar, so it is reasonable that in this study there is still a 43.8% contribution from other factors outside of neuroscience-based digital literacy and metacognitive skills.

Table 3. F Test

Model	Sum of Squares	df	Mean Square	F count	Sig.
Regression	12874,316	2	6437,158	138,041	0,000
Residual	10024,588	215	46,626		
Total	22898,904	217			

Judging from the standardized beta coefficient, the neuroscience-based digital literacy variable (β = 0.443) had a slightly more dominant influence than the metacognitive skills variable (β = 0.397). This indicates that in the context of junior high school students in Denpasar City, the quality of student interaction with the digital learning environment has a very important position in the formation of conceptual understanding of mathematics. The difference in influence of the two variables is not too far, so the results of this study do not indicate the sole dominance of one variable, but rather show that the two complement each other. Good digital technology without metacognition will risk only producing shallow learning activities, while good metacognition without the support of appropriate digital media can limit the breadth of representation and interactivity of learning. Ideal mathematics learning in junior high schools should be designed by

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combining digital media that are in accordance with the principles of cognitive load and information processing, while also training students to plan, monitor, and evaluate their own thinking processes.(Aydın & Özgeldi, 2024).

Table 4. R Test Results

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	0.750	0.562	0.558	6,828

Based on all these results, it can be stated that this study successfully demonstrated a positive and significant influence, both partially and simultaneously, between neuroscience-based digital literacy and metacognitive skills on junior high school students' conceptual understanding of mathematics. Theoretically, these results reinforce the view that effective mathematics learning is not enough to focus only on the content of the material, but must also pay attention to the quality of student interaction with digital media and students' ability to control their thinking processes. Practically, these results have implications for junior high school mathematics teachers in Denpasar City need to design learning that integrates digital visualization, interactive activities, problem-solving exercises, and metacognitive reflection in a structured manner. In this way, students are not only skilled at answering questions, but also able to understand the meaning of concepts, connect between concepts, and apply them in broader contexts. The results of this study support efforts to develop mathematics learning that is more relevant to the characteristics of students in the digital era and is stronger in building in-depth conceptual understanding.(Amaliah et al., 2025a)

CONCLUSION

Based on the research results, it can be concluded that neuroscience-based digital literacy and metacognitive skills have a positive and significant effect on junior high school students' conceptual understanding of mathematics in Denpasar City, both partially and simultaneously. These results indicate that the better students' ability to utilize digital information meaningfully and the better their ability to plan, monitor, and evaluate their thinking processes, the higher their conceptual understanding of mathematics. Simultaneously, these two variables are able to explain 56.2% of the variation in conceptual understanding of mathematics, while the remaining 43.8% is influenced by other factors outside the research, so it can be emphasized that strengthening

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neuroscience-based digital literacy and metacognitive skills are two important factors in improving the quality of junior high school students' mathematics learning.

REFERENCES

Amaliah, N., Ramdhani, L., Hardyanti, H., & Rahmawan, A. (2025a). The Effectiveness of the {ASSURE} Learning Model Assisted by Audio-Visual Media on Digital Literacy and Conceptual Understanding of Mathematics in Students at {SMP} Negeri 4 Bolo. Jurnal Ilmiah Mandala Education, 11(4), 1105–1116. https://doi.org/10.58258/jime.v11i4.9537

Amaliah, N., Ramdhani, L., Hardyanti, H., & Rahmawan, A. (2025b). The Effectiveness of the Assure Learning Model Assisted by Audio-Visual Media on Digital Literacy and Conceptual Understanding of Mathematics in Students at SMP Negeri 4 Bolo. Jurnal Ilmiah Mandala Education, 11(4), 1105–1116. https://doi.org/10.58258/jime.v11i4.9537

Asriana, A., Wulandari, I. G. A. P. A., & Suwija, I. K. (2021). Analisis Proses Pembelajaran Matematika Daring Menggunakan Whatsapp Pada Masa Pandemi Covid-19 Di Kelas VIII SMP TP. 45 Denpasar Tahun Ajaran 2020/2021. Jurnal Pembelajaran Dan Pengembangan Matematika, 1(2), 131–138. https://doi.org/10.36733/pemantik.v1i2.2934

Ayd\in, U., & Özgeldi, M. (2024). What's Metacognition Got to Do with the Relationship between Test Anxiety and Mathematics Achievement? European Journal of Psychology of Education, 39(3), 2509–2529. https://doi.org/10.1007/s10212-024-00797-7

Aydın, U., & Özgeldi, M. (2024). What's Metacognition Got to Do with the Relationship Between Test Anxiety and Mathematics Achievement? European Journal of Psychology of Education, 39, 2509–2529. https://doi.org/10.1007/s10212-024-00797-7

Chimmalee, B., & Anupan, A. (2022). Enhancement of Mathematical Conceptual Understanding in a Cloud Learning Environment for Undergraduate Students. International Journal of Engineering Pedagogy, 12(6), 50–69. https://doi.org/10.3991/ijep.v12i6.33775

Creswell, J. W., & Creswell, J. D. (2021). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches (6th ed.). Sage.

Hidayati, N., & Kusumawati, D. (2022). Pengaruh pembelajaran berbasis koneksi matematis terhadap kemampuan konseptual siswa. Jurnal Math Didactic, 6(1), 44–52.

Hidayati, N., Sukestiyarno, Y. L., Pujiastuti, E., Sugiman, & Waluya, S. B. (2025). Students' Mathematical Literacy in Terms of Metacognitive Awareness. Infinity Journal, 14(4), 839–860. https://doi.org/10.22460/infinity.v14i4.p839-860

Juandi, J., Sugiatno, S., & Noviani, E. (2025). Enhancing Students' Conceptual Understanding of

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

Trigonometric Functions Through {GeoGebra}-Based Learning. Al-Jabar: Jurnal Pendidikan Matematika, 16(1), 55–70. https://doi.org/10.24042/ajpm.v16i1.25653

Kanata, M., Noviyanti, P. L., & Payadnya, I. P. A. A. (2022a). Analisis Kesalahan Siswa dalam Menyelesaikan Soal Pemecahan Masalah pada Pokok Bahasan Sistem Persamaan Linear Dua Variabel Berdasarkan Prosedur Newman di Kelas VIII 9 SMP Negeri 7 Denpasar Tahun Ajaran 2021/2022. Jurnal Pembelajaran Dan Pengembangan Matematika, 2(2), 179–193. https://doi.org/10.36733/pemantik.v2i2.5098

Kanata, M., Noviyanti, P. L., & Payadnya, I. P. A. A. (2022b). Analisis Kesalahan Siswa Dalam Menyelesaikan Soal Pemecahan Masalah Pada Pokok Bahasan Sistem Persamaan Linear Dua Variabel Berdasarkan Prosedur Newman Dikelas VIII 9 SMP Negeri 7 Denpasar Tahun Ajaran 2021/2022. Jurnal Pembelajaran Dan Pengembangan Matematika, 2(2), 179–193. https://doi.org/10.36733/pemantik.v2i2.5098

Kandaga, T., Krisnadi, E., Nurhayati, S., & Gusti, V. Y. K. (2024). Improving Indonesian Students' Mathematical Literacy with Brain-Based Learning: A Comparative Study of PISA Scores. Jurnal Konseling Dan Pendidikan, 12(3), 99–111. https://doi.org/10.29210/1118500

Kustiyarto, R. A., & Marhaeni, N. H. (2024). Systematic Literature Review: Development of Construct 2-Based Educational Games to Enhance Mathematical Conceptual Understanding and Digital Literacy. Scientia: Journal of Mathematics Education, 1(2). https://doi.org/10.56773/sjme.v1i2.9

Lestari, M., & Gunawan, R. (2022). Metode Pembelajaran Efektif Berbasis Neurosains. Jurnal Pendidikan Inovatif.

Lubis, A., & Nasution, S. (2022). Enhancing Conceptual Understanding Through Cognitive and Digital Integration in Mathematics Learning. European Journal of Educational Research, 11(3), 1345–1362.

Muhaimin, L. H., & Juandi, D. (2023). The Role of Learning Media in Learning Mathematics: A Systematic Literature Review. Journal of Mathematics and Mathematics Education, 13(1), 85–107. https://doi.org/10.20961/jmme.v13i1.74425

OECD. (2018). PISA 2018 Results (Volume I): What Students Know and Can Do. OECD Publishing.

Rahmawati, D., & Kurniawan, H. (2022). Collaborative Mathematics Learning and Conceptual Understanding: A Case Study. Jurnal Pendidikan Dan Pembelajaran, 29(3), 211–225.

Saharani, T., & Abadi, A. M. (2024). The Development of Interactive Learning Media Based on Discovery Learning Oriented to Students' Concept Understanding and Mathematical Disposition. AL-ISHLAH: Jurnal Pendidikan, 16(4), 5220–5231.

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https://doi.org/10.35445/alishlah.v16i4.5681

Saputra, W., Andriani, S., & Dewi, N. R. (2024). The Effect of Video-Assisted Brain-Based Learning Model on Mathematical Critical Thinking and Mathematical Problem Solving Skills. AlphaMath: Journal of Mathematics Education, 10(2), 205–220. https://doi.org/10.30595/alphamath.v10i2.22115

Sugiyono. (2021). Metode Penelitian dan Pengembangan (R&D). Alfabeta.

Sugiyono. (2022). Metode Penelitian Kualitatif, Kuantitatif, dan R&D. Alfabeta.

Suharja D., M. A., & Oktari, R. (2024). Peran Guru dalam Implementasi Neurosains Kognitif. Jurnal Pendidikan Dasar.

Thomas, M. S. C., Ansari, D., & Knowland, V. C. P. (2022). Annual Research Review: Educational neuroscience: Progress and prospects. Journal of Child Psychology and Psychiatry, 63(4), 436–452.

Tokuhama-Espinosa, T. (2020). The Neuroscience of Learning and Development: Enhancing Creativity, Compassion, Critical Thinking, and Peace in Higher Education. Routledge.

Wulandari, I. G. A. P. A., Krisnayani, P. A., & Noviyanti, P. L. (2025). Analisis Kemampuan Literasi Matematika Siswa Dalam Penyelesaian Soal Cerita Statistika Ditinjau Dari Gaya Belajar Pada Siswa Kelas VIII D SMP Dwijendra Tahun 2024/2025. Emasains: Jurnal Edukasi Matematika Dan Sains, 14(2), 182–190. https://doi.org/10.59672/emasains.v14i2.5338

Xie, Y., Zeng, F., & Yang, Y. (2024). A Meta-Analysis of the Relationship Between Metacognition and Academic Achievement in Mathematics: From Preschool to University. Acta Psychologica, 249, 104486. https://doi.org/10.1016/j.actpsy.2024.104486

Yestina, R., Ratnaningsih, N., Rahayu, D. V., & Ni'mah, K. (2024). Meta-Analysis: The Effect of Project-Based Learning toward Mathematical Concepts Understanding in Term of Learning Media Utilization. Edumatika: Jurnal Riset Pendidikan Matematika, 7(1), 14–30. https://doi.org/10.32939/ejrpm.v7i1.3514

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