

Analysis of the Impact of Social Media Usage on High School Students' Mathematics Learning Achievement

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ABSTRACT

Social media is often used for communication, sharing information, and spending leisure time. Its usage can influence students' learning achievements, with varying effects depending on the context and research methods. This study aims to analyze in-depth the impact of social media usage on the mathematics learning achievement of tenth-grade students at Muhammadiyah Mlati Senior High School, involving 30 students as the research sample. Using a quantitative approach and a correlational method, the analysis results show a significant relationship between social media usage and students' learning achievements, with a t value of $21.771 > t_{table} 2.048$ and a significance level of $0.000 < 0.05$. This indicates that the use of social media can enhance students' mathematics learning achievements.

INTRODUCTION

The advancement of technology in the modern era has brought significant changes to various aspects of human life (Liu & Pásztor, 2022). Information production, which was previously limited to certain institutions, has now become a domain accessible to all individuals. The presence of the internet and platforms like Facebook, Instagram, and TikTok allows communication to cross geographical boundaries without barriers. Alloui & Mourdi (2023) states that social media is an internet-based platform that enables its users to share, interact, and build social connections in virtual spaces. This ease of access has changed the way people communicate, making information technology an essential part of modern life.

Various social media platforms have unique features that attract users to spend more time in the digital world. Facebook, with its networking features, or Instagram and TikTok, which focus on visual content, serve as entertainment and information sources. The internet provides unlimited access to various websites, catering to needs ranging from business, hobbies, education, and online transactions. Modern electronic devices, such as smartphones and tablets, allow people to connect anytime and anywhere (Siswanto & Peni, 2023). The internet has become a fundamental necessity that is now inseparable from daily routines, creating a virtual space that is an integral part of modern life.

In the world of education, information and communication technology has become a major focus in supporting more effective learning processes. Social media plays a significant role in opening up opportunities for collaboration between students and teachers (Syah et al., 2024). Yogyanto et al. (2024) shows that social media can expand networks of friendships and motivate students in learning. However, the negative impacts, such as reduced study time, decreased focus, and negative moral consequences, should also be monitored. Therefore, educational institutions have a major responsibility to guide students in using social media wisely, so that its positive benefits can be maximized to support learning.

Media literacy has become an essential skill for the younger generation in this era of globalization. Zhu et al. (2023) emphasizes that media literacy helps students develop the ability to analyze content critically. This skill is crucial, as information on social media is not always reliable and often contains fake news. With media literacy, students not only gain global insights but also become capable of selecting relevant and beneficial information (Alam et al., 2023). Media literacy education also serves as an effort to prevent the misuse of social media, so that students can focus more on their academic achievements and character development.

Senior High School students are among the most active groups in using social media. Suwarta et al. (2024) mentions that students are more vulnerable to internet addiction compared to other age groups. This is influenced by the transition phase to adulthood, often marked by emotional and psychological instability. Social media, on one hand, provides benefits by offering easy access to online literature and other learning materials. However, excessive use can lead to dependency, which impacts students' mindset and behavior.

In the context of learning, the role of teachers has undergone significant changes (Siswanto et al., 2024). Teachers are no longer just the main source of knowledge but also facilitators who support students in accessing information independently. Social media has become an important tool in facilitating academic information exchange. Through discussion groups or online learning platforms, students can expand communication networks, engage in discussions, and share insights with their peers (Astiwi et al., 2024). Additionally, social media provides various learning resources that can be accessed quickly and easily, making it a potential tool for enhancing learning efficiency.

Students at Muhammadiyah Mlati Senior High School, for example, show interesting phenomena in their use of social media. In the classroom, students are often more focused on their smartphones than on the material being presented by the teacher. A similar phenomenon is also observed in other school areas, such as the cafeteria, where direct interaction among students is often replaced by social media activity (Pisriwati et al., 2024). However, not all students use social media irresponsibly. Some of them utilize it to share assignments, discuss learning topics, and create positive experiences that support their academic activities.

The impact of social media on student learning has been a topic widely studied in research. The results indicate that the effect of social media can be both positive and negative, depending on the goals and manner of use. Students who use social media for academic purposes, such as completing assignments or searching for information related to their studies, tend to benefit significantly (Serafini et al., 2022). However, if social media use is not managed properly, it can disrupt concentration and decrease productivity, negatively affecting learning.

The biggest challenge in using social media is the risk of addiction and concentration disruption. However, on the other hand, social media also offers great opportunities when used wisely. Digital literacy becomes the key to optimizing the benefits of social media while minimizing its negative impacts. With proper guidance, students can be directed to use social media productively, turning it into a tool that supports their learning.

LITERATURE REVIEW

Development of Social Media in the Educational Context

Advances in information technology have brought about significant changes in various aspects of life, including education. Social media, which initially served as a communication and entertainment tool, has now evolved into a crucial resource for learning. Apriliyani (2021) states that social media is an internet-based platform that allows users to share information, interact, and build virtual communities. This transformation demonstrates that social media has become not only an integral part of digital culture but also reshaped the way students access and comprehend knowledge, especially in an era of rapidly expanding information.

Moreover, social media provides a tremendous opportunity for connecting students with a wider and more diverse range of learning resources.

Platforms such as WhatsApp, Instagram, and YouTube are now frequently used as informal learning tools, where students can find educational videos, e-books, and additional materials that cater to their academic needs (Kuswantara, 2024). With this ease of access, the learning process is no longer confined by time or space, allowing students to study independently anytime and anywhere. Some platforms even provide access to interactive and engaging content, which can further enhance students' motivation to learn.

However, the rise of social media in education also requires special attention. While social media simplifies access to information and encourages collaboration, its use must be directed to remain productive. Without proper supervision, social media can become a significant distraction, hindering students' focus on completing academic tasks (Putri, 2024). Therefore, educators and parents must collaborate to ensure that students not only understand the benefits of social media but also possess strong digital literacy to use it wisely in support of their learning.

Social Media Usage Among High School Students

High school students are one of the most active groups in using social media in their daily lives. Various platforms such as TikTok, Telegram, and Facebook are used for both academic and non-academic purposes (Afandi et al., 2024). Social media is often used to communicate with friends, share information, and even as a form of entertainment. Research by Astiwi (2024) found that the majority of students use social media as a primary tool for obtaining information and assisting them in their learning activities.

However, the intensity of social media use by students is often influenced by their primary purpose for using it. When social media is used to support academic activities, such as sharing lesson materials, discussing assignments, or seeking learning references, its use tends to yield positive results. Conversely, excessive use of social media for entertainment purposes can disrupt students' study time, reduce their focus on schoolwork, and even lead to procrastination. Therefore, students need to develop awareness to use social media more productively.

On the other hand, social media also reflects the students' need to stay connected with their social environment. Social media has become an effective tool for building interpersonal relationships online, although sometimes this reduces face-to-face interactions (Afandi, 2024). It is crucial for educators and parents to guide students on how to maintain a balance between using social media for academic and social purposes.

Social Media for Learning

Social media holds great potential in supporting students' learning, especially when its use is guided wisely and purposefully. One of the main benefits of social media is the easy access to various learning resources. Through platforms like YouTube, Google Classroom, or even educator-managed Instagram accounts, students can find diverse educational materials, such as interactive videos, e-books, or educational articles (Simamora, 2020).

This provides students the opportunity to delve deeper into the subjects and expand their knowledge beyond what is covered in class.

In addition to learning resources, social media also supports collaboration among students in completing group tasks or projects. With features like WhatsApp discussion groups, Google Meet, or Telegram forums, students can exchange ideas, share information, and collaborate to find solutions without time and place constraints. Suoth et al. (2023) states that students who use social media for collaborative learning tend to have higher motivation and better academic outcomes compared to those relying solely on traditional learning methods.

However, these positive impacts can only be achieved if social media use is supervised and guided adequately. Educators and parents must teach students digital literacy so they can choose relevant and beneficial content for their learning activities. When used correctly, social media not only becomes a support tool in the learning process but also helps students achieve optimal learning and strengthen 21st-century skills, such as collaboration, communication, and critical thinking.

Mathematics Learning Achievement

Mathematics learning achievement is an essential indicator in evaluating the quality of mathematics education (Siswanto & Susetyawati, 2024). This achievement not only reflects students' mastery of the material taught but also their ability to apply mathematical concepts in various situations. Intrinsic motivation plays a crucial role in enhancing students' understanding of mathematics, as highly motivated students tend to be more active in finding solutions to mathematical challenges.

Moreover, the teaching methods employed by educators also significantly impact mathematics learning achievement. Various learning approaches, such as Problem-Based Learning and constructivist approaches, have proven effective in enhancing students' understanding of mathematical concepts. This aligns with research by Maskar et al. (2023), which states that teaching methods involving active student participation in mathematical thinking processes can improve their learning achievement.

Another factor influencing mathematics learning achievement is the use of technology in teaching. With the advancement of technology, digital learning tools such as mathematics apps and social media can serve as supplementary resources that enrich students' learning experiences. The use of digital media in mathematics education allows students to understand complex concepts more easily through visualization and simulations. Thus, integrating various internal and external factors that support mathematics learning is crucial for improving students' academic achievement.

METHODOLOGY

This study employs a quantitative approach with a correlational method, which aims to analyze the relationship or association between two or more variables. The sample determination is conducted using a Non-Probability Sampling approach, utilizing the Saturation or Census Sampling technique,

where all members of the population are used as the sample. In this study, the sample consists of 30 students from class X at Muhammadiyah Mlati Senior High School. The research instrument is a questionnaire using a Likert scale with five response options: Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree. Data analysis is performed using simple linear regression. This technique is applied to analyze the relationship between one independent variable and one dependent variable (Sugiyono, 2019).

RESEARCH RESULT

This study aims to identify whether there is an influence between variable X (social media usage) and variable Y (student academic achievement). To analyze this relationship, the researcher used simple linear regression technique with the help of SPSS-25 software. After the analysis process was conducted, the results of the simple linear regression are presented as shown in the following output.

Normality Test

Before using the linear regression technique, a normality test was carried out first with a significance level of 5%. This normality test was carried out using SPSS-25.

Table 1. Normality Test Results

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Learning achievement	.141	30	.121	.948	30	.270
Use of social media	.128	30	.200*	.949	30	.144
*. This is a lower bound of the true significance.						
a. Lilliefors Significance Correction						

Based on the table above, in the Shapiro-Wilk test for the learning achievement variable, a statistical value of 0.948 was obtained with a significance (Sig.) of 0.270. Because the significance value is greater than 0.05, this indicates that the data for the learning achievement variable is normally distributed. Likewise, for the social media use variable, the Shapiro-Wilk test produces a statistical value of 0.949 with a significance (Sig.) of 0.144. With a significance value greater than 0.05, it can be concluded that the data for the social media use variable is also normally distributed. Overall, for both learning achievement and social media use variables, the results of the Shapiro-Wilk test show that the data for both variables are normally distributed, which means that the assumption of normality is met.

Homogeneity Test

Next, a homogeneity test was carried out assisted by the SPSS-25 program as follows.

Table 2. Homogeneity Test Results

		Levene Statistic	df1	df2	Sig.
Learning achievement	Based on Mean	.815	5	23	.517
	Based on Median	.622	5	23	.648
	Based on Median and with adjusted df	.621	5	18.177	.649
	Based on trimmed mean	.806	5	23	.522

Based on the table above, it can be seen that the results of the homogeneity test show a significance value (sig.) between the use of social media and learning achievement of 0.517 which is greater than 0.05, which means the data has a homogeneous distribution.

Coefficient of Determination

The coefficient of determination (R square) is used to measure the extent to which the independent variable (social media use) can influence the dependent variable (student learning achievement). The following are the results of testing the coefficient of determination (R Square).

Table 3. Model Summary Determination Test Results

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.953 ^a	.908	.906	1225.38638
a. Predictors: (Constant), Use_of_social_media				
b. Dependent Variable: Learning_achievement				

Based on the SPSS-25 model summary presented in the table above, the coefficient of determination or R Square value is 0.908. This shows that in this regression model, the independent variable (social media use) contributes 90.8% to the dependent variable (student learning), while the remaining 9.2% is influenced by other factors.

Anova Test

Table 4. ANOVA Test Results

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	711698644.162	1	711698644.162	473.969	.000 ^b
	Residual	72075445.118	48	1501571.773		
	Total	783774089.280	49			
a. Dependent Variable: Learning achievement						
b. Predictors: (Constant), Use of social media						

In the ANOVA table above, an analysis was carried out to determine whether the social media use variable (X) had a significant influence on the learning variable (Y). The output results show that the Fcount value is 473.969 with a probability significance level of $0.000 < 0.05$. Thus, the regression model can be applied to predict learning variables.

Significance Test

To calculate the t table value using a two-tail test with a significance level of 0.025, we can determine the degrees of freedom (df) by subtracting 2 from the number of samples (N-2). If the t-count value is greater than the t-table, this indicates that there is a significant influence between the two variables. Conversely, if the t-count is smaller than the t-table, then there is no significant influence between the two variables. This process is carried out using the SPSS-25 application to obtain the results.

Table 3. Significance Test Results

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	360.799	270.167		1.335	.188
	Use_of_social_media	1.133	.052	.953	21.771	.000
a. Dependent Variable: Learning_achievement						

From the table above, the t_{value} obtained is 21,771 with a significance value of 0.000. With a sample size of $N = 30$, the degrees of freedom (df) are calculated as $30 - 2 = 28$. Based on a significance level of 0,025, the t_{table} value obtained is 2,048. The calculation results show that the t_{value} of 21,771 is greater than the t_{table} of 2,048, and the significance value of 0,000 is smaller than 0,05. Therefore, it can be concluded that there is a significant influence between the use of social media on student learning.

DISCUSSION

With the advancement of technology, social media has rapidly evolved from merely a source of entertainment into a tool that supports the learning process. Not only serving as a platform for social interaction, social media now provides a wide range of information relevant to learning materials. Platforms like YouTube, Instagram, and WhatsApp are frequently used by students to find lecture materials, engage in academic discussions, and share learning resources. According to Thurston et al. (2020), the use of social media has been shown to have an impact on student learning, with a high correlation coefficient of 0.908. This finding aligns with Tarso et al. (2024), which states that appropriate use of social media can improve students' understanding of learning materials.

Social media makes it easier for students to access various sources of information that might have been difficult to obtain previously (Syah et al., 2024). Thanks to technological advancements, students can now search for and receive explanations on various learning topics by simply accessing social media platforms. This certainly has a positive impact, as students can learn flexibly and independently. Siswanto et al. (2024) emphasizes that this easy access allows students to contact their teachers or peers to discuss material that they do not yet understand. This process helps create a more open and

interactive learning environment, which in turn can improve their academic understanding.

Currently, many social media platforms provide educational content that students can use to delve into specific subjects. Platforms like YouTube, for example, offer tutorial videos that can help students understand material taught in class. Research by Wahyuni et al. (2024) shows that using social media as a learning resource has enhanced students' cognitive skills. Additionally, social media provides various articles, e-books, and discussion forums that can enrich students' understanding of specific topics. Therefore, using social media can enhance students' learning experiences outside of formal class hours.

Research conducted by Moghaddam & Esmailpour (2023) shows that there is a significant relationship between the use of social media and student learning. This suggests that social media is not only an entertainment tool but can also function as an effective learning support tool. However, as found in Pisriwati et al. (2024) research, this relationship is relatively low, with a correlation value of 0.908. This indicates that while there is an influence, social media is not the main factor determining student learning, but rather a supporting factor in the learning process.

Many students now use social media to communicate with their teachers and peers to complete assignments or share information about lecture materials. This aligns with research conducted by Putri et al. (2024), which states that developments in information and communication technology have enabled globalization in the way learning is perceived. Online learning and the use of social media allow students to interact with their instructors and classmates without time or location constraints, offering greater comfort and flexibility in the learning process.

In higher education environments, online learning methods have experienced rapid development. Besides saving time and costs, online learning also gives students the opportunity to access learning materials more freely. This aligns with findings from Supriadi et al. (2022), which states that social media can help students obtain information in real-time. Furthermore, research by Hidayati & Yansi (2020) shows that using social media in the context of learning can improve student learning, especially when used to find information that supports the learning process.

Wise use of social media has the potential to bring positive impacts for students. Research by Siswanto & Hanama (2024) reveals that using social media as a learning tool can have a positive relationship with student learning. On the other hand, using social media for entertainment can have a negative impact, as it may reduce the time that should be spent on learning activities. Therefore, students need to manage their social media usage to prevent it from interfering with their academic focus. Clear objectives for social media use will determine whether it has a positive or negative impact on student learning.

Relevant studies, such as those found by Ramdani et al. (2021), show that the impact of social media usage on a person's activities heavily depends on the individual's goals. If the goal of using social media is for learning and acquiring information, then the impact will be positive for learning. However, if it is used

solely for entertainment, social media tends to reduce study time and distract students from the material they are learning. Therefore, it is important for students to be self-aware in using social media in ways that support their academic development.

One major benefit of using social media for learning is its flexibility (Merliana et al., 2021). Students can access learning materials anytime and anywhere, according to their needs and convenience. This allows students to study independently outside of formal class hours. With social media, students are not limited to specific times and places to obtain the information necessary for understanding lecture materials. This advantage strongly supports the development of more independent and technology-based learning.

Overall, social media has great potential to support student learning, especially when used wisely. Although some studies show a low correlation between social media use and learning, the positive impact of social media as a learning tool is clearly evident. Therefore, it is important for students to use social media with clear objectives, such as for seeking information and engaging in discussions, so that social media can become an effective tool in enhancing learning and personal development.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of data analysis, this research shows that there is a positive and significant influence between the use of social media and the mathematics learning achievement of class X students at Muhammadiyah Mlati High School. This is proven by the t_{value} of 21.771 which is greater than the t_{table} value of 2.048, and the significance value of 0.000 which is smaller than 0.05. Thus, the hypothesis which states that there is an influence of social media on student learning can be accepted. The better students use social media as a lecture support, the higher the learning they can achieve.

Based on these findings, it is recommended that the results of this research can be used by teachers to provide insight to students about how to utilize social media in the teaching and learning process. Students are also expected to use social media wisely, as a tool that supports education to improve learning.

ADVANCED RESEARCH

For future researchers to be able to develop further research by exploring other aspects that have not been discussed, such as differences in achievement between students who use social media and those who do not, as well as evaluating the negative impacts of their use. Further research can also be carried out in different locations and with more varied techniques.

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REFERENCES

- Afandi, M. M., Astiwi, W., Putri, H. A., Wahyuni, N., Alghiffari, E. K., & Siswanto, D. H. (2024). Optimizing Marketing Strategies for Micro, Small, and Medium Enterprises (MSMEs) through Digital Marketing Training. *Civitas: Jurnal Pengabdian Masyarakat*, 1(1), 37–49. <https://journal.idscipub.com/civitas/article/view/349>
- Alam, R., Suparman, Samsinar, Siswanto, D. H., & Maretha, D. G. A. (2023). Kajian Bibliometrik untuk Menemukan Kebaruan dalam Penelitian Mengenai Berpikir Kritis. *PELITA: Jurnal Penelitian Dan Karya Ilmiah Volume*, 21(1), 49–60. <https://doi.org/https://doi.org/10.33592/pelita.v23i1.2960>
- Allioui, H., & Mourdi, Y. (2023). Exploring the Full Potentials of IoT for Better Financial Growth and Stability: A Comprehensive Survey. *Sensors*, 23(19). <https://doi.org/10.3390/s23198015>
- Apriliyani, S. W., & Mulyatna, F. (2021). Flipbook E-LKPD dengan Pendekatan Etnomatematika pada Materi Teorema Pythagoras. *Seminar Nasional Sains*, 2(1), 491–500.
- Astiwi, W., & Siswanto, D. H. (2024). Pengembangan e-LKPD pada materi relasi dan fungsi dengan model PAKEM untuk meningkatkan kemampuan berpikir kreatif. *Jurnal Praktik Baik Pembelajaran Sekolah Dan Pesantren*, 3(03), 118–132.
- Astiwi, W., Siswanto, D. H., & Suryatama, H. (2024). Description regarding the influence of teacher qualifications and competence on early childhood learning achievement. *Asian Journal of Applied Education (AJAE)*, 3(3), 347–358.
- Egara, F. O., & Mosimege, M. (2023). Students' Perceptions of Mathematics Teachers' Usage of Ethnomathematics Materials in the Teaching and Learning of Mathematics. *International Journal of Multicultural Education*, 25(2), 443–459. <http://www.ijmejournal.org/ijme/index.php/ijme/article/view/v25-2-33/v25-2-33.html>
- Hidayati, A., & Yansi, M. (2020). Role of Social Media in Marketing of Micro, Small, And Medium Enterprises (MSMEs) Product During Covid 19 Pandemic. *Jurnal Ilmiah Teunuleh*, 1(2), 239–249. <https://doi.org/10.51612/teunuleh.v1i2.39>
- Liu, Y., & Pásztor, A. (2022). Effects of problem-based learning instructional intervention on critical thinking in higher education: A meta-analysis. *Thinking Skills and Creativity*, 45(May). <https://doi.org/https://doi.org/10.1016/j.tsc.2022.101069>
- Maskar, S., Herman, T., Dasari, D., & Puspaningtyas, N. D. (2023). Creativity in Mathematics: Mathematical Reasoning Ability of Indonesian Students and Solution Recommendation. *Acta Scientiae*, 25(5), 303–331. <https://doi.org/10.17648/acta.scientiae.7813>
- Merliana, A., Aprily, N. M., & Agustini, A. (2021). Using Sway App as an Instructional Medium for Social Studies Learning in Elementary School. *Indonesian Journal of Primary Education*, 5(2), 214–222.

- <https://doi.org/10.17509/ijpe.v5i1.35381>
- Moghaddam, M. M., & Esmailpour, F. (2023). Persuasive Language in ELT-Related Ads on Social Media. *Journal of Psycholinguistic Research*, 52(4), 1263–1288. <https://doi.org/10.1007/s10936-023-09942-7>
- Pisriwati, S. A., Hardi, Y., & Siswanto, D. H. (2024). Enhancing organizational development through principal leadership to improve teacher and staff work discipline. *Journal of Organizational and Human Resource Development Strategies*, 1(1), 52–62. <https://doi.org/https://doi.org/10.56741/ohds.v1i01.670> Enhancing
- Pisriwati, S. A., Siswanto, D. H., Hardi, Y., & Alghiffari, E. K. (2024). Question making training with LOTS, MOTS, and HOTS cognitive levels for high school teachers. *Journal of Social and Community Development*, 1(1), 9–19. <https://doi.org/https://doi.org/10.56741/jscd.v1i01.666>
- Putri, H. A., & Siswanto, D. H. (2024). Teaching at The Right Level (TaRL) as an Implementation of New Education Concepts in the Insights of Ki Hajar Dewantara. *Indonesian Journal of Educational Science and Technology (Nurture)*, 3(2), 89–100. <https://doi.org/https://doi.org/10.55927/nurture.v3i2.9297>
- Putri, H. A., Siswanto, D. H., & Susanto, D. (2024). Developing teachers' skills in designing project-based learning in the merdeka curriculum through assembler edu training. *Civitas: Jurnal Pengabdian Masyarakat*, 1(1), 12–20.
- Ramdani, N. S., Nugraha, H., & Hadiapurwa, A. (2021). Potensi Pemanfaatan Media Sosial TikTok sebagai Media Pembelajaran dalam Pembelajaran Daring. *Akademika*, 10(2), 425–436. <https://doi.org/10.34005/akademika.v10i02.1406>
- Serafini, P. G., Moura, J. M. de, Almeida, M. R. de, & Rezende, J. F. D. de. (2022). Sustainable Development Goals in Higher Education Institutions: A systematic literature review. *Journal of Cleaner Production*, 370(August), 1–20. <https://doi.org/10.1016/j.jclepro.2022.133473>
- Simamora, R. M. (2020). The Challenges of Online Learning during the COVID-19 Pandemic: An Essay Analysis of Performing Arts Education Students. *Studies in Learning and Teaching*, 1(2), 86–103. <https://doi.org/10.46627/silet.v1i2.38>
- Siswanto, D. H., & Afandi, M. M. (2024). Analysis of the Implementation of Mindfulness in Senior High School Students' Learning. *Asian Pendidikan*, 4(1), 79–85. <https://doi.org/https://doi.org/10.53797/aspen.v4i1.9.2024> Analysis
- Siswanto, D. H., Alghiffari, E. K., & Pujiastuti, N. I. (2024). Implementation of the CTL Model as a Strategy to Increase Interest in Learning Mathematics. *Indonesian Journal of Educational Science and Technology (Nurture)*, 3(2), 61–74. <https://doi.org/https://doi.org/10.55927/nurture.v3i2.9168>
- Siswanto, D. H., & Peni, N. R. N. (2023). Publication Trend on the Plomp Development Model in Mathematics Education. *Asian Pendidikan*, 3(2), 71–80. <https://doi.org/10.53797/aspen.v3i2.9.2023>
- Siswanto, D. H., & Susetyawati, M. M. E. (2024). Comparison of the Effectiveness of Cooperative Learning Models TPS and GI on Students'

- Mathematical Concept Understanding Ability. *International Journal of Scientific Multidisciplinary Research (IJSMR)*, 2(7), 875–888. <https://doi.org/https://doi.org/10.55927/ijsmr.v2i7.10034>
- Siswanto, D. H., Syah, A. B. P. D. A. F., Yogyanto, N., & Yarkasi. (2024). Effectiveness of differentiated learning approaches to enhance students' literacy and numeracy. *Indonesian Journal of Educational Science and Technology (Nurture)*, 3(3), 153–166. <https://doi.org/https://doi.org/10.55927/nurture.v3i3.12287>
- Siswanto, D. H., Wibowo, W. A., Saputra, Y. D., Ramadhan, Rozaq, R., Suryatama, H., & Saputra, S. A. (2024). Qualitative Study on the Dynamics of Social Interaction Between Boarding Students and the Local Community. *International Journal of Scientific Multidisciplinary Research (IJSMR)*, 2(9), 1275–1288. <https://doi.org/https://doi.org/10.55927/ijsmr.v2i9.11385>
- Siswanto, H., & Hanama, A. (2024). The Influence of Pocket Money on the Desire to Learn Mathematics Among Elementary School Students. *International Journal of Learning Reformation in Elementary Education*, 3(03), 164–175. <https://doi.org/10.56741/ijlree.v3i03.652>
- Siswanto, H., & Kuswantara, H. (2024). Peningkatkan Keaktifan dan Hasil Belajar Limit Fungsi Aljabar Menggunakan Model Problem Based Learning Berpendekatan Culturally Responsive Teaching. *Jurnal Praktik Baik Pembelajaran Sekolah Dan Pesantren*, 3(03), 107–117. <https://doi.org/10.56741/pbpsp.v3i03.636>
- Sugiyono. (2019). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta.
- Suoth, A. A., Wuntu, C. N., & Rorintulus, O. A. (2023). The Effectiveness of Using Novels in Learning Process to Improve the English Language Skills: A Systematic Review. *Journal of English Language Teaching, Literature and Culture*, 2(1), 84–95. <https://doi.org/10.53682/jeltec.v2i1.6250>
- Supriadi, A., Mesnan, Akhmad, I., Dewi, R., & Suprayitno. (2022). The Effect of Learning Manipulative Skills Using Ball Thrower Learning Media on the Ability to Throw and Catch the Ball in Elementary School Students. *International Journal of Education in Mathematics, Science and Technology*, 10(3), 590–603. <https://doi.org/10.46328/ijemst.2441>
- Syah, A. B. P. D. A. F., Rachmawati, L., & Siswanto, D. H. (2024). Validity and practicality of the game-based learning media for mathematical logic using the quiz whizzer application. *JOELI: Journal of Educational and Learning Innovation*, 1(2), 107–118. <https://doi.org/http://doi.org/10.72204/xpxg2d74>
- Syah, A. B. P. D. A. F., Suwarta, & Siswanto, D. H. (2024). Enhancing teacher self-management and skills in designing teaching materials through a merdeka curriculum workshop at muhammadiyah 1 sleman vocational high school. *Jurnal Pengabdian Masyarakat Bestari (JPMB)*, 3(9), 585–598.
- Tarso, Fitriana, E., & Siswanto, D. H. (2024). Keefektifan Fitur-Fitur pada Aplikasi Telegram sebagai Media Pembelajaran Matematika Siswa Sekolah Menengah Kejuruan. *Papanda Journal of Mathematics and Sciences Research (PJMSR)*, 3(2), 99–109.

- <https://ejournal.papanda.org/index.php/pjmsr/article/view/958>
- Thurston, A., Roseth, C., Chiang, T. H., Burns, V., & Topping, K. J. (2020). The influence of social relationships on outcomes in mathematics when using peer tutoring in elementary school. *International Journal of Educational Research Open*, 1(June), 100004. <https://doi.org/10.1016/j.ijedro.2020.100004>
- Wahyuni, N., Siswanto, D. H., Alghiffari, E. K., & Alam, S. R. (2024). Esensial Literasi dalam Upaya Meningkatkan Minat Baca untuk Peserta Didik. *Adi Karsa: Jurnal Teknologi Komunikasi Pendidikan Volume*, 15(2), 134-139. <https://ejournal.btkp-diy.or.id>
- Yogyanto, N., Pisriwati, S. A., & Siswanto, D. H. (2024). Education on the contextual utilization of information technology based on the iot in the daily lives of senior high school students. *Civitas: Jurnal Pengabdian Masyarakat*, 1(1), 21-27.
- Yulianto, T., Pramudya, I., & Slamet, I. (2020). How the Effects of the 21st-Century Learning Model on Higher Level Thinking Ability and Mathematical Learning Creativity Viewed from Student Mathematical Disposition. *Advances in Social Science, Education and Humanities Research*, 397(Icliqe 2019), 1066-1076. <https://doi.org/10.2991/assehr.k.200129.132>
- Zhu, C., Klapwijk, R., Silva-Ordaz, M., Spandaw, J., & de Vries, M. J. (2023). Cognitive and embodied mapping of data: an examination of children's spatial thinking in data physicalization. *Frontiers in Education*, 8(December). <https://doi.org/10.3389/feduc.2023.1308117>