

RELATIONSHIP BETWEEN CHATGPT AND GOOGLE GEMINI USE AND MATHEMATICS LEARNING INTEREST AMONG FIFTH-GRADE STUDENTS AT SDN KEBALEN 05

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ABSTRACT

The objective of this study was to investigate the relationship between the use of generative artificial intelligence (AI), represented by ChatGPT and Google Gemini, and students' interest in learning mathematics among fifth-grade students at SDN Kebalen 05. This study was motivated by the increasing use of generative AI as a learning tool and the low level of students' interest in mathematics. A quantitative approach with a correlational survey design was employed. The population consisted of all fifth-grade students at SDN Kebalen 05, and a saturated sampling technique was used. Data were collected primarily through questionnaires, with observations, documentation, and interviews serving as supporting data. The data were analyzed using descriptive statistics and Pearson Product-Moment correlation analysis. The results showed a strong positive relationship between the use of generative AI, represented by ChatGPT and Google Gemini, and students' interest in mathematics learning ($r = 0.682$, $p < 0.001$). This finding indicates that higher use of generative AI was associated with higher interest in mathematics learning among fifth-grade students. The findings suggest that the appropriate use of generative AI may provide teachers with complementary tools for creating more interactive mathematics learning experiences and may be considered in supporting students'

learning interest. The study provides practical implications for teachers in integrating AI-based learning tools appropriately as complementary resources in primary mathematics education.

Keywords: *Artificial Intelligence, Chatgpt, Elementary School, Gemini, Generative AI, Learning Interest, Mathematics*

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INTRODUCTION

Improving the quality of human resources requires continuous improvement in education. Mathematics is a crucial subject because it develops students' logical, critical, and systematic thinking skills. However, mathematics is still perceived by many elementary school students as a difficult and tedious subject. Low interest in learning mathematics may consequently reduce students' engagement during learning activities and may be associated with less favorable academic outcomes. Students with high learning interest tend to participate more actively in mathematics lessons, whereas students with low learning interest tend to demonstrate less enthusiasm (Ihsan et al., 2024). In addition, the 2022 Program for International Student Assessment (PISA) results indicate that Indonesian students' mathematical proficiency remains below the international average. These conditions indicate that mathematics education in Indonesia continues to face challenges, particularly in creating learning experiences that can foster students' interest and engagement in mathematics.

The development of digital technology, particularly Artificial Intelligence (AI), has introduced new possibilities for creating more interactive and responsive learning experiences. One rapidly developing form of AI in education is generative artificial intelligence (AI), which includes platforms such as ChatGPT and

Google Gemini. As generative AI-based learning tools, these platforms can provide explanations, answer questions, generate examples and practice problems, and provide immediate responses to students' questions. These characteristics may make learning experiences more interactive, responsive, and personalized, which may be associated with students' interest in learning. Previous research has reported that ChatGPT can support student engagement and learning interest, while the use of AI in mathematics education has been associated with students' conceptual understanding and motivation to learn (Chandra et al., 2025; Lopez et al., 2025). Thus, the potential relevance of generative AI to mathematics learning is not merely related to its technological sophistication, but also to how its interactive features may shape students' learning experiences.

ChatGPT and Google Gemini are particularly relevant in this context because both provide generative AI capabilities that can be used to support students during learning. ChatGPT can generate explanations, examples, questions, and responses based on students' prompts, while Google Gemini provides multimodal capabilities that allow information to be processed and generated in forms such as text, images, audio, and video. These capabilities may provide students with alternative ways to explore mathematical concepts, obtain explanations, and practice solving problems according to their learning needs (Imran & Almusharraf, 2024). In this study, however, ChatGPT and Google Gemini are not treated as two separate research variables. Rather, both platforms are regarded as examples of generative AI-based learning tools, and their use represents the broader construct of generative AI use in learning.

The relationship between generative AI use and learning interest needs to be understood carefully because AI-related concepts represent different constructs. The use of generative AI as a learning tool refers to students' utilization of AI platforms to support learning activities, such as obtaining explanations, exploring information, answering questions, or practicing problems. This construct is different from AI literacy, which concerns students' knowledge and ability to understand and use AI appropriately. It is also different from frequency of AI use, which

refers to how often students use AI, and from perceived usefulness, which reflects students' beliefs about the benefits or usefulness of AI. Learning interest is a separate educational construct referring to students' attraction, enthusiasm, attention, and willingness to engage in learning activities. Therefore, evidence that AI is useful, frequently used, or well understood does not automatically demonstrate that its use is associated with students' interest in learning mathematics. This distinction is important in examining the specific relationship investigated in the present study.

Although previous studies have discussed the potential of ChatGPT and other AI technologies to support student engagement, motivation, and mathematics learning, research on generative AI in K–12 education remains relatively limited (Yusuf et al., 2024; Zhang & Tur, 2024). In addition, AI literacy and appropriate guidance are increasingly recognized as important components of AI integration in K–12 education (Otero et al., 2023; Liu & Zhong, 2024). However, limited research has specifically examined the relationship between the use of ChatGPT and Google Gemini as generative AI learning tools and mathematics learning interest among elementary school students.

The potential relationship between generative AI use and mathematics learning interest may be particularly relevant at the elementary-school level. Mathematics learning at this stage requires students to understand concepts while maintaining attention and active engagement in learning activities. Generative AI may provide immediate explanations, examples, and opportunities for interaction that can complement classroom instruction and potentially make mathematical learning experiences more engaging. However, the effective use of generative AI also requires teacher guidance. Successful learning with ChatGPT and Gemini depends not only on the capabilities of the technology but also on teachers' digital pedagogical skills in utilizing these tools appropriately (Imran & Almusharraf, 2024). Teachers need to guide students in using AI critically and responsibly, including verifying the accuracy of information generated by AI. Teachers' digital pedagogical competence is therefore an important component in creating innovative learning experiences through digital technology (Nafasabilla & Yohamintin, 2025). In this sense, generative AI

should function as a complementary learning resource within teacher-guided instruction rather than as a replacement for the teacher.

Preliminary interviews with a fifth-grade teacher at SDN Kebalen 05 provide a relevant contextual basis for this issue. The teacher indicated that technologies such as ChatGPT and Google Gemini could make mathematics learning easier and more engaging. The teacher also reported that interactive learning tools could encourage student engagement and reduce boredom during mathematics lessons. Students were already familiar with AI and used it as a study aid to find answers and understand learning materials, although some students had not yet mastered appropriate ways to use these technologies. These preliminary findings suggest that generative AI use may be associated with students' interest in learning mathematics. Nevertheless, the preliminary interview does not establish a causal relationship; rather, it provides an empirical context for further examination of the relationship between the two constructs.

The use of generative AI also involves potential limitations that need to be considered. Excessive reliance on AI may encourage students to depend heavily on technological assistance and reduce opportunities to develop critical and independent thinking. In addition, generative AI may produce inaccurate, incomplete, or inappropriate information. Therefore, students require teacher supervision and guidance when using AI for learning. These considerations indicate that the educational value of generative AI should not be assessed solely based on its technological capabilities, but also in relation to how students use it as a learning resource and how such use is associated with their learning experiences.

Although previous studies have discussed the potential of ChatGPT and other AI technologies to support student engagement, motivation, and mathematics learning, limited research has specifically examined the relationship between the use of generative AI as a learning tool and students' interest in learning mathematics at the elementary-school level. Existing studies have tended to emphasize AI effectiveness, acceptance, AI literacy, perceived usefulness, or learning outcomes, while students' learning

interest represents a distinct construct that requires separate investigation. Furthermore, limited empirical evidence is available regarding the relationship between the use of generative AI represented by multiple platforms, such as ChatGPT and Google Gemini, and mathematics learning interest among fifth-grade elementary school students. Therefore, an empirical investigation is needed to determine whether students' use of generative AI is significantly associated with their interest in learning mathematics.

Accordingly, this study aims to investigate the relationship between the use of generative artificial intelligence, represented by ChatGPT and Google Gemini, and students' interest in learning mathematics among fifth-grade students at SDN Kebalen 05. The hypothesis of this study is that there is a significant positive relationship between the use of generative AI and students' interest in learning mathematics among fifth-grade students. The findings are expected to provide practical implications for teachers and schools in considering the appropriate use of generative AI-based learning tools as complementary resources to support mathematics learning at the elementary-school level.

METHOD

To examine the relationship between the use of generative artificial intelligence (AI), represented by ChatGPT and Google Gemini, as the independent variable (X) and students' interest in learning mathematics as the dependent variable (Y), this study employed a quantitative approach with a correlational survey design. A quantitative approach was selected because it enables the researcher to obtain numerical data and analyze them using statistical techniques, thereby allowing the relationship between variables to be measured systematically and objectively (Ashour, 2024).

The population consisted of all fifth-grade students at SDN Kebalen 05, totaling 74 students, who were enrolled during the 2025/2026 academic year. Since the entire population was relatively small and accessible, all 74 students were included as the research sample using a saturated sampling technique (Syahid et al., 2025). Data were collected primarily through questionnaires using a four-point Likert scale. The questionnaire consisted of two sections

measuring the two research variables. The first section measured the use of generative AI as variable X, with ChatGPT and Google Gemini serving as examples of generative AI-based learning tools, while the second section measured students' interest in learning mathematics as variable Y. The use of generative AI was assessed through 12 items covering five indicators: frequency of AI use, purpose of AI use, intensity of AI use, interaction with AI, and AI-assisted learning activities. These indicators were designed to capture students' actual use of generative AI for mathematics learning, including how frequently, for what purposes, and to what extent students used ChatGPT and Google Gemini as learning resources. The mathematics learning interest variable was measured through 8 items based on predetermined indicators of students' interest in learning mathematics. All items were rated using a four-point Likert scale. Observations, interviews, and documentation were also used as supporting data during the preliminary stage of the study (Syahid et al., 2025).

Prior to the main data collection, the instruments were tested for validity and reliability to ensure that they adequately measured the intended constructs. The validity test involved 12 items for the use of generative AI (X) and 8 items for mathematics learning interest (Y), with all 20 items declared valid because their calculated correlation coefficients exceeded the *r*-table value of 0.229. The reliability test produced Cronbach's alpha values of 0.757 for variable X and 0.566 for variable Y, indicating acceptable internal consistency for the instruments used in the study (Love et al., 2019).

Before testing the research hypothesis, assumption tests were conducted using the Shapiro-Wilk normality test and linearity test. The normality test produced significance values of 0.928 for generative AI use and 0.501 for mathematics learning interest, both exceeding 0.05, indicating normally distributed data. The linearity test also indicated that the relationship between the two variables was linear, with the deviation from linearity exceeding 0.05. Therefore, the Pearson Product-Moment correlation test was used to examine the strength and direction of the relationship between generative AI use and mathematics learning interest. If the

assumptions were not met, the Spearman Rank correlation would be used as a non-parametric alternative (Ashour, 2024).

The data were analyzed using JASP (Jeffreys's Amazing Statistics Program), which was used to conduct descriptive statistics, normality and linearity tests, and Pearson Product-Moment correlation analysis. Hypothesis testing was performed at a 5% significance level ($\alpha = 0.05$). JASP supports systematic quantitative data analysis through its descriptive and inferential statistical procedures (Nurdiyanti et al., 2025).

RESULTS AND DISCUSSION

RESULT

Descriptive Statistics

Descriptive statistics were first calculated to describe the distribution of the two research variables before examining their relationship. The results are presented in Table 1.

Table 1. Descriptive Statistics of Research Variables

Variable	N	Mean	SD	Minimum	Maximum
Use of ChatGPT and Google Gemini (X)	74	33.53	5.80	20	48
Mathematics Learning Interest (Y)	74	24.05	3.37	16	32

As shown in Table 1, the study involved 74 fifth-grade students. The use of generative AI had a mean score of 33.53 (SD = 5.80), with scores ranging from 20 to 48. Meanwhile, mathematics learning interest had a mean score of 24.05 (SD = 3.37), with scores ranging from 16 to 32. These results provide an overview of the observed scores for both variables prior to the correlation analysis.

Normality and Linearity Tests

Before conducting the correlation analysis, normality and linearity tests were performed to determine whether the data met the assumptions for Pearson Product-Moment correlation.

Table 2. Normality Test

Variable	Shapiro-Wilk Sig.	Information
Use of Generative AI (X)	0.928	Normal
Mathematics Learning Interest (Y)	0.501	Normal

Table 2 shows that the significance value for the use of generative AI was 0.928, while the significance value for mathematics learning interest was 0.501. Both values exceeded 0.05, indicating that the data for both variables were normally distributed.

Table 3. Linearity Test

Test	Sig.	Information
Linearity	< 0.001	Linear
Deviation from Linearity	0.327	Linear

The linearity test indicated that the relationship between the use of generative AI and mathematics learning interest was linear. The significance value for deviation from linearity was greater than 0.05, indicating that there was no significant deviation from a linear relationship. Therefore, the normality and linearity assumptions were satisfied, allowing the Pearson Product-Moment correlation test to be applied.

Correlation Analysis

After the descriptive and assumption tests were completed, the Pearson Product-Moment correlation test was conducted to examine the relationship between generative AI use and students' interest in learning mathematics.

Table 4. Pearson Product-Moment Correlation between Generative AI Use and Mathematics Learning Interest

Variables	N	Pearson's r	P
Use of Generative AI (X)-Mathematics Learning Interest (Y)	74	0.682	< 0.001

Table 4 shows a statistically significant positive relationship between the use of generative AI and students' interest in learning mathematics ($r = 0.682$, $p < 0.001$, $N = 74$). The positive correlation indicates that students with higher levels of generative AI use tended to report higher levels of interest in learning mathematics. The correlation coefficient of 0.682 indicates a strong positive association between the two variables.

Because the p-value was below the 0.05 significance level, the null hypothesis (H_0) was rejected and the alternative hypothesis (H_1) was supported. Thus, the study provides empirical evidence of a significant positive relationship between the use of generative AI, represented by ChatGPT and Google Gemini, and students' interest in learning mathematics among fifth-grade students at SDN Kebalen 05. However, because this study employed a correlational design, the findings indicate an association between the variables and should not be interpreted as evidence that generative AI use causes an increase in students' interest in learning mathematics.

DISCUSSION

The results of this study showed a strong positive and statistically significant relationship between the use of generative artificial intelligence (AI), represented by ChatGPT and Google Gemini, and students' interest in learning mathematics ($r = 0.682$, $p < 0.001$, $N = 74$). This finding indicates that students who reported higher levels of generative AI use also tended to report higher levels of interest in learning mathematics. The strength of the correlation suggests that the two variables were substantially associated in this group of fifth-grade students. The finding of the present study is consistent with a recent study conducted among primary school students, which also found a positive relationship between the use of generative AI and students' interest in learning mathematics (Liu et al., 2025). However, because this study employed a correlational survey design, the finding should be interpreted as an association rather than evidence that generative AI use causes an increase in students' interest in mathematics.

One possible explanation for this positive relationship is the personalized assistance provided by generative AI. ChatGPT

and Google Gemini can respond to students' questions, provide explanations, generate examples, and offer alternative ways of understanding learning materials. In mathematics learning, such assistance may be particularly relevant because students can experience different levels of difficulty when understanding mathematical concepts. Access to explanations that respond directly to students' questions may make mathematical learning more accessible and interactive. Students may also feel more confident when they can seek additional explanations without having to wait for assistance. This increased accessibility and perceived support may be associated with greater attention, curiosity, and engagement in mathematics learning. Previous research has similarly reported that ChatGPT can support student engagement and learning interest, while AI-supported mathematics learning may contribute to students' motivation and conceptual understanding (Imran & Almusharraf, 2024). However, these mechanisms represent plausible explanations for the observed relationship rather than causal effects demonstrated by the present study.

Immediate feedback and interactive explanations may provide another possible explanation. Students can use generative AI to ask follow-up questions, request alternative explanations, and obtain examples when they encounter difficulties. This type of interaction may reduce frustration and uncertainty during learning and potentially make students more willing to continue engaging with mathematical tasks. Google Gemini may provide additional flexibility through its multimodal capabilities, allowing information to be processed and presented in different forms, including text, images, audio, and video. These capabilities may support more personalized and interactive learning experiences (Imran & Almusharraf, 2024). The individual support that ChatGPT offers might be one reason for this relationship. When students have trouble grasping mathematical topics, ChatGPT can offer rapid access to knowledge, explanations based on their enquiries, and fast feedback. Such support may make mathematics learning more accessible and interactive. This interpretation is consistent with (Kasneci et al., 2023), who highlighted the potential of large language models to provide personalized learning support, facilitate

feedback, and increase opportunities for interaction. However, these potential benefits should be understood as possible mechanisms underlying the observed association rather than evidence of a causal effect. Such characteristics may help explain why greater use of generative AI was associated with greater mathematics learning interest in the present study. Nevertheless, the correlational nature of the research does not allow it to be concluded that these features directly increased students' interest.

The positive association identified in this study should also be interpreted alongside potential negative or neutral effects of generative AI use. However, the positive relationship identified in this study should not be interpreted as evidence that greater AI use is always beneficial. Students may become overly dependent on AI-generated answers and may have difficulty evaluating the accuracy of the information provided. Similar concerns regarding accuracy, academic dependence, and the need for human guidance have been identified in discussions of ChatGPT in education (Tlili et al., 2023). These concerns are particularly relevant for elementary school students, who may require stronger teacher and parental guidance when interacting with generative AI. Frequent use of AI does not necessarily mean that students are engaging more deeply with mathematical reasoning. Over-reliance on AI may reduce opportunities for students to solve problems independently, particularly when students use AI primarily to obtain immediate answers rather than to understand the reasoning behind a solution. In addition, generative AI may produce inaccurate or incomplete mathematical information. Elementary school students may have limited ability to identify such inaccuracies or critically evaluate AI-generated responses. Consequently, greater AI use may coexist with greater learning interest without necessarily resulting in deeper mathematical understanding or stronger independent problem-solving skills. The responsible use of generative AI therefore requires appropriate digital literacy, critical evaluation, and human supervision (UNESCO, 2023).

The present findings are broadly consistent with previous empirical research concerning the potential of AI to support interactive and personalized learning experiences. Research on ChatGPT has reported its potential to support student engagement

and learning interest, while research on AI in mathematics education has identified potential benefits for motivation and conceptual understanding (Chandra et al., 2025; Lopez et al., 2025). Similarly, the capabilities of ChatGPT and Google Gemini have been associated with more interactive and personalized learning experiences (Imran & Almusharraf, 2024). The findings are also broadly consistent with previous reviews of ChatGPT in education, which have identified potential benefits for learning support, accessibility, and student engagement (Lo, 2023). Nevertheless, previous research has also highlighted limitations related to inaccurate information and students' dependence on AI-generated responses. The present study extends this discussion by examining the relationship between generative AI use and mathematics learning interest specifically among elementary school students. However, the present study contributes a different type of evidence because it specifically examines the statistical relationship between generative AI use and mathematics learning interest among elementary school students. Unlike studies that focus primarily on the potential, effectiveness, or perceived usefulness of AI, this study identifies an empirical association between students' reported use of generative AI and their interest in learning mathematics. At the same time, the cross-sectional and correlational design means that the finding cannot establish whether AI use produces greater interest or whether students who are already more interested in mathematics are more likely to use generative AI.

Teacher guidance is therefore important in interpreting the practical implications of this finding. Generative AI may be more educationally meaningful when students are guided to use it to understand mathematical concepts, compare alternative solutions, ask questions, and reflect on their reasoning rather than simply copy AI-generated answers. Teachers with appropriate digital pedagogical competence can help students select relevant learning resources, design meaningful learning activities, and evaluate AI-generated information critically (Nafasabilla & Yohamintin, 2025). For elementary school students, such guidance is particularly important because their ability to independently evaluate the accuracy and appropriateness of AI-generated information is still developing.

Overall, the findings suggest that the use of generative AI, represented by ChatGPT and Google Gemini, is positively associated with students' interest in learning mathematics. Personalized assistance, immediate feedback, interactive explanations, and increased access to learning support provide plausible mechanisms that may help explain this association. However, the potential benefits should be considered alongside possible dependence on AI, reduced independent problem-solving, inaccurate AI-generated responses, and students' limited ability to critically evaluate AI information. Therefore, generative AI should be positioned as a complementary learning resource within teacher-guided mathematics education rather than as a replacement for teachers or students' own reasoning. Further experimental or longitudinal research is needed to determine whether and how the use of generative AI contributes to changes in students' interest in mathematics over time.

CONCLUSION

This study concludes that the use of generative artificial intelligence (AI), represented by ChatGPT and Google Gemini, has a strong, positive, and statistically significant relationship with fifth-grade students' interest in learning mathematics at SDN Kebalen 05. The Pearson Product-Moment correlation analysis showed a strong positive relationship ($r = 0.682$, $p < 0.001$, $N = 74$). Students who reported higher levels of generative AI use also tended to report higher levels of interest in learning mathematics. However, because this study employed a correlational design, the findings do not establish that generative AI use causes or directly increases students' interest in mathematics.

The findings suggest that ChatGPT and Google Gemini may be used as complementary learning resources in elementary mathematics education. Their use should be guided by teachers to support students' understanding, critical evaluation, and independent problem-solving rather than replacing classroom instruction or students' own reasoning. Schools can support responsible AI integration through appropriate guidelines and the development of students' digital and critical literacy.

This study was limited by its sample of 74 fifth-grade students from one primary school, the use of self-reported questionnaire data, and the measurement of generative AI use through reported use rather than direct observation. The correlational design also limits causal interpretation. Future research should involve larger and more diverse samples, more comprehensive measurement instruments, and experimental or longitudinal designs to further examine the relationship between generative AI use, mathematics learning interest, and learning outcomes.

REFERENCES

- Ashour, L. (2024). A review of user-friendly freely-available statistical analysis software for medical researchers and biostatisticians. *Research in Statistics*, 00(00), 0. <https://doi.org/10.1080/27684520.2024.2322630>
- Chandra, M. P., Firman, & Netrawati. (2025). *Pengaruh Pemanfaatan ChatGPT Terhadap Minat Belajar Siswa dalam Konteks Teknologi Pendidikan: Studi Literatur*. 3(6), 158–161.
- Ihsan, N., Budi, S., Pratiwi, I. A., & Riswari, L. A. (2024). *Minat dan Motivasi Belajar pada Mata Pelajaran Matematika Siswa Sekolah Dasar*. 6(2), 161–170.
- Imran, M., & Almusharraf, N. (2024). Google Gemini as a next generation AI educational tool: a review of emerging educational technology. *Smart Learning Environments*. <https://doi.org/10.1186/s40561-024-00310-z>
- Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Hüllermeier, E., Krusche, S., Kutyniok, G., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., Stadler, M., Weller, J., ... Bannert, M. (2023). *ChatGPT for good? On opportunities and challenges of large language models for education Nutzungsbedingungen / Terms of use: ChatGPT for good? On opportunities and challenges of large language models for education*.
- Liu, J., Sun, D., Sun, J., Wang, J., Leung, P., & Yu, H. (2025). *Computers and Education: Artificial Intelligence Designing a generative AI enabled learning environment for mathematics word problem solving in primary schools: Learning*

- performance , attitudes and interaction. *Computers and Education: Artificial Intelligence*, 9(October 2024), 100438. <https://doi.org/10.1016/j.caeai.2025.100438>
- Lo, C. K. (2023). *education sciences What Is the Impact of ChatGPT on Education ? A Rapid Review of the Literature*. November 2022.
- Lopez, G. I. ., Jagom, Y. O., & Kaluge, A. H. (2025). *Pengaruh Penggunaan Artificial Intelligence MathGPT dalam Meningkatkan Prestasi Belajar Matematika Siswa*. 5(02), 35–44.
- Love, J., Selker, R., Jamil, T., Dropmann, D., Ly, A., Gronau, Q. F., Šmíra, M., Epskamp, S., Wild, A., Knight, P., & Morey, R. D. (2019). *JASP: Graphical Statistical Software for Common Statistical Designs*. 88(2). <https://doi.org/10.18637/jss.v088.i02>
- Nafasabilla, Z., & Yohamintin. (2025). *Analysis of Teachers ' Digital Pedagogical Competence in Creating Innovative and Creative Learning at Elementary*. 10(3), 295–305. <https://doi.org/https://doi.org/10.21462/educasia.v10i3.372>
- Nurdiyanti, D., Khairiyah, W., Rahmawati, A., Amaliyah, F., Guru, P., Dasar, S., & Kudus, U. M. (2025). *Pengaruh Minat Belajar dan Self Efficacy terhadap Literasi Matematika Siswa Kelas VI SD 2 Bandungharjo*. 9, 21063–21069.
- Otero, L. C., Catala, A., Morante, C. F., Taboada, M., Cebreiro, B., & Barro, S. (2023). AI literacy in K - 12: a systematic literature review. *International Journal of STEM Education*. <https://doi.org/10.1186/s40594-023-00418-7>
- Syahid, A., Nuraisyah, D., Jannah, M., & Sumarni. (2025). *Student Perspectives on JASP As a Learning Tool in English Educational Statistics*. 5(1), 16–28. <https://doi.org/https://doi.org/10.55148/etjar.v5i1.1267>
- Tlili, A., Shehata, B., Adarkwah, M. A., Bozkurt, A., & Hickey, D. T. (2023). What if the devil is my guardian angel : ChatGPT as a case study of using chatbots in education. *Smart Learning Environments*. <https://doi.org/10.1186/s40561-023-00237-x>
- UNESCO. (2023). *Guidance for generative AI in education and research*. <https://doi.org/https://doi.org/10.54675/EWZM9535>
- Yusuf, A., Pervin, N., & González, M. R. (2024). Generative AI and the future of higher education: a threat to academic integrity or reformation? Evidence from multicultural perspectives. *International Journal of Educational Technology in*

Higher Education. <https://doi.org/10.1186/s41239-024-00453-6>
Zhang, P., & Tur, G. (2024). *A systematic review of ChatGPT use in K-12 education*. *October 2023*, 1–22.
<https://doi.org/10.1111/ejed.12599>