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ADVANCES IN SOCIAL HUMANITIES RESEARCH

Application of Disaster-Literature Based Artificial Intelligence to Improve Students' Knowledge and Creative Thinking Skills at SMAN 39 Jakarta

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Abstract

This study aimed to evaluate the effectiveness of integrating artificial intelligence (AI) technologies into geography instruction to improve students' knowledge acquisition and creative thinking skills. A quasi-experimental research design employing pretest and posttest assessments was implemented with two groups: an experimental group that integrated AI-assisted learning strategies and a control group that received conventional instruction without AI support. The instructional materials focused on disaster-related topics and were delivered over six learning sessions in accordance with the principles of Indonesia's Merdeka Curriculum. The findings revealed substantial improvements in the experimental group's learning outcomes, with mean knowledge scores increasing by 50.98% and creative thinking skills improving by 52.73%. AI-powered platforms, including ChatGPT, Perplexity AI, Scholarcy, and Scite, were incorporated to facilitate access to relevant academic literature, support information exploration, and encourage independent, inquiry-based learning. In comparison, the control group demonstrated a 26.41% improvement in knowledge scores and a 33% increase in creative thinking skills. These descriptive differences suggest that AI-assisted instruction may provide additional benefits for developing students' conceptual understanding, information literacy, and higher-order thinking skills compared with conventional teaching approaches. However, the reported percentage improvements alone do not establish statistically significant differences between the groups. Overall, the findings highlight the potential of AI-integrated geography instruction to support disaster-related learning and creative thinking development in alignment with the objectives of the Merdeka Curriculum. The study emphasizes the importance of integrating AI technologies strategically, ethically, and contextually to promote adaptive, meaningful, and student-centered learning experiences in contemporary educational settings.

INTRODUCTION

Twenty-first-century education requires students not only to acquire and retain information but also to comprehend, critically evaluate, synthesize, and apply knowledge to address real-world challenges. These competencies are particularly important in geography education, which examines the relationships among human activities, environmental systems, spatial patterns, and the natural and social processes that influence everyday life. Disaster-related topics, particularly disaster mitigation and

adaptation, provide meaningful contexts for developing these competencies (Kitagawa, 2021; Shaw et al., 2021). Students are expected to identify different types of hazards, understand disaster risk factors, interpret spatial information, evaluate community vulnerabilities, and formulate appropriate mitigation strategies based on regional characteristics. Although factual knowledge provides an essential foundation, meaningful learning also requires analytical reasoning, contextual understanding, and the ability to generate practical solutions. Disasters should not be viewed solely as isolated natural events because their consequences are influenced by exposure, vulnerability, community capacity, land-use patterns, socioeconomic conditions, infrastructure quality, and emergency preparedness. Consequently, disaster education should encourage students to connect geographical concepts with their immediate environments and lived experiences (Logayah et al., 2024; Rumengan et al., 2025). Through this approach, students can develop the ability to distinguish hazards from disaster risks, explain variations in regional vulnerability, and critically evaluate feasible mitigation and adaptation strategies. Such learning experiences promote analytical thinking, problem-solving competencies, and creativity beyond the memorization of geographical concepts.

Advances in digital technology have transformed the educational environment by providing students with increasingly accessible information resources, including scientific articles, institutional reports, digital maps, news publications, and interactive educational materials. Nevertheless, greater access to information does not necessarily result in deeper conceptual understanding or improved learning outcomes. Students must develop information literacy skills to evaluate source credibility, identify contextual relevance, verify supporting evidence, and critically compare potentially conflicting information (Ng et al., 2021). These competencies are particularly important in disaster education, where inaccurate or misleading information may contribute to misconceptions about hazards, vulnerability, and disaster risk. Generative artificial intelligence (AI) technologies and AI-assisted academic literature tools offer opportunities to support these learning processes (Baidoo-Anu & Owusu Ansah, 2023; Kasneci et al., 2023; Lo, 2023). In educational settings, AI applications can facilitate question formulation, conceptual clarification, academic text summarization, information synthesis, comparative analysis, and access to additional learning resources (Crompton & Burke, 2023; Jauhiainen & Garagorry Guerra, 2024; Nurbaeva et al., 2025). ChatGPT can support interactive questioning and conceptual exploration, while Perplexity AI can assist with information discovery and source identification. Scholarcy can facilitate the summarization and organization of academic literature, whereas Scite can provide citation-context information to support the evaluation of scientific publications (Nicholson et al., 2021). Because these applications serve different functions, their integration into instructional activities should align with specific learning objectives and pedagogical requirements. In this study, these technologies were positioned as supplementary tools for strengthening information literacy and facilitating access to academic resources rather than replacing teachers, original scientific publications, or students' independent critical judgment.

Despite their educational potential, AI-assisted learning technologies present several challenges that require careful consideration. AI-generated responses may contain factual inaccuracies, incomplete explanations, misleading interpretations, or fabricated references (Walters & Wilder, 2023). Furthermore, automated summaries may oversimplify complex scientific arguments or omit important contextual information from original publications. Therefore, the effective integration of literature-based AI applications into geography education requires systematic information verification and critical engagement with primary sources. Students should be encouraged to examine cited publications, compare information across credible references, evaluate publication dates and contextual relevance, and justify their acceptance or rejection of AI-generated information. Incorporating these verification practices into instructional activities may strengthen critical information literacy while reducing the risks of excessive technological dependence and superficial engagement with academic materials (Chan & Hu, 2023; Zhai et al., 2024). Accordingly, AI should function as a tool that facilitates deeper investigation and meaningful learning rather than as a substitute for independent reasoning and intellectual participation.

The integration of AI-assisted literature exploration into disaster education is closely associated with two essential learning outcomes: knowledge acquisition and creative thinking skills. Knowledge acquisition involves understanding geographical concepts and information related to natural hazards, disaster risks, mitigation strategies, and adaptation measures. Adequate conceptual knowledge enables students to identify environmental problems, interpret relevant information, and develop evidence-based explanations (Djamarah, 2002). Access to diverse and credible academic resources may further enrich students' understanding by exposing them to multiple perspectives and encouraging connections between theoretical concepts and real-world conditions. Creative thinking is equally important because disaster-related challenges often require context-specific solutions rather than universally applicable responses. For example, effective flood mitigation strategies must consider geographical characteristics, community behavior, drainage infrastructure, land-use patterns, available resources, and institutional capacity. Learning activities that encourage students to generate alternative solutions, compare different approaches, propose original ideas, and develop practical implementation strategies may support creative thinking development (Doshi & Hauser, 2024; Habib et al., 2024; Urban et al., 2024). In this study, creative thinking skills were assessed through four indicators: fluency, flexibility, originality, and elaboration (Setiawan et al., 2024). These indicators provided a framework for examining students' abilities to generate multiple ideas, consider alternative perspectives, formulate original solutions, and develop their ideas into detailed and applicable recommendations.

Considering these educational opportunities and challenges, empirical investigation was needed to examine the integration of disaster-literature-based AI technologies into high school geography instruction. This study was conducted among eleventh-grade students at SMAN 39 Jakarta by comparing an experimental group receiving AI-assisted instruction with a control group receiving conventional instruction without AI support.

The instructional content focused on disaster mitigation and adaptation, emphasizing the application of geographical knowledge to authentic environmental challenges. Rather than evaluating the overall capabilities of AI technologies, the study specifically examined changes in students' knowledge acquisition and creative thinking skills following the instructional intervention. By comparing pretest and posttest results across the two instructional groups, the research sought to provide contextual evidence regarding the potential benefits and limitations of integrating AI-assisted academic literature exploration into geography education.

Previous studies have examined the opportunities and challenges associated with digital learning technologies, information accessibility, and the development of students' creative thinking skills (Harjanti et al., 2025; Jauhiainen & Garagorry Guerra, 2024; Urban et al., 2024). However, limited context-specific empirical evidence has examined whether integrating multiple AI-assisted academic literature tools into disaster geography instruction is associated with different patterns of improvement in both conceptual knowledge and creative thinking compared with conventional teaching approaches. This research gap is particularly relevant because AI-assisted information retrieval may improve learning efficiency and resource accessibility while simultaneously introducing risks related to inaccurate references, excessive technological dependence, and superficial information processing. The urgency of this investigation therefore lies in determining whether AI-supported instructional strategies can contribute to meaningful educational outcomes while maintaining appropriate standards of academic literacy and critical evaluation. The contextual novelty of this study lies in integrating several complementary AI-assisted literature functions into disaster-related geography instruction and examining two learning outcomes within the same six-session instructional period. However, the research did not attempt to isolate or measure the independent effects of individual AI applications.

Based on these considerations, this study aimed to examine changes in students' knowledge acquisition and creative thinking skills following participation in disaster-literature-based AI-assisted geography instruction and compare these changes with those observed among students receiving conventional instruction without AI support. Specifically, the research analyzed pretest and posttest results to evaluate differences in learning outcomes between the experimental and control groups. From a practical perspective, the findings were expected to provide geography teachers with evidence-informed considerations for designing instructional strategies that integrate academic information literacy, responsible AI use, and contextual environmental problem-solving activities. From an academic perspective, the study sought to contribute empirical evidence regarding the integration of AI technologies into secondary geography education, particularly in relation to disaster knowledge and creative thinking development. Furthermore, the findings were intended to inform future investigations employing larger and more diverse samples, validated assessment instruments, and more rigorous experimental and statistical approaches to examine the effectiveness and sustainability of AI-assisted learning interventions.

METHOD

This study employed a quantitative approach with a quasi-experimental pretest–posttest nonequivalent control group design at SMAN 39 Jakarta in May 2025. The study involved 72 eleventh-grade geography students from two intact classes, with 36 students in each group. Class XI Geography 2 served as the experimental group and received artificial intelligence (AI)-assisted instruction supported by disaster-related academic literature, while Class XI Geography 1 served as the control group and received conventional instruction without AI assistance. Participants were selected based on existing classroom groupings without individual random assignment. Both groups studied disaster mitigation and adaptation over six instructional sessions, each lasting 90 minutes.

The experimental group utilized AI-powered platforms, including ChatGPT, Perplexity AI, Scholarcy, and Scite, to explore academic literature, clarify geographical concepts, evaluate disaster-related information, and generate alternative solutions to environmental problems. The control group received conventional instruction covering the same learning materials. Data were collected using a 15-item multiple-choice test to assess students' disaster-related knowledge and an essay-based assessment to evaluate creative thinking skills across four indicators: fluency, flexibility, originality, and elaboration. Both instruments were administered before and after the instructional intervention. Instrument validity and reliability assessments were reported in the original study, although detailed coefficients were not provided. The study also reported normality test significance values of 0.264, 0.288, 0.053, and 0.114, along with homogeneity test significance values of 0.102 and 0.112.

Data were analyzed using descriptive and inferential statistical procedures. Descriptive analysis included calculating pretest and posttest mean scores and percentage changes to compare knowledge acquisition and creative thinking development between the experimental and control groups. Normality and homogeneity tests were conducted to assess the assumptions underlying parametric statistical analysis. An independent-samples t-test was also reported to examine differences between the instructional groups. However, the reported significance value of 0.00 was insufficiently detailed, as the corresponding t-statistics, degrees of freedom, exact p-values, confidence intervals, and effect sizes were not fully documented. Consequently, the findings were interpreted primarily in terms of observed differences in learning outcomes between the two groups, while acknowledging the limitations associated with nonrandom group assignment and incomplete inferential statistical reporting.

RESULTS AND DISCUSSION

Overview of research implementation

The implementation of the research centered on learning Geography of the Disaster Mitigation and Adaptation material. Both groups received the same material over the course of six meetings. The main difference lies in the support of learning resources: the experimental class integrates literature-based AI, while the control class follows learning without AI support. The design allows observation of the changes in scores that take place

in two different learning environments. Data is collected through pre- and post-learning measurements so that the results not only describe the final achievements, but also show the group's initial position.

In the experimental group, the use of AI provided students with an additional way to search for information and ask for explanations of the concepts learned. The activity was relevant to disaster material because the problems discussed had many aspects, including hazard characteristics, causative factors, risks, mitigation, adaptation, and preparedness. In the control group, learning took place without AI integration. It should be emphasized that this comparison does not mean that the control class did not learn at all or did not improve; the control class also showed an increase in scores on both variables.

Knowledge Outcomes

On the pre-test of the knowledge variable, the experimental class obtained an average of 51.22, with a high score of 73 and a low of 33. A median of 53 and a mode of 53 indicate that scores that were around the score were quite prominent in the distribution. The reported standard deviation of 10.06 indicated a variation in initial ability among students. Meanwhile, the control class had a pre-test average of 49.00, a high score of 67, a low score of 27, a median of 50, and a mode of 53. The standard deviation of the control class was reported to be 11.08. Descriptively, the initial average of the two classes was close to each other, although the average proximity did not in itself prove that all the characteristics of the two groups were equivalent.

After learning, the average knowledge of the experimental class increased to 77.31. The highest reported score was 87 and the lowest score was 67; median 80 and mode 87. The standard deviation was reported as 7.60 in the description of the results, while the thesis table contained the number of variances that needed to be rematched with the analysis output. Compared to the initial average of 51.22, the final average showed a large improvement. The thesis reported an increase of 50.98 percent.

In the control class, the average knowledge increased from 49.00 to 61.94. In the post-test, the highest score was reported to be 80, the lowest score was 40, the median was 67, and the mode was 67. The standard deviation of 11.79 indicated a wider distribution of values than the experimental class at the post-test, as reported in the thesis. The percentage increase in knowledge of the control class was recorded at 26.41 percent. Thus, the average increase in the experimental class was greater than the increase in the control class.

Table 1 summarizes the mean scores and percentage increases as reported in the thesis. This comparison is descriptive and needs to be distinguished from statistical conclusions regarding differences between groups.

Table 1. Average knowledge score before and after learning

Groups	Pre-test	Post-test	Improvement
Experiments	51,22	77,31	50,98%
Controls	49,00	61,94	26,41%

Source: Research data and tables reported in the original manuscript.

The difference in scores shows that after the study, the experimental class achieved a higher average of knowledge than the control class. However, a strong interpretation needs to consider the initial score, the method of calculating the percentage of improvement, and the results of the complete differential test. This article retains the descriptive figures of the thesis and marks the need for a re-examination of the inferential statistical report prior to publication.

Results of Creative Thinking Ability

In the creative thinking variable, the average pre-test of the experimental class was reported to be 55.64. The highest score was 68 and the lowest score was 46, with a median of 53 and mode of 50. The standard deviation was reported to be 6.25. In the control class, the initial average was 55.00, the highest score was 68, the lowest score was 46, the median was 53, and the mode was 53. The standard deviation of the control class was also reported as 6.25. The initial average score of the two groups was relatively close together, so that both started learning with similar creative thinking outcomes descriptively.

After learning, the average creative thinking of the experimental class increased to 84.00. The highest reported score was 98 and the lowest score was 73, with a median of 83.5 and a mode of 78. A standard deviation of 7.79 indicates that student scores still vary, although the class average increased. The thesis reported an increase in the creative thinking ability of the experimental class by 52.73 percent. This figure shows a considerable descriptive change between the initial and final measurements.

In the control class, the mean creative thinking increased from 55.00 to 73.00. The highest post-test score was reported to be 79 and the lowest score was 63, median was 75, and the mode was 78. The standard deviation was reported to be about 5.25 in the table, while the text description called 5.33; this small difference needed to be matched with the original data before the article was submitted. The improvement in the creative thinking ability of the control class was reported by 33 percent. These results showed that learning without AI was also followed by progress, but the average reported improvement was smaller than that of the experimental class.

Table 2. Average creative thinking score before and after learning

Groups	Pre-test	Post-test	Improvement
Experiments	55,64	84,00	52,73%
Controls	55,00	73,00	33,00%

Source: Research data and tables reported in the original manuscript.

The table shows that the experimental class experienced a larger average increase in creative thinking ability. However, the aggregate scores are not sufficient to determine which indicators improved the most. To explain the patterns of change in fluency, flexibility, originality, and elaboration in more detail, it is necessary to have a score table per indicator or student essay response data analyzed with rubrics. Because the information per indicator is not fully reported in the summary of available results, this article does not make a claim that any of the specific indicators experienced the highest improvement.

Prerequisite Tests and Inferential Analysis

The significance value of the normality test was above 0.05 for all groups and measurement times. The values presented were 0.264 and 0.288 in the experimental class and 0.053 and 0.114 in the control class. Based on the criteria used, the results showed that the data met the assumption of normality. The homogeneity test also produced a significance value of 0.102 for knowledge and 0.112 for creative thinking. Both values were greater than 0.05, so the variance was declared homogeneous in the research report.

For hypothesis testing, the thesis mentions the use of independent-samples t-tests. However, the available results table summarizes the significance as "0.00" and does not provide complete separate reporting for each variable. In scientific reporting, such a value should not be written as $p = 0.00$ because the probability is not reported as absolute zero; the software output needs to be checked to write down the p value with the correct accuracy, e.g. $p < 0.001$ if that is indeed the original output. In addition, the researcher needs to make sure the test is performed answering the research question: whether it is comparing post-test scores between groups, changes in scores within groups, or differences in changes between groups.

Thus, the main results that can be safely delivered at this stage are the average increase in both groups and a larger descriptive increase in the experimental group. Statements about the significance of the difference and the magnitude of the effect should await examination of the original statistical outputs. The test should report the t-value, degree of freedom, the exact p-value, the mean difference and confidence interval, and the effect size. If the pre-test score between groups differs or there are relevant initial factors, additional analyses such as change score comparisons or covariance analyses may be considered according to the feasibility of the data and the study design.

Research Limitations

This study has several limitations, namely the monitoring of the active involvement of all students during exploration using Artificial Intelligence (AI), especially students who tend to be passive. In addition, differences in experience and technology literacy levels between students in using AI platforms have the potential to affect the effectiveness of learning. This study was also only carried out in one school with a limited number of samples, so the generalization of results needs to be done carefully. Therefore, further research is recommended to involve a more diverse population and school context and pay attention to the readiness and involvement of students in the use of AI.

CONCLUSION

Among eleventh-grade students studying disaster-related geography at SMAN 39 Jakarta, the experimental group receiving artificial intelligence (AI)-assisted instruction demonstrated greater improvements in knowledge acquisition and creative thinking skills than the control group receiving conventional instruction. The experimental group's mean knowledge score increased from 51.22 on the pretest to 77.31 on the posttest, whereas the control group's mean score increased from 49.00 to 61.94. Similarly, the experimental group's mean creative thinking score increased from 55.64 to 84.00, compared with an

increase from 55.00 to 73.00 in the control group. These descriptive findings indicated that students receiving disaster-literature-based AI-assisted instruction achieved greater gains in both learning outcomes. The results suggest that guided exploration of academic literature using AI technologies may support students' conceptual understanding, information processing, and creative problem-solving abilities in disaster geography education. Nevertheless, the available inferential statistical results were insufficiently detailed to establish the statistical significance of the between-group differences or attribute the observed improvements exclusively to AI-assisted instruction. Therefore, the findings should be interpreted as preliminary evidence of the potential educational benefits of integrating AI-supported literature exploration into geography learning rather than definitive evidence of a causal treatment effect.

Future research should prioritize comprehensive assessments of instrument validity and reliability, verification of descriptive statistical consistency, and transparent reporting of inferential statistical results, including exact p-values, confidence intervals, and effect sizes. Further investigations involving larger samples, multiple educational institutions, and extended instructional periods are recommended to evaluate the consistency, generalizability, and long-term sustainability of improvements in students' knowledge acquisition and creative thinking skills. Longitudinal and more rigorously controlled experimental studies could also provide stronger evidence regarding the specific contribution of AI-assisted learning to educational outcomes. From a practical perspective, geography teachers are encouraged to integrate AI-powered academic literature tools into disaster education through structured, supervised learning activities that emphasize source verification, critical comparison with original scientific publications, and independent formulation of disaster mitigation and adaptation strategies. AI technologies should be positioned as supplementary instructional resources that facilitate information exploration and creative inquiry rather than substitutes for critical reading, independent reasoning, or professional instructional judgment. This approach may support responsible technology integration while strengthening students' geographic literacy, disaster preparedness knowledge, and higher-order thinking competencies.

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CONFLICT OF INTEREST

The author states that this research was conducted without any commercial or financial relationship that can be interpreted as a potential conflict of interest.

AUTHOR'S CONTRIBUTION

The author fully contributes to the formulation of the main idea idea, collects library data, analyzes and interprets the primary text of the figure, and prepares the manuscript. All authors have agreed on the final version of the manuscript.

GENERATIVE ARTIFICIAL INTELLIGENCE USAGE STATEMENT

The author states that generative artificial intelligence (AI) was used in the preparation of this manuscript. The author acknowledges the use of generative AI to help improve language clarity and improve the grammatical structure of the manuscript. The use is done in compliance with the applicable ethical guidelines regarding the use and disclosure of generative AI in scientific research. Each author has made substantial intellectual contributions to this work. The entire manuscript content has been carefully reviewed to ensure its accuracy, and the author is solely responsible for the integrity and final content of the manuscript.

REFERENCES

Baidoo-Anu, D., & Owusu Ansah, L. (2023). Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning. *Journal of AI, 7*(1), 52–62. https://doi.org/10.61969/jai.1337500

Chan, C. K. Y., & Hu, W. (2023). Students' voices on generative AI: Perceptions, benefits, and challenges in higher education. *International Journal of Educational Technology in Higher Education, 20*, Article 43. https://doi.org/10.1186/s41239-023-00411-8

Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education: The state of the field. *International Journal of Educational Technology in Higher Education, 20*, Article 22. https://doi.org/10.1186/s41239-023-00392-8

Djamarah, S. B. (2002). *Psikologi belajar*. Rineka Cipta.

Doshi, A. R., & Hauser, O. P. (2024). Generative AI enhances individual creativity but reduces the collective diversity of novel content. *Science Advances, 10*(28), Article eadn5290. https://doi.org/10.1126/sciadv.adn5290

Habib, S., Vogel, T., Anli, X., & Thorne, E. (2024). How does generative artificial intelligence impact student creativity? *Journal of Creativity, 34*(1), Article 100072. https://doi.org/10.1016/j.yjoc.2023.100072

Harjanti, F. D., Suhartono, Ardiansyah, R., & Suryandari, S. (2025). The effectiveness of artificial intelligence in enhancing critical and creative thinking within the Pancasila Student Profile framework. *EDUKASIA: Jurnal Pendidikan dan Pembelajaran, 6*(2), 1175–1186. https://doi.org/10.62775/edukasia.v6i2.1741

Jauhiainen, J. S., & Garagorry Guerra, A. (2024). Generative AI and education: Dynamic personalization of pupils' school learning material with ChatGPT. *Frontiers in Education, 9*, Article 1288723. https://doi.org/10.3389/feduc.2024.1288723

Kasneci, E., Seßler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günnemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., . . . Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences, 103*, Article 102274. https://doi.org/10.1016/j.lindif.2023.102274

Kitagawa, K. (2021). Conceptualising 'disaster education'. *Education Sciences, 11*(5), Article 233. https://doi.org/10.3390/educsci11050233

Lo, C. K. (2023). What is the impact of ChatGPT on education? A rapid review of the literature. *Education Sciences, 13*(4), Article 410. https://doi.org/10.3390/educsci13040410

Logayah, D. S., Ruhimat, M., Maryani, E., & Arrasyid, R. (2024). Earthquake disaster literacy learning model in geography and social sciences subjects in junior high school. *E3S Web of Conferences, 600*, Article 02012. https://doi.org/10.1051/e3sconf/202460002012

Ng, D. T. K., Leung, J. K. L., Chu, S. K. W., & Qiao, M. S. (2021). Conceptualizing AI literacy: An exploratory review. *Computers and Education: Artificial Intelligence, 2*, Article 100041. https://doi.org/10.1016/j.caeai.2021.100041

Nicholson, J. M., Mordaunt, M., Lopez, P., Uppala, A., Rosati, D., Rodrigues, N. P., Grabitz, P., & Rife, S. C. (2021). scite: A smart citation index that displays the context of citations and classifies their intent using deep learning. *Quantitative Science Studies, 2*(3), 882–898. https://doi.org/10.1162/qss_a_00146

Nurbaeva, A., Utebayev, N., Mukhanbetkali, A., Zakirova, S., & Bozhbanova, M. (2025). Organization of interdisciplinary integration in geography lessons using ChatGPT and digital technologies in shaping students' environmental culture. *International Journal of Innovative Research and Scientific Studies, 8*(6), 990–1001.

Rumengan, M. E., Leuwol, F. S., & Tetelepta, E. G. (2025). Enhancing disaster mitigation understanding through the design of a learning module at SMA Negeri 3 Ambon. *GEOFORUM, 4*(1), 36–42. https://doi.org/10.30598/geoforumvol4iss1pp36-42

Setiawan, F. A., Rahman, A. M., Triana, S., & Jayanti, M. A. (2024). Dominant indicator of creative thinking: The case of geography learning outcomes. *Jurnal Iqra': Kajian Ilmu Pendidikan, 9*(1). https://doi.org/10.25217/ji.v9i1.4376

Shaw, R., Sakurai, A., & Oikawa, Y. (2021). New realization of disaster risk reduction education in the context of a global pandemic: Lessons from Japan. *International Journal of Disaster Risk Science, 12*(4), 568–580. https://doi.org/10.1007/s13753-021-00337-7

Urban, M., Děchtěrenko, F., Lukavský, J., Hrabalová, V., Švácha, F., Brom, C., & Urban, K. (2024). ChatGPT improves creative problem-solving performance in university students: An experimental study. *Computers & Education, 215*, Article 105031. https://doi.org/10.1016/j.compedu.2024.105031

Walters, W. H., & Wilder, E. I. (2023). Fabrication and errors in the bibliographic citations generated by ChatGPT. *Scientific Reports, 13*, Article 14045. https://doi.org/10.1038/s41598-023-41032-5

Zhai, C., Wibowo, S., & Li, L. D. (2024). The effects of over-reliance on AI dialogue systems on students' cognitive abilities: A systematic review. *Smart Learning Environments, 11*, Article 28. https://doi.org/10.1186/s40561-024-00316-7