



Advantages and Disadvantages of Chatgpt in Science Learning: A Systematic Literature Review

Ahmad Maulid Asmiddin¹, Pradicta Nurhuda², Ruth Megawati^{3*}

¹ Universitas Dayanu Ikhsanuddin, Baubau, Indonesia

² Badan Riset dan Inovasi Nasional, Jakarta, Indonesia

³ Biology Education Study Program, Universitas Cenderawasih, Jaya Pura, Indonesia

Received: October 14, 2023

Revised: November 8, 2023

Accepted: December 20, 2023

Published: December 31, 2023

Corresponding Author:

Ruth Megawati

ruthmegawati@yahoo.com

DOI: [10.29303/jppipa.v9i12.6576](https://doi.org/10.29303/jppipa.v9i12.6576)

© 2023 The Authors. This open access article is distributed under a (CC-BY License)



Abstract: Currently many forms of sophisticated technology are used by many people. This course cannot be separated from the existence of artificial intelligence. One form of sophisticated technology is Chat GPT which was developed by Open AI. Science as a collection of knowledge is the result of human scientific creative activity. The results of scientific creative activities will produce knowledge in the form of facts, concepts, principles, laws, and theories. Science is a human activity characterized by thought processes that take place in the human mind. With developing technology, one of which is Chat GPT, it will make the current science learning process easier. The research aims to examine the advantages and disadvantages of Chatgpt in Science Learning: Systematic Literature Review. The review was conducted based on state-of-the-art methods using the preferred reporting items for reviews and meta-analyses (PRISMA) guidelines. The results of this research explain that. GPT chat has several uses, advantages, and disadvantages in science learning. For this reason, GPT chat must be used as wisely as possible, so that there are no mistakes in its application in science learning or other learning.

Keywords: Advantages and Disadvantages of gpt chat; Chatgpt; Science Learning

Introduction

Science is a way or method of studying the natural environment and how to uncover the mysteries within it systematically so that science is not just mastering a collection of knowledge in the form of facts, and concepts, but a process of discovery (Miedema, 2022). The way science observes the world is analytical, complete, and careful, and connects one natural phenomenon with other phenomena to form a new perspective on the object being observed. The mental activities of scientists encourage curiosity, imagination, and strong reasoning in trying to describe and explain natural phenomena (Ernst & Burcak, 2019).

Natural Science as a way of thinking is a human activity characterized by thought processes that take place in the minds of people involved in that field. Science Education (IPA) is related to how to find out about natural phenomena systematically, where science is not just mastery of a collection of knowledge in the

form of facts, concepts, or principles but is also a process of discovery (inquiry) (Suwono et al., 2017). Science learning is a part of education that generally has an important role in improving the quality of education, especially in producing quality students who can think critically, creatively, and logically and take the initiative in responding to issues in society caused by the impact of scientific developments.

Developments in natural science (science) learning seek to increase students' interest in developing knowledge, skills, and abilities to think about nature, which is full of endless secrets (Shana & Abulibdeh, 2020). Science learning is a combination of various fields of scientific study, namely physics, chemistry, and biology (Wong et al., 2023). Therefore, in its implementation, it is no longer separate but becomes a unified whole (Alhashem & Agha, 2020). Through science learning, students can gain direct experience, so that they can increase their strength to accept, retain, and apply the concepts they have learned (Loeng, 2020).

How to Cite:

Asmiddin, A. M., Nurhuda, P., & Megawati, R. (2023). Advantages and Disadvantages of Chatgpt in Science Learning: A Systematic Literature Review. *Jurnal Penelitian Pendidikan IPA*, 9(12), 1335–1341. <https://doi.org/10.29303/jppipa.v9i12.6576>

Natural Science is essentially: a way or way of thinking; a way of investigating (a way of investigating); a collection of knowledge (a body of knowledge), and science and its interactions with technology and society (Darling-Hammond et al., 2020).

The mental activities of scientists provide a picture of beliefs, curiosity, imagination, consideration, cause-and-effect relationships, self-testing, doubt, objective, and open (Hadzigeorgiou & Schulz, 2019). Natural Science as a way of investigating, provides many steps in compiling knowledge. Commonly used investigative activities are observing, collecting data, developing hypotheses, conducting experiments, and making conclusions (Pedaste et al., 2015). The progress and development of artificial intelligence (AI) is rapidly and significantly forming a new habit, society is currently using AI to simplify daily human activities, one of which is also used in science learning (Seo et al., 2021). Learning that has previously been considered difficult has resulted in the emergence of technology that can help implement science learning (Kelly et al., 2023). As a sophisticated chatbot, ChatGPT can fulfill text-based user requests, such as answering simple questions in science learning and completing assignments.

This technology is developing rapidly, and the presence of technology in human life can make people's daily work easier. One of the technologies currently being developed is conversational ChatGPT technology which has the function of helping humans search for information and create writing quickly. ChatGPT was released on November 30, 2022 (Roumeliotis & Tselikas, 2023); (Adetayo, 2023). ChatGPT was founded by Open AI, the Open AI laboratory is making rapid progress in developing AI technology and has created several machine learning products for the general public, such as DALL-E and ChatGPT. Generative Pre-Trained Transformer (GPT) is an artificial intelligence developed by Open AI that can produce a response text that is almost indistinguishable from humans. Chatgpt in Science Learning currently needs to be discussed.

Previous research has been conducted on the Impact of the Implementation of ChatGPT in Education: A Systematic Review (Montenegro-Rueda et al., 2023); ChatGPT in education: global reactions to AI innovations (Fütterer et al., 2023), but no research examines the Advantages and Disadvantages of Chatgpt

in Science Learning: Systematic Literature Review. With the aim of Based on the above background, this research aims to examine the Advantages and Disadvantages of Chatgpt in Science Learning: Systematic Literature Review. To study for the Advantages and Disadvantages of Chatgpt in Science Learning: Systematic Literature Review.

Method

We conducted this study as a systematic review following PRISMA guidelines (Page et al., 2021). The PRISMA guidelines provide several things to consider in preparing a systematic review (Figure 1). In this study, we will mainly focus on several main items: the usefulness of ChatGPT, and the advantages and disadvantages of ChatGPT in science learning. This helps form the basis of our assessment. Initially, we collected the latest studies on the role of GPT Chat in writing scientific articles, based on some selected keywords. Then, we apply eligibility criteria to the collection. We selected only literature published in 2015 or later to provide an overview of current trends. Apart from that, we limited the type of literature to only literature in the form of journals and proceedings.

Result and Discussion

Preferred Reporting Items for Systematic Reviews (PRISMA) was the reporting technique used in this study. The research was conducted methodically during the required research phases. The information provided is comprehensive and unbiased and aims to combine relevant research results. The steps of a systematic literature review include developing research questions, literature searches, screening and selecting relevant articles, screening and selecting the best research results, analysis, synthesis of qualitative results, and preparation of research reports. Writing the background and objectives of the research, collecting research questions, searching the literature, selecting articles, extracting articles, assessing the quality of basic studies, and summarizing the material are steps in the systematic literature review research process.

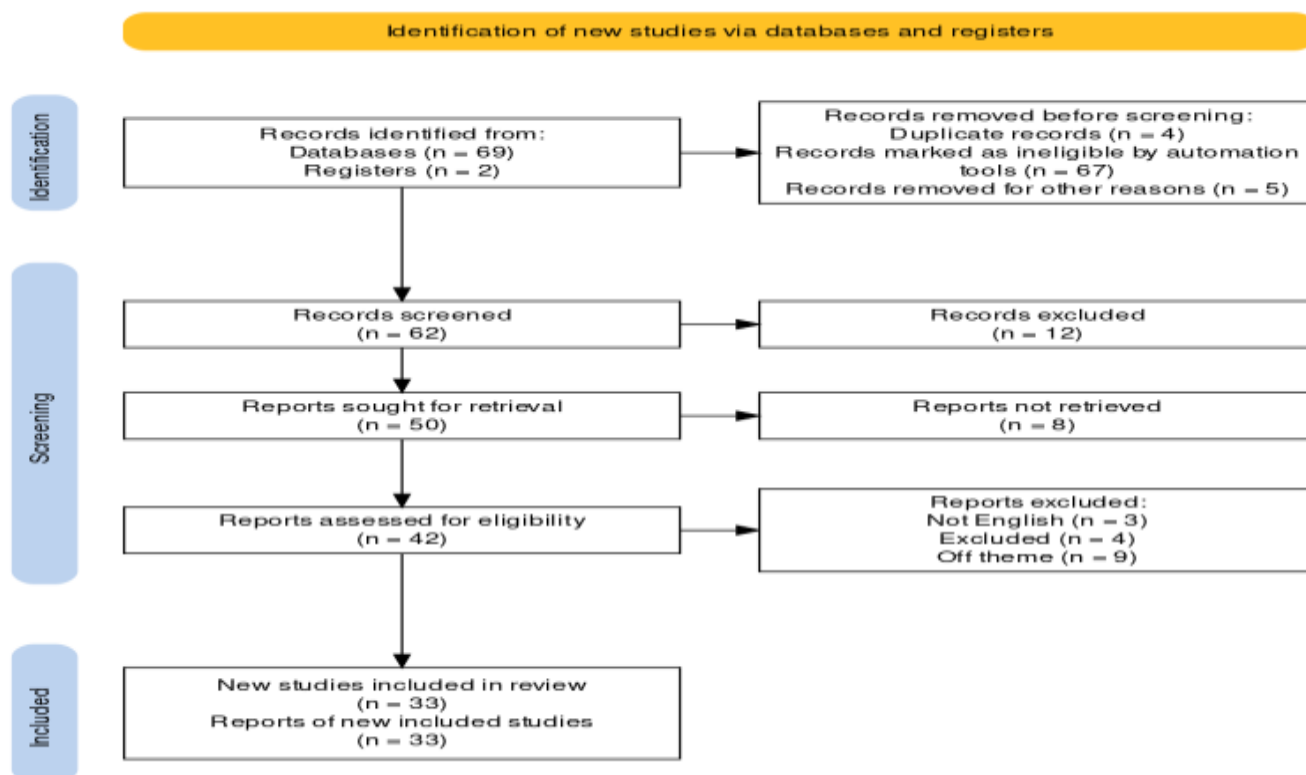


Figure 1. Flow of the literature search process based on PRISMA guidelines.

The complete article was published in an international journal in 2015-2023, indexed in a database, and has the theme Advantages and Disadvantages of

Chatgpt in Science Learning: Systematic Literature Review.

Table 1. Use of ChatGPT in science learning

Source	Uses of ChatGPT
(Agarwal et al., 2023); (Su (苏嘉红) & Yang (杨伟鹏), 2023); (Grassini, 2023); (Adiguzel et al., 2023); (Primastuti & Atun, 2018); (Ginzburg & Barak, 2023)	Answering difficult questions in science learning
(Bašić et al., 2023); (Javaid et al., 2023a)	Work on essays and math assignments
(Yilmaz & Karaoglan Yilmaz, 2023)	Doing coding

Some of the uses of ChatGPT in science learning are as follows: Answering difficult questions: Generally, we will use search engines to find complex information. Now, many people use ChatGPT like a search engine. The difference is, that they can vary the instructions or questions as desired; ChatGPT can also generate essays according to instructions provided by the user; Doing essays and math assignments: Starting from the topic, and number of words, to language style, you can adjust it to your wishes and then this chatbot will produce an essay exactly as written in the instructions. Amazingly, the resulting text tends to sound less robotic and has very low levels of plagiarism.

Apart from essays, some people have also discovered that they can use this AI technology to ask math questions; Doing coding: A use of ChatGPT that you might not have thought of before is being able to do

coding and debugging. You can give instructions to identify what is wrong with a series of JavaScript codes, then this AI will be able to help you find the error. However, programmers strongly do not recommend carrying out the deployment process using code produced by AI due to accuracy and limitation considerations.

In an increasingly sophisticated and connected era, the relationship between humans and technology continues to evolve. Along with these developments, one new innovation that is attracting attention is ChatGPT technology. This technology leverages artificial intelligence to open up opportunities for deeper and more meaningful conversations between humans and machines. Some of the advantages of chatgpt in science learning are Universal Language Capabilities: ChatGPT is capable of producing natural and coherent

text in a variety of topics and languages including those in science learning, enabling extensive interaction with users; Flexibility: ChatGPT has the flexibility to be used in a variety of contexts, including as a virtual assistant, study aid, creative writing, and more in science learning; Creativity Encouragement: Chatgpt is able to produce creative text, which really supports the creative process

of its users in science learning; Speed and are very responsive in science learning: its speed in providing answers and its very responsive nature in science learning; Answers are easy to understand in science learning ; The answers presented use language that is easy to understand.

Table 2. Advantages of Chatgpt in learning science

Source	The advantages of chatgpt in science learning
(Javaid et al., 2023b); (Xiao & Zhi, 2023a); (Cooper, 2023a); (Farrokhnia et al., 2023a)	Universal Language Capabilities
(Gill & Kaur, 2023)	Flexibility
(Dwivedi et al., 2023a)	Creativity Encouragement
(Liang et al., 2023); (Farrokhnia et al., 2023b)	Speed and are very responsive in science learning
(Xiao & Zhi, 2023b; Yilmaz & Karaoglan Yilmaz, 2023); (Zheng, 2023); (Rahman & Watanobe, 2023); (Bitzenbauer, 2023); (Cooper, 2023b); (Anagnostopoulos, 2023); (Mondal et al., 2023); (Ivanov & Soliman, 2023); (AlZaabi et al., 2023)	Answers are easy to understand in science learning

Table 3. Disadvantages of chatgpt in science learning

Source	Disadvantages of chatgpt in science learning
(Dwivedi et al., 2023b); (Yu, 2023);	Input is still done by humans, so the existing answers are only based on that.
(Cotton et al., 2023); (Baskara, 2023)	Limited search for information on GPT Chat and the Limitations of Understanding Deep Context
(Florindo, 2023)	Has no native knowledge
(Floridi & Chiriatti, 2020); (Tlili et al., 2023)	The nature of robots is that some questions are sometimes not as contextual as we would like

The shortcomings of GPT chat in science learning can be seen in several ways, namely limited understanding of in-depth context and limited search for information on GPT chat: Even though it is able to produce text that looks cohesive, ChatGPT sometimes has difficulty understanding more complex contexts, so its responses are not always accurate or precise. ; Has No Real Knowledge: ChatGPT relies only on training data, without having any actual knowledge. If not directed correctly, this can potentially result in incorrect answers; The nature of robots is that some questions are sometimes not as contextual as we would like: The nature of robots is that some questions are sometimes not as contextual as we would like; previous input was still carried out by humans so the answer is only based on that. Cannot fully base the credibility and validity of the answers, The nature of robots is that some questions are sometimes not as contextual as we would like. The result is a very generic answer that doesn't even address what we are looking for or need.

Conclusion

Learning is a communication process between teachers and students. Science learning is a communication process between teachers and students

about science which studies phenomena through a series of processes known as scientific processes which are built based on a scientific attitude and the results are realized as scientific products are composed of the three most important components in the form of concepts, principles, and theories. which applies universally. Science learning at any educational level must be developed by understanding various views about the meaning of science. Technology is needed that can help in science learning, one of which is using GPT chat. Gpt chat can be used in the right way and gpt chat has advantages and disadvantages.

Acknowledgments

Thanks to all parties who have supported the implementation of this research. I hope this research can be useful.

Author Contributions

Conceptualization, R. M., A. M. A., P. N.; methodology, R. M.; validation, A. M. A. and P. N; formal analysis, R. M.; investigation, A. M. A, and P. N.; resources, R. M. and A. M. A; data curation, P. N.: writing – original draft preparation., P. N.; A. M. A. And R. M.; writing – review and editing, P. N.: visualization, R. M and A. M. A. All authors have read and agreed to the published version of the manuscript.

Funding

This research was independently funded by researchers.

Conflicts of Interest

The authors declare no conflict of interest.

References

- Adetayo, A. J. (2023). Artificial intelligence chatbots in academic libraries: The rise of ChatGPT. *Library Hi Tech News*, 40(3), 18–21. <https://doi.org/10.1108/LHTN-01-2023-0007>
- Adiguzel, T., Kaya, M. H., & Cansu, F. K. (2023). Revolutionizing education with AI: Exploring the transformative potential of ChatGPT. *Contemporary Educational Technology*, 15(3), ep429. <https://doi.org/10.30935/cedtech/13152>
- Agarwal, M., Goswami, A., & Sharma, P. (2023). Evaluating ChatGPT-3.5 and Claude-2 in Answering and Explaining Conceptual Medical Physiology Multiple-Choice Questions. *Cureus*. <https://doi.org/10.7759/cureus.46222>
- Alhashem, F., & Agha, N. (2020). Analysis Based on the Three Objective Educational Domains for Final Summative Secondary Examinations of Science Subject (Chemistry, Physics, and Biology). *Education Research International*, 2020, 1–12. <https://doi.org/10.1155/2020/8886126>
- AlZaabi, A., ALAmri, A., Albalushi, H., Aljabri, R., & AalAbdulsalam, A. (2023). *ChatGPT applications in Academic Research: A Review of Benefits, Concerns, and Recommendations* [Preprint]. Scientific Communication and Education. <https://doi.org/10.1101/2023.08.17.553688>
- Anagnostopoulos, C.-N. (2023). ChatGPT impacts in programming education: A recent literature overview that debates ChatGPT responses. *F1000Research*, 12, 1393. <https://doi.org/10.12688/f1000research.141958.1>
- Bašić, Ž., Banovac, A., Kružić, I., & Jerković, I. (2023). ChatGPT-3.5 as writing assistance in students' essays. *Humanities and Social Sciences Communications*, 10(1), 750. <https://doi.org/10.1057/s41599-023-02269-7>
- Baskara, Fx. R. (2023). The Promises and Pitfalls of Using Chat GPT for Self-Determined Learning in Higher Education: An Argumentative Review. *Prosiding Seminar Nasional Fakultas Tarbiyah Dan Ilmu Keguruan IAIM Sinjai*, 2, 95–101. <https://doi.org/10.47435/sentikjar.v2i0.1825>
- Bitzenbauer, P. (2023). ChatGPT in physics education: A pilot study on easy-to-implement activities. *Contemporary Educational Technology*, 15(3), ep430. <https://doi.org/10.30935/cedtech/13176>
- Cooper, G. (2023a). Examining Science Education in ChatGPT: An Exploratory Study of Generative Artificial Intelligence. *Journal of Science Education and Technology*, 32(3), 444–452. <https://doi.org/10.1007/s10956-023-10039-y>
- Cooper, G. (2023b). Examining Science Education in ChatGPT: An Exploratory Study of Generative Artificial Intelligence. *Journal of Science Education and Technology*, 32(3), 444–452. <https://doi.org/10.1007/s10956-023-10039-y>
- Cotton, D. R. E., Cotton, P. A., & Shipway, J. R. (2023). Chatting and cheating: Ensuring academic integrity in the era of ChatGPT. *Innovations in Education and Teaching International*, 1–12. <https://doi.org/10.1080/14703297.2023.2190148>
- Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020). Implications for educational practice of the science of learning and development. *Applied Developmental Science*, 24(2), 97–140. <https://doi.org/10.1080/10888691.2018.1537791>
- Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., Baabdullah, A. M., Koochang, A., Raghavan, V., Ahuja, M., Albanna, H., Albashrawi, M. A., Al-Busaidi, A. S., Balakrishnan, J., Barlette, Y., Basu, S., Bose, I., Brooks, L., Buhalis, D., ... Wright, R. (2023a). Opinion Paper: “So what if ChatGPT wrote it?” Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. *International Journal of Information Management*, 71, 102642. <https://doi.org/10.1016/j.ijinfomgt.2023.102642>
- Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., Baabdullah, A. M., Koochang, A., Raghavan, V., Ahuja, M., Albanna, H., Albashrawi, M. A., Al-Busaidi, A. S., Balakrishnan, J., Barlette, Y., Basu, S., Bose, I., Brooks, L., Buhalis, D., ... Wright, R. (2023b). Opinion Paper: “So what if ChatGPT wrote it?” Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. *International Journal of Information Management*, 71, 102642. <https://doi.org/10.1016/j.ijinfomgt.2023.102642>
- Ernst, J., & Burcak, F. (2019). Young Children's Contributions to Sustainability: The Influence of Nature Play on Curiosity, Executive Function Skills, Creative Thinking, and Resilience. *Sustainability*, 11(15), 4212. <https://doi.org/10.3390/su11154212>
- Farrokhnia, M., Banihashem, S. K., Noroozi, O., & Wals, A. (2023a). A SWOT analysis of ChatGPT: Implications for educational practice and research. *Innovations in Education and Teaching International*,

- 1-15.
<https://doi.org/10.1080/14703297.2023.2195846>
- Farrokhnia, M., Banihashem, S. K., Noroozi, O., & Wals, A. (2023b). A SWOT analysis of ChatGPT: Implications for educational practice and research. *Innovations in Education and Teaching International*, 1-15.
<https://doi.org/10.1080/14703297.2023.2195846>
- Floridi, L., & Chiriatti, M. (2020). GPT-3: Its Nature, Scope, Limits, and Consequences. *Minds and Machines*, 30(4), 681-694.
<https://doi.org/10.1007/s11023-020-09548-1>
- Florindo, F. (2023). ChatGPT: A Threat or an Opportunity for Scientists? *Perspectives of Earth and Space Scientists*, 4(1), e2023CN000212.
<https://doi.org/10.1029/2023CN000212>
- Fütterer, T., Fischer, C., Alekseeva, A., Chen, X., Tate, T., Warschauer, M., & Gerjets, P. (2023). ChatGPT in education: Global reactions to AI innovations. *Scientific Reports*, 13(1), 15310.
<https://doi.org/10.1038/s41598-023-42227-6>
- Gill, S. S., & Kaur, R. (2023). ChatGPT: Vision and challenges. *Internet of Things and Cyber-Physical Systems*, 3, 262-271.
<https://doi.org/10.1016/j.iotcps.2023.05.004>
- Ginzburg, T., & Barak, M. (2023). Technology-Enhanced Learning and Its Association with Motivation to Learn Science from a Cross-Cultural Perspective. *Journal of Science Education and Technology*, 32(4), 597-606. <https://doi.org/10.1007/s10956-023-10048-x>
- Grassini, S. (2023). Shaping the Future of Education: Exploring the Potential and Consequences of AI and ChatGPT in Educational Settings. *Education Sciences*, 13(7), 692.
<https://doi.org/10.3390/educsci13070692>
- Hadzigeorgiou, Y., & Schulz, R. M. (2019). Engaging Students in Science: The Potential Role of "Narrative Thinking" and "Romantic Understanding." *Frontiers in Education*, 4, 38.
<https://doi.org/10.3389/feduc.2019.00038>
- Ivanov, S., & Soliman, M. (2023). Game of algorithms: ChatGPT implications for the future of tourism education and research. *Journal of Tourism Futures*, 9(2), 214-221. <https://doi.org/10.1108/JTF-02-2023-0038>
- Javaid, M., Haleem, A., Singh, R. P., Khan, S., & Khan, I. H. (2023a). Unlocking the opportunities through ChatGPT Tool towards ameliorating the education system. *BenchCouncil Transactions on Benchmarks, Standards and Evaluations*, 3(2), 100115.
<https://doi.org/10.1016/j.tbench.2023.100115>
- Javaid, M., Haleem, A., Singh, R. P., Khan, S., & Khan, I. H. (2023b). Unlocking the opportunities through ChatGPT Tool towards ameliorating the education system. *BenchCouncil Transactions on Benchmarks, Standards and Evaluations*, 3(2), 100115.
<https://doi.org/10.1016/j.tbench.2023.100115>
- Kelly, S., Kaye, S.-A., & Oviedo-Trespalacios, O. (2023). What factors contribute to the acceptance of artificial intelligence? A systematic review. *Telematics and Informatics*, 77, 101925.
<https://doi.org/10.1016/j.tele.2022.101925>
- Liang, Y., Zou, D., Xie, H., & Wang, F. L. (2023). Exploring the potential of using ChatGPT in physics education. *Smart Learning Environments*, 10(1), 52. <https://doi.org/10.1186/s40561-023-00273-7>
- Loeng, S. (2020). Self-Directed Learning: A Core Concept in Adult Education. *Education Research International*, 2020, 1-12. <https://doi.org/10.1155/2020/3816132>
- Miedema, F. (2022). Images of Science: A Reality Check. In F. Miedema, *Open Science: The Very Idea* (pp. 15-65). Springer Netherlands.
https://doi.org/10.1007/978-94-024-2115-6_2
- Mondal, H., Marndi, G., Behera, J. K., & Mondal, S. (2023). ChatGPT for Teachers: Practical Examples for Utilizing Artificial Intelligence for Educational Purposes. *Indian Journal of Vascular and Endovascular Surgery*, 10(3), 200-205.
https://doi.org/10.4103/ijves.ijves_37_23
- Montenegro-Rueda, M., Fernández-Cerero, J., Fernández-Batanero, J. M., & López-Meneses, E. (2023). Impact of the Implementation of ChatGPT in Education: A Systematic Review. *Computers*, 12(8), 153. <https://doi.org/10.3390/computers12080153>
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., ... Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *Systematic Reviews*, 10(1), 89.
<https://doi.org/10.1186/s13643-021-01626-4>
- Pedaste, M., Mäeots, M., Siiman, L. A., De Jong, T., Van Riesen, S. A. N., Kamp, E. T., Manoli, C. C., Zacharia, Z. C., & Tsourlidaki, E. (2015). Phases of inquiry-based learning: Definitions and the inquiry cycle. *Educational Research Review*, 14, 47-61.
<https://doi.org/10.1016/j.edurev.2015.02.003>
- Primastuti, M., & Atun, S. (2018). Science Technology Society (STS) learning approach: An effort to improve students' learning outcomes. *Journal of Physics: Conference Series*, 1097, 012062.
<https://doi.org/10.1088/1742-6596/1097/1/012062>

- Rahman, Md. M., & Watanobe, Y. (2023). ChatGPT for Education and Research: Opportunities, Threats, and Strategies. *Applied Sciences*, 13(9), 5783. <https://doi.org/10.3390/app13095783>
- Roumeliotis, K. I., & Tselikas, N. D. (2023). ChatGPT and Open-AI Models: A Preliminary Review. *Future Internet*, 15(6), 192. <https://doi.org/10.3390/fi15060192>
- Seo, K., Tang, J., Roll, I., Fels, S., & Yoon, D. (2021). The impact of artificial intelligence on learner-instructor interaction in online learning. *International Journal of Educational Technology in Higher Education*, 18(1), 54. <https://doi.org/10.1186/s41239-021-00292-9>
- Shana, Z., & Abulibdeh, E. S. (2020). Science practical work and its impact on students' science achievement. *Journal of Technology and Science Education*, 10(2), 199. <https://doi.org/10.3926/jotse.888>
- Su (苏嘉红), J., & Yang (杨伟鹏), W. (2023). Unlocking the Power of ChatGPT: A Framework for Applying Generative AI in Education. *ECNU Review of Education*, 6(3), 355-366. <https://doi.org/10.1177/20965311231168423>
- Suwono, H., Mahmudah, A., & Maulidiah, L. (2017). Scientific Literacy Of A Third Year Biology Student Teachers: Exploration Study. *KnE Social Sciences*, 1(3), 269. <https://doi.org/10.18502/kss.v1i3.747>
- Tlili, A., Shehata, B., Adarkwah, M. A., Bozkurt, A., Hickey, D. T., Huang, R., & Agyemang, B. (2023). What if the devil is my guardian angel: ChatGPT as a case study of using chatbots in education. *Smart Learning Environments*, 10(1), 15. <https://doi.org/10.1186/s40561-023-00237-x>
- Wong, B., Chiu, Y.-L. T., Murray, Ó. M., Horsburgh, J., & Copsey-Blake, M. (2023). 'Biology is easy, physics is hard': Student perceptions of the ideal and the typical student across STEM higher education. *International Studies in Sociology of Education*, 32(1), 118-139. <https://doi.org/10.1080/09620214.2022.2122532>
- Xiao, Y., & Zhi, Y. (2023a). An Exploratory Study of EFL Learners' Use of ChatGPT for Language Learning Tasks: Experience and Perceptions. *Languages*, 8(3), 212. <https://doi.org/10.3390/languages8030212>
- Xiao, Y., & Zhi, Y. (2023b). An Exploratory Study of EFL Learners' Use of ChatGPT for Language Learning Tasks: Experience and Perceptions. *Languages*, 8(3), 212. <https://doi.org/10.3390/languages8030212>
- Yilmaz, R., & Karaoglan Yilmaz, F. G. (2023). Augmented intelligence in programming learning: Examining student views on the use of ChatGPT for programming learning. *Computers in Human Behavior: Artificial Humans*, 1(2), 100005. <https://doi.org/10.1016/j.chbah.2023.100005>
- Yu, H. (2023). Reflection on whether Chat GPT should be banned by academia from the perspective of education and teaching. *Frontiers in Psychology*, 14, 1181712. <https://doi.org/10.3389/fpsyg.2023.1181712>
- Zheng, Y. (2023). ChatGPT for Teaching and Learning: An Experience from Data Science Education. *The 24th Annual Conference on Information Technology Education*, 66-72. <https://doi.org/10.1145/3585059.3611431>