Use of Artificial Intelligence (AI) in Writing Scientific Works

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Abstract: This study aims to describe the perceptions of students of the Faculty of Teacher Training and Education, University of Jambi towards the use of Artificial Intelligence (AI) in compiling scientific papers as the final assignment of the undergraduate education program. Using a quantitative approach, this study found that the mastery of the AI program was dominated by natural science students (66.40%), while social science students were only 33.60%. In terms of writing skills, natural science students had an average mastery of 64%, compared to 36% for social science students. Student perceptions of the use of AI in writing scientific papers showed positive results, with 86% of students strongly agreeing, 9% agreeing, and the rest being hesitant or disagreeing. In addition, the percentage of students who felt helped in terms of grammar reached an average of 92.66%, and in terms of the technique of compiling and developing scientific papers, the average was 91.58%. The results of hypothesis testing using ANOVA analysis showed a very small significance value (0.000), which means there is a significant relationship between the use of AI and the ability to write scientific papers. This study concludes that the mastery of various AI programs is dominated by natural science students compared to students from social science backgrounds.

Keywords: Artificial intelligence; Perception; Scientific paper; Students

Introduction

Scientific papers as one type of writing developed through scientific procedures, must be written honestly, objectively, and based on scientific data and facts. These requirements sometimes make students simplify various methods, with the main principle being the completion of their scientific papers (Darling-Hammond et al., 2020; Rahimi & Khatooni, 2024). In other words, the scientific papers they compile do not go through real scientific procedures. Those who follow this writing style are driven by laziness, do not have a scientific attitude, and do not think long about the subsequent impacts. Until now, there are still many students who have such principles. Such a situation will have a detrimental impact on the student. He can also become accustomed to his work life in the future. The attitude of students who work on scientific papers that they create through incorrect procedures cannot be justified. They

must be saved from such attitudes. Artificial Intelligence or artificial intelligence programs are computer technologies designed by humans to perform tasks or jobs that are usually done by humans, replaced by search engines (Xu et al., 2021; Collins et al., 2021).

In this case, solving a problem, learning, decision-making, and other tasks requested from simple to very complex, which should be done by humans, can be replaced by artificial intelligence in the form of a computer machine. Even computer technology has tried to create various search engines that are classified as artificial intelligence. Some of them are such as; AutoDraw, DALL-E, Copy.ai, Hotpot.ai, ElevenLabs, and various other types. According to Arslan et al. (2022), and Sheikh et al. (2023), Artificial Intelligence is a computer technology designed by humans to carry out tasks or jobs that are usually done. Mainly in solving problems, learning, decision-making, and other tasks requested from simple to complex. How Artificial

Intelligence works uses algorithms to do certain jobs. Often programmed to imitate actions and think like humans. This is because Artificial Intelligence is given a learning, reasoning, and self-correction process so that it can run (Ahmad et al., 2023; Zawacki-Richter et al., 2019). Artificial Intelligence focuses on cognitive issues related to human intelligence (Siemens et al., 2022; Korteling et al., 2021). Artificial Intelligence is a human-made machine that can think like humans has always been a major idea in this modern era (Marrone et al., 2024; Bellaiche et al., 2023). Hassani et al. (2020) explains that Artificial Intelligence is a field of computer science related to human intelligence behavior which refers to the software and hardware of machines consisting of artificial brains. Thus, artificial intelligence is a computer device that can be used by humans to help with their daily work. The way it works imitates the way the human brain works, so that's why it is called artificial intelligence.

Considering the definition of artificial intelligence, it is clear that there is a specific purpose for why humans create artificial intelligence programs. The purpose of creating Artificial Intelligence technology is to be used to create software or robots that can help humans in their daily routines, and humans can feel the various benefits that artificial intelligence also has, such as; impartiality, regardless of its users (McKee et al., 2023; Laitinen & Sahlgren, 2021). Without taking into account any factors, the assessment that has been made is correct, irreversible, and unchangeable, in other words, it can be used repeatedly (Leso et al., 2021; Patel et al., 2023). As stated by Wang et al. (2024) and Kamalov et al. (2023), that research and development of Artificial Intelligence in education is growing rapidly, especially in academic writing. According to Núñez-Pacheco et al. (2023) in all disciplines, it is proven that students have a high demand for services and support to improve scientific writing skills. Therefore, many universities currently offer academic writing courses using Artificial Intelligence for their students.

In general, Artificial Intelligence is needed for translation, paraphrasing, grammar correction, idea tracking, and plagiarism checking which contribute to improving the quality of academic writing (Malik et al., 2023). Then Khalifa et al. (2024), explained that Artificial Intelligence is designed to help with writing, from the first step to the end. In completing studies at an undergraduate level, students are required to write a scientific paper. A scientific paper can be interpreted as a work that is considered to have a certain scientific content and can be scientifically accounted for its truth. As a research paper, it must contain components of research problems, research methods, research objectives, theoretical basis for research, research objects, and research results. Thus, a scientific paper is written by paying attention to various scientific rules, requirements, and procedures. Various artificial intelligences or artificial intelligences are tools to facilitate and help certain jobs for humans.

Some of them are programs such as; Grammarly, Hemingway Editor, Evernote, CoSchedule Headline Analyzer, Atomic Reach, and various other writing programs. Through various artificial intelligence programs, students complete various assignments in their courses, to compile scientific papers to complete their studies. The purpose of this study is to see an overview of what types of artificial intelligence programs are mastered by students of the Faculty of Teacher Training and Education, University of Jambi that can be utilized to compile scientific papers for the final assignment to complete their studies to obtain a bachelor's degree in education.

Method

This study uses a descriptive research type, with a quantitative approach. This means that this study attempts to describe students' perceptions in the use of AI in writing their final study assignments. The approach used is a quantitative approach. This is to facilitate the implementation of the research, given the limited time.

Research Design

The research was designed with a quantitative research model, utilizing parametric statistics of regression analysis (ANOVA). In this regard, the fulfillment of parametric quantitative standards starting from the validity and reliability of the instrument as well as the homogeneity test and the data normality test were carried out first.

Population and Sample

The research population was students of FKIP, Jambi University in 2020/2021, who were completing their final study assignments. The research sample was determined through a purposive sample type, considering two groups of sciences, namely natural sciences and social sciences as many as 30, with details of 15 students with a natural science education background and 15 with a social science education background. Natural science students consist of; 5 majoring in mathematics education. 5 biology education majors, and 5 physics education majors. While social science students consist of; 5 Indonesian language education majors, 5 economic education majors, and 5 history education majors.

Research Data

The research is in the form of student perceptions of the use of AI in the context of compiling final study assignments. In this case, the type of data collected is an interval type of how students describe and view the use of AI in the context of compiling final student assignments in completing their studies.

Data Collection Techniques

Data were collected through questionnaire and interview techniques. The research instrument was compiled based on observation grids on; types of AI mastered by students, types of AI used in helping writing skills, and perceptions observed through a Likert scale ranging from strongly agree, agree, doubtful, disagree, and strongly disagree. The data were analyzed using percentage techniques, to determine the description of the percentage of student mastery of various types of AI, various types of AI specifically to help writing skills, and the percentage of student perceptions of the use of AI in completing final study assignments.

Figure 1. Research steps

Result and Discussion

The results of the study are described based on the formulation of the problem and the objectives of the study. In this study, the first objective is related to the formulation of the problem to be described, namely about the types of artificial intelligence programs mastered by students of the Faculty of Teacher Training and Education, Jambi University. The following table will describe the percentage of various types of artificial intelligence programs.

Table 1. Description of Types of Artificial Intelligence Mastered by Students

Types of Artificial Intelligence	Percentage of Students Who Master (%)	
	Natural science	Science Social
AutoDraw	74	26
DALL-E	68	32
Copy.ai	62	38
Hotpot.ai	57	43
ElevenLabs	71	29
Average	66.40	33.60

Looking at the table one above, it turns out that all types of programs have an average mastery dominated by students with a natural science background, which is

66.40%. While students with a social science background are only 33.60%. Then the mastery of artificial programs specifically for writing skills, based on the natural science group with social science is as illustrated in the following table two.

Table 2. Description of Mastery of Artificial Intelligence Types Specifically for Writing

Types of Artificial Intelligence	Percentage of Students Who Master (%)	
	Natural science	Science Social
Grammarly,	68	32
Hemingway Editor	63	37
Evernote	64	34
CoSchedule Headline Analyzer	62	29
Atomic Reach,	71	45
Average	64	36

Observing the table two above, it can be seen that the percentage of students who master artificial intelligence specifically for writing is also dominated by students with a natural science background when compared to social science students. The percentage of natural science students who master artificial intelligence specifically for writing is an average of 64%, while social science students are only 36%. Then the second problem in this study is about the perception of students of the Faculty of Teacher Training and Education, Jambi University regarding the use of artificial intelligence programs in compiling scientific papers for the final assignment of completing studies to obtain a bachelor's degree in education. An overview of the research results on this matter can be seen in the following table three.

Table 3. Description of Student Perceptions Regarding the Use of Artificial Intelligence in Writing Scientific Papers as Final Study Assignments

Student Perception Category	Percentage Amount (%)
Strongly agree	86
Agree	9
Doubtful	2
Don't agree	2
Strongly Disagree	1

Looking at Table 3, it can be seen that the percentage of perceptions of students of the Faculty of Teacher Training and Education, Jambi University regarding the use of artificial intelligence in writing scientific papers for the final assignment of study completion shows that almost all students have almost the same perception. They have the perception that the use of artificial intelligence in writing scientific papers for the final assignment of study completion is 86% strongly agree. While those who agree are 9%, those who

are hesitant and disagree are 2% each, and there are 1% who strongly disagree. The use of artificial intelligence in writing scientific papers for the final assignment of students of the Faculty of Teacher Training and Education, Jambi University is illustrated through two large parts, namely in terms of grammar, and scientific work development techniques. Concerning grammar, students are helped in terms of as illustrated in the following table four.

Table 4. Percentage of Students Who Are Helped in Terms of Grammar

Grammar Elements	Percentage Amount (%)
Punctuation	86
Letter Writing	89
Writing words	94
Choice of words	96
Composing effective sentences	98
Developing cohesive and coherent paragraphs	93
Average	92.66

Observing table four above, it can be seen that the percentage of students who are greatly helped in terms of grammar through the artificial intelligence program is very high. The percentage of all things related to grammar shows an average of 92.66%. Meanwhile, in terms of the technique of compiling and developing scientific works, it can be seen in the following table five.

Table 5. Percentage of Students Who Are Helped in Terms of Development Techniques

Grammar Elements	Percentage Amount (%)
Structure of Scientific Paper	88
Search for relevant articles	97
Systematics of writing scientific papers	86
Writing formulas, symbols, emblems, and signs	98
Compilation of table of contents, tables, figures, and graphs	99
Preliminary preparation	88
Preparation of literature review	96
Preparation of research methods	93
Compilation of research results	87
Drafting conclusions	95
Preparation of recommendations	84
Compiling a bibliography	98
Average	91. 58

Observing Table five above, it can be seen that the percentage of students who are greatly assisted in terms of the techniques of compiling and developing scientific papers, through the artificial intelligence program is very high. The percentage is an average of 91.58%. Then a description of how the use of artificial intelligence affects the writing of scientific papers for the final assignment of study completion can be seen in the following table six.

Table 6. Table of Statistical Test Results of Regression Analysis of the Use of Artificial Intelligence on Writing Scientific Papers for the Final Assignment of Study Completion

	Sum of				
1 Regresion	151.07	1	151.07	97.04	.000a
Residul	43.57	28	1.54		
Total	194.55	29			

a. Predictors (Constant), Artificial Intelligence
b. Dependent Variable: Writing Ability

Observing the Anova test table above, it turns out that the significance value is smaller than the significance level value, which is $0.000 < 0.05$, thus accepting the hypothesis. There is a significant relationship between the use of artificial intelligence and the ability to write scientific papers.

Discussion

Mastery of various types of artificial intelligence programs, the average mastery is dominated by students with a natural science background, which is 66.40%. While students with a social science background are only 33.60%. This can happen considering that students with a natural science background, mostly study computer science. While students with a social science background, only a few specific study programs study computer science. Therefore, computer science is important for every student to learn. Mastery of artificial programs specifically for writing skills, based on the natural science group with social science, also shows the percentage with social science. The percentage of natural science students who master artificial intelligence specifically for writing is an average of 64%, while social science students are only 36%. This is also influenced because the natural science group mostly studies computer science (Yanakieva et al., 2023). Regarding students' perceptions of the use of artificial intelligence programs in writing scientific papers, it is quite varied, ranging from strongly agree, agree, doubtful, disagree, to strongly disagree (Gasaymeh et al., 2024).

The percentage of perceptions of students of the Faculty of Teacher Training and Education, Jambi University regarding the use of artificial intelligence in writing scientific papers for the final assignment of study completion shows that almost all students have almost the same perception. They have the perception that the use of artificial intelligence in writing scientific papers for the final assignment 86% strongly agree. Those who agree are 9%, doubtful and disagree are 2% each, and strongly disagree are 1%. Thus, it is clear that students in general have a perception of strongly

agreeing with the use of artificial intelligence in writing scientific papers, reaching 86%. However, some students doubt, disagree, and strongly disagree with the use of artificial intelligence programs in writing, but only in a small percentage.

The use of artificial intelligence in writing scientific papers for the final assignment of students of the Faculty of Teacher Training and Education, Jambi University is illustrated through two large parts, namely in terms of grammar and scientific paper development techniques. The percentage of students who are greatly helped in terms of grammar through the artificial intelligence program is very high (Johnston et al., 2024). The percentage of all things related to grammar shows an average of 92.66%. The highest percentage is in terms of writing effective sentences, reaching 98%. Only 2% feel unhelped in terms of composing effective sentences. In terms of the technique of compiling and developing scientific papers, the percentage of students who are greatly assisted by the artificial intelligence program is very high showing an average of 91.58%.

The percentage of students who are very high is in terms of compiling tables of contents, tables, images, and graphs, which is 99%. Then the second thing is writing formulas, symbols, emblems, and signs, which is 98%. In terms of searching or searching for articles that are relevant to the topic of the scientific work being written, it is also very high, reaching 97%. Thus, the use of artificial intelligence in the context of compiling and developing systematic scientific writing helps students a lot (Kim et al., 2024; González-Calatayud et al., 2021; Wang et al., 2024). Then the picture of how the use of artificial intelligence affects the writing of scientific papers for the final assignment of the study looks very significant. This is evident from the results of hypothesis testing through the ANOVA analysis statistical test, it turns out that the calculated significance value is smaller than the significance level table value of 0.05. Thus, the research hypothesis is accepted. This is clear from the results of the ANOVA test that; 0.000 <0.05. This equation shows that there is a significant relationship between the ability to master artificial intelligence and the ability to write scientific papers as a final assignment for completing studies.

Based on the research findings, it is clear that the research findings are in line with creating Artificial Intelligence technology (Elbadawi et al., 2024; Mohideen, 2024; Refmidawati, 2023). As stated by Rashid et al. (2024), the purpose of developing artificial intelligence is to create software or robots that can help humans in their daily routines, make machines smarter than before, and help humans solve complex problems, such as through the development of fast-calculating smart calculators (Dwivedi et al., 2023; Tartuk, 2023), Without taking into account any factors, the assessment that has been made is correct. It cannot be changed and cannot be changed, in other words, it can be used repeatedly. Thus, artificial intelligence is very helpful for students. Therefore, the ability to master artificial intelligence is important for students, so it needs to be studied and mastered by students (Ng et al., 2021; Laupichler et al., 2022).

Artificial Intelligence programs or artificial intelligence as computer technology designed by humans to carry out tasks or jobs that are usually done by humans are replaced by search engines (Chen, 2023; Huang et al., 2018; Elahi et al., 2023). In this case, solving problems, learning, making decisions, and other required tasks ranging from simple to very complex, which should be done by humans, can be replaced by artificial intelligence in the form of computer machines. Even computer technology has attempted to create various search engines that are classified as artificial intelligence (Livberber et al., 2023). Some of them are AutoDraw, DALL-E, Copy.ai, Hotpot.ai, ElevenLabs, and various other types. Students must master one of the five programs, but if they can master all five it is much better (Alsharif et al., 2024).

Conclusion

The conclusion of this study shows that the mastery of Artificial Intelligence (AI) programs is more common among natural science students compared to social science students. Despite differences in the level of mastery, both groups of students showed consistent and positive perceptions of the role of AI in helping them compile scientific papers as their final assignments. This indicates that AI technology is seen as an effective tool to improve the quality of academic writing, helping students overcome challenges related to grammar, structure, and writing techniques. In addition, statistical analysis revealed a significant relationship between AI mastery and scientific writing skills, which emphasizes the importance of integrating this technology into the higher education curriculum. Thus, this study recommends the need for more attention from educational institutions to ensure that all students, regardless of their scientific background, can develop skills in using AI. This will not only improve the quality of scientific papers but also prepare students to face the demands of the world of work that increasingly relies on digital technology.

Author Contributions
Conceptualization; methodology; validation; formal analysis; investigation; resources; data curation: writing—original draft

preparation; writing—review and editing; visualization: A. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest
The authors declare no conflict of interest.

References

Ahmad, S. F., Han, H., Alam, M. M., Rehmat, Mohd. K., Irshad, M., Arraño-Muñoz, M., & Ariza-Montes, A. (2023). Impact of artificial intelligence on human loss in decision making, laziness, and safety in education. *Humanities and Social Sciences Communications*, *10*(1), 311. https://doi.org/10.1057/s41599-023-01787-8

Alsharif, H., Boyle, R., Maillou, P., & Cherukara, G. P. (2024). A study on digital tooth preparation assessment software in undergraduate pre-clinical skills teaching. *BDJ Open*, *10*(1), 91. https://doi.org/10.1038/s41405-024-00279-4

Arslan, A., Cooper, C., Khan, Z., Golgeci, I., & Ali, I. (2022). Artificial intelligence and human workers interaction at team level: A conceptual assessment of the challenges and potential HRM strategies. *International Journal of Manpower*, *43*(1), 75–88. https://doi.org/10.1108/IJM-01-2021-0052

Bellaiche, L., Shahi, R., Turpin, M. H., Ragnhildstveit, A., Sprockett, S., Barr, N., Christensen, A., & Seli, P. (2023). Humans versus AI: Whether and why we prefer human-created compared to AI-created artwork. *Cognitive Research: Principles and Implications*, *8*(1), 42. https://doi.org/10.1186/s41235-023-00499-6

Chen, Z. (2023). Ethics and discrimination in artificial intelligence-enabled recruitment practices. *Humanities and Social Sciences Communications*, *10*(1), 567. https://doi.org/10.1057/s41599-023-02079-x

Collins, C., Dennehy, D., Conboy, K., & Mikalef, P. (2021). Artificial intelligence in information systems research: A systematic literature review and research agenda. *International Journal of Information Management*, *60*, 102383. https://doi.org/10.1016/j.ijinfomgt.2021.102383

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., Koohang, 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. (2023). 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

Elahi, M., Afolaranmi, S. O., Martinez Lastra, J. L., & Perez Garcia, J. A. (2023). A comprehensive literature review of the applications of AI techniques through the lifecycle of industrial equipment. *Discover Artificial Intelligence*, *3*(1), 43. https://doi.org/10.1007/s44163-023-00089-x

Elbadawi, M., Li, H., Basit, A. W., & Gaisford, S. (2024). The role of artificial intelligence in generating original scientific research. *International Journal of Pharmaceutics*, *652*, 123741. https://doi.org/10.1016/j.ijpharm.2023.123741

Gasaymeh, A.-M. M., Beirat, M. A., & Abu Qbeita, A. A. (2024). University Students' Insights of Generative Artificial Intelligence (AI) Writing Tools. *Education Sciences*, *14*(10), 1062. https://doi.org/10.3390/educsci14101062

González-Calatayud, V., Prendes-Espinosa, P., & Roig-Vila, R. (2021). Artificial Intelligence for Student Assessment: A Systematic Review. *Applied Sciences*, *11*(12), 5467. https://doi.org/10.3390/app11125467

Hassani, H., Silva, E. S., Unger, S., TajMazinani, M., & Mac Feely, S. (2020). Artificial Intelligence (AI) or Intelligence Augmentation (IA): What Is the Future? *AI*, *1*(2), 143–155. https://doi.org/10.3390/ai1020008

Huang, M.-H., & Rust, R. T. (2018). Artificial Intelligence in Service. *Journal of Service Research*, *21*(2), 155–172. https://doi.org/10.1177/1094670517752459

Johnston, H., Wells, R. F., Shanks, E. M., Boey, T., & Parsons, B. N. (2024). Student perspectives on the use of generative artificial intelligence technologies in higher education. *International Journal for Educational Integrity*, *20*(1), 2. https://doi.org/10.1007/s40979-024-00149-4

Kamalov, F., Santandreu Calonge, D., & Gurrib, I. (2023). New Era of Artificial Intelligence in Education: Towards a Sustainable Multifaceted Revolution. *Sustainability*, *15*(16), 12451. https://doi.org/10.3390/su151612451

Khalifa, M., & Albadawy, M. (2024). Using artificial intelligence in academic writing and research: An essential productivity tool. *Computer Methods and Programs in Biomedicine Update*, *5*, 100145. https://doi.org/10.1016/j.cmpbup.2024.100145

Kim, J., Yu, S., Detrick, R., & Li, N. (2024). Exploring students' perspectives on Generative AI-assisted academic writing. *Education and Information Technologies*. https://doi.org/10.1007/s10639-024-12878-7

Korteling, J. E. (Hans)., Van De Boer-Visschedijk, G. C., Blankendaal, R. A. M., Boonekamp, R. C., & Eikelboom, A. R. (2021). Human- versus Artificial Intelligence. *Frontiers in Artificial Intelligence*, 4, 622364. https://doi.org/10.3389/frai.2021.622364

Laitinen, A., & Sahlgren, O. (2021). AI Systems and Respect for Human Autonomy. *Frontiers in Artificial Intelligence*, 4, 705164. https://doi.org/10.3389/frai.2021.705164

Laupichler, M. C., Aster, A., Schirch, J., & Raupach, T. (2022). Artificial intelligence literacy in higher and adult education: A scoping literature review. *Computers and Education: Artificial Intelligence*, 3, 100101. https://doi.org/10.1016/j.caeai.2022.100101

Leso, V., Fontana, L., Caturano, A., Vetrani, I., Fedele, M., & Iavicoli, I. (2021). Impact of Shift Work and Long Working Hours on Worker Cognitive Functions: Current Evidence and Future Research Needs. *International Journal of Environmental Research and Public Health*, 18(12), 6540. https://doi.org/10.3390/ijerph18126540

Livberber, T., & Ayvaz, S. (2023). The impact of Artificial Intelligence in academia: Views of Turkish academics on ChatGPT. *Heliyon*, 9(9), e19688. https://doi.org/10.1016/j.heliyon.2023.e19688

Malik, A. R., Pratiwi, Y., Andajani, K., Numertayasa, I. W., Suharti, S., Darwis, A., & Marzuki. (2023). Exploring Artificial Intelligence in Academic Essay: Higher Education Student's Perspective. *International Journal of Educational Research Open*, 5, 100296. https://doi.org/10.1016/j.ijedro.2023.100296

Marrone, R., Cropley, D., & Medeiros, K. (2024). How Does Narrow AI Impact Human Creativity? *Creativity Research Journal*, 1–11. https://doi.org/10.1080/10400419.2024.2378264

McKee, K. R., Bai, X., & Fiske, S. T. (2023). Humans perceive warmth and competence in artificial intelligence. *iScience*, 26(8), 107256. https://doi.org/10.1016/j.isci.2023.107256

Mohideen, H. L. M. (2024). Exploring the Opportunities of Implementing Artificial Intelligence (AI) Technology for Teaching Arabic to Non-Native Speakers: A Theoretical Approach. *Journal of Digital Learning And Distance Education*, 2(10), 760–767. https://doi.org/10.56778/jdlde.v2i9.225

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, 100041. https://doi.org/10.1016/j.caeai.2021.100041

Núñez-Pacheco, R., Vidal, E., Castro-Gutierrez, E., Turpo-Gebera, O., Barreda-Parra, A., & Aguaded, I. (2023). Use of a Gamified Platform to Improve Scientific Writing in Engineering Students. *Education Sciences*, 13(12), 1164. https://doi.org/10.3390/educsci13121164

Patel, A. S., Brahmbhatt, M. N., Bariya, A. R., Nayak, J. B., & Singh, V. K. (2023). "Blockchain technology in food safety and traceability concern to livestock products." *Heliyon*, 9(6), e16526. https://doi.org/10.1016/j.heliyon.2023.e16526

Rahimi, S., & Khatooni, M. (2024). Saturation in qualitative research: An evolutionary concept analysis. *International Journal of Nursing Studies Advances*, 6, 100174. https://doi.org/10.1016/j.ijnsa.2024.100174

Rashid, A. B., & Kausik, M. A. K. (2024). AI revolutionizing industries worldwide: A comprehensive overview of its diverse applications. *Hybrid Advances*, 7, 100277. https://doi.org/10.1016/j.hybadv.2024.100277

Refmidawati. (2023). Virtual Reality Media for Fun Learning. *Journal Of Digital Learning And Distance Education*, 2(4), 544–547. https://doi.org/10.56778/jdlde.v2i4.79

Sheikh, H., Prins, C., & Schrijvers, E. (2023). Artificial Intelligence: Definition and Background. In *Mission AI* (pp. 15–41). Springer International Publishing. https://doi.org/10.1007/978-3-031-21448-6_2

Siemens, G., Marmolejo-Ramos, F., Gabriel, F., Medeiros, K., Marrone, R., Joksimovic, S., & De Laat, M. (2022). Human and artificial cognition. *Computers and Education: Artificial Intelligence*, 3, 100107. https://doi.org/10.1016/j.caeai.2022.100107

Tartuk, M. (2023). Metaphorical Perceptions of Middle School Students Regarding the Concept of Artificial Intelligence. *International Journal of Education and Literacy Studies*, 11(2), 108–116. https://doi.org/10.7575/aiac.ijels.v.11n.2p.108

Wang, S., Wang, F., Zhu, Z., Wang, J., Tran, T., & Du, Z. (2024). Artificial intelligence in education: A systematic literature review. *Expert Systems with Applications*, 252, 124167. https://doi.org/10.1016/j.eswa.2024.124167

Xu, Y., Liu, X., Cao, X., Huang, C., Liu, E., Qian, S., Liu, X., Wu, Y., Dong, F., Qiu, C.-W., Qiu, J., Hua, K., Su, W., Wu, J., Xu, H., Han, Y., Fu, C., Yin, Z., Liu, M., … Zhang, J. (2021). Artificial intelligence: A powerful paradigm for scientific research. *The Innovation*, 2(4), 100179. https://doi.org/10.1016/j.xinn.2021.100179

Yanakieva, E., Bieniusa, A., Becka, T., Moser, B. B., Jerger, D., & Thyssen, C. (2023). Bridging the Gap: Infusing Natural Science Classes with Computer Science Concepts and Skills. In *Informatics in Schools. Beyond Bits and Bytes: Nurturing Informatics Intelligence in Education* (Vol. 14296, pp. 180–193). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-44900-0_14

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators? *International Journal of Educational Technology in Higher Education*, *16*(1), 39. https://doi.org/10.1186/s41239-019-0171-0