A Systematic Literature Review of ChatGPT Utilization in Education: Potentials and Concerns

Arif Husein Lubis[*], Adinda Safitri Ayuningsih, Salsadila Rizki Ikaputri

*Korean Language Education Study Program, Faculty of Language and Literature Education,
Universitas Pendidikan Indonesia, Bandung, Indonesia*
[*]*Corresponding author. Email: lubis_ah@upi.edu*

ABSTRACT

The advancement of Artificial Intelligence (AI) technology has transformed the way education is implemented. Recent publications have highlighted the role of AI technology such as chatbots in assisting teachers to maximize the learning process and students to elevate their personalized learning. However, the extent to which ChatGPT, in particular, plays a role in the education field is still under-explored. This paper aims to fill the void by reporting a review of research publications on the potential of ChatGPT in education and some concerns for teachers and students in making use of such chatbot technology. Using the PRISMA model, the researchers sorted out articles from Google Scholar in 2022-2023. The selection process yielded twelve relevant articles for further qualitative analysis. The analysis results reveal that ChatGPT has been considered as an advanced personal learning assistant. Such chatbot technology enables an effective learning process through quick and repeatable responses to any queries or prompts so that the teachers can enhance their learning productivity. Additionally, ChatGPT can play a role in escalating the students' language skills. Apart from that, teachers need to be concerned with the students' face-to-face interactions to maintain their important role in monitoring the learning process. Moral and ethical values are also pivotal to be instilled to raise the students' responsibility and academic honesty in using ChatGPT. This paper ends with some recommendations for future research to advance the praxis of using ChatGPT in the education field.

Keywords: ChatGPT, concerns, education, potentials, systematic literature review.

1. INTRODUCTION

Recent years have witnessed the advancement of educational technology, particularly Artificial Intelligence (AI) applications. According to the report from the Horizon Report 2019 Higher Education (Educause, 2019), AI technologies have received increasing attention and are predicted to grow significantly than ever in the teaching and learning field. This might be caused by the inquiry into how machines can use language, help people understand concepts or abstractions, and solve various problems experienced by humans (Zawacki-Richter, Marín, Bond, & Gouverneur, 2019). Previous literature (Luckin, Holmes, Griffiths, & Forcier, 2016) has noticed the potential applications of AI in education such as personal tutors, intelligent support to conduct collaborative learning, and intelligent virtual environment. Additionally, the applications of AI tools in the education field can be approached from three perspectives: learning assistant, adaptive or personalized learning management system, and instructional assistant (Baker & Smith, 2019). Together reinforces that studying the role of AI technology in education is crucial toward better quality of teaching and learning processes and outcomes.

One particular AI-powered tool, which has become a buzzword these days is ChatGPT. As a generative AI chatbot, ChatGPT has offered several benefits for teaching and learning purposes. For teachers, such GenAI tools can help teachers prepare the lesson plan and teaching materials, assist the implementation of the teaching process, support them with student assessment, and offer some suggestions for improvements (Trust, Whalen, & Mouza, 2023). For students' learning, ChatGPT assists in maximizing personalized learning (Kuhail, Alturki, Alramlawi, & Alhejori, 2023), enhancing creative thinking, undergoing an assessment process, and escalating literacy skills such as reading and writing (Trust et al., 2023). It is justified by several other studies mentioning that ChatGPT has the potential for

giving prompts to students or providing meaningful feedback to students (Kohnke, Moorhouse, & Zou, 2023), answering questions, and conducting research with human peers (Cooper, 2023), or facilitating discussions (Ray, 2023). Even, when the algorithms of ChatGPT are integrated into a digital learning platform, students can have an adaptive learning environment and monitor their progress based on their own needs (Firat, 2023). This means that ChatGPT has some potential in various fields of education.

Despite some potential uses of ChatGPT mentioned earlier, concerns are still raised to the surface. First, ChatGPT is reported to have limitations on information accuracy in certain ways, for instance, in the context that demands recent trends, facts, scientific information, or references since it is primarily based on pre-2021 data (Temsah et al., 2023). Second, since every user can use it almost effortlessly, queries demanding sensitive personal information can be provided by ChatGPT, rendering issues on data privacy (Bozkurt & Sharma, 2023). Transparency of demographic information or students' activities, for instance, becomes problematic since it can be tracked using such as GenAI tool (Ray, 2023). Third, users may be accused of unethical actions in the field of education if they solely rely on the information provided by ChatGPT, particularly for students while completing a task or assignment given by their teachers. Even, credible responses are still questionable related to controversial or sensitive topics due to a lack of transparency of the references, making the propositions unbalanced and biased (Mhlanga, 2023).

Although ChatGPT has grabbed considerably intensive attention among academicians, a review of recent publications on this concern is needed to evaluate the milestones of research outcomes generated from those studies. Hence, this paper seeks to review recent publications relevant to the potential uses and concerns of ChatGPT in the educational field.

2. LITERATURE REVIEW

ChatGPT is a generative AI-powered chatbot, developed by OpenAI, a Microsoft-backed company and released in November 2022 (https://chat.openai.com/auth/login), which has received over one million users since its inception (Mollman, 2022). OpenAI is a laboratory established in 2015 to facilitate the development of AI technologies and various public machine-learning products (Devlin, Chang, Lee, & Toutanova, 2018). It is designed to enable conversations with human users through the Internet (King, 2023). ChatGPT applies a generative model, which can generate new data, not only doing a classification or prediction from the data (Pavlik, 2023). Hence, the GPT itself is a machine-learning model, designed to understand human language and produce responses similar to the natural human language (Dale, 2021).
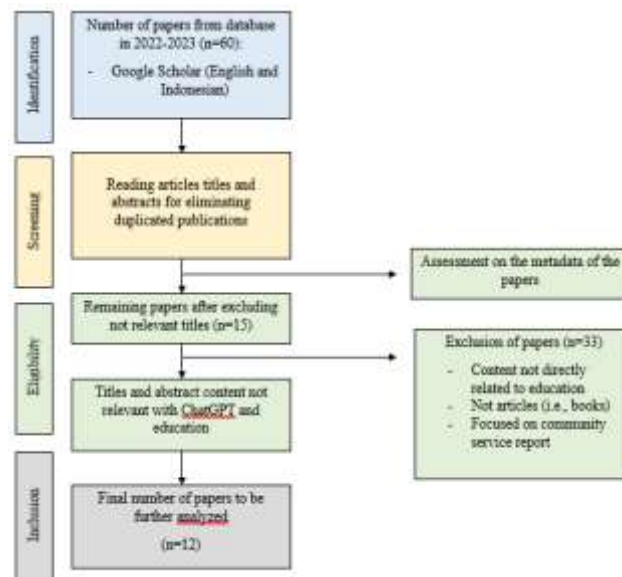

Figure 1 PRISMA model for the paper selection process.

Its GPT model enables the text-processing system to complete a wide range of text-based prompts and requests (Kurniadi, Septiana, & Sutedi, 2023; Liu et al., 2021). The simple requests or tasks include answering questions, providing explicit information related to a particular topic, and solving basic mathematical problems. The more advanced tasks comprise initiating critical discussions, assessing students' works, and generating various types of texts.

3. METHOD

A systematic review method was employed in this paper. In sorting out the relevant articles to be analyzed, researchers used a PRISMA model (see Figure 1). First, the researchers determined Google Scholar as the database and selected certain keywords (Indonesian and English) to search for related articles. The keywords cover ChatGPT, chatbot, and AI-powered chatbot in education. The search results yielded 60 papers published in 2022-2023 (n=30 papers in English; n=30 papers in Indonesian). To ensure the relevance of the papers, the researchers read the title and abstract. Second, the full text was reviewed, rendering an exclusion of 48 papers due to three reasons: (1) the content was not particularly concerned with ChatGPT in education; (2) they were not articles; and (3) the articles were about community service reports. It yielded twelve papers to be further analyzed.

The analysis process started with formulating an Excel file to record the metadata of the papers: eleven qualitative papers, one quantitative paper; eight papers written by Indonesian authors, and four papers written by authors from other countries. The process continued with coding the results and discussion section. The coding results were further categorized into bigger themes that can directly address the objectives mentioned earlier. Similarities and differences across studies were also analyzed to ensure the analysis results.

4. FINDINGS AND DISCUSSION

Table 1 depicts the matrix of previous studies, which comprises the main information for presenting the review results. The presentation of results is divided into two major themes: potential uses of ChatGPT in education and concerns related to ChatGPT in the education context.

Table 1. Matrix of previous studies

Author(s)	Purpose	Method	Findings
'Amala, Thohir, Reditiya, & Sari (2023)	To probe into university students' perspectives on the ethical uses of ChatGPT in educational field	Observation, interviews, and documentation	The results showed that the use of ChatGPT should be adhered to the digital ethics. ChatGPT can bring about advantages if considering ethics and morality in digital ethics.
Adiguzel, Kaya, & Cansu (2023)	To examine the potential of ChatGPT in education and raise awareness of ethics	Collecting and reviewing evidence	AI may improve learning outcomes, productivity, and student engagement by opening up new avenues for individualized education, feedback, and assistance.
Julianto & Ratumanan (2023)	To assess the suitability of ChatGPT for the text pre-processing phase in sentiment analysis	Utilization of ChatGPT compared with Rapidminer.	The result of K-Nearest Neighbor achieved 73.57% accuracy performance, while Naïve Bayes Rapidminer success got higher result with 75.33%.
Kohnke et al. (2023)	To explore potential uses of ChatGPT in language education	Collecting evidence across languages	ChatGPT can formulate questions for language tests, answer specific questions, and compose texts such as emails.
Kraugusteeliana, Indriana, Krisnanik, Muliawati, & Irmanda (2023)	To reveal the benefits of ChatGPT in improving work productivity	Collecting evidence	ChatGPT gives significant impact on lectures' job, such as preparing materials, providing guidance to students, conducting research, improving the quality of papers, and increasing work efficiency and productivity.
Lo (2023)	To enrich knowledge of ChatGPT capabilities and the potential in education	Synthesizing evidence from previous studies	The ChatGPT's performance varied across subject domains, ranging from outstanding (e.g., Economics) and satisfactory (e.g., Programming) to unsatisfactory (e.g., Mathematics).
Manik, Marbun, Simanjuntak, & Simarmata (2023)	To explore the use of ChatGPT in creating an article	Experimental approach	ChatGPT is capable to write good article when the researcher input keynotes. However, ChatGPT still needs human touch to maximize the quality.
Mhlanga (2023)	To explore the responsible and ethical utilization of ChatGPT in education	Synthesizing evidence from previous studies	The ethical application of ChatGPT in education necessitates safeguarding privacy, upholding principles of fairness and non-discrimination, and ensuring transparency in its use.
Murcahyanto (2023)	To examine whether ChatGPT can promote students' independent learning	Experimental one-group pre-test post-test design among university students	The use of ChatGPT gave a significant impact on the students' independent learning in learning education management, based on the comparison between pre-test and post-test results.
Setiawan & Luthfiyani (2023)	To explore potential use of ChatGPT to enhance student's essay writing skills	Collecting evidence using various prompts	The ChatGPT is able to write an essay with 693 words in a short time, but excluding the formulation of effective prompts prior to the experiment.
Shidiq (2023)	To discuss the impact of ChatGPT use on students' creativity in writing	Descriptive qualitative analysis	ChatGPT has the ability to answer questions, based on the prompts or words inputted, which is helpful for the users to develop creativity in the writing process
Supriyadi (2022)	To explore the use of ChatGPT in assisting writing research articles on Mathematics education	Collecting sample data and checked using Turnitin.	Based on the results from Turnitin, there is 67% similarity with other documents which indicates that the result of ChatGPT still has high-level similarity with other articles on the Internet.

4.1. Potentials of ChatGPT in Education

The review results reveal several main potentials of ChatGPT for maximizing the implementation of education (see Table 1 for the matrix of previous studies). They comprise: (1) providing help in developing learning materials and guidance to students; (2) conducting research; (3) enhancing efficiency and productivity; (4) promoting the quality of one's works; and (5) producing and analyzing texts. The results also demonstrate that the perceived performance of ChatGPT ranges from outstanding and satisfactory to unsatisfactory.

Previous literature (Kraugusteeliana et al., 2023) highlighted that ChatGPT can help lecturers prepare course materials as well as relevant references additional reading materials, or recommendations. This can make their work more efficient and maintain productivity since such AI-powered chatbots can generate responses suited to the prompts or instructions without consuming lengthy time. Educators can also utilize ChatGPT to guide students in accomplishing tasks or improving the quality of their work. This was justified by Setiawan and Luthfiyani (2023) that the chatbot can produce texts contextually relevant to the users toward better writing performance among the students. Another example of the potential use of ChatGPT in producing quality texts was given by Manik et al. (2023). They sought to test the tool in producing a quality article about using YouTube in the learning process during the COVID-19 pandemic. The article generated was perceived as good since it provides the main idea in each paragraph, supported by research results. Despite that, they argued that the role of the human writer needs to be considered as well, particularly in revising and editing the text. In this way, the use of ChatGPT can help human writers develop their writing skills.

In the context of Mathematics education, Supriyadi (2022) also conducted a personal experiment using ChatGPT to produce an academic article. The results showed that ChatGPT was capable of composing the text from the abstract to the conclusion section. Such results depend on to what extent the instruction is explicitly written. The writer further provides a sample of the abstract made by ChatGPT in which it already has the main elements that constitute an eligible abstract such as purpose, methods, and main outcomes.

ChatGPT has another potential benefit in processing and analyzing texts. Research initiated by Julianto and Ratumanan (2023) aimed to examine ChatGPT as an alternative tool in processing textual data from tweets, as compared to the other tool called Rapidminer. The comparative results demonstrated that although ChatGPT did not receive a higher score than Rapidminer, the gap between the two tools was not significant, meaning that ChatGPT can be used in processing textual data about sentiment analysis.

In terms of guiding students, an article written by Kohnke et al. (2023) noticed several areas of guidance that can be exploited by students in language education. By collecting evidence, the authors found that ChatGPT can support language learning through authentic interactions. Such interactions cover the identification of word meaning in context, correction, and explanation of certain language mistakes, production of texts in various genres, preparation of quizzes, annotation of texts, and translation of sentences, expressions, and even longer texts. Such capabilities have been examined in another language such as Chinese, allowing its users to learn their first language as well.

Related to the perceived performance of ChatGPT mentioned before, Lo (2023) probed into the perceived ChatGPT's performance in various domains. Economics obtained an outstanding assessment score and a satisfactory score was obtained in utilizing such technology in programming subjects. Meanwhile, Mathematics still received unsatisfactory scores. This might be caused by the types of problem-solving questions, which require accurate and critical explanations, not merely repetitive and general responses from ChatGPT. Apart from that, the perceived satisfaction in using ChatGPT is associated with its main aspect, i.e. ease of use, as expressed by Faiz and Kurniawaty (2023). They argued that students can navigate such chatbots easily since the features are simple and easy to understand. The users would experience using a personal chatting buddy available to assist them in various fields. Such perceived ease of its use and simplicity may promote students' independent learning, as justified by Murcahyanto (2023) that after applying ChatGPT, the students showed a significant increase in independent learning in learning education management.

4.2. Concerns of ChatGPT in Education

Like other AI-powered products, several concerns are identified in using ChatGPT for educational purposes. Generally, they comprise (1) moral issues; (2) originality of work; and (3) transparency issues.

The first concern is associated with the limitations of robots in transferring moral and ethical values to the students. Educators in this case play a pivotal role in maintaining good learning habits among their students. Faiz and Kurniawaty (2023) opined that ChatGPT can indeed assist students in learning in a fun and interactive way. However, such technology still cannot replace human beings in establishing emotional connections during the learning process

through the provision of modeling or good practice in achieving academic success. Additionally, the level of creativity offered by ChatGPT is dependent on the student's creative thinking itself, meaning that such technology cannot monitor the progress of students' creative skills, which are important aspects of learning. Since it is dependent on what is inputted by its users, ChatGPT has limitations in capturing learning nuance and students' various learning styles. Such limitations hinder the opportunity to guide students to think critically in dealing with problems or constraints during the learning process.

The decline of originality of one's work can be the second major concern of using ChatGPT in the education field. The ease in processing information from text inputs makes students less creative in producing or creating their ideas (Adiguzel et al., 2023; Shidiq, 2023). Particularly in English language classrooms, texts produced by such chatbots are typically good in terms of using English words, making the students have less initiative to develop the texts using their ideas. Another contradictive situation can result from the provision of texts, as mentioned by Manik et al. (2023) and Supriyadi (2022). The educators may also experience a decline of originality in writing an academic article, for instance since such a tool can help them compose the entire text, based on the request or instruction.

Last but not least, the use of ChatGPT is almost borderless, meaning that the users can ask for any information, potentially including personal data or information. 'Amala et al. (2023) and Mhlanga (2023) in this context argued that the use of ChatGPT requires respecting privacy, fairness, and non-discrimination, as well as ensuring transparency. Teachers and students need to be aware of the importance of keeping personal information obtained from the Internet confidential and not putting it to inappropriate use. They also have to be aware of the limitations of ChatGPT's algorithms in providing clear and unbiased explanations.

5. CONCLUSION

This paper has reported the review results of twelve recent publications related to the potentials and concerns of ChatGPT in the education sector. ChatGPT can accelerate and enhance the effectiveness of learning, benefiting educators in various domains. However, it must be balanced with meaningful interactions between teachers and students to play a productive role in education. Furthermore, collaborative efforts involving educators, researchers, and government entities are essential to ensure the ethical and responsible use of AI-powered technology like ChatGPT in education. A thoughtful strategy in using ChatGPT is also necessary to foster creativity among students.

ACKNOWLEDGMENTS

REFERENCES

'Amala, Y., Thohir, M., Reditiya, V. E., & Sari, N. I. P. (2023). Refleksi mahasiswa dalam berkeadaban digital melalui ChatGPT [Student reflections on digital civilization through ChatGPT]. *Intelektual: Jurnal Pendidikan dan Studi Keislaman*, *13*(2), 109-128. https://doi.org/10.33367/ji.v13i2.3978

Adiguzel, T., Kaya, M. H., & Cansu, F. K. (2023). Revolutionizing education with AI: Exploring the transformative potential of ChatGPT. *Contemporary Educational Technology*, *15*(3), 1-13. https://doi.org/10.30935/cedtech/13152

Baker, T. & Smith, L. (2019). *Educ-AI-tion rebooted? Exploring the future of artificial intelligence in schools and colleges*. Retrieved from: https://media.nesta.org.uk/documents/Future_of_AI_and_education_v5_WEB.pdf

Bozkurt, A. & Sharma, R. C. (2023). Challenging the status quo and exploring the new boundaries in the age of algorithms: Reimagining the role of generative AI in distance education and online learning. *Asian Journal of Distance Education*, *18*(1), 1-8.

Cooper, G. (2023). Examining science education in ChatGPT: An exploratory study of generative artificial intelligence. *Journal of Science Education and Technology*, *32*(3), 444-452.

Dale, R. (2021). GPT-3: What's it good for? *Natural Language Engineering*, *27*(1), 113-118.

Devlin, J., Chang, M. W., Lee, K., & Toutanova, K. (2018). Bert: Pre-training of deep bidirectional transformers for language understanding. *arXiv*, doi: 10.48550/arXiv.1810.04805.

EDUCAUSE. (2019). *Horizon report: 2019 higher education edition*. Retrieved from EDUCAUSE Learning Initiative and The New Media Consortium website: https://library.educause.edu/-/media/files/library/2019/4/2019horizonreport.pdf

Faiz, A. & Kurniawaty, I. (2023). Tantangan penggunaan ChatGPT dalam pendidikan ditinjau dari sudut pandang moral [Challenges of using ChatGPT in education viewed from a moral perspective]. *Edukatif: Jurnal Ilmu Pendidikan*, *5*(1), 456-463. https://doi.org/10.31004/edukatif.v5i1.4779

Firat, M. (2023). Integrating AI applications into learning management systems to enhance e-learning. *Instructional Technology and Lifelong Learning*, *4*(1), 1-14. https://doi.org/10.52911/itall.1244453

Julianto, T. S. & Ratumanan, S. (2023). Pemanfaatan generatif AI dalam pembelajaran bahasa untuk siswa SD: Pendekatan inovatif dalam meningkatkan kemampuan menulis [The utilization of generative AI in language education for elementary school students: An innovative approach to enhance writing skills]. *Bima Journal of Elementary Education*, *1*(2), 48-52.

King, M. R. (2023). The future of AI in medicine: A perspective from a Chatbot. *Annals of Biomedical Engineering*, *51*(2), 291-295.

Kohnke, L., Moorhouse, B. L., & Zou, D. (2023). ChatGPT for language teaching and learning. *RELC Journal*, 00336882231162868.

Kraugusteeliana, K., Indriana, I. H., Krisnanik, E., Muliawati, A., & Irmanda, H. N. (2023). Utilization of ChatGPT's artificial intelligence in improving the quality and productivity of lecturers' work. *Jurnal Pendidikan dan Konseling (JPDK)*, *5*(2), 3245-3249.

Kuhail, M. A., Alturki, N., Alramlawi, S., & Alhejori, K. (2023). Interacting with educational chatbots: A systematic review. *Education and Information Technologies*, *28*(1), 973-1018.

Kurniadi, D., Septiana, Y., & Sutedi, A. (2023). Alternative text pre-processing using ChatGPT Open AI. *Jurnal Nasional Pendidikan Teknik Informatika: JANAPATI*, *12*(1), 67-77.

Liu, X., Zheng, Y., Du, Z., Ding, M., Qian, Y., Yang, Z. & Tang, J. (2021). GPT understands, too. *arXiv*, doi: 10.48550/arXiv.2103.10385.

Lo, C. K. (2023). What is the impact of ChatGPT on education? A rapid review of the literature. *Education Sciences*, *13*(4), 1-15. https://doi.org/10.3390/educsci13040410

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). *Intelligence unleashed - an argument for AI in education*. Retrieved from http://discovery.ucl.ac.uk/1475756/

Manik, E., Marbun, Y., Simanjuntak, R. A. B., & Simarmata, R. J. (2023). Video Youtube dalam proses pembelajaran dengan ChatGPT. *Jurnal Pendidikan dan Konseling (JPDK)*, *5*(2), 2297-2303.

Mhlanga, D. (2023). Open AI in education, the responsible and ethical use of ChatGPT towards lifelong learning. *Education, the Responsible and Ethical Use of ChatGPT Towards Lifelong Learning (February 11, 2023)*.

Mollman, S. (2022). *ChatGPT gained 1 million users in under a week*. Accessed from: www.yahoo.com/lifestyle/chatgpt-gained1-million-followers

Murcahyanto, H. (2023). Penerapan media ChatGPT pada pembelajaran manajemen pendidikan terhadap kemandirian mahasiswa [Application of ChatGPT media in educational management learning towards student independence]. *Edumatic: Jurnal Pendidikan Informatika*, *7*(1), 115-122. https://doi.org/10.29408/edumatic.v7i1.14073

Pavlik, J. V. (2023). Collaborating with ChatGPT: Considering the implications of generative artificial intelligence for journalism and media education. *Journalism & Mass Communication Educator*, *78*(1), 84-93.

Ray, P. P. (2023). ChatGPT: A comprehensive review on background, applications, key challenges, bias, ethics, limitations, and future scope. *Internet of Things and Cyber-Physical Systems, 3*, 121–154.

Setiawan, A., & Luthfiyani, U. K. (2023). Penggunaan ChatGPT untuk pendidikan di era Education 4.0: Usulan inovasi meningkatkan keterampilan menulis [Using ChatGPT for education in the Education 4.0 era: Proposed

innovations to improve writing skills]. *JURNAL PETISI (Pendidikan Teknologi Informasi)*, *4*(1), 49-58. https://doi.org/10.36232/jurnalpetisi.v4i1.3680

Shidiq, M. (2023). The use of artificial intelligence-based ChatGPT and its challenges for the world of education; from the viewpoint of the development of creative writing skills. In *Proceeding of International Conference on Education, Society and Humanity*, *1*(1), 353-357.

Supriyadi, E. (2022). Eksplorasi penggunaan ChatGPT dalam penulisan artikel pendidikan Matematika [Exploration of the use of ChatGPT in writing Mathematics education articles]. *Papanda Journal of Mathematics and Sciences Research (PJMSR),* *1*(2), 54-68. https://doi.org/10.56916/pjmsr.v1i2.252

Temsah, O., Khan, S. A., Chaiah, Y., Senjab, A., Alhasan, K., Jamal, A., ... & Senjab, A. M. (2023). Overview of early ChatGPT's presence in medical literature: Insights from a hybrid literature review by ChatGPT and human experts. *Cureus*, *15*(4), 1-7.

Trust, T., Whalen, J., & Mouza, C. (2023). ChatGPT: Challenges, opportunities, and implications for teacher education. *Contemporary Issues in Technology and Teacher Education*, *23*(1), 1-23.

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), 1-27.