Exploring the Efficacy of AI Passion-Driven Pedagogy in Enhancing Student Engagement and Learning Outcomes: A Case Study in Philippines

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Abstract

The purpose of this study is to examine students' perceptions of the integration of artificial intelligence (AI) into educational settings as well as its impact on learning outcomes. Students are positive about their potential for personalized learning experiences and adaptive feedback despite limited exposure to AI-driven tools. An analysis of pre-test and post-test data demonstrates a significant improvement in academic performance, particularly among female students. Students should be educated about AI tools and receive enhanced training to be able to effectively use them in future educational initiatives. To address gender-based differences in intervention effectiveness, tailored approaches are necessary. Student engagement and fostering a conducive learning environment can be enhanced through continuous evaluation of AI-integrated programs. It highlights the potential of AI to revolutionize education, emphasizing the need for ongoing assessment and targeted support to ensure optimal implementation.

Keywords: *AI, ChatGPT, Bard, Bing. Perplexity, Pedagogy*

INTRODUCTION

Artificial Intelligence (AI) is becoming a focal point of contemporary research, offering the promise of revolutionizing traditional teaching methodologies, and enhancing learning outcomes. In recent years, educators and scholars alike have become increasingly aware of the potential for artificial intelligence to transform the educational landscape, resulting in a surge in interest in exploring its applications in various educational contexts. An area of particular interest within this burgeoning field is the effectiveness of AI-driven pedagogical approaches in increasing student engagement and improving learning outcomes. The purpose of this study is to investigate the effectiveness of AI passion-driven pedagogy, a novel instructional method that utilizes AI tools to cultivate students' interests and improve their learning outcomes.

Currently, there is a growing body of research exploring the application of AI to education. Studies conducted by Simonsen & Almeida (2020), Crompton & Song (2021), and others have demonstrated AI's practical utility in higher education, triggering discussions on its pedagogical implications. Additionally, Zhao et al. (2022), Hannan (2021), Boscardin (2023), and Ishaaq (2023) have examined AI's ability to enhance student learning experiences across diverse educational domains, emphasizing its transformative potential. A recent trend in educational research emphasizes the importance of AI literacy among learners and the need for comprehensive AI education initiatives.

Zhang (2023), Vasoya (2023), Lukianets & Lukianets (2023), and Xu & Ouyang (2022) have shed light on the importance of integrating AI into educational platforms and minimizing the associated risks. The potential impact of AI passion-driven pedagogy on student engagement and learning outcomes is a topic of growing interest in educational research. The use of artificial intelligence (AI) in education has the potential to revolutionize teaching and learning practices. AI-driven decision support tools have been shown to significantly impact decision-making processes in various fields, including healthcare (Barrett et al., 2019). Additionally, the integration of AI into pedagogical approaches requires a shift in the way educators and students engage with technology, emphasizing the importance of building evaluative judgment and literacies in an AI-mediated world (Bearman & Ajjawi, 2023).

In the context of the Philippines, where healthcare and education are critical areas of focus, the potential impact of AI passion-driven pedagogy on student engagement and learning outcomes is particularly relevant. The economic burden of healthcare-related issues, such as dengue fever and vaccination programs, underscores the importance of innovative approaches to education and healthcare delivery (Edillo et al., 2015; Haasis et al., 2015; Chootipongchaivat et al., 2016). Furthermore, the psychosocial impact of medical conditions, such as human papillomavirus infections, highlights the interconnectedness of health and well-being with educational practices (Miyashita et al., 2009; Buenconsejo et al., 2019). Research on student engagement and learning outcomes in various educational settings has demonstrated the significance of deliberate reflection and student-centered instruction in promoting engagement and improving learning outcomes (Granger et al., 2012; Ribeiro et al., 2019; Xu et al., 2022; Foster & Carboni, 2008; Tadesse & Edo, 2020). Moreover, the role of passion and cognitive engagement in problem-solving and online learning has been identified as crucial factors in shaping the learning experiences of students (Kartinah & Prasetyowati, 2022; Chang, 2023). As AI technology continues to evolve, understanding the impact of educational student engagement on learning outcomes becomes increasingly important. The potential benefits of AI-driven pedagogy in reducing clinician burden, improving clinical efficacy, and enhancing patient experience and outcomes in healthcare settings also have implications for educational practices (Ski & Rocca, 2020). Furthermore, the trust and perceptions of teachers regarding AI-based educational technology play a significant role in its adoption and integration into pedagogical approaches (Nazaretsky et al., 2022).

Despite the growing body of research in this area, there remains a gap in our understanding of the effectiveness of AI passion-driven pedagogy in fostering student engagement and improving learning outcomes. The purpose of this study is to fill this gap by empirically investigating the impact of AI-driven instructional approaches on student learning experiences. This study has significant implications for educators, policymakers, and researchers involved in shaping the future of education. This study aims to develop evidence-based instructional strategies aimed at maximizing student engagement and learning outcomes in diverse educational settings by elucidating the efficacy of AI passion-driven pedagogy.

This study focuses on the effectiveness of AI-driven instructional methods in fostering student engagement and improving learning outcomes. Moreover, it is imperative to investigate how AI tools such as ChatGPT, Perplexity, Bard, and Bing AI influence student learning experiences. Thus, this study provides empirical insight into the efficacy of passion-driven pedagogy to contribute to the ongoing discussion about AI's transformative potential in education. The purpose of this research is to advance our understanding of how artificial intelligence (AI) can be harnessed to enhance student engagement and learning outcomes in educational settings.

METHODOLOGY

Research Design

This study utilized a quasi-experimental pretest-posttest design to rigorously assess the efficacy of AI passion-driven pedagogy in comparison with conventional teaching methods among high school students. A practical constraint precluded random assignment of participants to treatment groups, making this study design an optimal method for evaluating the impact of the intervention in the given situation. The quasi-experimental design enabled researchers to draw meaningful comparisons between the experimental group, which received instruction infused with artificial intelligence-driven pedagogical strategies, and the control group, which underwent teacher-facilitated instruction using

conventional methods. Using a pretest-posttest design, the study examined changes in student engagement and learning outcomes over time, allowing insight into the effectiveness of the intervention.

Locale and Participants of the study

The study involved 71 high school students from Quirino National High School, focusing on STEM students. Purposive sampling was used to select students based on their interest and aptitude for technology-related subjects. The school was chosen for its diverse and representative sample, allowing for a comprehensive exploration of AI integration in education. The students' predisposition towards technology-related subjects made them ideal candidates for assessing the effectiveness of AI-driven pedagogical approaches. Focusing on a single school also facilitated the implementation of standardized instructional protocols, ensuring consistency in intervention delivery and minimizing potential confounding variables. The deliberate selection of participants and the research site, along with the gender and age distributions illustrated in Figures 1 and 2, reinforce the validity and reliability of the study's conclusions regarding the effectiveness of AI-driven pedagogy in enhancing student engagement and learning outcomes in STEM education.

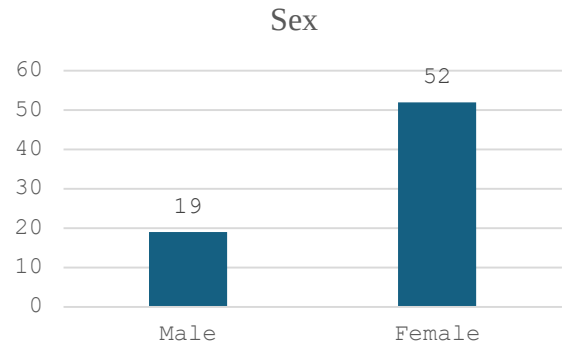

Figure 1. Gender distribution of the sampled participants.

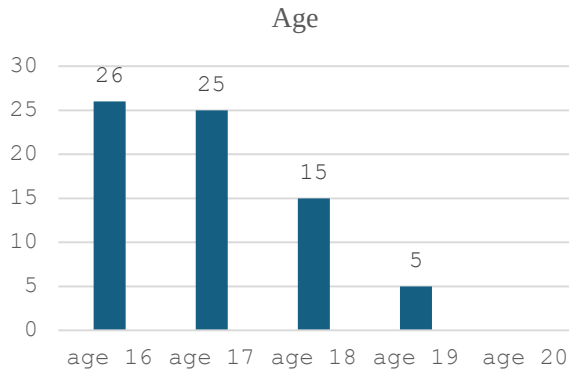

Figure 2. Age distribution of the sampled participants.

Procedures

Procedure and Treatment of the Experimental Group: The experimental group received instruction infused with AI-driven passion-driven pedagogy. It involved the systematic integration of AI tools such as ChatGPT, Perplexity, Bard, and Bing AI to enhance instruction, engage students, and analyze data.

As a result of ChatGPT, personalized learning materials have been generated, instant feedback has been provided, and interactive learning experiences have been facilitated. By engaging in meaningful discussions, asking questions, and receiving tailored responses, students gained a deeper understanding of the course material. To measure students' comprehension and engagement levels, Perplexity was used. AI-driven interventions were assessed in terms of their effectiveness in promoting

deeper learning and critical thinking by analyzing the complexity of students' responses to instructional prompts.

Bard was instrumental in developing curriculum and lesson plans. As a result of its capability to generate coherent and contextually relevant instructional materials, the program ensured alignment with educational standards and research objectives.

In addition, Bing AI was used to collect supplementary information and to verify the accuracy of the sources cited in the study. The study's findings were strengthened by its advanced search capabilities. A structured approach for incorporating AI into instructional practices was provided by the PREP & EDIT Framework throughout the research process.

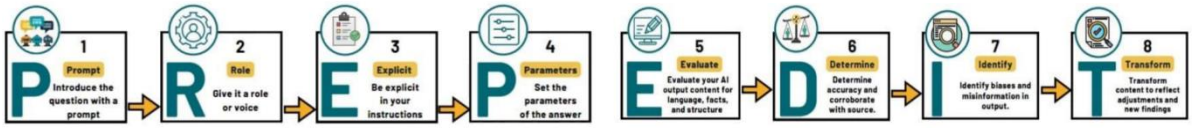

Figure 3. The PREP & EDIT Framework (Fitzpatrick, Fox & Weinstein (2023)

The P.R.E.P. framework guides research design by defining participants' roles and ensuring consistency in data collection and analysis as presented in the Figure 3. It sets parameters for outcomes, guiding the research process and enhancing efficacy. The E.D.I.T. framework evaluates research content for quality, accuracy, and reliability. Researchers assess language, verify factual accuracy, and identify biases. They examine their own assumptions and potential sources of bias.

Procedure and Treatment of the Control Group:_The control group, on the other hand, was instructed using conventional methods by a teacher. AI-driven pedagogical strategies were not incorporated into their instruction. In this procedure, traditional classroom instruction was used without the use of artificial intelligence tools. AI technologies enabled personalized learning experiences for the experimental group while conventional methods were used by the control group. Through traditional methods, they participated in classroom discussions, completed assignments, and received feedback from their teachers. Both groups were subjected to the same assessment measures throughout the study, allowing for direct comparison between AI passion-driven pedagogy and conventional teaching methods.

RESULTS

Students Engagement Using AI For Learning

The Table 1 reveals that 16.90% of students have used AI for learning, while 83.09% haven't. This suggests a gap in familiarity with AI-driven educational tools.

Table 1. Distribution of response of students in using AI.

Response	Frequency	Percentage (%)	Remarks
Yes	12	16.90	AI are not used earlier
No	59	83.09	
Total	**71**	**100**	

The data in Table 2 shows that students generally have positive perceptions of the use of artificial intelligence (AI) in teaching. They believe AI can adapt lessons to individual learning needs, providing tailored education. They also find AI-generated feedback helpful in improving understanding and suggesting relevant study materials. Students prefer AI chatbots

and materials for quick answers and tailored learning styles. They value AI's role in tracking performance and collaboration. Overall, students have a strong positive sentiment towards AI in teaching, with a mean score of 4.02 and a low standard deviation. This indicates a high level of confidence and optimism in the integration of AI technology in educational practices.

Table 2. Students' perception on the use of AI in teaching.

Indicators	Mean	S.D	Remarks
I believe AI can adapt lessons to my individual learning needs.	4.00	.678	Positive
I find AI-generated feedback helpful for improving my understanding.	4.00	.896	Positive
I appreciate AI suggesting relevant study materials based on my interests.	4.00	.964	Positive
I prefer using AI chatbots for quick answers to my questions outside class.	4.00	.675	Positive
I think AI adjusting lessons based on my progress would benefit me.	4.00	.875	Positive
I enjoy using AI simulations for hands-on experiments.	3.98	.578	Positive
I find AI tools helpful for language learning, like translation and pronunciation feedback.	4.04	.785	Positive
I prefer AI-generated materials tailored to my learning style.	4.23	.892	Positive
I value AI analytics tracking my performance to help me improve.	3.98	.643	Positive
I believe collaborating with AI developers could enhance my learning experience.	3.97	.675	Positive
Overall Mean	**4.02**	**.764**	**Positive**

The Table 3 shows students' ratings of AI in teaching and learning, categorized by frequency and percentage. No students expressed disinterest or aversion towards AI integration. Most students (83.09%) found the use of AI to be very interesting, indicating a strong positive sentiment towards its use in educational settings. The absence of low interest levels and the majority's enthusiasm for AI in educational practices suggest a consistent favorable attitude towards AI in various aspects of teaching and learning. Overall, the data reveals a high level of interest and enthusiasm among students for AI integration in education.

Table 3. Students rating in the used of AI in teaching and learning.

Indicators	Frequency	Percentage (%)	Remarks
Not Interesting	0	0	Very Interesting
Fairly Interesting	0	0	
Averagely Interesting	12	16.90	
Very Interesting	59	83.09	
Highly Interesting	0	0	
Total	**71**	**100**	

Table 4 shows the results of a paired sample test comparing pre-test and post-test scores of 71 students. The mean pre-test score is 16.09, with a standard deviation of 1.14. The t-value is 1.66, and the degrees of freedom are 70. The p-value is.00, indicating a statistically significant difference between the pre-test and post-test scores. The null hypothesis is rejected, indicating a significant difference in scores between the pre-test and post-test. This suggests that the intervention or teaching method implemented between the pre-test and post-test has significantly improved students' test scores.

Table 4. Paired sample test result of the pre-test and post-test scores of students.

Variable	N	Mean	SD	t-value	df	p-value
Pretest	71	16.09	1.14	1.66	70	.00
Post test	71	24.95	4.52			

The Table 5 compares pre-test and post-test scores of students based on their gender. The data is divided into male and female groups. The mean scores for males were 15.66 and 16.18, respectively, and for females it was 23.25 and 25.30. The standard deviation for males was 2.06, while for females it was 0.94. The t-value for pre-test was -1.19, and for post-test it was -3.36. The mean difference between pre-test and post-test scores was -0.520 and -2.050, respectively. The results suggest that females outperformed males in both pre-test and post-test, and that the intervention or treatment had a differential effect on males and females. This suggests that there are gender differences in the effectiveness of the intervention or treatment, with females benefiting more in terms of improved test scores compared to males.

Table 5. Independent t -test result of the pre-test and post test scores based on their sex.

Variable	**Sex**	**N**	**Mean**	**SD**	**t**	**df**	**p-value**	**Mean Dif.**	**Stdr. Error Diff.**
Pre-Test	M	12	15.66	2.06	-1.19	13	0.25	-0.520	0.777
	F	59	16.18	0.94					
Post Test	M	12	23.25	3.65	-3.36	16	0.00	-2.050	1.174
	F	59	25.30	4.04					

The Table 6 analyzed the pretest and posttest scores of 12 male students, with a mean of 15.66 and 23.25 respectively. The paired sample t-test showed a significant difference between the two, with a p-value of 0.00. This suggests that the intervention or treatment applied had a substantial effect on improving the test scores of male students. The findings suggest that the intervention or treatment implemented for male students led to a statistically significant improvement in their test scores, with posttest scores being remarkably higher than pretest scores.

Table 6. Paired sample t-test between the pretest and posttest scores of male students (N-12).

Sample	**N**	**Mean**	**SD**	**t**	**Df**	**p-value**
Pretest	12	15.66	2.06	-10.650	11	0.00
Post Test	12	23.25	3.65			

Table 7 shows a paired sample t-test comparing pretest and posttest scores of female students. The sample size is 59 female students. The mean pretest score is 16.18, while the mean posttest score is 25.30. The t-value is -33.32, indicating a significant difference between the two. The p-value is less than 0.05, rejecting the null hypothesis. The findings suggest that the intervention or treatment applied significantly improved the test scores of female students, with posttest scores being significantly higher than pretest scores. This suggests that the intervention or treatment led to a significant improvement in their test scores.

Table 7. Paired sample t-test between the pretest and posttest scores of female students (N-59).

Sample	N	Mean	SD	t	Df	p-value
Pretest	59	16.18	0.94	-33.32	58	0.00
Post Test	59	25.30	4.04			

DISCUSSION

The study highlights the need for further exploration and integration of artificial intelligence (AI) in education. It reveals that only a small percentage of students have utilized AI for learning purposes, highlighting the gap in familiarity with AI technologies. However, students' express confidence in AI's ability to adapt lessons to individual learning needs, provide tailored education, and offer valuable feedback. The widespread interest and enthusiasm among students for AI integration in teaching and learning underscore the potential of AI to positively impact various aspects of education. The study also demonstrates a significant improvement in students' test scores following the implementation of AI-driven instructional approaches, highlighting the efficacy of AI-driven instructional approaches in improving academic performance. The study also identifies gender differences in the effectiveness of the intervention, emphasizing the importance of considering gender-specific factors in educational interventions. The findings contribute to the ongoing efforts to harness the transformative potential of AI in education and improve learning experiences for students globally.

According to Zawacki-Richter et al. (2019), there is a gap in familiarity with AI technologies among students, but they have shown confidence in AI's ability to customize lessons, deliver personalized education, and provide valuable feedback. The integration of AI in education has been found to enhance students' test scores and boost academic performance. Gender-specific variations in the efficacy of AI interventions have also been recognized. The literature emphasizes the need for innovative research and practice with AI in education, particularly in higher education contexts. Luan et al. (2020) suggest that AI can aid educators in identifying students' learning trajectories, formulating lesson plans, and implementing effective teaching strategies. The potential of AI to revolutionize teaching methodologies, learning experiences, and educational outcomes is evident, and it is important to integrate AI technologies into educational practices.

CONCLUSION

As a conclusion, the study reveals that students have a positive perception of the integration of artificial intelligence (AI) into educational settings, even though only a minority has used AI-driven educational tools. Students are enthusiastic about the potential of artificial intelligence in providing personalized learning experiences, adaptive feedback, and tailored study materials. A significant improvement in test scores was observed between the pre-test and post-test, demonstrating the effectiveness of the educational approach. The gender-based analysis indicates that female students tend to outperform male students, with the intervention showing a more pronounced positive effect on female students.

In the future, educational institutions should prioritize initiatives aimed at bridging the knowledge gap among students regarding artificial intelligence-driven educational tools. To effectively utilize AI-driven educational tools, students and educators need enhanced training and support. Considering the gender differences in the effectiveness of interventions, tailored approaches should be developed to address the specific needs and preferences of males and females. It is imperative to continuously evaluate AI-integrated educational programs to determine their effectiveness and identify areas for improvement. Educators can leverage the potential of artificial intelligence to enhance student engagement, improve learning outcomes, and create a conducive educational environment by addressing these recommendations.

REFERENCES

Barrett, M., Boyne, J., Brandts, J., Rocca, H. B., Maesschalck, L. D., Wit, K. D., … & Zippel-Schultz, B. (2019). Artificial intelligence supported patient self-care in chronic heart failure: a paradigm shift from reactive to predictive, preventive and personalised care. EPMA Journal, 10(4), 445-464. https://doi.org/10.1007/s13167-019-00188-9

Bearman, M. and Ajjawi, R. (2023). Learning to work with the black box: pedagogy for a world with artificial intelligence. British Journal of Educational Technology, 54(5), 1160-1173. https://doi.org/10.1111/bjet.13337

Boscardin, C. K., Gin, B., Golde, P. B., & Hauer, K. E. (2023). Chatgpt and generative artificial intelligence for medical education: potential impact and opportunity. Academic Medicine, 99(1), 22-27. https://doi.org/10.1097/acm.0000000000005439

Buenconsejo, L., Kothari-Talwar, S., Yee, K., Kulkarni, A., Lara, N., Roset, M., … & Garland, S. M. (2019). Estimating the burden of illness related to genital warts in the philippines: a nationally representative cross-sectional study. Infectious Agents and Cancer, 14, 1-25. https://doi.org/10.1186/s13027-019-0240-y

Chang, Y. (2023). A meta-analysis based study of the factors influencing students' engagement in classroom learning. Proceedings of the 2022 3rd International Conference on Artificial Intelligence and Education (IC-ICAIE 2022), 772-777. https://doi.org/10.2991/978-94-6463-040-4_117

Chootipongchaivat, S., Chantarastapornchit, V., Kulpeng, W., Ceria, J. A., Tolentino, N. I., & Teerawattananon, Y. (2016). Vaccination program in a resource-limited setting: a case study in the philippines. Vaccine, 34(40), 4814-4819. https://doi.org/10.1016/j.vaccine.2016.08.014

Crompton, H. and Song, D. (2021). The potential of artificial intelligence in higher education. Revista Virtual Universidad Católica Del Norte, (62), 1-4. https://doi.org/10.35575/rvucn.n62a1

Edillo, F. E., Halasa, Y. A., Largo, F. M., Erasmo, J. N. V., Amoin, N. B., Alera, M. T., … & Shepard, D. S. (2015). Economic cost and burden of dengue in the philippines. The American Journal of Tropical Medicine and Hygiene, 92(2), 360-366. https://doi.org/10.4269/ajtmh.14-0139

Foster, P. and Carboni, I. (2008). Using student-centered cases in the classroom. Journal of Management Education, 33(6), 676-698. https://doi.org/10.1177/1052562908328747

Granger, E. M., Bevis, T. H., Saka, Y., Southerland, S. A., Sampson, V., & Tate, R. L. (2012). The efficacy of student-centered instruction in supporting science learning. Science, 338(6103), 105-108. https://doi.org/10.1126/science.1223709

Haasis, M. A., Ceria, J. A., Kulpeng, W., Teerawattananon, Y., & Alejandria, M. M. (2015). Do pneumococcal conjugate vaccines represent good value for money in a lower-middle income

country? a cost-utility analysis in the philippines. Plos One, 10(7), e0131156. https://doi.org/10.1371/journal.pone.0131156

Hannan, E. (2021). Ai: new source of competitiveness in higher education. Competitiveness Review: An International Business Journal, 33(2), 265-279. https://doi.org/10.1108/cr-03-2021-0045

Ishaaq, N. and Sohail, S. S. (2023). Re: investigating the impact of innovative ai chatbot on post-pandemic medical education and clinical assistance: a comprehensive analysis. ANZ Journal of Surgery, 94(3), 494-494. https://doi.org/10.1111/ans.18721

Kartinah , K., & Prasetyowati, D. (2022). Students' Cognitive Engagement in Problem Solving and Online Learning. *KnE Social Sciences*, *7*(14), 1012–1020. https://doi.org/10.18502/kss.v7i14.120

Luan, H., Géczy, P., Lai, H., Gobert, J. D., Yang, S. J. H., Ogata, H., … & Tsai, C. C. (2020). Challenges and future directions of big data and artificial intelligence in education. Frontiers in Psychology, (11) 1-11. https://doi.org/10.3389/fpsyg.2020.580820

Lukianets, H. and Lukianets, T. (2023). Promises and perils of ai use on the tertiary educational level. Grail of Science, (25), 306-311. https://doi.org/10.36074/grail-of-science.17.03.2023.053

Miyashita, M., Agdamag, D. M., Sasagawa, T., Matsushita, K., Salud, L. M., Salud, C. O., … & Ishiguro, H. (2009). High-risk hpv types in lesions of the uterine cervix of female commercial sex workers in the philippines. Journal of Medical Virology, 81(3), 545-551. https://doi.org/10.1002/jmv.21416

Nazaretsky, T., Cukurova, M., & Alexandron, G. (2022). An instrument for measuring teachers' trust in ai-based educational technology. LAK22: 12th International Learning Analytics and Knowledge Conference. https://doi.org/10.1145/3506860.3506866

Ribeiro, L. M. C., Mamede, S., Brito, E. M. d., Moura, A. S., Faria, R., & Schmidt, H. G. (2019). Effects of deliberate reflection on students' engagement in learning and learning outcomes. Medical Education, 53(4), 390-397. https://doi.org/10.1111/medu.13798

Simonsen, H. K. and Almeida, J. M. E. B. d. (2020). Artificial intelligence and learning activities: a match made in heaven?. EDEN Conference Proceedings, (1), 198-206. https://doi.org/10.38069/edenconf-2020-rw-0022

Ski, C. F. and Rocca, H. B. (2020). Putting ai at the centre of heart failure care. ESC Heart Failure, 7(5), 3257-3258. https://doi.org/10.1002/ehf2.12813

Tadesse, T. and Edo, B. (2020). The relationships between student engagement and learning outcome in the undergraduate sports science program in ethiopia. Journal of Applied Research in Higher Education, 13(1), 48-62. https://doi.org/10.1108/jarhe-01-2019-0017

Vasoya, N. H. (2023). The role of parents and educators in managing the risks of artificial intelligence. Asian Journal of Education and Social Studies, 41(4), 1-5. https://doi.org/10.9734/ajess/2023/v41i4899

Xu, W. and Ouyang, F. (2022). The application of ai technologies in stem education: a systematic review from 2011 to 2021. International Journal of STEM Education, 9(1). https://doi.org/10.1186/s40594-022-00377-5

Xu, X., Bos, N. A., & Wu, H. (2022). The relationship between medical student engagement in the provision of the school's education programme and learning outcomes. Medical Teacher, 44(8), 900-906. https://doi.org/10.1080/0142159x.2022.2047168

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

Zhang, J. (2023). Design and simulation of autonomous learning platform for constructive english teaching based on artificial intelligence. Sixth International Conference on Intelligent Computing, Communication, and Devices (ICCD 2023). https://doi.org/10.1117/12.2683093

Zhao, Y., Li, J., Liu, K., & Wang, J. (2022). Analyzing the spatio-temporal characteristics and influencing factors of "ai + education" network attention in china. Mathematical Problems in Engineering, 2022, 1-17. https://doi.org/10.1155/2022/5101967