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ANALYSIS OF HIGHER EDUCATION STUDENT'S ATTITUDE TOWARDS AI-BASED EDUCATIONAL INTERVENTION FOR LEARNING

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Abstract

The AI revolution is bringing about further technological innovation that is changing the face of education. This tendency makes it necessary to do research on how students view its application. Thus, the purpose of this study was to find out how college students felt about its use in teaching, learning, and research. This work was premised from the foregoing; thus, the study investigates student's attitude towards AI-based educational intervention for learning. Three questions and three null hypotheses guided the study. The descriptive survey design was used. The population was 15,875 higher education students in the University of Port Harcourt and a sample of 150 students was randomly drawn using a stratified sampling technique based on gender. Student's attitude towards AI-based education intervention for learning Scale was used to obtain the data. Validities was ensured using expert judgement and empirical evidence of factor analysis. Cronbach alpha was used to obtain a reliability coefficient of 0.82. Data were analyzed using mean, standard deviation, t-test and one-way ANOVA. The result showed that 98% representing majority of students had a positive attitude towards AI-based educational intervention for learning and research. Result further showed that gender and age did not have a significant influence on students' attitude. It was accordingly recommended among others that educators should familiarize themselves with AI-based educational interventions and their potential benefits to effectively incorporate them into their teaching practices while students should take advantage of AI technology opportunities to learn about its applications in learning and research.

Keywords: Artificial Intelligence, Educational interventions, Learning, Attitude, gender, age.

Introduction

Artificial intelligence (AI) and other technological breakthroughs are bringing about a revolutionary shift in education. The use of a digital machine to carry out activities often performed by intelligent individuals is known as artificial intelligence (AI) (Chiu et al. 2023). It may also be understood as computer systems built to do human-like functions as learning, adapting, synthesizing, self-correcting, and leveraging data to perform intricate tasks (Popenici & Kerr 2017). Artificial intelligence, to put it simply, is the intelligence shown by robots as opposed to humans (Ahmad et al., 2021). AI is having an increasingly big impact on the development of many industries, including manufacturing, science, health, education, economics, the judiciary, defense and security, and media (Alzahrani, 2023; Cui 2020; Gupta et al., 2021; Leslie 2020; Maruthappu, 2018; Maree et al., 2020; Moreno, 2019; Trocin et al 2021; Wang & Tian 2023). The term "AI-based educational interventions" describes a variety of tools and programs that use AI methods and algorithms to improve learning. Terms like AI in education have been used by Chiu et al. (2023) in reference to the same idea. Machine learning algorithms, natural language processing, and other AI approaches are used in AI-based educational interventions to improve teaching, learning, and research processes. Intelligent tutoring systems (ITS), chatbots, virtual assistants, intelligent content generating systems, adaptive learning platforms, writing helpers, automated grading systems, and detecting systems are all included in this category of interventions. Chui et al. (2023) define AI in Education as the use of

AI technologies, including chatbots, robots, intelligent tutoring systems, and the automated evaluation of all forms of digital artifacts that support and improve education.

Intelligent tutoring systems (ITS) is one prominent example. It makes use of AI algorithms to provide students adaptive feedback and individualized education depending on their unique learning requirements. Others include virtual help and immersive technology (virtual and augmented reality). Virtual assistants and immersive technology provide dynamic and interesting learning environments. They also provide students on-demand help by responding to inquiries, giving advice, and supplying materials (Wang et al., 2016; Wu et al., 2020; Yang et al., 2023). Using AI algorithms, adaptive learning systems customize learning paths and material for each student, maximize their development in the classroom. Automated grading systems enhance speed and uniformity in the grading process by using AI methods to evaluate and offer comments on student work. Another example is data-driven research support, which aids in the collection and analysis of pertinent data for their scholarly work. AI algorithms are used by programs like Grammarly, Quill Bot, and Zotero to help with writing, citation management, and proofreading. Another AI intervention with an emphasis on teaching is Intelligent Content Generation/Chatbots. Customized learning resources may be produced by AI algorithms depending on predetermined themes or prompts. Chatbots are computer programs that help people with a variety of tasks by using natural language processing. (Shawar & Atwell 2007; Mendoza 2022) These AI-generated resources are available for use by students as study and reference materials. These comprise, among others, Bing, Bard AI, and OpenAI's GPT-3 model.

Researchers have studied the use of various AI solutions in education for research, teaching, and learning across time. Research has explored the integration of artificial intelligence (AI) with many educational technologies, including chatbots (Clark, 2020) and voice recognition technology to enhance student learning (Johnson, 2010). Immersion technologies, such as virtual and augmented reality, are being used in healthcare and medical education, together with intelligent tutoring and automated grading systems (Crow et al., 2018). Wang et al., 2016; Michael et al., 2014). collaboration and depersonalization of learning experiences (Luckin et al., 2016); scheduling of learning activities and adaptive feedback on learning processes (Koedinger et al., 2012); anticipating the likelihood that students will drop out of school or be admitted (Popenici & Kerr, 2017); tracking student progress (Gaudioso et al., 2012); summative assessment, such as automated essay scoring (Okada et al., 2019; Yuan et al., 2020); research study by Ogan et al. (2017) where teachable agents assist in reducing language barriers and students' attitudes towards AI in education and some factors influencing these attitudes (Ahmad et al 2023)

Artificial intelligence (AI)-driven interventions provide new ways to improve learning outcomes, customize learning pathways, and involve students actively in their own education. Furthermore, these interventions are essential in transforming research methods, creating new research directions, and hastening scientific discoveries. According to most other researchers, using AI in education improves student learning outcomes, expedites work processes, increases access educational resource, provides feedback and a guided learning pathway, and lowers costs through increased retention, a shorter educational path, and a shorter completion time (Ahmad et al., 2023; Celik et al., 2022; Humble & Mozelius, 2022; Klutka et al., 2018; Kulik & Fletcher, 2016; Roll & Wylie, 2016).

The discussion above makes clear how much AI-based educational interventions have the potential to positively change higher education. But there are certain disadvantages and risks as well. The possible decrease in human-to-human contact is one of the primary drawbacks of AI-based educational interventions for learning. An over-reliance on AI may result in less human relationships and the development of critical skills. Use of AI in education requires a substantial technical infrastructure. For universities with little funding or technical assistance, this might be difficult. In addition, there are ethical questions about using AI in education for learning. For instance, concerns about algorithmic transparency, accountability, and data

ownership. The danger of educational data security, the risk of educational inequity and the breakdown of the teacher-student role structure, and the risk of being estranged from educational objectives are some more. (Bu 2022), the propensity for excessive AI usage to hinder students' capacity to study on their own and cultivate 21st century abilities like critical thinking and problem solving (Wogu et al., 2018), and instructors' lack of technical infrastructure and technological expertise (McCarthy et al., 2016).

Notwithstanding these dangers, obstacles, and difficulties, integrating AI-based educational interventions has enormous potential to transform research and learning methodologies, spur innovation, and promote both domestic and international transformation. It is critical to consider students' opinions regarding AI-based educational interventions as higher education institutions work to fully use the advantages of these technologies. That is to say, attitudes among students, including their desire to interact with them, are critical to the effective integration and acceptance of AI technology in education. The term "attitude" describes how someone sees and assesses something or someone, as well as their propensity to react either positively or negatively to a certain concept, item, person, or circumstance. Sanchez Vargas et al. (2016). Regarding artificial intelligence, it speaks to students' inclination to react positively or negatively to AI-based educational interventions in the context of teaching and learning.

Students' opinions on AI-based educational interventions may be influenced by a number of factors, including perceived utility, simplicity of use, past experience, trust, psychological aspects, and socio demographic elements like gender and age, to name a few. AI-based educational interventions may be seen as tools that help improve the learning process by offering individualized information, immediate feedback, and adaptable learning paths by students who have a favorable attitude toward technology and innovation. Additionally, those who are adaptable and welcome new teaching techniques can be more accepting of AI in the classroom since they perceive it as a means of keeping up with the most recent developments in their industry. However, some students may not see AI as a positive development in the classroom since they believe it would ultimately replace human teachers and cause job displacement in the teaching field. Similarly, a negative view of AI-based educational interventions may also stem from worries about data privacy, the moral application of AI, and biases in AI systems.

One element that might affect attitude is age. An individual's age is a measure of their life expectancy, usually given in years (Iruloh & Eteng-Uket 2023). Younger students may see AI-based treatments more favorably since they have grown up in a digital era and are more tech-savvy. They could feel more at ease using technology to aid in their education. However, since they may be less tech-savvy or worry about adjusting to new teaching techniques, older students may be more hesitant when it comes to AI in the classroom. Another element that might affect attitude is gender. The social, cultural, and psychological traits connected to being male or female are collectively referred to as gender (Iruloh & Eteng-Uket 2023). Students' perceptions of AI in the classroom may be influenced by gender preconceptions and prejudices. For instance, female students' opinions and interest in AI-based interventions may be influenced if AI is primarily linked to sectors with a male preponderance. Gender-specific learning preferences could also have an impact. Learning preferences may also be influenced by gender, and male and female students may see AI systems that adjust to their unique learning patterns differently. Therefore, creating inclusive and productive learning environments requires an awareness of the views, attitudes, and concerns of male and female students of all ages about AI-based interventions (Liao et al., 2019).

This fact may explain some of the reasons why researchers (Ahmad et al., 2023; Alzahrani 2023; Al Saad et al., 2023; Doumat, 2022; Horowitz MC, & Kahn L 2021; Ooi et al., Swed 2021, Pinto Dos Santos et al., 2019; Sindermann et al., 2021) have looked into students' attitudes toward AI in education and some of the factors influencing these attitudes. The aforementioned highlights the dearth of knowledge and investigation on Nigerian students' perceptions of AI-based educational

interventions for research and learning, especially in Rivers State's higher education. There is a substantial information vacuum about students' opinions, beliefs, and worries surrounding AI in the Nigerian educational framework for learning and research, despite studies being done outside of Africa in a number of other nations. It is crucial to investigate and understand Nigerian students' attitudes toward AI-based interventions by doing research on students' attitudes toward AI in higher education in Rivers State for learning and research in order to effectively integrate and deploy AI technologies in education.

Hypotheses

The following null hypothesis were tested at 0.5 sig level

Ho1: There is no significant mean difference between students with positive and negative attitude towards AI-Based educational intervention for learning

Ho2: There is no significant mean difference between gender and students' attitude towards AI-Based educational intervention for learning

Ho3: There is no significant mean difference between age and students' attitude towards AI-Based educational intervention for learning

Methodology

Non-experimental design of survey research type was adopted for this study. Population consists 15,875 undergraduate at the University of Port Harcourt enrolled in the 2022–2023 academic year. Using disproportionate stratified random selection, 150 people were selected (86 female and 64 male) for the sample. Data were collected using a measure called the Student's Attitude towards AI-based Education Intervention for Learning scale. The scale was divided into two halves, A and B. The purpose of Section A was to collect demographic information from the respondents, including age and gender. Part B had sixteen questions aimed at determining students' attitudes and dispositions about AI-based educational interventions for learning. Using a modified Likert scale with four categories—strongly disagree, agree, disagree, and strongly agree—respondents are asked to score each item on the scale. A high score on this test suggested an optimistic mindset; a low score suggested the opposite. Positive attitudes are indicated by scores over 32, while negative attitudes are indicated by scores below 32. For positively stated item, the replies are scored 4, 3, 2, and 1, while for negatively stated items, the scores are reversed.

Factor analysis and expert judgment were used to establish the face, content, and construct validities. By consulting professionals in test administration and measurement as well as counseling psychology, face and content validity were established. The language, usefulness, completeness, clarity, and literacy requirements of the items were rigorously examined by these specialists. Only the items that obtained substantial acceptance from the experts were kept for item analysis, based on their critiques and remarks. Using multivariate factor analysis, the construct validity of the scale was evaluated, and all items showed a first factor loading that was considerably more than 1. The range of values obtained for the inclusion of the item in the instrument was.30 to.70. The reliability and construct validity of the instruments were estimated using the Cronbach alpha internal consistency technique. These tests were piloted on a sample of thirty respondents. The Cronbach alpha technique was used to assess the selection and quality of each test item. With Cronbach alpha, a reliability coefficient of 0.82 was therefore obtained. The t-test, one-way ANOVA, mean, and standard deviation were used to examine the data.

Results

Hypothesis 1: There is no significant mean difference between students with positive and negative attitude towards AI-Based educational intervention for learning

Table 1: Independent samples t -test analysis showing mean difference in the attitude of students towards AI-Based educational intervention for learning and research

Attitude	N	%	$\bar{x}$	SD	Df	T	Sig.	Decision
Positive	147	98	39.53	6.33	148	4.797	.000	Reject Ho_1
Negative	3	2	21.66	5.03				P<0.05

The investigation of students' perceptions of AI-based educational interventions for research and learning is shown in Table 1. The table gives details about the independent samples t-test analysis, mean, standard deviation (SD), and associated statistical values. According to the Table, just 2% of students have a negative attitude toward AI-based educational interventions, compared to 98% of students who have a good opinion. The group with a positive attitude has a mean score of 39.53 and a standard deviation of 6.33. The negative attitude group, on the other hand, had a mean score of 21.66 and a standard deviation of 5.03. Students generally have a good attitude about AI-based educational interventions for learning. Most students have a positive attitude toward these interventions, indicating their acceptance and willingness to engage with AI technologies for educational purposes.

To ascertain if there is a significant difference between the means of the groups with positive and negative attitudes, an independent samples t-test analysis was performed with a t-value of 4.797, and a degree of freedom (df) of 148 was obtained: The stated significance value (Sig.) is.000, indicating a lower limit of significance than the predetermined 0.05 threshold. Thus, we reject the null hypothesis (Ho1) at the 0.05 significance level based on the t-test findings. This suggests that the positive and negative attitude groups had quite different views on AI-based educational initiatives. According to Table 1, most students (98%) have a favorable opinion of AI-based educational aids for research and learning. Just 2% of respondents have a pessimistic view. The substantial difference in opinions between the groups with positive and negative attitudes suggests that students generally have positive perception of AI-based educational interventions.

Hypothesis 2: There is no significant mean difference between gender and students' attitude towards AI-Based educational intervention for learning

Table 2: Independent samples t -test analysis of mean difference of the influence of gender on attitude of students towards AI-Based educational intervention for learning

Gender	N	%	$\bar{x}$	SD	Df	T	Sig.	Mean Decision
Male	64	43	38.64	6.808	148	.577	.599	Accept Ho_1
Female	86	57	39.36	6.772				P>0.05

The examination of how gender affects students' perceptions of AI-based educational interventions for learning is shown in Table 2. According to the table, 86 female participants make up 57% of the sample, while 64 male participants make up 43% of the sample. With a standard deviation of 6.808, the mean attitude score for male students for AI-based educational interventions is 38.64. For female students, the mean attitude score is 39.36, with a standard deviation of 6.772. Based on the information provided, female students' mean attitude score (39.36) is somewhat higher than male students' (38.64). It suggests a trend of slightly more positive attitudes towards AI-based educational interventions for learning among female students.

To ascertain if there is a statistically

significant mean difference in the views of male and female students, an independent samples t-test analysis is performed. After computing the t-value of 0.577, with 148 degrees of freedom (df). The stated significance value (Sig.) 0.599 is higher, indicating that it above the significance threshold of 0.05. We accept the null hypothesis (Ho1) at the 0.05 significance level based on the t-test findings. Based on the information provided, female students' mean attitude score (39.36) is somewhat higher than male students' (38.64). It indicates a tendency of female students having somewhat higher favorable sentiments regarding AI-based educational initiatives. This suggests that attitudes about AI-based educational interventions are not significantly different between male and female students as seen by the no statistical difference in their mean scores. Gender therefore has no discernible impact on students' opinions of AI-based educational interventions for learning. Between male and female students, there is no statistically significant mean difference in views.

Hypothesis 3: There is no significant mean difference between age and students towards AI-Based educational intervention for learning

Table 3: ***One-way ANOVA of*** **age and attitude of students towards AI -Based educational intervention for learning**

Age	*N*	$\bar{x}$	*SD*	*Df*	*F*	*Sig.*	*Decision*
16-20yrs	7	37.57	8.100				
21-25yrs	89	38.41	.6843		.839	.474	Accept Ho_1 P>0.05
26-30yrs	34	40.14	7.556	3, 146			
31 above	20	40.15	6.772				

The examination of how age affects students' perceptions of AI-based educational interventions for learning is shown in Table 3. The age categories taken into consideration are shown in the table as "16–20 years," "21–25 years," "26–30 years," and "31 years and above." Different age groups have different numbers of participants: 7 in the "16-20 years" group, 89 in the "21-25 years" group, 34 in the "26-30 years" group, and 20 in the "31 years and above" group. For every age group, the standard deviations and mean attitude scores are also shown. The "16-20 years" group's mean attitude score is 37.57, with an 8.100 standard deviation. The mean attitude score for the "21-25 years" category is 38.41, with a standard deviation of 0.6843. The "26-30 years" group's mean attitude score is 40.14, with a 7.556 standard deviation. Finally, with a mean attitude score of 40.15 and a standard deviation of 6.772, the "31 years and above" group is the last one.

There may be minor variations in how students of different age groups see and interact with these interventions, as shown by the differing mean ratings for the various age categories in respect to their views about AI-Based educational interventions. The observed variations in mean scores point to possible inclinations or patterns in the attitudes of the students. The older age groups' higher mean scores (those between 26 and 30 years old and those over 31) may indicate that students in these age ranges have more positive opinions toward AI-based educational interventions. This may be explained by their comfort level and familiarity with technology, or by their awareness of the advantages artificial intelligence (AI) may provide in education. The intermediate mean score within the "21-25yrs" category and the lower mean scores among the younger age group (16-20yrs) however, imply that there could be some differences in attitudes within these age groups. Different exposure to AI technology, educational experiences, or individual student choices among these categories might all be contributing factors.

To analyze the influence of age on mean attitudes towards AI-Based educational intervention, a one-way ANOVA test is

conducted. The F-value is reported as 0.839, with degrees of freedom (df) of 3 and 146. The significance value (Sig.) is presented as 0.474, which is higher than the significance level of 0.05. Based on the result, the null hypothesis (Ho1) is accepted at the 0.05 significance level. This indicates that there is no significant influence of age on students' attitudes towards AI-Based educational intervention for learning.

Discussion of Findings

The analysis's conclusion shows that students generally have a good view toward AI-based educational interventions for learning. This result is consistent with other studies (Ahmad et al., 2023; Al Saad et al., 2023; Ooi et al., Swed 2021) that demonstrated students' favorable attitudes toward artificial intelligence in the classroom. The findings of this research have shown how AI may be used to improve learning outcomes and educational experiences.

It seems that students understand the benefits and worth of using AI technology in education, as seen by the high number of students (98%) who have a favorable attitude toward AI-based interventions. AI may be seen by students as a useful tool that may boost their academic achievement, increase their comprehension of difficult subjects, and provide individualized guidance. The comparatively high mean score of 39.53 for the positive attitude group also reflects the favorable attitude regarding AI use. There might be a number of reasons for the little percentage of students (2%) who have a bad opinion of AI-based solutions. To allay any worries or misgivings, it is crucial to investigate the causes of this pessimistic mindset. Some possible explanations may be a lack of expertise with AI technologies or bad encounters with them in the past, worries about data security and privacy, doubts about AI's usefulness in education, or sociocultural and cultural factors. Students' opinions and acceptance of AI-based interventions vary significantly, as seen by the t-test analysis, which also shows a significant difference in attitudes between the positive and negative attitude groups. This research emphasizes how critical it is to comprehend and remove any obstacles or worries that could be causing people to have negative opinions.

Students' positive attitudes regarding AI-based educational interventions are encouraging and show that they are eager to accept and use AI technology for learning. It's possible that students have encountered AI technology in a variety of contexts, including voice assistants, cellphones, and recommendation engines. Their attitude toward AI-based educational interventions may have been impacted by their familiarity with and positive encounters with AI in their everyday lives. Additionally, students may believe that AI-based instructional interventions are helpful for their education. Positivity may be influenced by the advantages that AI technology is seen to provide. It's possible that prior AI-based educational interventions for students resulted in positive experiences and results. Positive attitudes about these interventions might result from successful experiences, such as greater motivation, better comprehension, or improved academic achievement. Additionally, since they grew up in a technologically advanced environment, today's students are sometimes referred to as "digital natives." They could be more at ease with technology and have a favorable inclination to accept new developments in the field, such as AI-based tools and interventions. Students may be aware of how crucial AI knowledge and abilities are becoming in today's society. They could have a positive attitude toward AI-based educational interventions as they see them as helpful in giving them the necessary help and preparing them for their future employment. It implies that students understand the potential advantages and worth that artificial intelligence (AI) may provide to their learning experiences, opening the door for AI's successful incorporation in settings related to higher education.

For many stakeholders in the education industry, the results, which show that students have a mostly positive view toward AI-based educational interventions for learning, have important ramifications. A positive attitude toward AI-based educational interventions for learning suggests that educational institutions have an opportunity to use AI technology to improve

teaching and learning. To guarantee the ethical and successful integration of AI in education, it also emphasizes the significance of resolving ethical issues, giving educators proper training, and carrying out more research. It's interesting to note that opinions of students about AI-based educational interventions are not significantly influenced by gender. It implies that attitudes and views about the use of AI in education are comparable among male and female students. This finding casts doubt on the idea that gender significantly influences how students feel about technology in the classroom. Even yet, this result differs with Sindermann et al.'s (2021) findings. A possible explanation for this inconsistent outcome might be variations in the socio-demographic characteristics of the research sample, such as the kind of institution, location, and so on. For example, Sindermann et al.'s research from 2021 was conducted outside of Nigeria and Africa, while the present study was conducted in Rivers state Nigeria. These results suggest that gender-related concerns may not always take precedence when putting AI-based solutions into practice. Rather, emphasis should be placed on giving all students, regardless of gender, equal access to resources and opportunities so they may interact with and profit from artificial intelligence (AI) in the classroom.

The result demonstrates that students' opinions about AI-based educational interventions are not significantly influenced by age, which is consistent with findings by Sindermann et al (2021). The lack of a discernible gender gap in opinions on AI-based educational interventions further emphasizes AI's ability to advance equality and inclusiveness in the classroom. Regardless of a student's gender, educators may design individualized and customized learning experiences that meet their requirements and preferences by using AI tools and resources. This may support equal access to educational opportunities and help narrow the gender gap in technology use. The findings imply that students' perceptions about AI-based educational interventions are not significantly influenced by age. Students have similar opinions on the usage of AI in the classroom regardless of their age. This result suggests that age-related variables do not significantly affect opinions toward AI based interventions.

Conclusion

The University of Port Harcourt's undergraduate students have a positive attitude toward AI-based educational interventions for learning, according to the study's findings, which are noteworthy. Additionally, gender and age had no discernible influences. It was found that students' opinions of AI-based educational interventions for learning are not much influenced by age. This research highlights how AI technologies have the potential to be inclusive and useful for people of all ages.

Recommendations

The recommendations that follow were made in light of the study's findings.

1. It is recommended that students both male and female from any age group should embrace AI-Based educational interventions as tools that can enhance learning experience and improve academic outcomes. Similarly, educators should familiarize themselves with AI-based educational interventions and their potential benefits to effectively incorporate them into their teaching practices and also that students should take advantage of opportunities to learn about AI and its applications in learning and research.
2. Students should engage actively with AI tools, ask questions, and provide feedback to optimize their effectiveness irrespective of their gender or age. That is students should develop digital literacy skills to be able to enjoy the benefits that AI offers. Even educators and test developers
3. Educators and school administrators should stay updated on the latest advancements in AI and how they can be applied in education to make informed decisions about their use.
4. Test developers should help Ensure fairness and validity by conducting rigorous validation studies to ensure that AI-based tests are fair, reliable, and unbiased across diverse student populations.

References

Amisha, M. P., Malik, P., Pathania, M. & Rathaur, V. K. (2019). Overview of artificial intelligence in medicine. *J Family Medical Primary Care.* 8(7), 2328-2331.

Ahmad M.N, Abdallah SA, Abbasi SA, Abdallah AM. (2023). Student perspectives on the integration of artificial intelligence into healthcare services. *Digital health* 9, https://doi.org/10.1177/20552076231174095

Alzahrani, Latifa. (2023). Analyzing students' attitudes and behavior toward artificial intelligence technologies in higher education. *International Journal of Recent Technology and Engineering* 11, 65-73. http://doi.org/10.35940/ijrte.F7475.0311623.

Al Saad M. M., Shehadeh A., Alanazi S., Alenezi M., Abu al/\ez A., Eid H., Alfaouri M. S., Aldawsari S. & Alenezi R. (2022). Medical students' knowledge and attitude towards artificial intelligence: An online survey. *Open Public Health Journal.* 15,. https://doi.org/10.2174/18749445-v15-e2203290

Bu, Q. (2022). Ethical risks in integrating artificial intelligence into education and potential countermeasures. *Science Insights*, 41, (1), 561-566. https://doi.org/10.15354/si.22.re067

Cui, Y. (2020). *Artificial Intelligence and Judicial Modernization*; Springer:

Clark, D. (2020). *Artificial intelligence for learning: How to use AI to support employee development*. Kogan Page Publishers.

Celik, I., Dindar, M., Muukkonen, H., & Järvelä, S. (2022). The promises and challenges of artificial intelligence for teachers: A systematic review of research. *Tech Trends, 66*, 616 - 630.

Chiu, T. K., & Chai, C. S. (2020). Sustainable curriculum planning for artificial intelligence education: A self-determination theory perspective. *Sustainability, 12*(14),5568. https://doi.org/10.3390/su12145568

Chiu, Xia, Q., Chiu, T.K., Zhou, X., Chai, C.S., & Cheng, M. (2023). Systematic literature review on opportunities, challenges, and future research recommendations of artificial intelligence in education. *Computers And Education: Artificial Intelligence*. 4, 100118. https://doi.org/10.1016/j.caeai.2022.100118C

Crow, T., Luxton-Reilly, A., & Wuensche, B. (2018). Intelligent tutoring systems for programming education: A systematic review. In Proceedings of the 20th Australasian Computing Education Conference (Pp. 53-62). ACM.

Doumat, G., Daher, D., Ghanem, N. N., & Khater, B. (2022). Knowledge and attitudes of medical students in Lebanon toward artificial intelligence: A national survey study. *Frontiers In Artificial Intelligence*, *5*. https://doi.org/10.3389/frai.2022.1015418

Eteng-Uket, S. & Iruloh, B. R. N. (2023). Differential and interactional influence of socio-demographic variables on intellectual ability. *Journal of Pedagogical Research*, 7(4), 111-130. https://doi.org/10.33902/JPR.202320992

Gaudioso, E., Montero, M., & Hernandez-Del-Olmo, F. (2012). Supporting teachers in adaptive educational systems through predictive models: A proof of concept. *Expert Systems with Applications,* 39(1), 621–625. https://doi.org/10.1016/j.eswa.2011.07.052

Gupta, S., Kamboj, S. & Bag, S. (2023). Role of risks in the development of responsible artificial intelligence in the digital healthcare domain. *Inf Syst Front* https://doi.org/10.1007/s10796-021-10174-0

Horowitz, M.C., & Kahn L., (2021) What influences attitudes about artificial intelligence adoption: Evidence from U.S. local officials. *Plos ONE* 16(10), e0257732. https://doi.org/10.1371/journal.pone.0257732

Humble, N., Mozelius, P. (2022). The threat, hype, and promise of artificial intelligence in education. *Discover Artificial Intelligence* 2, 22-32 https://doi.org/10.1007/s44163-022-00039-z

Johnson, W. L. (2010). Serious use of a serious game for language learning. *International Journal of Artificial Intelligence in Education, 20*, 175–195.

Koedinger, K. R., Corbett, A. T., & Perfetti, C. (2012). The knowledge learning-instruction framework: bridging the science-practice chasm to enhance robust student learning. *Cognitive Science*, 36(5), 757–798. https://doi.org/10.1111/j.1551-6709.2012.01245.x

Klutka, J., Ackerly, N., & Magda, A. J. (2018). *Artificial intelligence in higher education: Current Uses and future applications*. Learning House.

Kulik, J. A., & Fletcher, J. D. (2016). Effectiveness of intelligent tutoring systems: A meta-analytic review. *Review of Educational Research*, 86(1), 42-78.

Leslie, D. (2020). Tackling COVID-19 through responsible AI innovation: Five steps in the right direction. *Harvard Data Science Review*, (Special Issue 1). https://doi.org/10.1162/99608f92.4bb9d7a7

Liu, R., Gupta, S., Patel, P. (2021). The application of the principles of responsible AI on social media marketing for digital health. *Inf. Syst. Front*.

Luckin, R., Holmes, W., Grifths, M., & Forcier, L. B. (2016). *Intelligence unleashed: An argument for AI in education*. Pearson Education

Michael., H. Abboudi, J. Ker, M. Shamim Khan, P. Dasgupta, K. Ahmed (2014). Performance of technology-driven simulators for medical students—A systematic review. *Journal of Surgical Research*, 192 (2) 531-543, https://doi.org/10.1016/j.jss.2014.06.043

Moreno, R.D (2019). The arrival of artificial intelligence to education. *RITI* J. 7, 260–270.https://doi.org/10.36825/RITI.07.14.022

Maruthappu M. (2018). Artificial intelligence in medicine: Current trends and future possibilities. *Br J Gen Pract* .68, 143-144.

Maree, C., Modal, J.E.,Omlin, C.W. (2020). *Towards responsible ai for financial transactions*. In Proceedings of the 2020 IEEE Symposium Series on Computational Intelligence (SSCI), Canberra, Australia, 1–4; pp. 16–21.

McCarthy, T., Rosenblum, L. P., Johnson, B. G., Dittel, J., & Kearns, D. M. (2016). An artificial intelligence tutor: A supplementary tool for teaching and practicing braille. *Journal Of Visual Impairment & Blindness, 110*(5), 309–322. https://doi.org/10.1177/0145482X1611000503

Mohammed, P. S. (2019). *Towards inclusive education in the age of artificial intelligence: Perspectives, challenges, and opportunities. In Artificial Intelligence and Inclusive Education*. Springer, Singapore.

Ogan, A., Yarzebinski, E., De Roock, R., Dumdumaya, C., Banawan, M., & Rodrigo, M. M. (2017). *Proficiency and preference using local language with a teachable agent*. In International Conference on Artificial Intelligence in Education (pp. 548-552). Springer, Cham.

Okada, A., Whitelock, D., Holmes, W., & Edwards, C. (2019). E-authentication for online assessment: A mixed-method study. *British Journal of Educational Technology*, 50(2), 861–875.

Ooi, S. K. G., Makmur, A., Soon, A. Y. Q., Fook-Chong, S., Liew, C., Sia, S. Y., Ting, Y. H., & Lim, C. Y. (2021). Attitudes toward artificial intelligence in radiology with learner needs assessment within radiology residency programmes: A national multi-programme survey. *Singapore Medical Journal*, *62*(3), 126–134. https://doi.org/10.11622/smedj.2019141

Popenici, S. A., & Kerr, S. (2017). Exploring the impact of artificial intelligence on teaching and learning in higher education. *Research and Practice in Technology Enhanced Learning*, 12(1), 1–13. https://doi.org/10.1186/s41039-017-0062-8

Pinto Dos Santos, D., Giese, D., Brodehl, S., Chon, S. H., Staab, W., Kleinert, R., Maintz, D., & Baeßler, B. (2019). Medical students' attitude towards artificial intelligence: A multicenter survey. *European Radiology*, *29*(4), 1640–1646. https://doi.org/10.1007/s00330-018-5601-1

Roll, I., & Wylie, R. (2016). Evolution and revolution in artificial intelligence in education. *International Journal of Artificial Intelligence in Education*, 26(2), 582–599. https://doi.org/10.1007/s40593-016-0110-3

Sindermann, C., Sha, P., Zhou, M. Wernicke J, Schmitt H.S., Li M., Sariyska R, Stavrou M., Becker B & Montag C. (2021). Assessing the attitude towards artificial intelligence: Introduction of a short measure in German, Chinese, and English Language. *Künstl Intell* 35, 109–118 https://doi.org/10.1007/s13218-020-00689-0

Shawar, B.A.; Atwell, E. (2007) Chatbots: Are they really useful? *Ldv Forum* 22, 29–49.

Trocin, C., Mikalef, P., Papamitsiou, Z. & Conboy K.. (2023). Responsible AI for Digital Health: a Synthesis and a Research Agenda. *Inf Syst Front* 25, 2139–2157 https://doi.org/10.1007/s10796-021-10146-4

VanLehn, K., Siler, S., & Murray, C. (2003). Why do only some events cause learning during human tutoring? *Cognition And Instruction*, 21(3), 209–249.

Vargas-Sánchez, A., Plaza-Mejía, M.Á., Porras-Bueno, N. (2016). Attitude. In: Jafari, J., Xiao, H. (eds) *Encyclopedia of Tourism.* Springer, https://doi.org/10.1007/978-3-319-01384-8_11

Wang, N., Tian, M.Y. (2023). Intelligent justice: Human-centered considerations in China's legal AI transformation. *AI Ethics* 3, 349–354. https://doi.org/10.1007/s43681-022-00202-3

Wu, B., Yu, X., & Gu, X. (2020). Effectiveness of immersive virtual reality using head−mounted displays on learning performance: A meta−analysis. *British Journal of Educational Technology*, *51*(6), 1991-2005. https://doi.org/10.1111/bjet.13023

Wogu, I. A. P., Misra, S., Olu-Owolabi, E. F., Assibong, P. A., & Udoh, O. D. (2018). Artificial intelligence, artificial teachers, and the fate of learners in the 21st century education sector: implications for theory and practice. *International Journal of Pure and Applied Mathematics*, 119(16), 2245-2259

Yuan, S., He, T., Huang, H., Hou, R., & Wang, M. (2020). Automated chinese essay scoring based on deep learning. CMC-*Computers Materials & Continua*, 65(1), 817–833. https://doi.org/10.32604/cmc.2020.010471