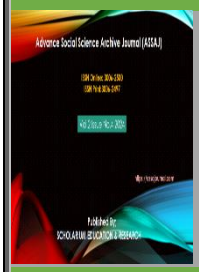


Advance Social Science Archive Journal
Available Online: https://assajournal.com
Vol.3 No.1,January-March,2025.Page No.947-964
Print ISSN: 3006-2497 Online ISSN: 3006-2500
Platform & Workflow by: Open Journal Systems

USE OF ARTIFICIAL INTELLIGENCE IN TEACHING PRACTICES: AN ANALYSIS

Dr Azmat Farooq Ahmad Khurram	Assistant Professor, Khawaja UEIT, Rahimyar Khan, Pakistan.
	Email: azmatfarooqazmat@gmail.com
Riaz Ahmad Muazzmi	Deputy Director Legal, PhD Scholar, Quaid-e-Azam University, Islamabad, Paksitan.
	Email: ch.mozmi@gmail.com
Ms Sadaf Aslam	Lecturer, University of Central Punjab, Pakistan.
Ms Nadia Saleem	Lecturer, University of Central Punjab, Pakistan.

ABSTRACT

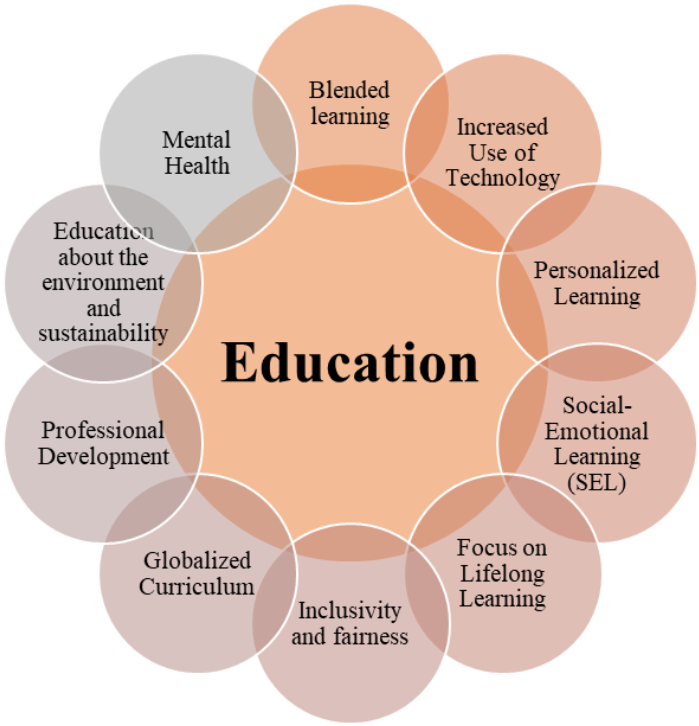
This study was conducted to analyze the integration of Artificial Intelligence (AI) in educational practices over the past decade (2015-2024). Artificial Intelligence is rapidly and continuously reshaping teaching and learning. This research was conducted to explore how AI has increased paradigm shifts from inactive to dynamic learning, from vogue to personalized education, and from teacher-centered to student-centered. A mixed-method approach was employed to explore the implications of AI on teaching dynamics and student outcomes. Qualitative data were collected through literature review, surveys, interviews, and focus group discussions which were processed and analyzed by using NVivo, however, quantitative data were collected by employing a questionnaire. The findings indicate trends, and practices in vogue, and provide guidelines for teachers, officials, and shareholders on the successful integration of AI into learning. It is recommended that further research be conducted to find out further insight and depth to maximize AI's worth use in pedagogy.

Keywords: Artificial Intelligence, Teaching Practices, Analysis

I. Introduction

Artificial intellect (AI) pertains to emulating human intellect in computers, which are programmed to engage in cognitive processes, acquire knowledge, and execute activities comparable to human beings (Sanzogni et al., 2017). The field of study comprises several subdisciplines, such as machine learning, natural language processing, computer vision, and robotics (Aggarwal & Kumar, 2018). Artificial Intelligence (AI) pertains to advancing computer systems capable of executing tasks that conventionally necessitate human intelligence, encompassing visual perception,

speech recognition, decision-making, and language translation (Tripathi, 2021). The origins of AI can be traced back to multiple academic fields; however, it was John McCarthy who officially introduced the phrase "Artificial Intelligence" in 1956 during the organization of the Dartmouth Workshop. This event is pivotal in establishing AI as a distinct area of academic inquiry. During its nascent stages, prominent figures in artificial intelligence include Alan Turing, Marvin Minsky, Allen Newell, and Herbert A. Simon.



The definitions provided below exemplify the complex nature of artificial intelligence and encompass diverse viewpoints of the characteristics that define machine intelligence. The domain of artificial intelligence (AI) has witnessed ongoing evolution, with the establishment of these fundamental criteria significantly influencing its progress and investigation throughout the preceding few decades. According to Nilsson (2012), the concept of Artificial Intelligence (AI), as proposed by John McCarthy, involves the scientific and engineering aspects of creating intelligent machines, with a particular emphasis on intelligent computer programs; Artificial Intelligence (AI) is a scientific discipline focused on enabling machines to perform tasks that would typically necessitate human intelligence (Minsky & Papert, 1988). This concept pertains to examining agents that receive sensory inputs from their surroundings and subsequently execute actions, according to Russell and Norvig (2021).

Teaching is a varied and intricate process encompassing a range of elements, including the formulation of plans, the organization of resources, the execution of instructional activities, and the assessment of educational outcomes (Wu et al., 2023). Education, psychology, and cognitive science have studied teaching, a complex, diverse process Suzuki, (Ed.), 2023). Based on trends in education leading up to that time. By 2023, teaching might have evolved in the following ways:

Because of what happened with the COVID-19 outbreak, many schools have probably improved their ability to teach online and started Blended learning. By 2023, it has become more normal for teachers and students to use a hybrid model that combines in-person and online learning (Kortemeyer et al., 2023). Similarly, As technology improves, digital tools and platforms might be used more in classes. Augmented Reality (AR), Virtual Reality (VR), and Artificial Intelligence (AI) could be used more often to improve learning (Alam, 2021, November). If there were better data and tools, there might be a bigger push toward personalized learning, in which each student's education is based on their needs, learning speeds, and tastes (Bernacki et al., 2021). Furthermore, Social-Emotional Learning (SEL) emerged that focuses on developing students' social and emotional skills and academic material, might be more integrated into curricula (Maloney et al., 2016).

Because of how quickly the job market, new technologies, and industries change, there might be a bigger push to teach skills that help people learn and adapt throughout their lives (Anthonysamy et al., 2020). Efforts to make education more inclusive and fairer may have moved forward, with more resources to ensure all students, no matter where they come from, have the same chances to do well (Levinson et al., 2022: O'Leary et al., 2020). Skill-based learning is needed in this globalized world (Hayden et al., 2020). Continuous professional development (CPD) is for teachers affected by integrating technology into instruction(Sancar et al., 2021). Education has been connected with sustainability, environmental awareness, and the skills of the green economy (Agbedahin, 2019). The education system needs attention due to the challenges faced by climate and pandemic (Gogoi et al., 2022).

The main objective of this study was to examine recent research studies on the use of artificial intelligence (AI) in educational settings. The research comprehensively explains how AI might enhance, replace, and reinvent educational practices. Collecting data from multiple research and academic papers, it aims to shed light on trends, potential, issues, and outcomes related to integrating AI with educational techniques.

The following objectives of the meta-analysis are to:

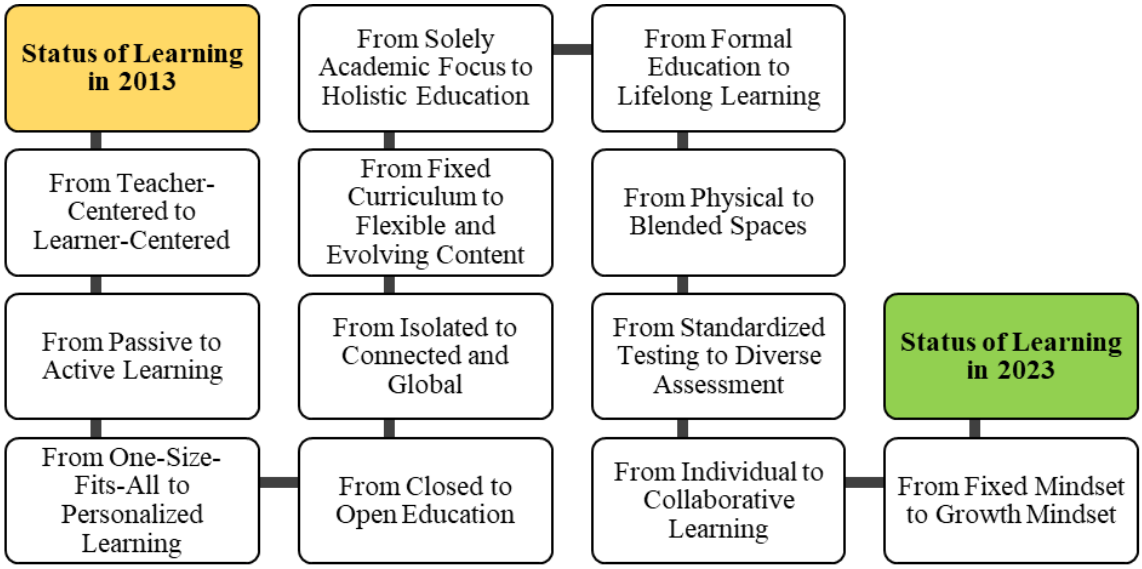
1. Determine Paradigm Shifts in Teaching and Education Between 2013 and 2023
2. Identify emerging trends, practices, and the application of artificial intelligence in learning
3. Provide educators, policymakers, and stakeholders with guidelines and recommendations for effectively integrating AI in educational contexts.

II. Paradigm Shift in Teaching and Education Between 2015 to 2025

A paradigm shift in any discipline denotes a profound alteration in methodology or foundational presumptions. From 2013 to 2023, discernible modifications in teaching and education were seen, indicating the emergence of various paradigms. The following are notable changes:

a. **From Teacher-Centered to Learner-Centered:** As previously indicated, the foundation of this concept can be traced back to the scholarly contributions of esteemed educational theorists such as Dewey (2016), Piage (2013), Vygotsky (2012), Rogers and Freiberg (1994), and Montessori (2011). Historically, conventional educational practices have commonly positioned the teacher as the central figure in the learning process, assuming the primary role of imparting knowledge. A notable transition occurred throughout the decade towards an educational approach prioritizing the learner, emphasizing students' agency, active involvement in the learning process, and the customization of their learning trajectories (Robinson & Aronica, 2009).
b. **From Passive to Active Learning:** Students have transformed from passive recipients of knowledge to assuming an active role as participants in their learning process (Ofstad & Brunner, 2013). Implementing educational methodologies such as problem-based learning, collaborative group discussions, and experiential, hands-on projects distinguished the above transition.
c. **From One-Size-Fits-All to Personalized Learning:** The advent of educational technology (edtech) and adaptive learning platforms has facilitated a more personalized approach to education, enabling students to engage in learning activities at a speed that suits their particular needs and aligns with their personal preferences (McCombs, 2008).
d. **From Closed to Open Education:** The emergence of MOOCs (Massive Open Online Courses) and open educational resources has posed a significant challenge to conventional conceptions of educational accessibility. The democratization of education has been facilitated by the accessibility of high-quality courses and materials that are either free or offered at a reduced cost (Piedra et al., 2015)

e. **From Isolated to Connected and Global:** Technology has facilitated interactions beyond the physical confines of the classroom. The collaboration of students from many regions across the globe has the potential to facilitate project-based activities, thereby cultivating a more comprehensive global outlook (Owens & Hite, 2022).
f. **From Fixed Curriculum to Flexible and Evolving Content:** Due to the quick pace of societal and technical transformations, educational curricula have undergone more regular modifications, incorporating contemporary events, emerging technology, and the latest scientific discoveries (Jonker et al., 2020).
g. **From Solely Academic Focus to Holistic Education:** In addition to cultivating academic competencies, there has been an increasing focus on developing social-emotional learning, character education, and life skills to equip students to navigate problems encountered effectively and outside the educational setting (Jacobs & Farrell, 2001)
h. **From Formal Education to Lifelong Learning:** The notion that education concludes upon completion of formal schooling has been called into question. Acquiring ongoing knowledge and developing new skills is imperative in a rapidly changing labor market and global landscape (Laal & Salamati, 2012).
i. **From Physical to Blended Spaces:** The COVID-19 epidemic expedited the implementation of online learning, resulting in a convergence of physical and digital educational environments. The hybrid approach has become a permanent fixture in numerous educational environments (Hunt et al., 2012).
j. **From Standardized Testing to Diverse Assessment:** Cai (2020) and others suggested that increased doubt emerged regarding the efficacy and validity of high-stakes standardized testing. Alternative assessment approaches (McArthur, 2023), like portfolios (Baharom & Shaari, 2022)., project-based evaluations (Goyal et al., 2022), and real-world problem-solving, have acquired significant attention and acceptance in educational contexts.
k. **From Individual to Collaborative Learning:** Laal and Laal (2012) advocated that while the significance of individual accomplishment persisted, there was a growing focus on the importance of teamwork (Prada et al., 2022), collaboration (Loes, 2022), and communal problem-solving in anticipation of a more interconnected global context.
l. **From Fixed Mindset to Growth Mindset:** Haimovitz and Dweck (2017) reported a shift towards cultivating a growth mindset among students, emphasizing that abilities and intelligence may be enhanced through exertion and persistence and further supported by Reid et al. (2014, March).



The paradigm above shifts signifies a comprehensive reassessment of the fundamental tenets of education, which are influenced by societal shifts, technological improvements, and enhanced comprehension of human learning and development.

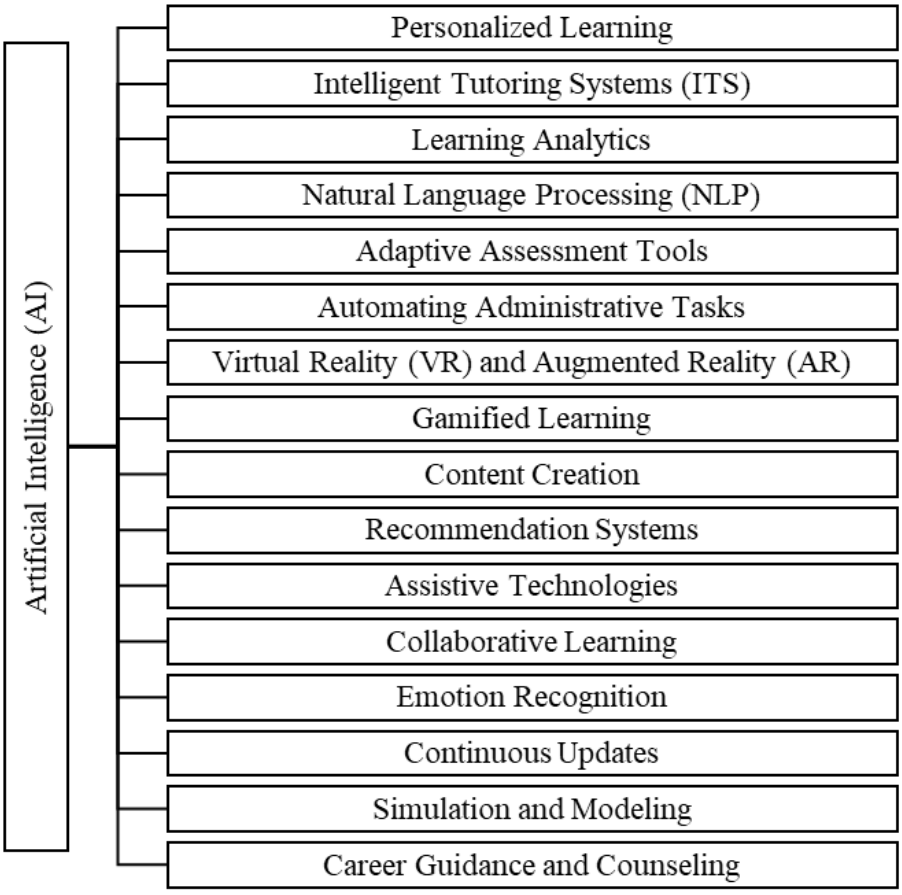
III. Application of Artificial Intelligence in Learning

Artificial Intelligence (AI) possesses a multitude of applications that have the potential to enhance the process of learning and various learning methodologies. The utilization of artificial intelligence (AI) in facilitating the learning process has proven to be of paramount significance. Multiple ways are listed below how AI is assisting in educational activities (Alam, 2022, April; Sharma et al., 2021).

a. **Personalized Learning**: Artificial intelligence (AI) algorithms gauge students' academic achievements and ensure that the educational experience is tailored to meet the specific needs (Chen et al., 2020) like the platforms powered by AI suggest different resources and predict their goals.
b. **Intelligent Tutoring Systems (ITS):** Information Technology Systems provide feedback to learners (Barmaki & Hughes, 2015, November), and guides to avoid errors (Ng et al., 2022). Huang et al. (2023) say that teachers can amend the assignments' difficulty level.
c. **Learning Analytics:** AI is helpful in data collection and analysis (Holmes et al., 2023) and blends learning practices. Furthermore, it can predict academic tasks (Dwivedi et al., 2021).

d. **Natural Language Processing (NLP):**
   i. **Chatbots:** Singh et al. (2022, December) indicated that AI-powered chatbots are useful for learners' inquiries and assist them with their assignments, projects, tasks, and providing pertinent material.
   ii. **Language Learning:** Artificial intelligence systems facilitate enhancing language vocabulary, improving pronunciation, validating grammar, and communicating linguistic exercises (Junaidi, 2020).

e. **Adaptive Assessment Tools:** AI assists in modifying tests, and shifting the difficulty (Kurdi et al., 2020). This method provides a better assessment of students. Assume a kid is taking an adaptive math exam. The test will go on to progressively difficult questions if a student correctly answers the first few inquiries. The test will



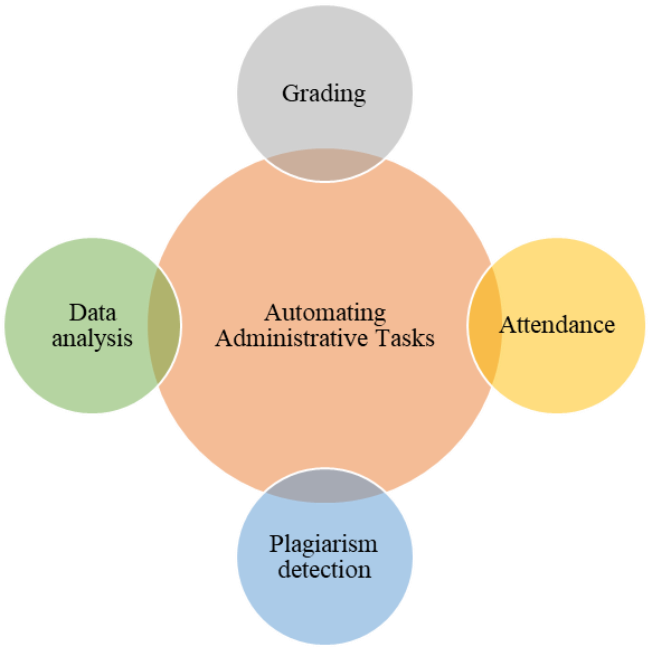
provide easier questions if the student answers the next few questions incorrectly. This strategy will be used repeatedly until a thorough understanding of the student's level of knowledge is attained.

f. **Automating Administrative Tasks:** Grading, managing attendance, and detecting plagiarism are just a few of the many educational processes that may be automated

by artificial intelligence (AI), according to Nazaretsky et al. (2022), Kammüller and Satija (2023) and Xiao et al. (2022, November). By automating these tasks, AI technology enables educators to devote their time and energy to more engaging and individualized training techniques.

i. **Grading**: Chen et al. (2020), Alam (2022), and Huang (2021) reported that AI-powered grading systems can assess essays, quizzes, and examinations more rapidly and correctly than human instructors; and allow teachers to concentrate on other crucial tasks, including giving pupils constructive criticism.
ii. **Attendance:** Using AI-powered attendance systems, automatically monitors student attendance; and ensures that the teacher knows his students and treats them equally and unbiased (Nazaretsky et al., 2022).
iii. **Plagiarism detection:** AI is used to identify plagiarism in academic papers; teachers may guide their students in preventing plagiarism and copy-paste (Kammüller and Satija, 2023).
iv. **Data Analysis:** Artificial intelligence (AI) can analyze data and find out patterns and themes in the data which helps use this information to improve teaching methods and students' problems (Rivas et al., 2021).

g. **Virtual Reality (VR) and Augmented Reality (AR):** Artificial intelligence (AI), virtual reality (VR), and augmented reality (AR) can be combined to produce a learning metaverse (2023). Students get the benefit of the virtual environment which is cost-effective and reduces physical classrooms.



Medical institutions now use virtual reality (VR) in surgery to educate and improve the skills of students.

Similarly, Mughal et al. (2022) stated that a learning environment by using a smartphone is augmented reality (AR) and enhances additional information. In addition, augmented reality may be helpful in all areas and subjects.

h. **Gamified Learning:** Bennani et al. (2022) and Zhan (2022) showed that artificial intelligence helps teach through game-based platforms. For example, a spelling game in which students have to find and type the right way to spell different words. The AI-powered app looks at how well each student does and changes how hard the game is based on that.
i. **Content Creation:** Chen (2020) reported that artificial intelligence (AI) tools can assist in producing content such as summaries, flashcards, or quiz questions derived from reading materials.
j. **Recommendation Systems**, akin to those employed by streaming platforms, utilize artificial intelligence to provide relevant resources, courses, or materials tailored to students' individual interests and requirements (Chen, 2020; Grassini, 2023).
k. **Assistive Technologies,** such as voice assistants, predictive text, and other tools, are employed in the context of AI to enhance accessibility to digital learning resources for students with impairments (Garg & Sharma, 2020).
l. **Collaborative learning** can be enhanced with the use of AI, enabling students from various locations to engage in synchronized learning experiences and fostering group projects and conversations (Soller et al., 2023).
m. **Emotion Recognition:** AI can recognize facial expressions and the emotional state of learners (Alam, 2022) during e-learning sessions.
n. **Continuous Updates**: Artificial intelligence enables the continuing apprising of instructive material, confirming its relevance (Chen, 2022).
o. **Simulation and Modeling** are valued tools in almost all areas of computer science, Chemistry, and other stem learning (Faddegon et al., 2020). Through the use of artificial intelligence (AI), learners have the chance to actively partake in educational tasks (Williamson, 2020).
p. **Career Guidance and Counseling:** Artificial intelligence (AI) facilitates career counseling and advice (Westman et al., 2021); and generates informed suggestions regarding career or academic specialties, tracks pace, traces further endeavors, scholarship hunting, and related achievement (Su et al., 2022).

IV. Methodology

A mixed-method approach was employed to explore the implications of AI on teaching dynamics and student outcomes. Qualitative data were collected through literature review, surveys, interviews, and focus group discussions which were processed and analyzed by using NVivo, however, quantitative data were collected by employing a questionnaire.

The current study's goal was to comprehensively evaluate pertinent academic literature to evaluate and synthesize the body of knowledge. The study underwent a thorough analysis of the academic literature including academic databases, scholarly publications, conference proceedings, research archives, research papers, books, articles, and reports about using artificial intelligence (AI) in an educational context. This provided in-depth insight, a key conception, and findings from earlier scientific inquiries.

Focus groups include a teaching force, AI knowledgeable, and relevant experts that provided a thorough understanding of the real-world application, significances, and probable hindrances to integrating artificial intelligence (AI) in educational contexts. For gaining a better knowledge of subtleties and experiences, focus group discussions have proven very helpful.

In addition, the researcher created a survey questionnaire to get feedback from educators, pupils, and administrators who have previously used teaching methods based on artificial intelligence. The replies were gathered more quickly using Google Forms and Internet survey platforms—this study's survey aimed to gather information on the advantages and potency of AI technology in education.

V. Data Analysis

Data were obtained quantitatively and qualitatively. The quantitative data were processed and analyzed by using SPSS version 27. Means, standard deviation, and t-statistics were measured accordingly. One sample t-test was employed to measure these values. At the same time, qualitative data were processed and analyzed by using NVivo. The data were systematically coded into categories, allowing the discovery of themes and patterns. NVivo made organizing and visualizing the data easier, allowing for a more thorough investigation of underlying themes and connections.

Quantitative Data

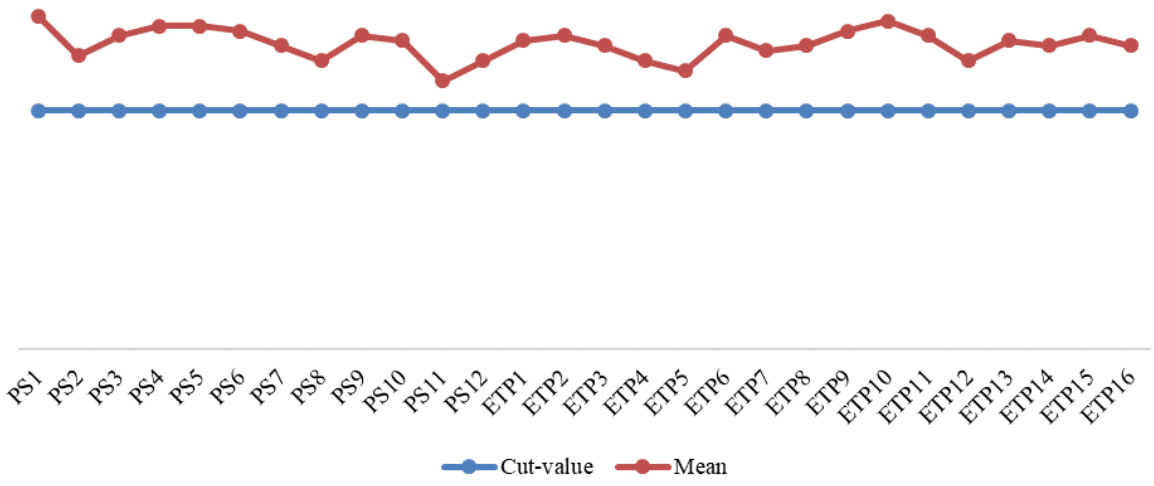
The respondents were the researchers in AI/education, educators/teachers, administrators, policymakers, prospective teachers, and students. 6.3% of respondents had extensive experience with AI in education, 43.8% limited experience, 25% had moderate experience, and 25% had no experience with AI in education.

The table results indicate that one sample t-test was conducted to measure the effectiveness of using artificial intelligence in teaching practices as a paradigm shift and for emerging trends, practices, and applications of artificial intelligence in learning.

	N	M	SD	t	df	Sig.	Mean Difference	99.5% Confidence Interval of the Difference	
								Lower	Upper
PS	16	3.9	.59	26.247	15	.000	3.86250	3.3789	4.3461
ETP	16	3.8	.67	22.803	15	.000	3.84375	3.2898	4.3977

The results for using artificial intelligence in teaching practices as a paradigm shift indicated a statistically significant difference ($t(15) = 26.247$, $p < .001$). The mean difference was 3.86250, with a 99.5% confidence interval ranging from 3.3789 to 4.3461. Similarly, the results for using artificial intelligence in teaching practices as the emerging trends, practices, and application of artificial intelligence in learning indicated a statistically significant difference ($t(15) = 26.247$, $p < .001$). The mean difference was 3.86250, with a 99.5% confidence interval ranging from 3.2898 to 4.3977.

The graph indicates that the respondents' mean score on each item of the questionnaire remained greater than the neutral response i.e., 3.



Conclusion

The data results indicate paradigm shifts in teaching and education, identified emerging trends, practices, and the application of artificial intelligence in learning, and provided educators, policymakers, and stakeholders with guidelines and recommendations for effectively integrating AI in educational contexts. The study

concludes by suggesting future research directions and practical considerations for maximizing AI's positive influence on pedagogical practices.

References

Agbedahin, A. V. (2019). Sustainable development, Education for Sustainable Development, and the 2030 Agenda for Sustainable Development: Emergence, efficacy, eminence, and future. *Sustainable Development*, *27*(4), 669-680.

Aggarwal, J., & Kumar, S. (2018). A survey on artificial intelligence. *International Journal of Research in Engineering, Science and Management*, *1*(12), 244-245.

Alam, A. (2021, November). Possibilities and apprehensions in the landscape of artificial intelligence in education. In *2021 International Conference on Computational Intelligence and Computing Applications (ICCICA)* (pp. 1-8). IEEE.

Alam, A. (2022). Employing adaptive learning and intelligent tutoring robots for virtual classrooms and smart campuses: reforming education in the age of artificial intelligence. In *Advanced Computing and Intelligent Technologies: Proceedings of ICACIT 2022* (pp. 395-406). Singapore: Springer Nature Singapore.

Alam, A. (2022, April). A digital game based learning approach for effective curriculum transaction for teaching-learning of artificial intelligence and machine learning. In *2022 International Conference on Sustainable Computing and Data Communication Systems (ICSCDS)* (pp. 69-74). IEEE.

Anthonysamy, L., Koo, A. C., & Hew, S. H. (2020). Self-regulated learning strategies in higher education: Fostering digital literacy for sustainable lifelong learning. *Education and Information Technologies*, *25*, 2393-2414.

Baharom, N., & Shaari, A. H. (2022). Portfolio Based Assessment and Learner Autonomy Practice among ESL Students. *Journal of Language and Linguistic Studies*, *18*, 1289-1305.

Barmaki, R., & Hughes, C. E. (2015, November). Providing real-time feedback for student teachers in a virtual rehearsal environment. In *Proceedings of the 2015 ACM on International Conference on Multimodal Interaction* (pp. 531-537).

Bennani, S., Maalel, A., & Ben Ghezala, H. (2022). Adaptive gamification in E-learning: A literature review and future challenges. *Computer Applications in Engineering Education*, *30*(2), 628-642.

Bernacki, M. L., Greene, M. J., & Lobczowski, N. G. (2021). A systematic review of research on personalized learning: Personalized by whom, to what, how, and for what purpose (s)?. *Educational Psychology Review*, *33*(4), 1675-1715.

Cai, L. (2020). Standardized testing in college admissions: Observations and reflections. *Educational Measurement: Issues and Practice*, *39*(3), 34-36.

Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: A review. *Ieee Access*, *8*, 75264-75278.

Chen, Y. (2022). The Impact of Artificial Intelligence and Blockchain Technology on the Development of Modern Educational Technology. *Mobile Information Systems*, *2022*.

Dewey, J. (2016). Excerpts from democracy and education (1916). *Schools*, *13*(1), 127-139.

Dwivedi, Y. K., Hughes, L., Ismagilova, E., Aarts, G., Coombs, C., Crick, T., ... & Williams, M. D. (2021). Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. *International Journal of Information Management*, *57*, 101994.

Faddegon, B., Ramos-Méndez, J., Schuemann, J., McNamara, A., Shin, J., Perl, J., & Paganetti, H. (2020). The TOPAS tool for particle simulation, a Monte Carlo simulation tool for physics, biology and clinical research. *Physica Medica*, *72*, 114-121.

Garg, S., & Sharma, S. (2020). Impact of artificial intelligence in special need education to promote inclusive pedagogy. *International Journal of Information and Education Technology*, *10*(7), 523-527.

Gogoi, M., Webb, A., Pareek, M., Bayliss, C. D., & Gies, L. (2022). University Students' Mental Health and Well-Being during the COVID-19 Pandemic: Findings from the UniCoVac Qualitative Study. *International journal of environmental research and public health*, *19*(15), 9322.

Goyal, M., Gupta, C., & Gupta, V. (2022). A meta-analysis approach to measure the impact of project-based learning outcome with program attainment on student learning using fuzzy inference systems. *Heliyon*, *8*(8).

Grassini, S. (2023). Shaping the future of education: exploring the potential and consequences of AI and ChatGPT in educational settings. *Education Sciences*, *13*(7), 692.

Haimovitz, K., & Dweck, C. S. (2017). The origins of children's growth and fixed mindsets: New research and a new proposal. *Child development*, *88*(6), 1849-1859.

Hayden, M., McIntosh, S., Sandoval-Hernández, A., & Thompson, J. (2020). Global citizenship: changing student perceptions through an international curriculum. *Globalisation, Societies and Education*, *18*(5), 589-602.

Huang, J., Saleh, S., & Liu, Y. (2021). A review on artificial intelligence in education. *Academic Journal of Interdisciplinary Studies*, *10*(206).

Huang, X., Zou, D., Cheng, G., Chen, X., & Xie, H. (2023). Trends, research issues and applications of artificial intelligence in language education. *Educational Technology & Society*, *26*(1), 112-131.

Hunt, L., Huijser, H., & Sankey, M. (2012). Learning spaces for the digital age: Blending space with pedagogy. In *Physical and virtual learning spaces in higher education: Concepts for the modern learning environment* (pp. 182-197). IGI Global.

Jacobs, G. M., & Farrell, T. S. C. (2001). Paradigm shift: Understanding and implementing change in second language education.

Jonker, H., März, V., & Voogt, J. (2020). Curriculum flexibility in a blended curriculum. *Australasian Journal of Educational Technology*, *36*(1), 68-84.

Junaidi, J. (2020). Artificial intelligence in EFL context: rising students' speaking performance with Lyra virtual assistance. *International Journal of Advanced Science and Technology Rehabilitation*, *29*(5), 6735-6741.

Kammüller, F., & Satija, D. (2023). Explanation of Student Attendance AI Prediction with the Isabelle Infrastructure Framework. *Information*, *14*(8), 453.

Kortemeyer, G., Dittmann-Domenichini, N., Schlienger, C., Spilling, E., Yaroshchuk, A., & Dissertori, G. (2023). Attending lectures in person, hybrid or online—how do

students choose, and what about the outcome?. *International Journal of Educational Technology in Higher Education*, *20*(1), 1-24.

Kurdi, G., Leo, J., Parsia, B., Sattler, U., & Al-Emari, S. (2020). A systematic review of automatic question generation for educational purposes. *International Journal of Artificial Intelligence in Education*, *30*, 121-204.

Laal, M., & Laal, M. (2012). Collaborative learning: what is it?. *Procedia-Social and Behavioral Sciences*, *31*, 491-495.

Laal, M., & Salamati, P. (2012). Lifelong learning; why do we need it?. *Procedia-Social and Behavioral Sciences*, *31*, 399-403.

Levinson, M., Geron, T., & Brighouse, H. (2022). Conceptions of educational equity. *AERA Open*, *8*, 23328584221121344.

Loes, C. N. (2022). The Effect of Collaborative Learning on Academic Motivation. *Teaching & Learning Inquiry*, *10*.

Maloney, J. E., Lawlor, M. S., Schonert-Reichl, K. A., & Whitehead, J. (2016). A mindfulness-based social and emotional learning curriculum for school-aged children: The MindUP program. *Handbook of mindfulness in education: Integrating theory and research into practice*, 313-334.

McArthur, J. (2023). Rethinking authentic assessment: work, well-being, and society. *Higher education*, *85*(1), 85-101.

McCombs, B. L. (2008). From one-size-fits-all to personalized learner-centered learning: The evidence. *The FM Duffy Reports*, *13*(2), 1-12.

Minsky, M. L., & Papert, S. A. (1988). Perceptrons: expanded edition.

Montessori, M. (2011). *The absorbent mind*. Lulu. com.

Mughal, M. Y., Andleeb, N., Khurram, A. F. A., Ali, M. Y., Aslam, M. S., & Saleem, M. N. (2022). Perceptions of teaching-learning force about metaverse for education: a qualitative study. *Journal of Positive School Psychology*, *6*(9), 1738-1745.

Nazaretsky, T., Ariely, M., Cukurova, M., & Alexandron, G. (2022). Teachers' trust in AI-powered educational technology and a professional development program to improve

it. *British journal of educational technology*, *53*(4), 914-931.Holmes, W., Bialik, M., & Fadel, C. (2023). Artificial intelligence in education. Globethics Publications.

Ng, D. T. K., Lee, M., Tan, R. J. Y., Hu, X., Downie, J. S., & Chu, S. K. W. (2022). A review of AI teaching and learning from 2000 to 2020. *Education and Information Technologies*, 1-57.

Nilsson, N. J. (2012). John McCarthy. *National Academy of Sciences*, 1-27.

O'Leary, E. S., Shapiro, C., Toma, S., Sayson, H. W., Levis-Fitzgerald, M., Johnson, T., & Sork, V. L. (2020). Creating inclusive classrooms by engaging STEM faculty in culturally responsive teaching workshops. *International Journal of STEM education*, *7*, 1-15.

Ofstad, W., & Brunner, L. J. (2013). Team-based learning in pharmacy education. *American journal of pharmaceutical education*, *77*(4).

Owens, A. D., & Hite, R. L. (2022). Enhancing student communication competencies in STEM using virtual global collaboration project based learning. *Research in Science & Technological Education*, *40*(1), 76-102.

Piaget, J. (2013). *The construction of reality in the child* (Vol. 82). Routledge.

Piedra, N., Chicaiza, J., López-Vargas, J., & Caro, E. T. (2015). Seeking Open Educational Resources to Compose Massive Open Online Courses in Engineering Education an Approach based on Linked Open Data. *J. Univers. Comput. Sci.*, *21*(5), 679-711.

Prada, E. D., Mareque, M., & Pino-Juste, M. (2022). Teamwork skills in higher education: is university training contributing to their mastery?. *Psicologia: Reflexao e Critica*, *35*.

Reid, K. J., & Ferguson, D. M. (2014, March). Do design experiences in engineering build a "growth mindset" in students?. In *2014 IEEE Integrated STEM Education Conference* (pp. 1-5). IEEE.

Rivas, A., Gonzalez-Briones, A., Hernandez, G., Prieto, J., & Chamoso, P. (2021). Artificial neural network analysis of the academic performance of students in virtual learning environments. *Neurocomputing*, *423*, 713-720.

Robinson, K., & Aronica, L. (2009). *The element: How finding your passion changes everything*. Penguin.

Rogers, C. R., & Freiberg, H. J. (1994). *Freedom to learn*. Merrill/Macmillan College Publishing Co.

Russell, S., & Norvig, P. (2021). Artificial intelligence: a modern approach, 4th US ed. *University of California, Berkeley*.

Sancar, R., Atal, D., & Deryakulu, D. (2021). A new framework for teachers' professional development. *Teaching and Teacher Education*, *101*, 103305.

Sanzogni, L., Guzman, G., & Busch, P. (2017). Artificial intelligence and knowledge management: questioning the tacit dimension. *Prometheus*, *35*(1), 37-56.

Sharma, U., Tomar, P., Bhardwaj, H., & Sakalle, A. (2021). Artificial intelligence and its implications in education. In *Impact of AI Technologies on Teaching, Learning, and Research in Higher Education* (pp. 222-235). IGI Global.

Singh, N., Bathla, G., & Sharma, V. (2022, December). AI-powered Chatbot: A Link between Learning and Technology. In *2022 11th International Conference on System Modeling & Advancement in Research Trends (SMART)* (pp. 483-488). IEEE.

Soller, A., Wiebe, J., & Lesgold, A. (2023, January). A machine learning approach to assessing knowledge sharing during collaborative learning activities. In *Computer Support for Collaborative Learning* (pp. 128-137). Routledge.

Su, J., Zhong, Y., & Ng, D. T. K. (2022). A meta-review of literature on educational approaches for teaching AI at the K-12 levels in the Asia-Pacific region. *Computers and Education: Artificial Intelligence*, *3*, 100065.

Sugimoto, M., & Sueyoshi, T. (2023). Development of Holoeyes Holographic Image-Guided Surgery and Telemedicine System: Clinical Benefits of Extended Reality (Virtual Reality, Augmented Reality, Mixed Reality), The Metaverse, and Artificial Intelligence in Surgery with a Systematic Review. *Medical Research Archives*, *11*(7.1).

Suzuki, Y. (Ed.). (2023). *Practice and Automatization in Second Language Research: Perspectives from Skill Acquisition Theory and Cognitive Psychology*. Taylor & Francis.

Tripathi, S. (2021). Artificial intelligence: A brief review. *Analyzing future applications of AI, sensors, and robotics in society*, 1-16.

Turing, A. M. (2009). *Computing machinery and intelligence* (pp. 23-65). Springer Netherlands.

Vygotsky, L. S. (2012). *Thought and language*. MIT press.

Westman, S., Kauttonen, J., Klemetti, A., Korhonen, N., Manninen, M., Mononen, A., ... & Paananen, H. (2021). Artificial Intelligence for Career Guidance--Current Requirements and Prospects for the Future. *IAFOR Journal of Education*, *9*(4), 43-62.

Williamson, B. (2020). New Digital Laboratories of Experimental Knowledge Production: Artificial Intelligence and Education Research. *London Review of Education*, *18*(2), 209-220.

Wu, M., Sun, D., Yang, Y., Li, M., & Sun, J. (2023). Investigating students' performance at self-regulated learning and its effects on learning outcomes in chemistry class at the senior secondary school. *International Journal of Science Education*, 1-24.

Xiao, Y., Chatterjee, S., & Gehringer, E. (2022, November). A new era of plagiarism the danger of cheating using AI. In *2022 20th International Conference on Information Technology Based Higher Education and Training (ITHET)* (pp. 1-6). IEEE.

Zhan, Z., He, L., Tong, Y., Liang, X., Guo, S., & Lan, X. (2022). The effectiveness of gamification in programming education: Evidence from a meta-analysis. *Computers and Education: Artificial Intelligence*, 100096.