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Research Paper

Preparing teachers of the future in the era of artificial intelligence

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ABSTRACT

Artificial Intelligence (AI) is designed to create intelligent systems capable of performing tasks traditionally dependent on human intellect. Its integration into the field of education presents both opportunities and challenges as it is quickly expanding. Preparing teachers for this rapidly advancing technological shift is essential for success, as education itself is not static. This position paper adopts the methodology of synthesizing existing literature on innovative strategies for integrating AI into the preparation of Teachers of the Future. The concept of Teachers of the Future was introduced in this paper, addressing concerns surrounding AI's potential to replace teachers. The paper recognized the irreplaceable roles of teachers in providing emotional and moral support as well as nurturing critical thinking among learners. It further explored the importance of AI for effective application in teaching and learning processes. Drawing upon the synthesis of literature collected from the review of related works, strategies for preparing Teachers of the Future in the Era of AI can be realized by implementing approaches such as development of AI literacy, integrating AI into teacher training courses, promoting collaborative learning among teachers in training, offering continuing education opportunities, and nurturing a positive attitude towards AI utilization. The paper suggested, among others, that Teachers of the Future should be provided with foundational training in AI application for teaching and learning processes within teacher education programmes offered by teacher training institutions.

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1. INTRODUCTION

Artificial Intelligence (AI) represents a field within computer science committed to creating smart machines capable of undertaking activities typically associated with human intelligence. AI systems rely on algorithms and statistical models to interpret data, identify patterns, and generate forecasts [1], [2]. AI is often classified into two categories: weak or narrow AI and strong or general AI. Narrow AI is designed to execute a particular task, whereas general AI seeks to emulate human intelligence and consciousness [2], [3]. AI encompasses various subfields, such as machine learning, natural language processing, computer vision, and robotics [4], [5], [6]. Machine learning, is a branch of AI that enables machines to learn and refine their abilities through experience, without the need for explicit programming instructions [5]. Natural language processing is dedicated to instructing machines in understanding human language and respond in a natural way. Computer vision is concerned with enabling machines to interpret and analyze visual data, while robotics involves the creation of intelligent machines that can interact with their environment [7].

The rapid advancement of AI technology has led to its integration across numerous industries such as manufacturing, entertainment, finance, healthcare, telecommunications, transportation, agriculture, and education, among other. The integration of AI into education has the potential to revolutionize teaching and learning by enabling personalized learning experiences, more efficient grading and assessment, and improved student engagement. According [8], AI could have a significant impact on education, potentially transforming the way teachers teach and students learn. It has the potential of AI to help teachers modify their instruction to individual student needs and provide real-time feedback to help students improve their learning outcomes [9]. Furthermore, AI can automate many of the administrative tasks that teachers face, freeing up their time to focus on delivering high-quality instruction. AI could also address some of the challenges facing education, such as the need for lifelong learning and the growing demand for up skilling and reskilling in the workforce [10]. The potential of AI to enable more personalized learning experiences and enhance accessibility to education [11].

As AI technology continues to evolve and become increasingly accessible, it becomes imperative for teachers to comprehend the importance of AI in education and embrace its potential benefits. The transformative potential of AI in education, offering personalized instruction, improved feedback mechanisms, and administrative task automation, underscores the need for teachers to adapt and harness these opportunities. This paper explored the importance and strategies for preparing Teachers of the Future in AI integration for teaching and learning.

2. RELATED WORK

2.1 Importance of AI in Teacher Education

The integration of AI into teacher education has become increasingly important in recent years. AI has the potential to transform the way teachers teach and students learn, by enabling personalized learning experiences, more efficient grading and assessment, and improved student engagement. As a result, there has been a growing emphasis on preparing future teachers to effectively integrate AI into their teaching practices. Recent studies have also shown the importance of AI in teacher education. For example, a study by [11] indicated that integrating AI into teacher education can improve teachers' abilities to personalize learning experiences, create more effective assessments, and engage students in more meaningful ways. Similarly, another study by [12] reveled that, that AI can help teachers to identify struggling students earlier, provide targeted interventions, and ultimately improve student outcomes. Moreover, according to [13], AI is also playing a critical role in addressing the challenges posed by the COVID-19 pandemic. The shift to remote learning has stressed the need for innovative solutions that can help teachers to deliver high-quality instruction in a virtual environment. AI-powered tools, such as chat-bots and adaptive learning platforms, can help to facilitate remote learning and provide students with personalized support [8].

One of the benefits of AI in teacher education is the potential to personalize learning experiences for individual students. AI technology can be used to analyze student data and provide tailored

recommendations and feedback to help students achieve their learning goals [14]. By using AI-powered tools, teachers can create customized learning paths for students, based on their individual learning styles and needs. AI can also help to improve the efficiency and accuracy of grading and assessment. AI-powered grading systems can provide grades that are as accurate as those provided by human graders, while also being more consistent and efficient [15], [16]. By automating grading tasks, teachers can save time and focus on delivering high-quality instruction.

Furthermore, AI can help to improve student engagement by offering interactive and deeply learning experiences. For instance, AI-driven chat-bots can be utilized to offer students with personalized support and guidance, while virtual reality (VR) technology can be used to create immersive learning environments [8], [11]. There is also a growing demand for teachers who are skilled in using AI technology. AI skills are becoming increasingly important in the workforce, and teachers who are proficient in AI can help to bridge the gap between the skills that are currently in demand, that is 21st Century Skills, and the skills that are being taught in schools [17], [18], [19].

2.2 The Possibility of AI Replacing Teachers

The question of whether AI will replace teachers is a topic of debate in the field of teacher education. While some argue that AI has the potential to improve the teaching and learning experience, others worry about the impact of AI on the teaching profession. Some argument in favor of AI is its potential to personalize learning experiences for students. AI-powered educational platforms can adjust to the unique requirements of individual students and offer personalized feedback, thereby facilitating a more engaging and efficient learning experience [4], [20]. More so, AI can help to lessen the time and resources needed for grading and assessments, allowing teachers to focus on more interactive and collaborative classroom activities [4], [11], [21].

However, [22] expressed that, there exit concerns regarding the impact of AI on the teaching profession. One of the primary concerns revolves around the potential replacement of teachers, leading to loss of jobs for teachers. A report by [23] revealed that AI could potentially replace up to 30% of current teaching activities, including administrative tasks and basic instruction. This prompts inquiries into the shortcomings of AI in education, such as the role of teachers in the classroom and their ability to provide the personal touch and emotional support that AI may not be able to replicate [24], [25]. Moreover, there are also concerns about the potential biases and inaccuracies in AI algorithms. AI-powered learning platforms can perpetuate biases based on race, gender, and socio-economic status if not properly designed and monitored [14]. More so, AI may not be able to replicate the creativity and critical thinking skills that are essential for instruction [20].

Another concern with AI replacing teachers is the potential loss of social and emotional interactions between teachers and students. A study conducted by [26] found that students valued their relationships with teachers and appreciated the support and guidance provided by them. Furthermore, teachers play a crucial role in identifying and addressing student mental health issues, which AI may not be able to do [27]. Also, the use of AI in education raises questions about the quality of the content being taught. Although AI can offer personalized learning experiences, there is a risk that students may only receive surface level knowledge without deep understanding or critical thinking skills [28].

In light of these concerns, it is safe to conclude that AI is unlikely to fully replace teachers, but it can augment and enhance their roles in education. Therefore, it is important for teachers to be trained in AI technology and its ethical and responsible use to leverage its benefits effectively. Teachers can take advantage of AI to improve their teaching practices, such as using AI-powered analytics to track student progress and adjust their instructional approaches accordingly [29]. In line with this, [4] stressed on the important for teacher education programs to integrate AI-focused coursework and training into their curriculum to ensure that future teachers are equipped with the necessary skills and knowledge to effectively use AI in their teaching practices. While AI has the potential to revolutionize education, it is unlikely to fully replace teachers in the classroom. The role of teachers in providing emotional support, personalization, and creative and critical thinking skills is essential in the classroom. However, it is

important as noted by [21], [22], [30] that, Teachers of the Future should be trained in AI technology and integrate it into their teaching practices in an ethical and responsible way.

2.3 Teachers of the Future

The term Teachers of the Future embodies a new breed of teachers who possess a multifaceted set skill to cope with the complexities of modern education. According to [31], Teachers of the Future are not only adept at integrating emerging technologies, such as AI into their teaching practices but also serve as crucial bridge between the school, students, and parents. In essence, they play a key role in shaping the existential identity of students in educational and social contexts. As highlighted by the [32], [33] as well as other scholars [6], [22], [34] Teachers of the Future are characterized by their adaptability within evolving educational frameworks and their commitment to personalized learning experiences for students. They possess the necessary technological know-how to take advantage of AI and other technologies effectively, enhancing both their teaching efficacy and student engagement.

As emphasized by [31], the role of Teachers of the Future transcends mere technical proficiency; they also focus on developing and improving students' emotional intelligence, taking advantage of technology as a tool for nurturing empathy, metacognition, and other essential emotional skills. Moreover, the Teacher of the Future must possess a diverse skill set beyond technological proficiency. This includes critical thinking, problem-solving, collaboration, creativity, communication, and a deep understanding of subject matter [31], [35]. In an increasingly globalized and technology-driven world, the Teacher of the Future faces new challenges and opportunities [36]. As such they must be able traverse the intersection of pedagogy and technology while also serving as advocates for students' emotional and social development. By embracing their roles as teachers, guidance, and facilitators of learning, Teachers of the Future are poised to shape the educational experiences and outcomes of future generations.

According to [37], the Teacher of the Future must be flexible and adaptable, continuously seeking out the best technological advances to enhance their teaching practices and achieve educational goals. They must also be vigilant in addressing common threats such as cyberbullying and fake news, utilizing technology to verify sources and facilitate critical thinking among students [37]. Furthermore, Teachers of the Future must be able to utilize technology to make learning more engaging and interactive, leveraging live educational technological tools to capture students' attention and excitement for learning [38]. 5 posited that Teachers of the Future must have the necessary knowledge, confidence, beliefs, and culture to embrace and implement new technologies. Hence, the Teacher of the Future embodies a comprehensive approach to education, integrating emerging technologies, nurturing emotional intelligence, and possessing a diverse skill set to meet the needs of diverse learners. Therefore, in training Teachers of the Future, it is imperative to incorporate courses that enhance their proficiency in utilizing emerging technologies, thus preparing them to effectively integrate innovative tools and methods into teaching and learning environments, ultimately preparing students for success in the 21st century.

3. METHODOLOGY

The methodology of this position paper centers on synthesizing existing literature and analyzing innovative strategies for the preparation of Teachers of the Future in the era of AI. A review of related works was conducted, focusing on scholarly works and research studies related to AI integration in education. Through this review, key information and arguments are extracted to inform the paper's position. Following the review of related work, innovative strategies are presented in form of result and discussion on the effectiveness and feasibility of these strategies. Drawing upon the findings from the literature review, the synthesis of gathered information formed the basis for constructing a narrative supporting the paper's position on strategies for preparing Teachers of the Future for the challenges and opportunities presented by AI. This synthesized literature helped inform the suggestions presented in the paper for implementation.

4. RESULTS AND DISCUSSION

4.1 Innovative Strategies for AI Integration in Preparing Teachers of the Future

Based on the synthesis of information gathered from the review of related works, a range of strategies emerged for preparing Teachers of the Future in the Era of AI. These strategies include.

4.2 Developing AI Literacy

Embedding AI literacy components directly into the teacher training curriculum ensures that future teachers graduate with a foundational understanding of AI concepts and applications in education. This integration can be achieved through dedicated courses, modules, or workshops focused on AI ethics, AI-enhanced pedagogy, and the responsible use of AI tools. Providing practical, hands-on experiences with AI technologies within the teacher training curriculum allows aspiring teachers to gain proficiency in using AI-powered tools for instructional purposes [7], [31]. These experiences could include simulations, interactive labs, and project-based learning activities that expose teachers to a variety of AI applications relevant to their future classrooms. Similarly, incorporating assessments and reflection activities into the AI literacy curriculum enables teacher trainees to evaluate their own understanding of AI concepts and reflect on their implications for teaching and learning [15]. This could involve case studies, discussions, or reflective essays that prompt teachers to critically examine the ethical, social, and pedagogical dimensions of AI integration in education.

4.3 Incorporating AI in Teacher Training Courses

Infusing AI content throughout existing teacher training courses ensures that AI concepts are woven into the fabric of the curriculum rather than treated as standalone topics. This approach allows teacher trainees to see the interconnectedness of AI with other aspects of teaching and learning, such as curriculum design, assessment, and classroom management [39]. Designing specialized modules or practicum experiences focused on AI integration provides teacher trainees with opportunities to apply AI concepts in authentic educational contexts. These modules could involve designing AI-enhanced lesson plans, implementing AI-powered adaptive learning systems, or analyzing student data to inform instructional decisions. Collaborative projects among teacher trainees encourages teamwork and innovation while addressing real-world educational challenges related to AI integration. These projects could involve interdisciplinary teams working on AI-driven research initiatives, curriculum development projects, or technology integration plans for school-wide implementation.

4.4 Encouraging Collaborative Learning among Teachers' Training

Establishing peer learning communities within teacher training programmers creates a supportive environment where teacher trainees can share ideas, resources, and experiences related to AI integration [34], [40]. These communities could take the form of study groups, online forums, or professional learning networks focused specifically on AI in education. Pairing teacher trainees with experienced teachers who have expertise in AI integration can provide valuable mentorship and guidance. Mentorship programmers could involve one-on-one coaching sessions, classroom observations, or collaborative lesson planning activities focused on incorporating AI technologies effectively. [38] Expressed that, forming action research teams within teacher training programmers allows teacher trainees to conduct systematic inquiries into the impact of AI on teaching and learning outcomes. These teams could collaborate on research endeavors, gather and assess data, and disseminate their discoveries through presentations or publications.

4.5 Continuing Education

Offering continuing education such as workshops and seminars on AI integration allows practicing teachers to stay abreast of the latest developments in AI technology and pedagogy [39], [40]. These workshops could cover topics such as emerging AI tools, data analytics in education, and ethical considerations for AI use in the classroom. Establishing virtual learning groups for practicing teachers

facilitates ongoing collaboration and knowledge-sharing around AI integration. These groups could take advantage of online platforms, webinars, and discussion forums to connect trainees and practicing teachers from different geographical locations and facilitate peer-to-peer support [37]**.** Developing advanced certification programmer in AI integration for teachers provides an opportunity for professional growth and recognition. These programmer could offer specialized coursework, hands-on training experiences, and assessments designed to validate teachers' proficiency in AI-enhanced teaching practices.

4.6 Developing Positive Attitude towards the Use of AI

Providing professional development opportunities that promote a growth mindset towards AI encourages teachers to embrace change, take risks, and adapt their teaching practices to leverage AI technologies effectively. These opportunities, according to [31], [39], [40], could include workshops, seminars, or online courses focused on developing growth mindset and cultivating a willingness to experiment with new technologies. Recognizing and celebrating teachers who demonstrate innovative AI integration practices can inspire others to follow suit. This could involve highlighting success stories through awards, testimonials, or professional publications that showcase the transformative impact of AI on teaching and learning. Hosting community building events, such as AI showcases or innovation fairs, brings teachers together to share their experiences and celebrate achievements related to AI integration. These events provide a platform for networking, collaboration, and peer recognition, promoting a sense of community among teachers committed to advancing AI in education [41].

4.7 Suggestions for Implementation

Based on the synthesized review of related works in this paper, the following suggestions are proposed for preparing Teachers of the Future in the era of AI:

1. In preparing teachers for the future, it is important to provide them with foundational training in AI to equip them with the necessary knowledge and skills. [40] Emphasize the importance of workshops and seminars tailored to teacher trainees, focusing on AI concepts such as its capabilities, limitations, and ethical implications. These sessions aim to deepen trainees' understanding of the roles of AI in education and how it can enhance teaching and learning experiences. Furthermore, insights from AI experts shared through guest lectures enrich trainees' learning experiences, providing real world perspectives and encouraging critical thinking about implications of AI in education [34].
2. Teacher education programmer play a significant role in preparing teachers for the integration of AI into their future classrooms. Integrating dedicated modules on AI into teacher education curricula is essential [33]. These modules should offer a comprehensive exploration of AI theory, providing trainees with a strong theoretical foundation. Moreover [40], [38] stress the importance of practical experience with AI tools, suggesting that such modules should also incorporate hands-on components where trainees engage with AI-powered technologies relevant to education. Collaborative projects within these programmers allow trainees to apply AI concepts in simulated educational settings, enabling them to develop the skills needed for effective AI integration.
3. Cultivating a favorable attitude towards AI among teacher trainees is crucial for promoting innovation and collaboration in education. [40] Highlights the significance of establishing professional learning communities within teacher education programmer. These communities provide trainees with a supportive environment where they can exchange experiences, share ideas, and collaborate on AI integration projects. Incentive programmer further incentivize trainees to actively engage in AI integration efforts, recognizing and rewarding their contributions to advancing AI in education [32].
4. Continuous professional development is essential to ensure that teacher trainees remain updated on the newest developments in AI technology and its applications in education. Workshops, online resources, and mentorship programmers offer trainees avenues for continuous learning and skill development in AI [31], [38]. These initiatives will encourage trainees to cope with the ever-changing terrain of AI in education confidently, ensuring that they are well-prepared to integrate AI effectively into their future classrooms.

5. CONCLUSION

The field of education, like other sectors, is anticipated to witness an increasing reliance on AI technology, as such teacher training institutions must prepare teachers to succeed in a rapidly changing world by providing them with the necessary skills and knowledge for the effective application of AI. This position paper has indicated that while AI has the potential to revolutionize education, it is unlikely to entirely replace teachers due to their central roles in providing emotional and moral support, as well as nurturing critical thinking among learners. However, to effectively harness the benefits of AI in the field of education, Teachers of the Future must embrace emerging technologies including developing AI literacy. This can be accomplished by integrating AI into teacher training programmers, which can be achieved through implementing strategies such as developing AI literacy, integrating AI into teacher training courses, fostering collaborative learning among teachers in training, providing continuing education opportunities, and cultivating a positive attitude towards the use of AI.

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Author Contributions Statement

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

Conflict of Interest Statement

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Informed Consent

All participants were informed about the purpose of the study, and their voluntary consent was obtained prior to data collection.

Ethical Approval

Not applicable.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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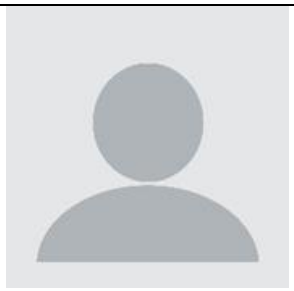
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