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AI-Driven Teacher Development: Digital-Age Mentorship and Professional Training Models

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Abstract: ***Artificial Intelligence (AI) is increasingly influencing teacher training by enabling dynamic mentorship and ongoing professional development. This study explored how trainee and in-service teachers in Jamaica use AI tools to enhance pedagogical and technological skills, while promoting continuous learning. Through a mixed-methods approach involving 40 participants, comprising teacher-educators, cooperating teachers, and trainee and in-service teachers. The study examined perceptions of AI-driven mentorship, skill-building, and access to professional learning. The data was collected using interviews, questionnaires, and focus group discussions. Results suggest positive responses among trainee teachers, with tools like ChatGPT and Grammarly being widely adopted. However, challenges remain around ethical concerns, digital literacy, and equitable access. The findings highlight the potential of AI to support teacher training while emphasizing the need for inclusive training programs.***

Keywords: teacher training, educational technology, artificial intelligence, professional development, digital learning

1. Introduction and Literature Review

Across several sectors, the digital age has ushered in transformative changes, more so in education. The necessity for effective teacher training has increasingly become critical, especially as technology continues to evolve at an exceptional pace. Not only does the incorporation of digital tools in the classrooms effectively enhance the learning experience for students, but it also creates new challenges for educators who must adapt their teaching practices to measure up with technological advancements. The demand of the 21st century has proven that traditional methods are becoming insufficient in providing the ongoing personalized support required to enhance their career, as teachers are no longer relying only on traditional models of professional development such as seminars and one-time workshops **[1]**. In this context, Artificial intelligence (AI) has materialised as a transformative resource, providing cutting-edge solutions to enhance teacher training. Luckin *et al.* **[2]** stated that through AI technologies, personalized learning experiences that are tailored to professional development to meet the unique needs of individual educators, could be sanctioned and made possible. AI has become an emerging area of research and is effective in mentorship and professional development. Teachers could participate in self-directed learning, access a wealth of resources that encourage continuous growth, while receiving real-time feedback using AI-driven platforms **[3]**. Mentorship is also supported through AI by fostering collaborative relationships, connecting novice teachers with experienced professionals that enhance teaching effectiveness **[4]**. AI can promote reflective teaching, meaningfully impact instructional practices and adaptive learning strategies as studies suggest **[5, 6]**. However, challenges remain, including concerns about data privacy, the need for adequate training in the use of AI tools and the reliability of AI-generated feedback **[7]**.

In the previous era, educators relied on traditional methods that emphasised face-to-face training, to develop professionally. This usually requires planning these sessions appropriately for engagement and at times usually interrupt teaching times sometimes leaving teachers feeling burdened to play catch after. Not only that, but some teachers have also found that while these sessions are good, they are not necessarily effective if they are not able to actively learn from the presentations and demonstration activities. As pointed out by Ponticell **[8]**, they tend to depend on traditional teaching methods and 'reflexively resist' instructional innovation and curricula. However, based on the increased demands of teachers, their educational environments have become more technologically advanced. Not only are teachers required to understand digital tools, but they should also integrate these resources effectively into their teaching practices based on the shift now seen toward digital learning. This became very evident during the COVID-19 pandemic, which involved stay-at-home measures, forcing teachers to go online regardless of being technology savvy or not. This created chaotic and improvised training sessions, facilitated by technologically savvy teachers, but some teachers were still not able to comprehend their uses. By personalizing learning experiences and facilitating ongoing support for teachers at various stages of their careers, a promising solution to address challenges faced through the integration of AI into education. Technology can enhance teacher professional development through its promotion, collaboration, provision of resources for the improvement of access, and ensuring

reliable feedback, as stated by Darling-Hammond, *et al*. **[9]**. The preparation of educators to reign supreme in their roles and appease diverse learners' warrants comprehending how important AI can buttress mentorship and professional development. The effective use of technology within the classrooms has created new opportunities for professional growth, however, there is a growing concern from educators that despite this, this has nonetheless made many feel unready. Consequently, it is critical to prepare educators to excel in their roles to meet the needs of diverse learners, through understanding how to support mentorship and professional development.

Digital technological development has brought changes to various aspects of life, more so in the field of education, as we can see its prominence in the role it now plays. In this digital era, teachers are required not only to understand the learning material but also to be able to integrate technology into the teaching process **[10]**. Several teachers have shown the significance of continuous support and training in the classroom through technological applications in the context of their professional development **[11, 12]**. Due to the rapid changes in educational technology, teachers' professional development has become increasingly essential, more so as they adapt to the new ways of using technology effectively inside the classrooms. **[10]**. The increased demand for educational adaptability was experienced more than ever, which became even more evident during the COVID-19 pandemic, where adaptability and innovativeness by teachers have been made more noticeable **[13, 14]**. The customary, conventional view of mentoring in an academic setting is viewed as an experienced teacher (mentor) supporting and guiding an in-service teacher (mentee) as they enter the profession and carry on evolving their beliefs, values, and skills **[15]**.

1.1 The Evolution of Teacher Training and Mentorship

To enhance educators' knowledge and skills, traditional approaches to teacher professional development are designed to have classical emphasized structured, instructor-led sessions. There are many characteristics of traditional approaches such as in-person workshops and conferences where traditional professional development is centred around. There are also one-time training sessions that focus on specific topics; however, this approach often lacks opportunities for ongoing practices or support even when new information is being received **[16]**. Additionally, limited resources and follow-up support are frequently received after workshop attendance by educators, which are necessary to assist them in implementing newly learnt strategies in their classrooms, and as a result not being able to convert the knowledge gained into actual practices **[17]**. The one-size-fits-all approach where traditional development is usually standardised, does not account for the individual needs and contents of educators **[1]** are also seen as other characteristics of traditional approaches. There are many advantages to traditional approaches that impact teacher training and development. One such advantage is that a structured learning environment provides an organised position for teachers to learn new skills and information pertinent to their practice. Also, the opportunity for networking exists through the various workshops and conference participations, aimed at fostering share ideas, experiences and resources. Traditional approaches also introduces professionals who are readily accepted by educators in their schools, who can offer creative strategies and discernment. **[18]**. There are drawbacks to these traditional professional development approaches as the present contents may be too difficult for trainee and in-service teachers to associate their specific teaching contexts to the necessity of their students - leading to reduced demotivation to apply learning strategies **[16]**. The lack of ongoing support does not allow for trainee and in-service teachers to fully connect to their specific student needs and teaching contexts, due to the standardized nature offered by one-time training sessions of traditional professional development **[19]**. As expected, resistance to change is another drawback of traditional approaches, as at times you find educators who may resist implementing new methods. This could be brought on by various reasons, such as the lack of confidence or a perceived disconnect from their usual practices. These reasons often stifle innovation and hinder effective education strategies adaptation **[20]**.

1.2 AI in Education: Global Perspectives

Not surprisingly, artificial intelligence (AI) has become a metamorphic force in education. Across the globe - teaching, learning, assessment, and management have been revamped. Its application has been explored by institutions worldwide, as they probe into its implementation, complexities, and consequences, exposing a diverse landscape with varying degrees of adaptation and use.

1.2.1 Transformative Potential of AI in Education

AI technology supplies a customized learning framework that's adaptive and influences the implementation of personalized versatile learning among individual students as a strategy of teaching and learning, to action disparity **[21]** offering promising solutions for many educational challenges. Countries such as the United States of America, Canada, Finland and the United Kingdom have actively implemented AI-driven personalized learning platforms that has enhance the engagement and performance of their students, facilitating quality education for all students **[22]**. AI also promotes administrative efficiency, as its platform can be utilized to simplify and automate various administrative classroom management - making it an effective classroom management tool. This tool facilitates educators to concentrate more on teaching **[23]**. Globally, many countries are now emerging with innovative initiatives and projects through the utilisation of AI in education.

- **Within the European Union** many organisations, for example, the European Commission have acknowledged AI's possibilities for strengthening its educational quality. They have integrated programmes such as the "Digital Education Action Plan" aimed at addressing issues that are ethical related to privacy and data usage while amalgamating the use of AI tools **[24]**.
- In the next continent we observe that the **Chinese government** has invested heavily in AI education and technology integration. They have launched initiatives aimed at aligning its national innovation strategy with "AI + Education". They use AI algorithms to deliver unique learning experiences tailored to millions of

students, through companies like Squirrel AI aimed at promoting individualized education at scale **[25]**.

- Within the confines of **the United States** AI applications such as educational Chatbot and Intelligent tutoring systems is becoming progressively well-received in kindergarten to twelve grades and higher education settings. For example, Carnegie Learning utilized AI to facilitate personalize instructions for their mathematics subject, resulting in improvement seen in the learning outcomes of students across demographics **[26]**.

1.3 AI and Educator's Professional Development

AI can augment alliance among educators by associating them with resources. Aggarwal **[27]** highlighted that regardless of geographical restrictions, AI tools can support collaborative professional development by assisting teacher-networks that sanction the exchange of best practices. Within the teacher's professional development, AI technologies can provide innovative solutions to the more traditional challenges. Innovative solutions can be had from AI technologies more so, to traditional challenges in teacher professional development. Not only do generative AI technologies enrich the learning experiences, it also increases the efficiency of teaching **[28]**. AI can generate adaptive learning environments that can provide immediate feedback and recommendations, fostering personal reflective practices among educators **[2]**. Taking into consideration that the role of teachers is vital in educational activities, their capability in AI technologies is critical for guaranteeing high-quality instruction. This attests that AI-driven platforms can in fact modify learning experiences tailored to teachers' individual needs, making it important that any gap seen be bridged. Presently, teachers are trained to concentrate on employing technology that strengthens students' understanding of traditional content. The introduction of AI to teacher training could see an upward trend towards improving the comprehension of lesson contents, while acquiring the necessary relevant knowledge to today's world **[29]**.

1.4 Mentorship that is facilitated by AI

AI often compliments mentorship, and for seasoned teachers, holds tremendous potential in transforming the educational landscape, and is said to offer a revolutionary approach to education. Based on their specific needs, AI systems can easily and efficiently match novice teachers with experienced mentor to meet their professional goals **[30]**. AI systems can adeptly complement novice teachers with experience mentors by aligning their professional goals and needs. It can also support mentors in enhancing the quality of guidance offered through its provision of data-driven insights. It can evaluate the unique needs, strengths and weaknesses of each mentee creating a unique learning path for mentees, for ultimate goal development **[31]**. By analyzing interactions, AI can help evaluate mentorship effectiveness, allowing for continuous improvement and adjustment to best support novice teachers **[32]**. This data-driven approach can help refine mentorship strategies, ensuring that they are effective and relevant.

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1.5 The Role of AI in Enhancing Professional Development

AI has empowered teachers with the cutting-edge technology necessary to enhance their teaching skills with the associated student learning outcomes, through its provision of practical strategies for its integration into the classroom. Luckin, *et al*. **[2]** explained that while encouraging reflective practices among teachers, AI can generate adaptive learning environments that deliver immediate feedback and recommendations. For teachers, AI technologies that are generative not only increase teaching efficiency, but they also enrich the learning experience enabling them to invest more time to student interaction and instructional innovation **[28]**. Therefore, within teacher professional development AI technologies afford more innovative solutions to traditional challenges observed. These platforms can tailor to teachers' individual needs through personalized learning experiences that it facilitates. While traditional approaches to teacher professional development have played a crucial role in fostering educational growth, their limitations warrant re-assessment of how educators are trained and supported. Based on how technology-driven and complex the educational environments have become, there is a growing pressing need that engage educators in continuous improvement, and learning for more relevant, personalized, and sustainable professional development practices.

1.6 Challenges and Ethical Consideration in AI Integration

Although AI tools have been integrated worldwide in education and are well-known to offer benefits, they come with their challenges. The integration of these AI tools in education has been affected by barriers. Educators and policymakers have experienced digital literacy issues and have such are not ready for AI. Moreover, there are even concerns about algorithm bias, data privacy, and the need to ensure equitable access to AI-enhanced learning.

1.6.1 Digital Literacy and AI Adoption Challenges

Globally a lot of educators lack the necessary training experience and confidence in effectively employing AI tools in the classroom, which has caused significant barriers in AI adoption. UNESCO **[33]** has shared that there are only a few countries that have instituted clear AI capabilities for teachers or even incorporated national training programmes. However, many educators have been left without proper guidance that is well-needed. Langreo **[34]** shared that 7 out of 10 teachers have no AI training, while teachers in rural areas are highly unlikely to have exposure to AI tools. These teachers who experience this skills deficit are wary of AI as they are interested in its potential, and as such they are either resistant or hesitant in adopting the AI tools **[33, 34]**. Therefore, it is with great urgency that professional development sessions be organized to facilitate AI literacy programmes or training so that teachers can become equipped with the requisite AI skills needed for effective AI integration into curricula. Educators will continue to struggle if they do not gain sufficient training experience to incorporate AI tools into their instructional strategies or even provide guidance to students on responsible AI use.

Consequently, this will slow down the rate of AI adoption in the educational systems. Educators in Jamaica also experienced similar challenges coupled with local barriers such as the lack of resources, inconsistent access to infrastructure, and formal AI education. Cunningham, *et al.* **[35]** in a study focusing on AI tools for teacher training, revealed that 70% (of 60) of the Jamaican trainee teachers who participated in the study stated that they used AI tools or observed their use during their practicum experience. However, how teachers have engaged with these tools varied significantly. Some expressed that the primarily used AI tool was ChatGPT which they were more familiar with; others shared that they hardly had any interaction with AI tools because of limited exposure and the absence of rigorous training in specialized applications **[35]**. Furthermore, not all schools have the necessary resources/ infrastructure to provide digital learning, which has impeded teachers' hands-on experience with AI technologies. According to Digital Watch Observatory **[36]**, these gaps have been considered, and the Jamaican Ministry of Education has developed planned initiatives to enhance digital literacy such as upgrading the technological infrastructure of schools and training teachers through coding workshops. Cunningham *et al.* **[35]** recommended that policymakers expand technological accessibility for teachers and students and incorporate comprehensive AI training programmes so that no one will feel excluded from AI integration opportunities. Finally, to fully harness AI's potential in changing teaching and learning, across the world – the broader global education sector, it is important for AI literacy to be strengthened through the improvement of infrastructure and targeted professional development.

1.6.2 Ethical Considerations in AI Implementation

Even with the benefits that can be derived from harnessing AI-driven educational tools, there exist several ethical considerations that must be carefully managed to guarantee responsibility and equitable implementation. Based on research studies surrounding AI tools, the most pressing issues of concern are algorithmic bias, data privacy, and equity in AI-generated feedback. As such, schools must prioritise protecting sensitive information such as students' information, including academic records and behavioural data, particularly with the vast data inputs that many AI platforms rely on. Consequently, AI developers and schools must ensure that the tool is managed correctly so that students' data is not inadvertently exposed to any third-party services that would raise serious privacy concerns. For example, some schools, more so in the US school districts, use AI-powered student applications, if parents leverage this tool and it abruptly shuts down when in use, parents may worry about their children's data being stored or used without their knowledge **[37]**. With this kind of incident clear policies must be established on AI data security, where schools implement encryption, anonymization, and legal compliance measures to safeguard sensitive information. Establishing proper safeguards, emphasising that AI tools are trustworthy, not violate the ethical principle of "do not harm" **[37]**. This concern is even more equally relevant in Jamaica, where there is a growing integration of AI tools for the education system. It therefore, is pertinent for policymakers to stringent data protection standards for AI deployment. Another major area for ethical concern is algorithmic bias, where AI systems algorithms [training data or design] have been found to reinforce existing inequalities due to biases. Research has uncovered that AI-based educational tools can unintentionally disadvantage student groups that are particularly considered to be of marginalized backgrounds **[38]**. For instance, persons of colour have been misidentified using facial recognition AI tools, and established AI writing detection tools have been found to flag non-native English speakers' work as AI-generated more frequently than native speakers' work **[38, 39]**. These biases raise concerns about AI tools being fair, especially considering cases such as the evaluations of student learning outcomes and assessments. It is necessary that AI systems are regularly audited and carefully designed continuously to be more integrative of marginalized persons based on colour and language patterns, ensuring close alignment with the AI's training data. In Jamaica, according to Cunningham, *et al*., **[35]**, educators have shared concerns of algorithmic biases encouraging the importance of AI tools developing culturally relevant and contextually appropriate information [materials]. Therefore, AI developers can establish fairness by training diverse data sets and complete rigorous testing of the AI models and educators need to critically examine AI-generated feedback before implementing it in classrooms. Furthermore, equity should also be paramount in AI-generated feedback, as these tools constantly act as teaching assistants that facilitate feedback and personalised learning experiences coupled with automated grading opportunities.

1.6.3 Disparities in AI Access in Education Systems

Additionally, there is a threat of AI access widening the achievement gap, causing the "AI divide", due to infrastructural and socioeconomic factors where some schools lack the basic technological infrastructure, and others have well-resourced educational tools **[33]**. This is usually very evident in high-income countries or well-funded schools, especially those usually in the urban areas, where schools benefit from modern devices, high-speed internet, and adequate budgets to pilot and leverage AI-driven tools. On the other hand, developing countries or rural areas often face significant problems such as outdated hardware, insufficient funding, and limited internet connectivity, thereby struggling to adopt basic educational technology, and much less advanced AI tools **[33]**. Additionally, AI tools may differ in terms of interaction with students based on their learning styles, language proficiency, or their access to digital tools. For instance, students who complete their studies using Standard English may benefit greatly from AI tutoring programmes in comparison to those using local dialects, hence having varying learning experiences. Furthermore, the challenge that developing and rural areas may face is the likelihood of being left behind with these technological advancements, resulting in an enlarging of the social, economic, and technological divides in education. As a result, students who may be in dire need of improving their learning experiences may be the least likely to access AI-assisted tutoring and adaptive learning tools, particularly for personalized learning opportunities **[35, 38]**. For Jamaica's education system, the Education Ministry reported in late 2023, that half the number of the primary and secondary schools now have access to broadband internet **[36]**. However, there were still 50% of schools that would be left behind in leveraging or gaining

exposure to AI tools, since they would either be without internet access or even insufficient connectivity. Teachers in Jamaica have indicated their experiences of infrastructural deficiencies and unequal AI access as significant barriers to integrating AI tools in their classrooms, emphasizing the need for targeted interventions to bridge the gap. For example, an urban school that may be very well-equipped due to sponsorships or considered high-income can successfully implement an AI-powered mathematics or science tutor, while a rural school may not even have a computer lab to provide similar opportunities, putting its students at a clear disadvantage. These disparities are urgently needed for government and educational institutions to actively intervene in the digital division, to encourage AI tools' ability to cater to diverse learning needs **[35]**. This can be achieved by investing in affordable internet access, providing educational technology infrastructure, and support for offline AI applications that can be adapted in low-resource environments.

1.7 Rationale for the Study

Despite the increasing adoption of AI tools in education, research remains underdeveloped on AI serving as a mentorship tool in teacher training. According to Zawacki-Richter, *et al.,* **[40]** AI-driven tools with the potential of being virtual mentors for pre-service and in-service teachers have not been fully investigated even though they can provide personalized learning and automated feedback. If AI developers considered AI tools carefully for mentorship, teachers could be adaptively offered guidance, benefitting from lesson planning support, personalized feedback, and real-time instructional enhancement. However, Zang, *et al*., **[41]** shared that existing studies often focus on AI-assisted tutoring for students but do not clearly define AI's role in supporting educators. Moreover, Salah-Eldin & Mohamed **[42]** shared in a study that teachers can benefit from AI-based mentorship opportunities with AI's potential to improve teacher preparedness through immediate, data-driven insights on pedagogy, classroom management, and subject-specific teaching strategies.

Significant gaps in the growing recognition of AI as the key driver of innovation continue to be demonstrated in the current educational landscape, despite the potential advantages of its integration into teacher training. The difficult task confronted in modern teaching in fulfilling the diverse demands of educators, employing the conventional professional development approach has proven - quite often - to be fruitless. Trainee teachers' professional growth and effectiveness are presently being blind-sided by robust mentorship and professional development progammes that are under-represented within their field. This deficiency has brought on fundamentally limited guidance leading to the exploitation of AI to augment learning outcomes within educational institutions. Trainee teachers are faced with challenges in their professional growth that have limited their development through inadequate support systems; managing diverse needs from students; and limited resources, to name a few. How effectively they can leverage technology is important for their growth and development. The need for AI-enhanced mentorship and continuous professional learning has become more relevant, more so as traditional mentoring has its restrictions. With the scarcity of available qualified mentors, access to mentorship opportunities has become more uneven. Moreover, its quality and consistency become questionable, as students may be limited to the amount of personalised attention given, making it difficult for them to thrive personally and academically within their field of study. This study aimed to explore the role of AI in the digital age in improving professional development and mentorship for trainee teachers, through the examination of current literature and existing practices. The research also tries to ascertain AI tools and strategies that are effective and evaluate their influence on the growth of teachers, while exploring the perception of educators regarding the amalgamation of AI into their professional journeys. The findings intent not only to make available practical insights for creating active professional development programmess that meet the demands of contemporary teaching, but it would also give rise to the ongoing debate on technology in education.

1.8 Research Questions

The research questions can be defined as follows:

a) What are the key challenges associated with integrating AI-driven mentorship and professional development tools in teacher training?
b) What are the key opportunities associated with integrating AI-driven mentorship and professional development tools in teacher training?
c) How do trainee and in-service teachers perceive the role of AI in enhancing professional development and mentorship in teacher training programmes?

1.9 Significance of the Study

This study signifies the contribution to teacher education and digital learning that emphasizes the potential of AI's transformation, in developing effective teaching and learning practices, while preparing trainee teachers for the challenges of an educational landscape that is technological-driven. It also demonstrates implications for policymakers, trainee-teacher education institutions and developers of educational technology, as it will provide a roadmap for the integration of AI into teacher training, while enhancing their professional development. It will also foster an environment within the field that enhances the quality of teaching and learning while embracing innovations. By offering support to AI, it would enhance its opportunities for professional development and mentorship, and impact positively on the retention and skill development of trainee teachers within the field. Not only would this contribute positively to a more sustainable and qualified teacher workforce within our society, it would also transform the development of professional practices as well as transforming the education of our teachers within our zestful educational landscape.

1.10 Definition of Terms

- *Trainee Teachers or Teacher Trainees:* These are individuals who attend teacher training institutions to become certified teachers who previously lacked teaching experience, professionally or otherwise.

- *In-service Teachers:* These are currently classroom teachers who interact with students daily but lack the teacher training certification required.
- *Educational Technology:* According to Lathan **[43]**, educational technology can be defined as the digital tools and media necessary to facilitate the communication of knowledge to students, as well as the creation of immersive lessons to engage students in a fun-filled manner.
- *Professional Development:* This involves the engagement of trainee, in-service, and certified teachers with ongoing training activities to improve their skills, knowledge, and expertise concerning their teaching practices to positively influence students' learning outcomes in an evolving education landscape **[44]**.
- *Mentorship of Teachers Using AI Tools:* This can be defined as the usage of AI tools by teachers to get support similar to human mentors through personalized guidance as well as matching mentors and mentees based on unique mentee needs, offering real-time feedback **[45]**.

2. Methodology

2.1 Research Design

This study involved a mixed methods design that explored how AI has been able to supplement human mentorship in teacher training, particularly with the looming teacher shortages in Jamaica. The quantitative data allowed us for instance to examine the trends and/or patterns related to participants [teacher trainees and in-service teachers] who believe AI has improved mentorship, along with their skills, while facilitating professional development. Qualitative data collected from interviews and focus groups provided opportunities to identify and discuss themes - such as AI as a personalized mentor - that facilitate on-demand feedback, along with assisting with lesson planning.

2.2 The Participants

This study incorporated teacher trainees, in-service teachers, cooperating teachers, and teacher educators. Data was collected from the teacher trainees and in-service teachers using questionnaires via an online link through the adoption of a snowball sampling method where each person shared the link with their peers. Convenient sampling was also utilised for the focus group discussions as well as interviews with the trainees, in-service teachers, cooperating teachers, and teacher educators who volunteered to be interviewed. This study comprised 25 teacher trainees, 5 in-service teachers, and 10 educators [classified as cooperating teachers and teacher-educators]. There were participants of six (6) teacher training institutions which included teachers' colleges and universities in Jamaica located in the parishes of Kingston, St. Andrew, and Manchester. The sample is very diverse which included both males and females between ages 17-45, who studied primary, secondary, and early childhood education. These teacher trainees and in-service teachers were selected using snowball sampling from years 2, 3, and 4 of their teacher training programmes. This facilitated and efficient reach of a wide range of participants across various teacher training institutions, particularly those eligible who were not readily accessible. It also provided the opportunity for a multifaceted and reflective sample of trainee and in-service teachers, to capture differing perspectives of use of AI for mentorship and professional development during teacher training practicum. The educators in this study were selected based on their years of experience working with teacher trainees and in-service teachers during the teaching practicum. The practicum period was from September 2023 to April 2024. These educators [teacher-educators] supervised some of the teacher trainees and in-service teachers who are participants in this study. One drawback of the study was the need for a better representation of the participants, particularly the small number of in-service and practicum supervisors. This limited the study's scope to capture a wider range of perspectives of experienced educators, especially to provide a richer comparison of trainee teachers and in-service teachers of how AI tools facilitated mentorship and professional development. Nonetheless, the study could provide valuable, contextual insights into the administrative and pedagogical ramifications of the incorporation of AI tools in teacher training programmes.

The demographics of the study revealed the diverse nature of undergraduate trainee and in-service teachers who participated in the study in terms of their age groups, programmes of study, and year group (see Figure 1 and Figure 2). The majority of the participants (56.7%) are within the age range of 17-25; another significant portion (30%) with trainee and in-service teachers of ages between 26 and 35. The participants of age ranges 36-45 and over 45

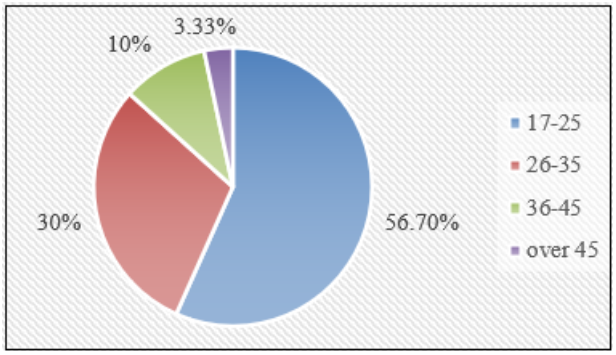

Figure 1: Age distribution of trainee and in-service teachers

are less represented. There was one in-service teacher over 45 years of age. The distribution shows that the participants are predominantly young people but includes older participants, particularly those with experiences in the classroom. The data in Figure 2 shows that 70% of participants were female trainee and in-service teachers studying in the bachelor's degree (BEd.) programmes for Primary, Secondary, and Early Childhood Education, to incorporate into the study diverse perspectives and experiences in exploring the role that AI plays in providing mentorship and professional development in teacher training education. There were over 50% of participants enrolled in the Secondary Mathematics Education programme including Year 2, Year 3, and Year 4 trainee and in-service teachers. The others, however, were participants from the Primary, Early Childhood, and Secondary English Language and Science Education programme comprising Year 2, Year 3, and Year 4.

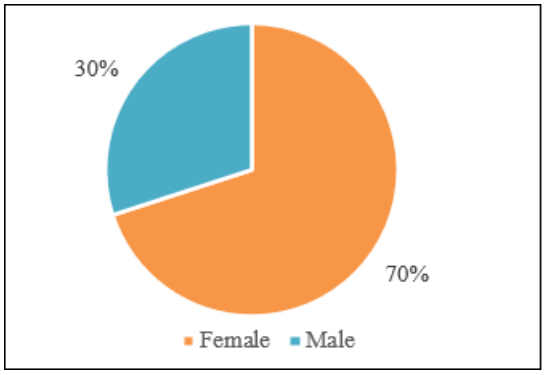

Figure 2: Gender of trainee and in-service teachers

2.2 Data Collection and Data Analysis

Data was collected using interviews, focus group discussions, and questionnaires. Questionnaires were developed and shared using an online link which was sent to the teacher trainees and in-service teachers. This allowed data to be collected on how teacher training and mentorship have evolved since the digital age, the usage of AI in education particularly teacher training as well as the challenges and benefits of integrating AI in teacher training. Interviews and focus groups allowed for a more in-depth conversation online as well as face-to-face into their experiences, perceptions, and challenges in adopting AI for mentorship and professional development. The interviews with the educators, on the other hand, facilitate the data triangulation. The study ensured that all participants provided informed consent and were told at any point in time they desired to withdraw they had the right to do so. Also, the study ensured that data privacy was observed along with proper storage through encryption of online data and carefully protected cabinets with physical information. The data in the study was analysed using codes and themes, descriptive statistics, and inferential statistical methods. Quantitative data collected from the surveys were analysed using descriptive statistics to discuss the perceived role of AI in enhancing professional development and mentorship, barriers, and key-related opportunities. Additionally, inferential statistical methods was utilized such as Chi-square, to assess the relationship between teacher category and perception level and t-test (Welch's t-test) to investigate the perceived benefits of using AI in teacher training.

3. Results

3.1 Results Based on Research Question 1

How do trainee and in-service teachers perceive the role of AI in enhancing professional development and mentorship in teacher training programmes?

It is pertinent to understand the role of AI in enhancing professional development and mentorship in teacher training programmes from the trainee and in-service teachers' perspectives particularly to evaluate the AI tools that would be most suited to adopt in these programmes. This research question seeks to establish the general sentiments of the teachers toward AI tools to analyse if they consider the integration of the tools to be favourable or may have resistance in integrating them. With this, insights can be provided to indicate the existing challenges and benefits that may exist in integrating AI-driven tools in teacher training.

Table 1 displays the percentage of participants (trainee and in-service teachers) who believed that AI tools have improved mentorship, skill development, and accessibility to professional learning. Most of the participants (53.3%) reported that they benefitted from mentorship which constituted on-demand guidance and personalized learning pathways. It was revealed that these participants, comprising 14 trainee and 1 in-service teachers believed that the use of AI-driven mentorship and professional development tools helped in improving their teaching skills and curriculum planning, found AI easy to use in teaching, providing access to professional learning. This indicated that a little more than half of the trainee teachers benefited from the tools while one of the in-service teachers agreed. In other words, trainee teachers are more receptive to AI integration in teacher training, while in-service teachers have a lower acceptance rate. According to Cunningham, *et al.,* **[35]** and Lee, *et al.,* **[46]** AI has the potential to revolutionise education by providing support for teachers and administrators, in facilitating mentorship and professional development. Furthermore, AI-driven mentorship platforms were also adopted including Mentorly (6.67%), CoachHub (6.67%), and TeachBoost (6.67%) - but even with the increase observed, availability were not well-adopted by the trainee teachers. Four trainee teachers used these platforms - Mentorly which provided virtual mentorship; CoachHub which facilitated personalized coaching and professional development; and TeachBoost which is a professional learning network. These platforms were minimally adopted indicating that most trainee teachers are unaware of them and expressed that using AI tools for mentorship was secondary to being mentored by humans. Other AI-powered teaching support tools such as TeachFX (3.33%), and Copilot for Education (Microsoft) (6.7%), that also assist with monitoring engagement, were not widely adopted by the trainee teachers. TeachFX, though rarely used, provided teachers the opportunity to get feedback from their teacher talk time (lesson delivery) along with insights for engagement. Copilot for Education (Microsoft), however, is an AI teaching assistant that facilitates collaboration and lesson planning. Desimone **[1]** inferred that this was a good move on the trainee teachers' part because traditional teaching methods were no longer sufficient to facilitate mentorship and professional development in this dynamic landscape [digital age]. However, the low adoption rates suggested that the [trainee] teachers indicate that they are unfamiliar with using these tools and expressed that training would be helpful to leverage the technologies. Sixteen (16) of the trainee teachers expressed that improved mentorship exposed them to best practices and resources offered by AI platforms, particularly ChatGPT, unbeknownst to them previously. So, they can "better complete lesson reflections by recording lessons and analyse them to improve students' participation and performance, especially before appraisal meetings". Four (4) of the trainee teachers, however, explained that with the increasing need to address teacher shortages and deal with large class sizes, the improved mentorship allowed them to "facilitate tutoring services and ongoing professional resources inaccessible in the education system". Additionally, the participants reported that they have experienced an improvement in skills development,

Table 1: Trainee and in-service teachers' perception of effects (improvements) in using AI tools in teacher training

Perception of Effects (Improvements)	Indicators	Percentage of Participants
Improve Mentorship	Benefits from on-demand guidance and personalized learning pathways; can better complete lesson reflections by recording lessons and making analyses to improve students' participation and performance, especially before appraisal meetings; facilitate tutoring services and ongoing professional resources inaccessible in the education system.	53.33%
Skills Development:		
1) ***Pedagogical skills***		
a) Active Learning Techniques	Improve students' engagement with course material with the aid of manipulatives, etc; use strategies such as discussion, writing, and problem-solving; and active learning techniques such as simulations, gamification, and game-based learning, flip the classroom, and problem-based learning, for deeper understanding; improve students' motivation to learn.	30%
b) Classroom Management	Employing the integration of AI tools to aid in managing classroom dynamics.	13.3%
c) Differentiated Instruction	Improved designing activities to facilitate different types of learners.	30%
d) Assessment & Evaluation	Used quiz platforms such as Quizziz and Quillionz to aid assessment, especially for practice	10%
e) Curriculum Planning	Improve lesson planning skills; lesson planning is less stressful.	63.3%
2) ***Technological Skills (Digital Literacy & AI Integration):***		
• AI-Powered Teaching Tools	It is very helpful to better write lessons, create course content materials, including animations, and automate assessment.	70%
a) ***Professional & Soft Skills:***		
• Critical Thinking & Problem-Solving	Better able to identify classroom challenges and identify solutions for each class, particularly considering the environment and students' learning styles.	43.3%
• Communication & Collaboration	Better able to communicate with students, resulting in students' improved understanding; better able to collaborate with colleagues.	46.7%
b) ***AI & Research-Oriented Skills:***		
• AI-Assisted Lesson Personalisation	Improve my ability in tailoring lessons, particularly for students' conceptual understanding; improve creative skills; assist with providing individual learning profiles of students to improve differentiated instruction and students' performance.	63.3%
• Ethical Considerations in AI Use	Becoming more aware of ethical bias, particularly in using AI, better able to consider fairness in education.	13.33%
• Research & Continuous Learning	Far more aware of emerging trends in the education system locally and overseas, improved learning of emerging trends related to AI integration in education.	20%
c) ***Conceptual Understanding***	Improve my content knowledge; Better able to break down complex concepts in the teaching and learning process.	43.3%
Access to Professional Learning	While there is not much availability of real in-person training programmes, workshops and courses to help with practicum, AI tool assisted kinda to some extent; Need of inclusivity and equity in education, more evidence-based practices are needed in learning content; need to make collaboration more practical based on hands-on activities.	50%

particularly in areas such as differentiated instruction (30%), assessment and evaluation (10%), and curriculum development (63.3%). It was uncovered that 30% of the participants positively perceived the impact of differentiated learning as a skill development for instructional delivery. Upon further investigation, the study revealed that the use of AI tools to tailor instructions to meet the diverse needs of the students was found to be more beneficial to trainee teachers than to in-service teachers. The trainee teachers shared that they usually struggle to clearly understand differentiated instructions, but after employing AI tools, their skills have developed. Nine (9) trainee teachers shared they have a much better understanding of differentiated instruction and what it entails, thus they are more able to design activities for each lesson plan that can facilitate the different types of learners in an organized manner. They are now able to not only adapt teaching strategies to differentiated instructions but provide personalized learning experiences as much as possible for each learner particularly to support each based on their varying skill levels. Also, the study uncovered that there is a difference in the confidence levels of the trainee and in-service teachers, particularly as a result of the in-service teachers' lack of exposure to pedagogy related to the use of technology and therefore struggle as they sought to integrate into their traditional classroom practices AI-based differentiation techniques. This suggests that the trainee (younger) teachers found the AI tools to be valuable in organizing resources, preparing lesson plans, and ensuring educational standards are met. Each in-service teacher was either uncertain or lacked experience with AI tools, suggesting that they are more resistant as they expressed "While yes, we want exciting and creative lessons, we do not want to be overly reliant on tools". Upon further discussions, it was revealed that they seem more reliant on traditional curriculum planning methods, having little to almost no familiarity with AI-driven lesson plan designs or afraid that they might lose autonomy over instructional content. One of the cooperating teachers [she] when interviewed, expressed that the trainee teachers who were placed at her school often used ChatGPT to assist with the development of their lesson

planning to generate creative ideas, particularly, in designing learning activities and assessments for their students. She went on to say that she observed growth in the lesson planning and content delivery during the duration of the practicum experience of one of the trainee teachers she was assigned to supervise. She further explained that she began accepting the benefits of AI tools in assisting with the improvement in the students' performances, while learning herself about its uses, despite possessing some reservations. Additionally, 3 trainee teachers have improved in setting assessment activities promptly using online quiz platforms such as Quizziz and Quillionz to give students homework, classwork, and practice activities. Quillionz (10%), an AI tool for formative assessment was underutilized due to the unfamiliarity of the tool which is unknown to most teachers who expressed they were familiar with Quizzizz [not primarily an AI tool, mostly considered an education technology tool]. This suggests that additional training may be required for the 3 trainee teachers to integrate Quillionz for automated testing and feedback. Also, the trainee teachers seemed to be more confident in using the AI tools for assessment and evaluation when compared to in-service teachers, as most in-service teachers were not fully knowledgeable with its use. The trainee teachers expressed their appreciation in having these AI tools especially since the tools provided real-time analytics and data driven insights. Moreover, 16 trainee and 3 in-service teachers (63.3%) expressed that their lesson planning skills have improved and that they now find the planning to be less stressful since engaging with AI tools. A small proportion (13.3%) of the teachers shared that they were now better prepared to handle classroom management, and a greater percentage (13.3%) indicated that their active learning techniques had improved. Three (3) trainee and 1 in-service teachers stated that through the integration of AI tools into their classroom management dynamics, they have seen improvement in students' behaviour and more participation in the lessons. Overall, it was uncovered that with this small percentage of 13.3% of participants who saw improvement in their classroom management skills, there need to be training and exposure since these AI tools were not widely adopted nor understood. As such this indicates that a potential gap exist in the effectiveness of AI tools to help prepare teachers to ensure student discipline, engage then in the teaching and learning process using various engagement strategies, and facilitate classroom control. On the other hand, 6 trainee and 3 in-service teachers have found some excellent active learning such as simulations, gamification, game-based learning, flipped classroom, and problem-based learning to get students more engaged with course material, particularly, to improve their understanding of concepts.

Table 2: AI-driven mentorship and professional development tools

AI-driven mentorship and professional development tools	Purpose	Percentage of Participants
Mentorly	Virtual mentorship platform for educators	6.67%
CoachHub	Personalized coaching and professional development	6.67%
Copilot for Education (Microsoft)	Teaching assistant for planning and collaboration	6.67%
TeachFX	Feedback and teacher talk time and engagement	3.30%
Coursera	AI-driven courses for professional development	6.67%
LinkedIn Learning AI Recommendation	AI-driven course recommendations for educators	10%
Grammarly for Education	Refine and edit written documents including lesson plans, essays, and reports	46.7%
Quillbot	Edit and refine lesson plans, essays, and reports	40%
Quillionz	Formative assessments, discussion prompts, AI-generate quizzes	10%
TeachBoost	Professional learning network for educators	6.67%
ChatGPT	Mentorship, lesson planning, personalized feedback	70%
Socratic (Google)	Used to understand complex concepts to explain to students	10%
Euaide.AI	Educational assistance and specific AI science simulations	13.3%
MagicSchool	Facilitate lesson planning, assessment, and quizzes, automated grading and feedback, administrative task automation, differentiated instruction support	3.30%

Most of the participants (70%) shared that their technological skills have improved, and they now employ AI-powered teaching tools. They stated that 'it was very helpful to better write lessons, create course content materials including animations and automate assessment" (see Table 1). Two of the cooperating teachers shared that they benefitted from training in technological tools, along with trainee teachers who were placed at their institutions. They expressed their derived benefits from collaboration with EdTech companies, online courses, and workshops. However, the majority of trainee and in-service teachers expressed that they did not benefit from training at their schools. A small proportion of participants (43.3%) shared that their critical thinking and problem-solving abilities have improved especially where they are now more equipped to identify the classroom challenges coupled with solutions for each. These participants expressed that since engaging with AI tools their ability to engage in higher-order thinking had increased along with their ability to analyse problems and make decisions. The smaller number of in-service teacher (1) indicated that improving their critical thinking skills using AI tools would require training and exposure. This suggested that the majority did not perceive the AI tools to be beneficial in improving higher-order skills, particularly 80% of the in-service teachers in comparison to 60% of the trainee teachers. Also, 46.7% of the participants expressed that they were "better able to communicate with students resulting in students' improved understanding". However, 4 of these teachers (including 2 in-service teachers) mentioned that they were "better able to collaborate with their colleagues". Table 1 revealed that the teachers experienced an improvement in the following AI & research-oriented skills: AI-assisted lesson personalization (63.3%), ethical consideration in AI use (13.33%), and research and continuous learning (20%). Sixteen (16) trainees and 3 in-service teachers believed that they had acquired AI-assisted

lesson personalization skills that enhanced their creativity in creating activities or generating ideas to help improve their lesson writing and instructional delivery. The findings revealed that teachers strongly preferred using AI tools to facilitate the writing of lesson plans while completing other written documents. These teachers used Grammarly for Education (46.7%), ChatGPT (70%) [comprised 16 trainees and 5 in-service teachers], and Quillbot (40%) [comprised 12 trainee teachers] were the most widely used tools; and MagicSchool (3.30%) [comprised 1 Science trainee teacher] the least favourite for lesson planning. ChatGPT facilitated not only lesson planning but mentorship and personalized feedback, which was found effective in providing guidance and support. This indicates that ChatGPT was highly adopted by educators suggesting that it was the most trusted tool because they found it adaptable and versatile in helping with creating teaching-related activities for well-developed lesson content to provide clarifications of complex topics instantaneously. The educators who participated in the study stated that the trainee teachers who used AI tools benefited from efficiently preparing lesson plans in comparison to previous times before the wide-scale knowledge of AI tools which has helped them focus on their content delivery to improve the students' learning experiences little by little. Even though the trainee teachers improved marginally, it was evident that their creativity greatly improved. These educators also mentioned that the in-service teachers were somewhat hesitant to use the tool, especially based on familiarity and competence; a few of them, however, were able to adapt AI in their lesson delivery, to improve their creativity skills and use of online quizzes to better manage their time. These educators indicated that even though they embrace the adoption of these tools, they believe that teachers must strategically build their skills [particularly creative skills] through critical thinking and problem-solving to avoid being overly dependent on these tools. This was followed by their preference for using educational assistance platforms, professional development courses, and personalized learning recommendations. Eduaide.AI (13.3%), was recognized by 4 trainee teachers that mostly pursued a BEd. Secondary Science to complete simulated science experiments. Coursera (6.67%) was used by 2 trainee in-service teachers while 3 trainee teachers expressed that they used LinkedIn Learning AI Recommendation (10%). It was uncovered that Coursera and LinkedIn Learning AI Recommendation were known for their ability to help enhance teacher knowledge. Ten percent (10%) of the participants also used Socratic (Google) to help them understand complex concepts so they could in turn provide better explanations for difficult concepts to students, thereby improving instructional delivery. Two (2) trainee and 2 in-service teachers, however, shared that their knowledge of ethical considerations in AI use has improved particularly in enhancing fairness in education. Four (4) trainee teachers (13.33%) expressed that as their research skills improved they have been continually learning particularly about emerging trends in education, especially in integrating AI into education. Additionally, 43.3% of the participants (13 trainee teachers) experienced improved conceptual understanding and are now able to "breakdown complex concepts in the teaching and learning process" which in turn has helped improve students' conceptual understanding of course material. Finally, 50% of the participants (13 trainee and 2 in-service teachers) shared that they have access to professional learning resources using AI-powered tools. They explained that there have not been many available real in-person training programmes and workshops to help improve their teacher training experiences. They went on to say there have been quite a few discussions however as to the need for policies to use the increasing number of AI tools rather than how to employ these tools to leverage the teaching and learning experiences for teaching practicum. Moreover, they mentioned further that equity and inclusivity are important to improve our education system as well as to incorporate evidence-based practices. However, there is a need for more exposure and training for better adaptation of AI-driven mentorship models; particularly to facilitate access to experienced mentors utilizing AI-driven platforms, as well as producing personalized learning plans, as a way of up-skilling and receiving professional guidance. The trainee teachers expressed that even though they had some exposure to these AI-driven mentorship and professional development tools, in accessing professional learning both groups seemed to not strongly feel any great earned benefits from the professional learning opportunities. These teachers expressed that they were not quite familiar with the AI tools that may be adept at providing training programmes for professional learning and have also stated their concerns about the credibility of these tools, when compared to the traditional training methods.

To make a comparison of the perceptions of trainee and in-service teachers, a Chi-square test of independence at the 5% level of significance was conducted using the hypotheses outlined in Table 3 based on the contingency table as shown in Table 4. The results from the test displayed the test statistics 6.0686 and a p-value, p = 0.048109. Since the p-value, $p < 0.05$, we fail to accept the null hypothesis and conclude that the result is significant indicating that there is a relationship between teacher category (trainee vs in-service)

Table 3: Hypotheses related to determining the relationship between teacher category and perception level

Null Hypothesis (H_0): There is no significant relationship between teacher category (trainee vs in-service) and perception level (favourable, neutral, unfavourable).
Alternative Hypothesis (H_1): There is a significant relationship between teacher category (trainee vs in-service) and perception level (favourable, neutral, unfavourable).

Table 4: Contingency table for performing Chi-square test

Perception of AI	Trainee Teachers	In-service Teachers	Total
Favourable	18	2	20
Neutral	6	1	7
Unfavourable	1	2	3
Total	25	5	30

* level of significance = 5%, chi-square statistics = 3.1542, p = 0.206571

and perception level (favourable, neutral, unfavourable). This suggests that the trainee and in-service teachers have varying views and concerns on the usage of AI tools for mentorship and professional development. It is noteworthy to mention that trainee teachers are more acquainted with the AI tools, but in-service teachers may have the teaching experiences to help leverage these tools based on their

potential benefits. Moreover, the Chi-square test result revealed that there may be a need for AI-driven professional development strategies to be used by both groups in the same proportion in teacher training. The study went further to compare the distinct means for further insights into the benefits of AI generally for teacher training focusing on the Likert scale scores and associated frequencies for trainee and in-service teachers. Based on Table 5, it was revealed that 66.67% of the participants, comprised of 18 trainee teachers and 2 in-service teachers, agreed that AI is beneficial for teacher training, particularly in this digital age where students are very tech-savvy and easily distracted. This suggests that AI tools have the potential to not only engage learners but to provide personalized instructional content for particular courses and concepts as well as to support teachers in lesson planning and classroom management. The study indicates that a high percentage of participants (66.67%) consider the growing importance of adopting AI-driven tools with the intent of ensuring their effectiveness to enhance pedagogy. Moreover, the mean response rate per trainee teacher is 4.08 which indicates that AI tools are valuable for

Table 5: AI is beneficial for teacher training

Likert Score	Frequency (Trainee Teachers)	Frequency (In-service Teachers)
Strongly Disagree (1)	0	1
Disagree (2)	0	1
Neutral (3)	7	1
Agree (4)	9	1
Strongly Agree (5)	9	1

(1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)

* mean response for trainee teachers = 4.08; mean response for in-service teachers = 3.0

the teaching and learning process (see Table 5). On the other hand, the rate per in-service teacher is 3.0 which indicates their level of uncertainty of the real benefits they can derive from using AI tools for teacher training. Also, the standard deviation for the trainee teachers is 0.80 and that of the in-service teachers is 1.47 (see Table 7). The standard deviation for the trainee teachers is less than that of the in-service teachers, revealing that the in-service teachers' responses were more varied. It indicates that there is a mixture of feelings among the in-service teachers, where some feel more enthused about AI integration in teacher training while others are uncertain about its effectiveness. Additionally, the variability may be tied to the varied technological competencies of the in-service teachers, and their attitudes toward digital learning which seems to be tied to their previous experiences in using AI tools. Conversely, the trainee teachers' responses seemed more consistent and less varied since there is a cluster around the mean, 4.08, suggesting that these teachers recognise the role that AI tools play in [teacher] education. Adopting AI tools can help them reshape their teaching experiences to help address their classroom challenges. Furthermore, a t-test, particularly an independent samples t-test (Welch's t-test) for the Likert scale scores concerning the question AI is beneficial for teacher training. The t-test was conducted based on the hypotheses shared in Table 6, which examined whether any statistical differences existed between trainee and in-service teachers' perceptions of the benefits one can derive from using AI tools in teacher training.

Table 6: Hypotheses related to perceived benefits of using AI in teacher training

Null Hypothesis (H_0): There is no significant difference in perceived benefits of using AI in teacher training between the trainee and in-service teachers. $H_0: m_1 = m_2$
Alternative Hypothesis (H_1): There is a significant difference in perceived benefits of using AI in teacher training between the trainee and in-service teachers. $H_1: m_1 \neq m_2$
Formula used to test if the difference is statistically significant: $t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$ where: $\bar{x}_1$ and $\bar{x}_2$ are the means of the two groups trainee teachers and in-service teachers respectively s_1^2 and s_2^2 are the variances n_1 and n_2 are the sample sizes

The study revealed that the t-statistic is 1.6601 based on the question that AI is beneficial for teacher training while the p-value is 0.1722 (see table 9). Since the p-value (0.1722) is

Table 7: Independent Samples t-test (Welch's t-test) Results

Mean perception score (Trainee Teachers)	$\bar{x}_1 = 4.08$
Mean perception score (In-service Teachers)	$\bar{x}_2 = 3.0$
Standard deviation (Trainee Teachers)	$s_1 = 0.80$
Standard deviation (In-service Teachers)	$s_2 = 1.41$
t-Statistic	$t = 1.6601$
Two tailed p-value	$p = 0.1722$

greater than the common significant level of 0.05, we fail to reject the null hypothesis and conclude that no statistical difference exists between trainee and in-service teachers. This indicates that both groups have interest in integrating AI tools in their professional development and mentorship experiences.

It is noteworthy to mention that 3 older in-service teachers have expressed more skepticism in integrating AI into their teacher training especially those who are not tech-savvy. Upon further investigation they indicated that this is due to their level of technological proficiency, concerns that AI may replace human mentorship, and their fear that this will cause an increased workload.

3.2 Results Based on Research Question 2

What are the key challenges associated with integrating AI-driven mentorship and professional development tools in teacher training?

As AI evolves, it can be adopted and used to integrate AI-driven mentorship tools in teacher training programmes as well as professional development AI tools. However, with all the benefits to be derived, such as real-time performance analysis, and adaptive learning experiences for trainee and in-service teachers, there are challenges particularly to ensure its seamless adoption. It is therefore paramount to not only identify the key challenges but to understand them to develop strategies and techniques that will ensure AI enhances the teacher training process, rather than disrupts it. This research question sought to identify the barriers that affect AI adoption in education. Figure 3 displays the key

challenges shared by the participants they have experienced in integrating AI-driven mentorship and professional development tools in the teacher training practicum. A few participants (10%) which comprised 2 in-service and 1 trainee teachers expressed that they struggled significantly to integrate these tools, due to their lack of digital literacy, and lacking training opportunities. Trainee teachers have expressed that even though they have not adequately benefitted from training opportunities they are more digitally literate, particularly after being exposed to digital tools in courses related to educational technologies; which has equipped them to adapt AI tools to their teaching strategies. They shared that they were not trained in the use AI tools, but based on attending seminars and even exposure on social media such as TikTok, they have been made privy to these tools in name only. As such, they were unfamiliar with using them to help assist them in the teaching and learning process from the curriculum planning aspect to the actual lesson delivery. The educators in this study shared that they have observed the same during the practicum, particularly amongst the other ones and those who are not tech-savvy. These educators emphasized that the lack of professional development particularly by providing structured training programmes at teacher training institutions seems to account for this, mostly because AI tools and digital skills have not yet been incorporated into the curriculum to help develop teachers' confidence. Also, it is noteworthy to mention that teachers need to understand and develop the technical and cognitive skills needed to use these digital technologies. A cooperating teacher and a practicum supervisor expressed concern about trainee and in-service teachers' continued

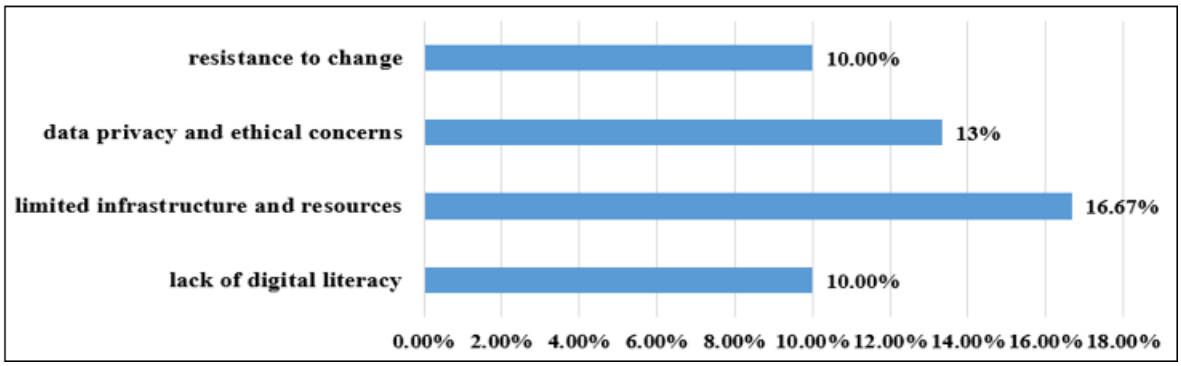

Figure 3: Key challenges in integrating AI-driven mentorship and professional development tools in teacher training

challenges in effective lesson planning. They pointed out that while AI tools have provided helpful ideas and activities, the core problem remains unresolved – there is a great need for these teachers to acquire the cognitive skills necessary to drive proper lesson planning decisions. Specifically, the trainee and in-service teachers must know how to use these activities, when to apply them, and why they are appropriate remains a fundamental challenge, even with the support of AI. This call for foundational planning skills existed before these teachers' adoption of AI tools and continues to be a concern today. A notably significant portion, 16.67%, reported that limited infrastructure and resources are a challenge in integrating these tools. This group consisted of 2 in-service teachers and 3 trainee teachers either located in rural areas or their schools are considered substandard to others. These teachers shared that the main problem is unreliable internet connectivity, especially for teachers who should be among the priority of individuals accessing the internet at the schools. One teacher stated that insufficient institutional support is also a key barrier which gravely affects them in not only adopting the tools but to become equipped where they can use AI effectively and efficiently in their classrooms. These teachers have stated that acquiring the necessary hardware such as laptops [tablets or smartphones], smart classrooms and AI-powered learning management systems (LMS) are real challenges coupled with the class size. Instead, they must contend with using outdated technology infrastructure [not suited to run AI applications], limited professional development opportunities, and gaps in IT support which is often said to be a result of lacking adequate funding. A few teachers, including the in-service teachers, trainee teachers, and educators have also reported that they believe at times nepotism is also involved; and there is a need for their equity and accessibility concerns to be addressed to minimize the digital divide. They went on to say that schools that are considered to have well-connected individuals usually benefit from access to available resources while those underserved [that are more deserving] and suffering from scarcity suffer continually. As such they cannot fully engage with the AI-driven mentorship programmes to inform their practice whether through preparation, providing feedback, or even receiving feedback so they can improve their teaching practices. Two educators also reported that the present curricula across schools are lacking in incorporating AI tools due to a lack of limited AI literacy training, a lack of standardized AI assessment frameworks, and resistance to change. They went further to say that teachers are the ones training themselves especially since the COVID-19 pandemic to become familiar with these tools particularly since students they are teaching nowadays are more technologically inclined at times even more than they are. So, they are grappling to adjust to becoming relevant in this digital age by not sticking to only the traditional approaches but equipped with modern ones. On the other hand, 13.33% of the participants along with the educators shared that the key challenges experienced are data privacy and ethical concerns. They expressed that they have apprehension about AI tracking performance and decision-making bias and shared concerns about data privacy. They further stated that they feared that sensitive data would be collected and stored in AI systems without any knowledge of what security measures were in place. Also, they expressed that they worry about biases that may be introduced or being unfairly evaluated by AI-driven assessments based on their teaching abilities. This has caused them to be skeptical, leading to

rethinking about engaging with AI tools. They stated that if schools include these assessment tools, they are concerned about job security, breaches of personal data, or even unjustifiable scrutiny; this indicates that their trust in AI systems remains low. A teacher explained that if schools are implementing AI tools for assessment, the teachers need to be engaged in its use [including ethics] and what [clear] policies will be put in place to ensure data protection, and teacher autonomy. The final challenge mentioned by participants (10%) is teachers' resistance to change. Three teachers (2 in-service and 1 trainee) stated that they are hesitant to adopt AI technologies for reasons such as preferring traditional mentorship models, AI tools might be complex to learn, might cause increased workload, might be biased in mentorship recommendations and unfairly favouring certain teaching styles or demographics. They explained that existing biases may become even more pronounced and may not guide them in personalized professional learning. They also explained that the preparation process and time will increase their workload because it requires research and dedicated time; additionally, some AI tools might require them to learn which will also involve dedication of their time and might be difficult to comprehend the tools and new pedagogical approaches in order to use and adapt. These two in-service teachers have at least three years of classroom experience stated that the traditional mentorship approaches are still very effective which incorporates human judgement. Green-Santos **[38]** inferred that AI tools need to become culturally relevant and considering the socio-economic state of countries such as Jamaica. This will allow teachers to benefit more from activities particularly for instruction differentiation and classroom management where the schools may be resource-stricken and crowded classroom not being able to access and leverage technology tools. Generally, throughout the research findings from the interview, focus group discussions and survey, the educators, in-service and trainee teachers expressed that the AI tools occasionally provide inaccurate [incorrect] information especially for technological subjects like mathematics or cannot provide information on everything.

3.3 Results Based on Research Question 3

What are the key opportunities associated with integrating AI-driven mentorship and professional development tools in teacher training?

It is important to know the key opportunities that facilitate the integration of AI-driven mentorship and professional development tools in teacher training so that teachers can be able to personalise learning, improve their teaching abilities and grow more professionally. This research will identify and explain what each key opportunity entails and establish solutions that can be considered to address the challenges. AI tools facilitate the improvement of personalized learning in various professions including the teaching profession where real-time feedback can be provided along with carefully designed professional development plans. With most participants, 53.33%, (1 in-service teacher and 15 trainee teachers) having this opportunity, educators can obtain instant data-driven insights about their teaching performance to facilitate self-reflection to help improve their weaknesses in a targeted manner. Additionally, with AI tools that provide training that is not 'one-size-fits-all', teachers can become more confident in their classroom delivery and more ready and willing to try innovative strategies. Since AI tools can track progress, they can drive continuous professional development. On the other hand, it is important to use AI tools to bridge the knowledge gap so that learning can be continuous on the platform and the ability to benefit from micro-credential opportunities. Approximately thirty-seven percent (37%) of the participants (10 trainee teachers and 1 in-service teacher) believed it was necessary to use AI-powered platforms to bridge the knowledge gap where they were able to access learning resources that focus on evolving teaching strategies along with pedagogical theories, and technological advancements. These teachers have expressed how happy they are that these tools allowed them to self-pace themselves which can facilitate earning micro-credentials in various areas, especially ones they desire to specialize in which can eventually enhance their career prospects and/ or qualifications. For the schools that employ these teachers, there will be a much more adaptive workforce that will not only enhance the quality of the teaching and learning process but also improve students' outcomes.

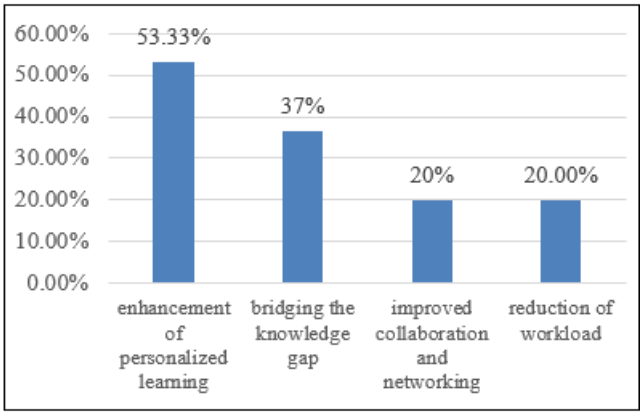

Figure 4: Key opportunities to integrate AI-driven mentorship and professional development tools in teacher training)

Additionally, these tools facilitate equitable access to professional development and mentorship, particularly since schools can subscribe for teachers to benefit from, in resource-constrained environments to eliminate the financial barriers associated. AI tools have been very effective in improving collaboration and networking, as shared by 20% of the participants (6 trainee teachers) who have aided teacher support and their professional growth across geographic locations. They have expressed that even though they find the tools beneficial in collaboration and networking, they are, to some extent, limited by their lack of consistent training and confidence in using these tools effectively. They went on to say that they need to first have sufficient exposure to using these tools that will afford them the opportunities to seek guidance from experienced mentors and exchange best practices, as well as engage in interdisciplinary learning. Adopting AI tools to facilitate collaboration and networking is slower for in-service teachers than trainee teachers, particularly because they are not familiar which adds to them being reluctant. Twenty percent (20%) of the participants (1 in-service and 5 trainee teachers), however, reported that AI tools have helped to

reduce their workload by assisting with lesson planning, administrative tasks, and assessments. Ten trainee teachers shared that when they set quizzes online using Quizziz or Moodle for homework or classwork for completion by students, once the quizzes end, and the students can get real-time automated feedback and grading. This allowed the trainee teachers to be able to focus on reviewing and refining teaching strategies to improve their instructional delivery, as well as to enhance student engagement. The in-service teachers, however, reported that in their resource-stricken environment, AI tools have allowed them to ensure their classroom responsibilities are taken care of, and benefitted from professional development. The educators have stated that they are, however, very concerned about teachers' over-reliance on AI tools.

3.4 Further Discussions and Implications

This study provides valuable insights into the perceptions of AI in teacher training [though mixed] as shared by the trainee teachers and in-service teachers. It was uncovered generally that trainee teachers were more optimistic than in-service teachers in integrating AI tools in teacher training programmes mostly based on their beliefs about the usefulness of each tool. Throughout the entire study, they resonated that the differences in their belief are mostly due to their levels of digital exposure, training experiences, and how familiar they are with these tools. Ten percent (10%) of them shared that they could assess and evaluate students quickly reducing their administrative workload to some extent since grading is automated and real-time feedback can be provided along with data analysis. On the other hand, the teachers all had reservations about accessing AI tools for professional learning, as to the impact of these on mentorship and skill-building. Throughout the study however, it was shared that a significant portion of the teachers benefitted from AI-powered mentorship, even though the adoption rates of tools such as Mentorly, CoachHub, and TeachBoost were low. A closer glance at the role of AI in mentorship and professional development, it was revealed that 63.3% of the participants, comprising 16 trainee teachers and 3 in-service teachers, expressed that AI is a personalized mentor even for the AI tools that might not be formally designed for mentorship but can facilitate lesson planning, provide on-demand and tailored guidance (see Table 9). Additionally, AI

Table 9: Important points from interviews and focus group discussions

Important Points	Indicators	Percentage of participants
AI as a personalized mentor	providing on-demand feedback, lesson planning	63.3%
AI accessibility to professional development	AI improving accessibility to training materials and professional development courses	50%
Challenges to integrate AI-based mentorship	challenges teachers face in integrating AI-based mentorship into their learning process	100%

tools [CoachHub, Coursera, ChatGPT, and TeachBoost] provide teachers with access to training professional development by making available training resources as shared by 50% of the participants (12 trainee and 3 in-service teachers). These resources usually come in the form of training materials and even courses on AI-driven platforms, such as Coursera (6.67%) and LinkedIn AI Learning Recommendations (10%), which helps to bridge the gaps in education. Despite teachers indicating that their skills have improved – especially curriculum, differentiated instruction, and assessment – the teachers still showed different levels of familiarity with using AI-powered teaching assistant tools. Lee, *et al.,* **[46]** inferred that the integration of AI tools to provide support should be organized in a manner for mentorship and professional development of teachers to improve their familiarity. Additionally, outside of mentorship and skill development based on teacher training traits, the study uncovered that AI was found to have the potential to improve teachers' problem-solving skills, instructional delivery, and critical thinking. In contrast, the low percentage of teachers who indicated benefits in using AI tools for classroom management and active learning techniques indicates that the integration of AI tools into pedagogical strategies remains underexplored. The study also found that teachers have developed an increasing interest in ethical considerations related to the use of AI revealing that teachers believe that they must use AI with responsibility. Also, the professional learning resources provided by AI are very advantageous for teachers especially since there are limited availability of in-person training workshops. Furthermore, based on the Chi-square test, there is a statistically significant relationship between perception level and teacher category but there also seems to be a generational divide between trainee and in-service teachers, reflecting that trainee teachers are more receptive to integrating AI in teacher training (see Table 3 and Table 4). On the other hand, the t-test results showed that no significant statistical difference exists between the two groups of teachers' perceptions of AI's positive impact on teacher training ($p = 0.1722 > 0.05$). Moreover, trainee teachers' receptive stance aligns with their high levels of digital literacy coupled with their prior exposure to technologies indicating that the group of teachers [in-service and trainee teachers] need to benefit from AI-based professional strategies through uniformity across all trainee programmes to establish inclusivity. Additionally, the variability of teacher category responses can further be attested by the calculation of a larger standard deviation in the trainee teachers' responses suggesting that they were enthused about integrating AI tools effectively in teacher training while the in-service teachers remained skeptical. The in-service teachers seemed optimistic but in a cautious manner particularly based on their expressed concerns based on the risk that AI tools may replace human mentorship and their technological competence.

The teachers (100%) have reported that even with the benefits derived from using AI tools, particularly AI-based mentorship tools, there have been challenges experienced with the integration in teacher training. This reinforces that teacher training programmes require training to adapt AI into the curriculum along with hands-on workshops and institutional support **[35]**. The key challenges seem to arise mostly based on the perceptions of teachers in regard to their

use of AI in teacher training. The study uncovered that there exists a generational digital divide between trainee teachers and in-service teachers. This is so because most of the trainee teachers are younger than most of the in-service teachers. Moreover, most of the trainee teachers are tech-savvy and have been far more willing to embrace AI tools, while the in-service teachers who have more experience in the classroom are often skeptical. The skepticism was revealed in their expressions of concern about their lack of exposure to hands-on AI-driven teaching methods and more than anything AI affecting their job roles with its capability to replace traditional mentorship roles. Even with these concerns, the in-service teachers are not completely resistant to AI, as they shared that they have benefitted from some AI tools for some things but have fears because they lacked the experience to use some of the tools and the unfamiliarity affects their views. This suggests that they would greatly benefit from professional development initiatives to give them exposure so they become more comfortable with the AI tools that can boost their confidence while improving their AI literacy which is also welcomed by the trainee teachers. The findings suggest that developers of AI tools are needed along with school administrators in charge of professional development sessions so that teachers can see AI as a supportive tool rather than feeling like it will replace them. This indicates that AI tools need to be more teacher-friendly to ensure that traditional methods are not considered just a thing of the past to be done away with, and school administrators need to present AI tools to teachers to help them improve their skills without feeling like their jobs will eventually not be needed [that is substituted by AI tools]. This will require the schools to become intentional about providing targeted AI training for these teachers and user-friendly AI interfaces for teachers that are not technical and can be easily adopted coupled with AI literacy courses **[35, 46, 47]**. Moreover, the teacher training institutions need to come to the forefront of driving this initiative of digital literacy as well as encouraging tech-savvy educators to facilitate mentorship to help bridge the divide through hands-on workshops and seminars not just meet and talk. Another pressing challenge noticed is infrastructure limitations that affect the teacher training programmes. As such, funding initiatives are needed to address these limitations such as government funding, public-private partnerships, offline AI solutions, and mobile friendly AI mentorship platforms.

The findings have revealed that several implications emerged despite the acknowledged benefits of AI tools particularly because of varied enthusiasm that seemed to exist between trainee and in-service teachers. Here are the implications that can add valuable insights:

Readiness to adopt AI: The findings revealed that there is a significant difference in the readiness of trainee and in-service teachers' willingness to adopt AI in their teacher training programmes. The trainee teachers' level of enthusiasm is higher, and they were more open to adopting AI tools for mentorship and professional development revealed by their higher mean scores. The in-service teachers, on the other hand, expressed skepticism about the effectiveness of AI tools which was also reflected in their mean score signalling that they are being more caution particularly due to their limited experiences with AI tools. This call for targeted AI training programmes for each group based on their specific needs, but with a more tailored focus on in-service teachers. The trainee teachers who are more familiar with AI tools, may benefit from advanced AI applications to further enhance their instructional design and differentiated learning skills particularly in identifying their weaknesses and upskill accordingly. In-service teachers, however, may need hands-on experiences of AI's use in the classroom, structured workshops and mentorship programmes that will not only build their confidence but develop their experiences particularly to merge the modern experiences with the traditional. This will help bridge the generational gap between trainee and in-service teachers.

Need for Structured Professional Programmes: The findings continuously reiterate and emphasised that there is a great need for teacher training programmes to have structured professional programmes that include hands-on workshops, and peer learning that encourage collaboration [of in-service and trainee teachers amongst others such as other educators and institution administrators] for effective AI integration. Moreover, with the variability of responses based on teachers' perception of AI tools integration, hands-on workshops would be able to facilitate real-world applications that provide experimentation with AI tools in a control setting. These workshops could, in addition, create opportunities for teachers to share their knowledge, engage in mentorship, and benefit from guided discovery [exploration] of AI-driven teacher strategies through peer learning initiatives. These types of programmes, if designed, will could demystify AI, so teachers see AI as a supportive tool rather than feeling like they will be replaced. Also, these programmes can drive collaborative initiatives that will equip new and experienced teachers continuously with the skills and confidence they need to integrate AI into their teaching practice effectively.

AI's Potential in Shaping Modern Teacher Training Programmes: The study underscores that with the transformative nature of AI tools embedded into the teacher training curricula, institutions can benefit from innovative learning experiences coupled with scalable and flexible learning experiences to equip educators with digital pedagogical skills. Moreover, due to the self-paced learning opportunities provided by AI-powered platforms where teachers can benefit from on-demand training materials, virtual coaching, and automated assessments tailored to each teacher's needs. Moreover, as the saying goes 'AI is going nowhere because it is here to stay', then education systems will continue to be revolutionized, teaching training institutions and policymakers need to strategically consider ways to carefully integrate AI to ensure that all educators regardless of their experience level can thrive in the new digital age of teaching and learning through empowerment and confidence in their skills.

Equitable AI adoption: Based on the findings, it was revealed that there needs to be equity in AI integration [adoption] in teacher education programmes to afford both trainee and in-service teachers' fair access to AI tools for professional development and mentorship. This will address the digital [generational] divide where trainee teachers are more tech-savvy and enthused than in-service teachers about

AI integration in teacher training programmes due to the in-service teachers limited exposure and gaps in their digital knowledge. The digital literacy PAs can be addressed by implementing AI training initiatives that are inclusive for all educators at all levels of technological proficiency. These AI tools, programmes, and workshops need to be affordable and can create a balanced learning environment using a sustainable framework to benefit all teachers in their professional growth and classroom innovation. Additionally, knowledge exchange and collaboration can be facilitated where tech-savvy trainee teachers can be paired with experienced [in-service] teachers using a mentorship model to promote competence and confidence.

4. Conclusion

The findings suggest that in-service teachers were cautious in accepting AI tools, while trainee teachers were optimistic. This indicates a generational digital divide between trainee and in-service teachers that must be addressed with urgency. The study revealed that trainee and in-service teachers considered mentorship, curriculum planning, and AI-assisted lesson personalization to reflect strong perceived benefits or improvements, especially among the trainee teachers. The study's findings revealed that the strongest perceived benefits were related to curriculum planning and AI-assisted lesson personalisation, expressed by 63.3% of the participants who stated that they were able to use AI tools for lesson planning, improve creativity which helped reduced their workload, particularly administrative duties, and assisted with improving students' conceptual understanding. The least beneficial areas in using AI tools, however, were critical thinking, problem-solving, and classroom management which indicated concerns to be addressed by providing teachers with more exposure and training. Additionally, ChatGPT (70%) is considered the most preferred tool for AI-driven mentorship for teacher training; followed by Grammarly for Education (46.7%) which is widely embraced and used for lesson planning, thereby driving professional development. LinkedIn Learning AI and Coursera were moderately adapted by the teachers for AI course recommendations, indicating that they sought career growth.

The study revealed key challenges such as infrastructure limitations, data privacy and ethical concerns, and lack of digital literacy which mostly caused the in-service [experienced] teachers to be skeptical, and insufficient access to training materials and resources. The findings revealed that these challenges can be addressed by placing emphasis on providing user-friendly AI tools and institutional support, and structured AI-driven training programmes. Moreover, to bridge the digital divide and optimize the use of AI, teacher training curricula can integrate AI tools and include its literacy courses, as well as facilitate peer learning between trainee and in-service teachers through mentorship, while developing public-private partnerships, particularly for the development of AI infrastructure.

Resoundingly, this study emphasises that despite the skepticism of teachers, AI is a supportive tool for human educators and not their replacement to help enhance their professional learning, instructional effectiveness, and mentorship. However, this calls for all hands-on board, including institutions, educators, and policymakers to effectively integrate AI tools in teacher training to not only provide supportive environments for AI-driven tools that can benefit trainee and in-service teachers, and incorporate strategic interventions in professional development and mentorship that focus on AI literacy but to promote equity to access these tools. When these gaps are addressed, AI can serve as a transformative tool to not only equip educators through skill-building but also help them recognize the need for modernization of teacher training tools particularly to thrive in this digital age.

5. Recommendations

There is great need for teacher training institutions to develop structured AI literacy modules that facilitate formal training of trainee, in-service and certified teachers with the technical and ethical skills and expertise needed to leverage AI tools. Additionally, to enhance infrastructure and provide equitable access to AI-powered platforms, it is necessary for policymakers and educational institutions to obtain investments that can support mentorship and professional development.

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References

[1] Desimone, L. M. (2009). Improving impact studies of teachers' professional development: Toward better conceptualization and measurement. *Educational Policy*, *23*(1), 16-40. https://doi.org/10.1177/0895904808315858

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

[3] Wu, D., Zhang, S., Ma, Z., Yue, X.-G., & Dong, R. K. (2024). Unlocking Potential: Key Factors Shaping Undergraduate Self-Directed Learning in AI-Enhanced Educational Environments. *Systems*, *12*(9), 332. https://doi.org/10.3390/systems12090332

[4] Lan, Yanzhen (2024). Through tensions to identity-based motivations: Exploring teacher professional identity in Artificial Intelligence-enhanced teacher training. Published by Elsevier Ltd. http://creativecommons.org/licenses/bync/4.0/

[5] Marcus-Quinn, A., & McCoy, S. (2024). S. Future Proofing Schools: Bringing School Policies into the AI Era. file:///C:/Users/10012857/Downloads/Future%20Proofing%20Schools-%20Bringing%20School%20Policies%20into%20the%20AI%20Era.pdf.

[6] Phillips, et al, (2022). An AI toolkit to support teacher reflection. International Journal of Artificial Intelligence in Education. Retrieved from https://doi.org/10.1007/s40593-022-00295-

[7] Johnson, N. & Heidari, H. (2023) Assessing AI Impact Assessments: A Classroom Study. Retrieved from https://arxiv.org/pdf/2311.11193.

[8] Ponticell, J. A. (2003). Enhancers and inhibitors of teacher risk taking: A case study. Peabody Journal of Education, 78(3), 5-24

[9] Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). Effective teacher professional development. Palo Alto, CA: Learning Policy Institute.

[10] Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for integrating technology in teacher knowledge. Teachers College Record, 108(6), 1017- 1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

[11] Lawless, K. A., & Pellegrino, J. W. (2007). Professional development in integrating technology into teaching and learning: Knowns, unknowns, and ways to pursue better questions and answers. Review of Educational Research, 77(4), 575-614. https://doi.org/10.3102/0034654307309921.

[12] Tondeur, J., van Braak, J., Ertmer, P. A., & Ottenbreit-Leftwich, A. (2017). Understanding the relationship between teachers' pedagogical beliefs and technology use in education: A systematic review of qualitative evidence. Educational Technology Research and Development, 65(3), 555-575. https://doi.org/10.1007/s11423-016-9481-2

[13] Carver, M. & Shanks, R. (2021). New teachers' responses to COVID-19 in Scotland; doing surprisingly well? *Journal of Education for Teaching: International Research and Pedagogy*, 47 (1), 118-120.

[14] Duignan, P. (2020). Leading Educational Systems and Schools in Times of Disruption and Exponential Change: a Call for Courage, Commitment and Collaboration. UK: Emerald Publishing

[15] Spooner-Lane, R., 2017. Mentoring beginning teachers in primary schools: research review. Professional Developmentin Education, 43, 253–273

[16] Guskey, T. R. (2002). Professional development and teacher change. *Teachers and Teaching: Theory and Practice*, 8(3), 381-391. https://doi_org/10.1080/135406002100000512.

[17] McLaughlin, M. W., & Costa, L. (2008). Professional development in the context of school reform. *In Professional Development in Education: New Directions for Theory and Practice* (pp. 53-66). Routledge.

[18] Parsad, B., et al. (2001). *Teacher Preparation and Professional Development: 2000* (NCES 2001-088), pp. 4–5. U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office

[19] McLaughlin, M. W., & Tallman, R. (2006). Professional development: A case study analysis. *Educational Policy Analysis Archives, 14*(7). https://doi.org/10.14507/epaa.v14n7.2006

[20] Borko, H. (2004). Professional development and teaching learning: Mapping the terrain. *Educational researcher*, 33(8), 3-15. https://doi.org/10.3102/0013189X03300803.

[21] Peng, H., et al, (2019). Personalized adaptive learning: an emerging pedagogical approach enabled by a smart learning environment Smart Learning Environments, 6 (2019), 10.1186/s40561-019-0089-y

[22] Zhang, L. (2020). *Understanding the implementation of personalized learning*. ScienceDirect. https://www.sciencedirect.com/science/article/abs/pii/S1747938X19306487.

[23] 21st CentEd, (2025). Streamlining Administrative Tasks with AI: A Teacher's Guide. Retrieved from https://21stcented.com/streamlining-administrative-tasks-with-ai-a-teachers-guide/

[24] European Commission. (2021). Digital Education Action Plan 2021-2027. Retrieved from European Commission

[25] eTOC (2024). The Role of AI in Transforming Chinese Education and Learning. Retrieved from https://ecommercetochina.com/the-role-of-ai-transforming-chinese-education-and-learning/

[26] Carnegie Learning (2021). Transforming math education with AI. Retrieved from Carnegie Learning

[27] Aggarwal, D. (2023). Integration of innovative technological development and AI with Education for an adaptive learning pedagogy. Catalyst Research. *Petroleum Processing and Petrochemical Technology*, Volume 23. Issue 2. Pg. 709-714.

[28] Kshetri, N. (2023). The future of education: Generative artificial intelligence's collaborative role with teachers. IT Professional, 25 (6), pp. 8-12, 10.1109/MITP.2023.3333070

[29] Wilichowski, T. & Cobo, C. (2023). AI-powered teacher training: Promise or pitfall? Retrieved from https://blogs.worldbank.org/en/education/ai-powered-teacher-training-promise-or-pitfall

[30] Mbambo, G., Plessis, E., (2024). Impact of Artificial Intelligence on Teacher Training in Open Distance and Electronic Learning. International Journal of Mentoring and Coaching.

[31] Schnieders, A. 2025. Mentoring in the AI World. Retrieved from https://chronus.com/blog/mentoring-in-the-ai-world

[32] McCoy, L. P., Theobald, P. K., & Tschannen-Moran, M. (2020). Using data analytics to evaluate the impact of mentorship on teacher development. *International Journal of Mentoring and Coaching

[33] Gonzales, S. (2024, August 6). AI literacy and the new digital divide – A global call for action. *UNESCO.* https://www.unesco.org/en/articles/ai-literacy-and-new-digital-divide-global-call-action

[34] Langreo, L. (2024, October 24). Teachers desperately need AI training. How many are getting it? Education Week. https://www.edweek.org/technology/teachers-desperately-need-ai-training-how-many-are-getting-it/2024/03.

[35] Cunningham, D., Cunningham, S., Haye, K., Ellis, A., Facey, D., Hamilton, A., Jacobs, N., Miller, J., Morris, C., Morris, S., Noble, R., Ogeare, J., Samuels, S., & White, C. (2025, January 3). Navigating Tomorrow's Jamaican Classrooms: Assessing the Impact of AI on Teacher Training During Teaching Practicum in Jamaica. *American Journal of*

Educational Research; 13(1):1-16. doi: 10.12691/education-13-1-1.

[36] Digital Watch Observatory. (2023, November 28). Fifty percent of schools across Jamaica are connected to broadband. *GIP Digital Watch*. https://dig.watch/updates/fifty-percent-of-schools-across-jamaica-are-connected-to-broadband.

[37] Soares, W. (2024, December 13). AI platform use by teachers leads to student privacy worries. *Chalkbeat*. https://www.chalkbeat.org/2024/12/13/ai-tools-used-by-teachers-can-put-student-privacy-and-data-at-risk/

[38] Greene-Santos, A. (2024, February 22). Does AI have a bias problem*?* *NEA Today*. https://www.nea.org/nea-today/all-news-articles/does-ai-have-bias-problem

[39] Stanford University. (2023, May 15). AI-detectors biased against non-native English writers. Stanford HAI. https://hai.stanford.edu/news/ai-detectors-biased-against-non-native-english-writers.

[40] Zawacki-Richter, O., Marín, V. I., & Bond, M. (2023). *AI in teacher education: Mapping the research landscape and future directions*. Computers & Education, 180, 104612.

[41] Zhang, W., Li, Y., & Johnson, M. (2024). *The impact of AI on pedagogical innovation: A systematic literature review*. Educational Technology & Society, 27(1), 25-41.

[42] Salah-Eldin, M., & Mohamed, A. (2024). Leveraging artificial intelligence to enhance teaching and learning in higher education: Promoting quality education and critical engagement. *ResearchGate.*

[43] Lathan, J. (2022, July 25). *What is educational technology? [Definition, examples & impact]*. University of San Diego Online Degrees. https://onlinedegrees.sandiego.edu/what-is-educational-technology-definition-examples-impact/.

[44] Schwartz, S. (2024, February 2). *Teacher professional development, explained*. Education Week. Retrieved April 11, 2025, from https://www.edweek.org/leadership/teacher-professional-development-explained/2023/07.

[45] Stefanic, D. (2025, March 17). *AI in peer learning and mentorship*. Hyperspace^{mv} - the metaverse for business platform. https://hyperspace.mv/ai-peer-learning/#:~:text=AI%20mentorship%20offers%20personalized%20guidance,serve%20large%20numbers%20of%20learners.

[46] Lee, Y., et al. "Korean in-Service Teachers' Perceptions of Implementing Artificial Intelligence (AI) Education for Teaching in Schools and Their AI Teacher Training Programs." International Journal of Information and Education Technology_ijiet, International *Journal of Information and Education Technology*, 4 Feb. 2024, www.ijiet.org/vol14/IJIET-V14N2-2042.pdf.

[47] Cukurova, M., et al. Professional Development for Teachers in the Age of AI. *European Schoolnet, Jan. 2024*, Brussels, Belgium.