DEVELOPING THE CAPACITY OF CONTEMPORARY TEACHERS THROUGH ARTIFICIAL INTELLIGENCE IN PUBLIC SENIOR SECONDARY SCHOOLS IN FEDERAL CAPITAL TERRITORY, ABUJA

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Abstract
Introducing Artificial Intelligence (AI) into education presents key opportunities for enhancing teachers' competence-based knowledge, skills, and effectiveness. This study explored the level of AI tools usage by teachers in their classroom instruction, in assessment practices, and the development of teacher competence, in senior secondary schools in the FCT, Abuja. Guided by the Technology Acceptance Model (TAM) and Constructivist Theory, a mixed-methods descriptive survey design was adopted for the study. The target population was 3,420 teachers in the public senior secondary schools in the FCT, Abuja. A sample size of 280 teachers was randomly selected through stratified random sampling technique ensuring representation from six Area Councils, and 12 teachers were purposively sampled for semi-structured interviews. Data were collected through a 35-item questionnaire titled Questionnaire on Artificial Intelligence and Teacher Capacity (QAITC), validated through expert judgment and a reliability coefficient of 0.87, and a semi-structured interview guide. Quantitative data were analysed using frequency counts, simple percentages, means, standard deviations, and Pearson Product-Moment Correlation, while qualitative data were thematically analysed. Response rate on the returned questionnaires was 94.3% (264 out of 280 questionnaires returned). The study found moderate use of AI tools by the teachers, especially for lesson planning and the preparation of instructional resources. Conversely, the use of AI tools for automated grading and students' performance analysis was very low. The result also revealed a significant positive relationship between teachers use of AI tools and their teaching competence ($r = 0.61$, $p < 0.001$). Poor digital infrastructure, limited access to AI tools training, and soaring cost of

internet data and digital devices were identified as main challenges to effective use of AI by teachers. The study found that frequent in-service training for teachers, integration of AI tools into the curriculum, improvement of digital infrastructure, as well as government funding and policy formulation would help to enhance teachers' capacity to effectively use AI tools in their classroom instruction. The study concludes that, through effective integration of AI tools, regular teacher professional development, as well as availability of physical and financial resources, education system in Nigeria can use AI tools to improve instruction..

Keywords*: Artificial Intelligence, Teacher Capacity, Professional Development, Education 4.0, Senior Secondary Schools, FCT Abuja*.

Introduction

Teaching is undergoing series of changes as a result of rapid technological advancement. One of the technologies that is increasingly influencing teaching and learning is Artificial Intelligence (AI). AI has to do with computer system that is designed to execute everyday jobs that would ordinarily require human brains, such as learning, reasoning, problem-solving, language processing, forecast, and decision-making. In the education sector, AI is being used to support lesson planning, assessment, personalised learning, instructional material development, classroom feedback, learning analytics, and teachers' expert development. These developments are changing the expectations placed on teachers in the twenty-first century. Teachers are no longer expected to function only as providers of information. They are more and more required to serve as facilitators of learning, instructional planners, mentors, evaluators, and informed decision-makers. UNESCO (2023) observes that the growing use of generative AI is reshaping educational practices and creating new demands for teachers to develop their digital and professional competencies. This shift is closely connected to the Fourth Industrial uprising and the increasing use of intelligent technologies in learning systems worldwide.

According to Luckin et al. (2016), AI in education involves the function of computer systems to tasks traditionally associated with human intelligence, including adaptive learning, automated feedback, language processing, and data analysis. Similarly, the Organisation for Economic Co-operation and

Development (OECD, 2023) highlights the growing interest in using AI for development, instructional quality, support teachers, personalise learning, and address educational challenges. With the emergence of generative AI applications, teachers now have additional opportunities to prepare teaching materials, develop classroom activities, and access educational information more capably. However, the effective use of AI requires more than the ability to operate digital applications. Teachers need to understand how AI works, recognise its limitations, and apply it appropriately to their teaching tasks. They must also develop competencies in AI literacy, digital technology, critical thinking, data protection, ethical decision-making, and the integration of technology into classroom instruction.

Budding teachers' capacity through AI therefore involves reinforcing their knowledge, skills, attitudes, values, and professional judgement. AI tools can assist teachers in preparing lesson plans, developing instructional materials, designing classroom activities, generating assessment questions, analysing students' performance, and creating learning resources for students with different abilities. These applications can reduce the time spent on routine tasks and allow teachers to concentrate more on meaningful interactions with their students. AI can also contribute to teachers' professional development by providing access to educational resources, supporting reflective practice, assisting with research activities, and creating opportunities for professional collaboration. When suitably applied, these tools can help teachers discover new teaching strategies and improve the quality of their classroom practices.

In spite of these benefits, AI should not replace teachers' professional knowledge or the human relationships that are vital to effective education. Teachers play important roles in motivating learners, understanding their individual needs, promoting social interaction, and supporting their emotional development. AI can assist these responsibilities, but it cannot independently replace the judgement, empathy, creativity, and professional accountability required of teachers.

Another key consideration is the potential risk associated with AI use. AI-generated information may be wrong, biased, or misleading. The unsuitable use of AI may also expose students' personal information or encourage excessive dependence on automated systems. Teachers must therefore learn

how to verify AI-generated content, protect students' information, recognise possible bias, and make informed decisions about when and how AI should be used. For AI to improve teaching and learning, schools must provide more than access to technological tools. Teachers require appropriate training, reliable internet connectivity, electricity, digital devices, institutional support, and opportunities for continuous professional development. They also need clear guidance on responsible AI use, including academic integrity, privacy, misinformation, and the importance of human supervision.

As digital transformation continues to be a critical strategic focus in Nigeria, there have been a variety of efforts to assist educational institutions in exploring the use of AI and other emerging technologies. The National Digital Economy Policy and Strategy (NDEPS) 2020-2030 also has identified digital technologies as a vital tool for development. Several initiatives are under way to advance digital learning and technological innovation, leading to growing interest in how skills can be enhanced through innovative applications in classrooms, especially use of AI. AI can serve as a valuable support to teachers in senior secondary schools by providing personalised instruction through customised content catering to individual student needs and proficiency levels (Luckin et al., 2016), raising productivity by providing support to lesson planning and question generation, enhancing interactivity, and enabling learning analytics and intervention.

But the rapid proliferation of AI use in education poses daunting prospects, especially in contexts where digital devices are relatively scarce. UNESCO (2023) highlights key challenges associated with AI use in education, including infrastructure and connectivity issues, teacher competence, ethics and privacy, and access for all. Limited internet access, lack of electricity, high data costs, inadequate access to digital devices, and lack of training are some of the bottlenecks that could hinder teachers from optimally leveraging AI tools in teaching, while some teachers may also have little understanding of how AI can complement standard curricula and assessment practices. The increasing availability of AI devices in the Federal Capital Territory, Abuja, offers both opportunities and challenges for teachers in senior secondary schools. Knowing the adoption and application of AI by teachers, the implication for their capacity, the

challenges faced, and possible mitigating measures would be crucial.Against this back-ground, the present study examine*d* how AI can be a solution to the enhancement of teachers' capacity in senior secondary schools in FCT. The study however focused on, teachers' use of AI, felt effect of AI on teachers' capacity, bane on the effective use of AI, and remedies for the optimal use of AI.

Method

The study employed a mixed method survey design. The design was appropriate as it was used to gather quantitative and qualitative information, teachers' experiences, perceptions, use of AI tools and challenges in the use of AI without influencing or altering the variables of the study. The quantitative component was used to determine the extent of AI use, examine its relationship with teachers' professional capacity, and identify the challenges and strategies associated with AI integration. The qualitative part provided a deeper understanding of teachers' experiences, perceived benefits, difficulties, and professional development needs. Combining these two approaches enabled the researcher to examine the study problem from different perspectives and use teachers' experiences to provide additional insight into the quantitative findings. This approach is consistent with the mixed-methods principles discussed by Creswell and Plano Clark (2018).

The study population consisted of 3,420 teachers in all public senior secondary schools in the FCT. The study used the FCT-SEB (2023) school census data. A sample of 280 teachers was used to quantitatively capture the phenomenon of interest in this study. Random sampling techniques were adopted to select these teachers. The teachers were selected to represent the six Area Councils in the FCT. Teachers were purposively selected to be part of semi-structured interviews on account of their contact with, and or use of, AI-supported learning. The responses from questionnaires and semi-structured interview notes were expected to enrich the data collected in order to better understand the use of AI by teachers and the implications thereof on their professional development.

Two instruments were used for data collection: Questionnaire on Artificial Intelligence and Teacher Capacity (QAITC). The QAITC was a 35-item, four-point Likert-scale questionnaire. It consisted of four sections: Section

A: Demographic information; Section B: Extent of AI use; Section C: Influence of AI on teacher capacity; and Section D: Challenges and strategies relating to AI integration. The questionnaire was subjected to face and content validation by three experts in Educational Technology and Measurement and Evaluation. The reliability of the instrument was determined using Cronbach's alpha, which produced a reliability coefficient of 0.87, indicating acceptable internal consistency. A semi-structured interview guide consisting of eight questions was used to obtain qualitative information about teachers' experiences of using AI for teaching, assessment, lesson preparation, and continuous professional development.

The quantitative data were analysed by means of frequency counts, percentages, means, standard deviations and Pearson Product-Moment Correlation. The first four research questions were answered by means of descriptive statistics. The proposed hypothesis was tested using Pearson Product-Moment Correlation at the 0.05 level of significance. The mean of 2.50 was used as a decision criterion for the four-point scale responses, for answering the four research questions. Mean responses of 2.50 and above were used to interpret the use of or agreement with an item, while mean responses below 2.50 were used to interpret the low use of or disagreement with items for which appropriate. The qualitative data from the interviews were analysed thematically, by reading through the responses, capturing ideas which occurred repeatedly and grouping such observations into themes in accordance with the principles of thematic analysis as outlined by Braun and Clarke (2006).

Results

Demographic Characteristics of Respondents: Of the 280 questionnaires distributed to respondents, 264 were properly completed and returned, representing a response rate of 94.3%.The demographic results showed that 58% of the respondents were female, while 42% were male. Approximately 45% had between one and ten years of teaching experience. However, only 22% reported having received formal training in the use of AI tools.The relatively small proportion of teachers who had received formal AI training, points to a potential gap in professional development. This finding highlights the importance of providing teachers with appropriate training and support to help them understand and apply AI tools effectively in their professional practice.

Research Question 1:
To what extent do teachers use AI tools in public senior secondary schools in the FCT ?

Table 1: Test of the Extent of AI Use by Teachers in senior secondary schools in Federal Capital Territory Abuja. Mean and Standard Deviation of the Extent of AI Use by Teachers (N = 264)

S/N	Item	Mean	SD	Decision
1	I use ChatGPT to generate lesson plans.	2.92	0.74	High
2	I use AI for grading.	2.31	0.89	Low
3	I use AI tools for creating presentations and instructional content.	2.78	0.81	High
4	I use AI for analysing student performance.	2.24	0.91	Low
	Grand Mean	2.56		Moderate

Decision rule: A mean score of 2.50 or above indicates relatively high use, while a mean below 2.50 indicates low use.

Table 1 reveals that the general use of AI tools by teachers was moderate, with a grand mean score of 2.56. When looking at the different types of AI utilisation by teachers, the use of AI for preparation of lesson plans was high (mean = 2.92) and use of AI for creating presentations and instructional materials (mean = 2.78) was moderately high. Conversely, the use of AI to grade and analyse student work was relatively low (mean = 2.31; 2.24).These findings suggest that teachers primarily use AI to make lesson preparation and instructional material development easier. However, the lower scores for grading and student-performance analysis indicate that AI has not been adopted to the same extent for assessment-related activities and the analysis of students' learning progress.The results point to an opportunity to provide further training and practical guidance on the appropriate use of AI in assessment and student-performance monitoring.

Research Question: What is the influence of AI use on teachers' capacity in public senior secondary schools in the FCT.?

Table 2: Test of the Influence of AI on Teacher Capacity in senior secondary schools in Federal Capital Territory Abuja

Domain	Mean	SD	Decision
Instructional Planning	3.14	0.62	High
Classroom Instruction	2.89	0.71	High
Assessment-and Feedback	2.61	0.78	High
Professional Development	2.95	0.68	High
Overall Capacity	2.9		High

The results in Table 2 indicate that AI was perceived to contribute positively to teachers' professional capacity, with an overall mean score of 2.90. Instructional planning recorded the highest mean score of 3.14, suggesting that teachers particularly valued AI for preparing lessons and organising instructional activities. Professional development followed with a mean score of 2.95, while classroom instruction recorded a mean score of 2.89. Assessment and feedback had the lowest mean score of 2.61, although it remained above the criterion mean of 2.50. These findings suggest that teachers perceive AI as a useful resource for improving lesson preparation, supporting classroom activities, and promoting professional learning. However, the comparatively lower score for assessment and feedback indicates that further support may be needed to help teachers use AI effectively in these areas. Overall, the findings highlight the potential value of AI as a tool for strengthening teachers' professional practice, provided that its use is supported by appropriate training, adequate resources, and sound professional judgement.

Research Question 3
What challenges confront the integration of AI in public senior secondary schools in the FCT.

Table 3: Test of Challenges Confronting AI Integration in senior secondary schools in Federal Capital Territory Abuja

S/N	Challenges	Mean	SD	Decision
1	Poor internet connectivity and unreliable electricity	2.35	0.92	Reported
2	Lack of adequate AI training	2.34	0.91	Reported
3	High cost of internet data and digital devices	2.41	0.84	Reported
4	Limited institutional support and guidance on AI use	2.23	0.81	Reported
	Grand Mean	2.33		Challenges Identified

Table 3 presents some of the major challenges affecting the integration of AI into senior secondary schools in the FCT. The high cost of internet data and digital devices recorded a mean score of 2.41, making it the highest-rated challenge among the three items presented. Poor internet connectivity and unreliable electricity followed with a mean score of 2.35, while the lack of adequate AI training recorded a mean score of 2.34. These results suggest that the cost and availability of technological resources, together with limited opportunities for AI training, may restrict teachers' ability to use AI consistently in their professional activities.

The findings also indicate that improving teachers' access to AI tools requires attention to both infrastructure and professional development. Providing AI applications without addressing electricity, internet access, device affordability, and teacher training may limit their practical value in schools.

Research Question 4
What strategies can enhance the effective use of AI in public senior secondary schools in the FCT.

Table 4: Test of Strategies for Building AI Capacity in senior secondary schools in Federal Capital Territory Abuja

S/N	Strategy	Mean	SD	Decision
1	Regular training of teachers in the use of AI tools	3.62	0.71	Agreed
2	Provision of AI-enabled digital infrastructure in schools	3.78	0.65	Agreed
3	Integration of AI into the school curriculum	3.54	0.82	Agreed
4	Government funding and policy support	3.69	0.74	Agreed
	Grand Mean	3.66		Agreed

The results indicate that respondents agreed with all four proposed strategies for enhancing teachers' effective use of AI. The grand mean of 3.66 exceeds the criterion mean of 2.50. Provision of AI-enabled digital infrastructure recorded the highest mean score (3.78), followed by government funding and policy support (3.69), regular teacher training (3.62), and integration of AI into the curriculum (3.54). The result demonstrates that respondents considered infrastructure, policy support, and continuous professional development essential for sustainable AI integration.

Test of Hypothesis
H_0 1: There is no significant relationship between teachers' use of Artificial Intelligence and their instructional capacity in senior secondary schools in the FCT Abuja.

Table 5: This table shows the relationship between teachers level of using AI and the extent of instruction it can cover on the learner.

Variables	N	R-cal	p-value	Decision
Teachers' AI Use and Instructional Capability	264	0.61	0.001	Significant

Note: The correlation is significant at the 0.01 level (2-tailed).

Correlation result for teachers' use of AI and instructional capacity The analysis result in Table 5 indicates a positive significant relationship between teachers' use of AI and teachers' instructional capacity in senior secondary schools in the FCT, Abuja ($r = 0.61$, $p < 0.001$). The strength of correlation of.61 between variables in Table 5 is moderately strong. The calculated p-value (<.0001) is lower than the.05 alpha significance, consequently, the null hypothesis (H_0 1) which stated there is no significant relationship in Teachers' Artificial Intelligence use and Instructional capacity in Senior secondary school in FCT, Abuja was rejected, implying there is a significant positive relationship.

Discussion

This means that the teachers' overall use of AI tools was moderate (grand mean= 2.56). The data also reveal that teachers used AI more often in preparing lesson plans (mean= 2.92), followed by the development of presentations and instructional materials (mean= 2.78). The least AI tools used by teachers were grading and tracking student performance (mean= 2.31, 2.24).These findings suggest that teachers primarily use AI to make lesson preparation and instructional material development easier. However, the lower scores for grading and student-performance analysis indicate that AI has not been adopted to the same extent for assessment-related activities and the analysis of students' learning progress.The results point to an opportunity to provide further training and practical guidance on the appropriate use of AI in assessment and student-performance monitoring.

The findings imply that teachers perceive AI as a useful resource for improving lesson preparation, supporting classroom activities, and promoting professional learning. However, the comparatively lower score

for assessment and feedback indicates that further support may be needed to help teachers use AI effectively in these areas. Overall, the findings highlight the potential value of AI as a tool for strengthening teachers' professional practice, provided that its use is supported by appropriate training, adequate resources, and sound professional judgement.

This finding aligns with the claim that teachers need adequate professional development to translate initial exposure into pedagogically useful integration of AI. It also underscores the need for teacher AI literacy as a must-have to make a successful move.

The research also revealed that AI had positive effects on the teachers' self-perceived professional capacity, with an overall mean of 2.90. Instructional planning registered the highest mean value. This means that AI can support teachers practically by helping them to come up with lesson ideas, structure lessons, design activities, and modify the content for the learner. Furthermore, the Pearson correlation outcome, $r = .61$, $p < .0001$, also supports the presence of a positive and significant relationship between use of AI and perceived instructional capacity. This is aligned with the Technology Acceptance Model, that argues that perceived usefulness and perceived ease of use are factors that play a role in user acceptance of new technology (Davis, 1989). When teachers perceive AI as useful for their work, they are more likely to use it, and may further develop their instructional practice.

The result can also be interpreted from the perspective of Constructivist Theory. AI can serve as a form of scaffolding by providing teachers with resources, suggestions, examples, and alternative approaches that support experimentation and professional learning. However, teachers remain responsible for evaluating and adapting AI-generated outputs to their specific educational contexts.

The study identified infrastructure, training, affordability, and institutional support as major challenges to AI integration. Poor internet connectivity and unreliable electricity are particularly important concerns in contexts where AI applications depend on continuous digital access. Similarly, limited formal training may prevent teachers from progressing beyond basic uses of AI.

The qualitative findings reinforce the quantitative results. Teachers described AI as a time-saving tool but simultaneously reported learning AI independently because they had not received adequate formal training. This combination suggests that teachers have considerable interest in AI but require systematic institutional support to translate individual experimentation into sustainable professional practice.

The discovery that respondents strongly supported regular teacher training, AI-enabled infrastructure, curriculum integration, and government funding further demonstrates that successful AI adoption cannot be achieved by providing software alone. AI integration requires a broader ecosystem involving infrastructure, teacher competence, policy, curriculum, ethics, and continuous professional development.

Conclusion

This study concludes that AI has considerable potential to develop the capacity of contemporary teachers in senior secondary schools in the FCT Abuja. Teachers reported that AI supports lesson planning, classroom instruction, assessment and feedback, and professional development. However, the overall level of AI use remains moderate, with teachers making greater use of AI for lesson preparation and content creation than for assessment and student-performance analysis.

The important positive relationship between AI use and instructional capacity indicates that teachers who make greater use of AI tend to report higher levels of instructional capacity. Nevertheless, AI adoption is constrained by inadequate infrastructure, limited formal training, high data and device costs, and insufficient institutional guidance.

The study therefore concludes that AI should not be introduced into schools merely as a technological innovation. It should be integrated as part of a broader teacher-capacity development strategy that combines AI literacy, pedagogical knowledge, ethical awareness, infrastructure, institutional support, and continuous professional development. When appropriately integrated, AI can complement teachers' expertise and strengthen the quality, efficiency, and adaptability of teaching in the era of Education 4.0.

Recommendations

Based on the findings, the following recommendations were made:

1. Growth of AI Education Policy: The Federal Ministry of Education and the FCT Education authorities should develop clear policies and guidelines for AI use in teacher education and school-based teaching. Such policies should address AI literacy, ethical use, academic integrity, data protection, assessment, and human oversight.
2. Continuous Professional Development: The National Teachers' Institute (NTI), Teachers Registration Council of Nigeria (TRCN), UBEC, SEB and relevant FCT education agencies should institutionalise regular AI-focused continuing professional development programmes. Training should be practical, hands-on, continuous, and subject-specific.
3. Provision of Digital Infrastructure: The FCT Secondary Education Board should collaborate with relevant public and private-sector partners to provide reliable internet connectivity, electricity or alternative energy sources, digital devices, and other infrastructure required for AI-supported teaching.
4. AI Teacher Hubs: An AI Teacher Hub should be established in each Area Council to provide opportunities for teachers to share AI resources, effective prompts, lesson ideas, assessment practices, and experiences. These hubs could operate as communities of professional practice.
5. Incorporation into Teacher Education: Colleges of Education, universities, and other teacher-training institutions should integrate AI literacy, digital pedagogy, prompt formulation, AI evaluation, ethics, and data protection into pre-service teacher education programmes.
6. Institutional AI Guidelines: Individual schools should develop clear guidelines on acceptable AI use. These guidelines should address responsible use, academic integrity, privacy, assessment, misinformation, and the appropriate balance between AI assistance and teachers' professional judgement.
7. Government Funding and Partnerships: Government should provide adequate funding for AI-related teacher development and digital infrastructure. Partnerships with technology organisations and other

relevant stakeholders should be encouraged while ensuring that such partnerships protect teachers' and learners' data.

8. Monitoring and Evaluation: Education authorities should set up mechanisms for monitoring AI adoption and evaluating its effects on teacher performance, instructional quality, student learning, and professional development. Such monitoring should inform periodic improvement of AI policies and training programmes.

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