

# Artificial Intelligence, Insecurity, and the Quest for Quality Computing and Digital Education in Nigeria.

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*Abstract- The quality of computing and digital education in Nigeria is increasingly shaped by the rapid emergence of Artificial Intelligence and persistent insecurity challenges. While Artificial Intelligence offers opportunities for personalized learning and instructional support, it also raises concerns related to academic integrity, over-reliance, and the weakening of core computing skills. Concurrently, insecurity across various regions of Nigeria continues to limit access to quality education, disrupt learning continuity, and constrain effective delivery of computing and digital education. This conceptual and analytical paper examines the influence of Artificial Intelligence on the quality of computing and digital education in Nigeria and analyzes the impact of insecurity on access to quality learning opportunities. Drawing on existing literature and contextual analysis, the paper further analyzes the combined effects of Artificial Intelligence and insecurity on the development of core computing competencies among learners. Based on these analyses, context-sensitive strategies are proposed to sustain quality computing and digital education, including guided integration of Artificial Intelligence in instruction, capacity building for educators, strengthened assessment frameworks, and resilient digital learning models suited to insecure contexts. The paper contributes to ongoing discourse on maintaining educational quality in complex and evolving learning environments*

## I. INTRODUCTION

Computing and digital education have become central to contemporary educational systems, particularly in developing countries where digital skills are increasingly linked to national development, employability, and innovation. In Nigeria, computing education encompasses the teaching and learning of computer science, information and communication technologies, and related digital competencies across secondary and tertiary institutions. Digital education, in this context, refers to the use of digital technologies, platforms, and resources to support teaching, learning, and assessment processes. As demand for digitally

skilled graduates continues to grow, concerns about the quality of computing and digital education have become more pronounced (UNICEF, 2023; Ibitoye & Abdullahi, 2025).

Within this evolving educational landscape, the emergence of Artificial Intelligence (AI) has introduced significant changes to how computing and digital education is delivered. Artificial Intelligence (AI), broadly defined as the use of computer systems to perform tasks that typically require human intelligence such as problem-solving, pattern recognition, and decision-making, is increasingly embedded in educational tools and platforms. In computing education, AI-powered systems support activities such as automated code generation, intelligent tutoring, and adaptive learning. While these developments offer new instructional possibilities, they also raise questions about how learning quality, particularly the development of foundational computing skills, can be sustained (Ibitoye & Abdullahi, 2025; Acosta-Enriquez et al., 2024).

The growing presence of Artificial Intelligence in education has intensified discussions around quality assurance in computing and digital education. Quality assurance, in this paper, refers to the systematic processes through which educational inputs, teaching practices, assessment methods, and learning outcomes are evaluated to ensure that learners acquire relevant and transferable skills. In computing education, quality is closely related to learners' ability to think computationally, solve problems independently, and apply programming concepts effectively. As AI tools increasingly assist learners in completing tasks, concerns have emerged regarding over-reliance on such tools and the potential erosion of deep learning, academic integrity, and problem-solving competence

(Frontiers in Education, 2024; Wiley Newsroom, 2024).

Beyond technological change, the Nigerian educational system continues to face persistent insecurity challenges that further complicate efforts to maintain quality computing and digital education. Insecurity, as used in this paper, refers to conditions of violence, conflict, and instability that disrupt normal social and institutional functioning, including banditry, insurgency, kidnapping, and communal conflicts. These conditions have resulted in school closures, disrupted academic calendars, restricted access to learning facilities, and uneven implementation of digital education initiatives, particularly in affected regions in Nigeria (Reuters, 2026). Consequently, access to quality computing and digital education remains uneven and fragile.

The interaction between Artificial Intelligence and insecurity creates a complex educational environment in which access to learning and the quality of learning are simultaneously challenged. In contexts where insecurity limits face-to-face instruction, learners increasingly depend on digital and AI-supported learning tools to sustain academic engagement. While such tools may provide temporary continuity, unregulated or excessive reliance on AI within already disrupted learning environments risks weakening the acquisition of core computing competencies and widening educational inequalities (UNICEF, 2023; Ibitoye & Abdullahi, 2025).

Against this backdrop, this paper examines the influence of Artificial Intelligence on the quality of computing and digital education in Nigeria and analyzes the impact of insecurity on access to quality learning opportunities. It further analyzes the combined effects of these challenges on the development of essential computing competencies among learners. By adopting a conceptual and analytical approach, the paper proposes context-sensitive strategies aimed at sustaining quality computing and digital education in Nigeria amid rapid technological transformation and persistent insecurity.

Conceptualizing Quality in Computing and Digital Education

Quality in computing and digital education is a multidimensional construct that extends beyond access to digital tools or the presence of technology in learning environments. In contemporary educational discourse, quality generally refers to the extent to which educational inputs, processes, and outcomes align with established learning goals and societal needs (Tsiligris & Hills, 2021). Within computing and digital education, quality is increasingly associated with learners' acquisition of relevant technical knowledge, problem-solving ability, computational thinking, and adaptability to evolving digital environments (OECD, 2023; UNESCO, 2024). This understanding positions quality not merely as technological availability, but as the effectiveness of teaching and learning processes in producing meaningful learning outcomes.

From a conceptual standpoint, computing education emphasizes the development of skills such as computational thinking, programming competence, algorithmic reasoning, and logical problem-solving (Becconi et al., 2022). Computational thinking, in this context, refers to the cognitive processes involved in formulating problems and designing solutions that can be executed by humans or machines. High-quality computing education therefore equips learners with the ability to decompose problems, recognize patterns, design algorithms, and apply programming concepts independently (ICILS Assessment Framework, 2023). Literature suggests that when these competencies are insufficiently developed, learners may possess surface-level digital familiarity without deeper conceptual understanding, thereby undermining educational quality (Ibitoye & Abdullahi, 2025).

Digital education, which involves the use of digital platforms, online resources, and technology-mediated instructional strategies, further complicates the conceptualization of quality. Studies on digital learning emphasize that quality digital education is not defined solely by online delivery but by pedagogical coherence, learner engagement, instructional support, and meaningful assessment practices (UNESCO, 2024; ICDE Quality Network, 2023). In developing contexts such as Nigeria, digital education quality is also shaped by infrastructure reliability, educator competence, institutional support, and learner

readiness (World Bank, 2025; UNICEF, 2023). Consequently, quality must be understood as context-sensitive rather than universally uniform.

Recent literature highlights quality assurance as a central mechanism for maintaining standards in computing and digital education (Jansawang et al., 2025). Quality assurance refers to the systematic monitoring and evaluation of educational processes to ensure alignment with learning objectives and expected outcomes. In computing education, quality assurance increasingly focuses on curriculum relevance, instructional design, assessment integrity, and graduate competence (Acosta-Enriquez et al., 2024). Scholars argue that without robust quality assurance frameworks, digital and AI-supported learning environments risk prioritizing convenience over cognitive depth, leading to weakened skill acquisition (Acosta-Enriquez et al., 2024).

The emergence of Artificial Intelligence has further reshaped how quality in computing and digital education is conceptualized. AI-enabled tools, including intelligent tutoring systems and automated code generation platforms, have been shown to support personalized learning and instructional efficiency. However, recent studies caution that unregulated AI use may compromise learning quality by reducing learner effort, masking skill deficiencies, and challenging academic integrity (Wiley Newsroom, 2024; OECD, 2023). As a result, quality in the AI era is increasingly linked to how effectively institutions balance technological assistance with pedagogical control and skill validation.

In the Nigerian context, the conceptualization of quality in computing and digital education must also account for structural and systemic constraints. Policy and empirical reports indicate that disparities in digital access, educator preparedness, and institutional capacity continue to affect the consistency and effectiveness of computing education delivery (World Bank, 2025; UNICEF, 2023). These constraints suggest that quality cannot be detached from access conditions, learning continuity, and contextual realities, particularly in environments affected by insecurity. Thus, quality computing and digital education in Nigeria is best understood as the product

of pedagogical effectiveness, technological appropriateness, institutional support, and learner access within a challenging socio-educational landscape.

#### Artificial Intelligence and the Quality of Computing Education

Artificial intelligence (AI), as earlier introduced, has increasingly influenced teaching and learning processes, particularly within computing and digital education. Its growing integration into educational systems has transformed the ways in which students engage with programming tasks, problem-solving activities, and digital learning environments. Within computing education, AI-powered tools such as intelligent tutoring systems, automated code generators, adaptive learning platforms, and generative chatbots are increasingly used to support instruction and improve learning experiences. These technologies are designed to provide individualized assistance, automate routine instructional tasks, and increase learners' access to educational content (OECD, 2023; Zawacki-Richter et al., 2019).

The emergence of AI in computing education is largely driven by the expectation that it can improve the quality of learning. Existing studies indicate that AI-driven systems can provide immediate feedback, personalize learning pathways, and support learners in understanding difficult programming concepts. Zawacki-Richter et al. (2019) found that AI applications in higher education improve learning efficiency by adapting instruction to the needs of individual learners. Likewise, Holmes et al. (2022) argue that AI tools can support structured learning by guiding students through problem-solving processes in a step-by-step manner. In computing education, such guidance is particularly important because it can assist students in developing programming logic, algorithmic thinking, and coding competence.

Recent evidence further suggests that students generally accept AI when they perceive it as useful to their learning. AI is valued because it offers personalized support, real-time feedback, faster access to information, and increased learning flexibility. Students who perceive these benefits are more likely to adopt AI tools and integrate them into their learning

activities, whereas skepticism toward AI tends to have a weaker influence on usage decisions. Thus, the educational value of AI depends not only on the availability of the technology but also on whether learners believe it can genuinely improve their learning outcomes.

Despite these instructional opportunities, a growing body of literature raises concerns about the implications of AI for the quality of computing education. One major concern is the possibility of reduced cognitive engagement. Cognitive engagement refers to the extent to which learners actively think through, analyze, and understand what they are learning. In computing education, this is particularly important because students are expected to develop the ability to reason logically and solve problems independently. However, excessive reliance on AI tools, especially automated code generators and generative AI systems, may reduce the level of intellectual effort required from learners. Acosta-Enriquez et al. (2024) argue that overdependence on AI may discourage students from actively participating in coding and problem-solving tasks. Similarly, Kasneci et al. (2023) observe that students may rely on AI-generated solutions without fully understanding the concepts underlying those solutions.

This concern is reinforced by recent findings showing that AI can encourage superficial learning when students use it primarily to obtain quick answers rather than to develop genuine understanding. Although AI may help learners complete assignments more quickly, it may also weaken independent thinking, creativity, and long-term retention if students become dependent on automated outputs. In this sense, AI may improve task completion without necessarily improving the deeper competencies required in computing education, such as critical thinking, programming logic, and analytical problem-solving.

Another major issue identified in the literature concerns assessment integrity. Assessment integrity refers to the extent to which assessment results accurately reflect learners' actual knowledge, skills, and competencies. In computing education, assessment often involves coding exercises,

programming projects, and problem-solving activities. However, the increasing availability of AI tools capable of generating essays, programming codes, and complete solutions has made it more difficult for educators to determine whether submitted work is genuinely produced by students. Cotton et al. (2023) noted that generative AI has complicated traditional forms of assessment by making it easier for students to present AI-generated responses as their own work. The use of AI in this manner threatens the validity and reliability of assessment because students may receive high scores without demonstrating genuine competence.

Closely related to this issue is the broader concern about academic integrity. AI tools can provide complete answers and ready-made codes that students may submit without modification. As a result, AI increases the risk of plagiarism, dishonesty, and shortcut learning. Studies indicate that many students are tempted to use AI not merely as a learning aid but as a substitute for independent effort. Consequently, the increasing use of AI requires educators and institutions to rethink how computing competencies are assessed. Greater emphasis may need to be placed on practical demonstrations, oral explanations, project-based tasks, and supervised assessments that can more accurately reveal students' actual level of understanding.

Beyond its implications for assessment, AI also affects the relationship between teachers and learners. Excessive dependence on AI may reduce direct interaction between educators and students, thereby weakening the human dimension of learning. In computing education, teacher-student interaction is important because students often require encouragement, clarification, and guided explanation when learning abstract concepts. The literature warns that when AI replaces rather than supports the teacher, learning may become impersonal and less meaningful. Some scholars therefore caution against the dehumanization of education and argue that AI should remain a supportive tool rather than a replacement for human instruction.

The integration of AI further raises ethical concerns relating to privacy, data protection, and responsible

use. Most AI systems collect and process large amounts of learner data in order to personalize instruction. However, inadequate regulation may expose students to risks associated with unauthorized data use, weak privacy safeguards, and limited transparency in the operation of AI systems. These concerns are particularly significant in educational contexts where there are no clear institutional policies guiding the use of AI. Thus, while AI may improve learning, its use must be guided by ethical standards that protect students' rights and ensure responsible educational practice.

The role of educators therefore becomes increasingly important in AI-supported computing education. Rather than functioning only as transmitters of knowledge, teachers are now expected to guide students in the appropriate and ethical use of AI tools. This requires educators to develop new pedagogical competencies, including the ability to design learning activities that promote independent thinking while using AI as a supportive instructional resource. Existing studies, however, indicate that many educators are not yet adequately prepared for this transition. Holmes et al. (2022) and OECD (2023) note that insufficient teacher preparation may lead to unstructured AI use, thereby reducing the quality of learning rather than improving it.

Theoretical explanations of students' acceptance of AI further support the need for careful integration. The Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) suggest that learners are more likely to use AI tools when they perceive them as useful, easy to use, and beneficial to their academic performance. However, if students distrust AI or believe that it undermines their learning, they are less likely to adopt it effectively. Thus, the successful integration of AI in computing education depends not only on the technology itself but also on students' attitudes, confidence, and willingness to engage with it.

In the Nigerian context, the influence of AI on computing education is further shaped by infrastructural and social constraints. Access to reliable electricity, internet connectivity, digital devices, and AI-enabled learning platforms remains

uneven across schools and regions. Consequently, while some students may benefit substantially from AI-supported learning, others may be excluded because of limited access. This situation creates a digital divide that may widen existing inequalities in educational quality and opportunity. Evidence suggests that AI can inadvertently benefit already advantaged learners while leaving disadvantaged students further behind. In Nigeria, where disparities in access to digital infrastructure already exist, this problem is likely to be more severe.

Overall, the literature suggests that AI performs a dual role in computing education. On one hand, it enhances instructional support, learning flexibility, and personalized learning opportunities. On the other hand, it creates challenges relating to reduced cognitive engagement, superficial learning, academic integrity, ethical concerns, and unequal access. The quality of computing education therefore depends not simply on the presence of AI, but on how effectively it is integrated, regulated, and balanced with human teaching. These concerns become even more significant when considered alongside persistent insecurity in Nigeria, which further restricts access to quality computing and digital education.

#### Insecurity and Access to Quality Computing and Digital Education in Nigeria

Insecurity has become a defining challenge affecting access to education in Nigeria, with significant implications for computing and digital learning. In this context, insecurity refers to persistent threats to safety arising from armed conflict, banditry, kidnapping, and communal violence, which disrupt normal social and institutional activities. Over the past decade, these challenges have intensified, particularly in northern Nigeria, where schools have increasingly been targeted, leading to widespread fear and instability within the education system (UNICEF, 2022; Ogunode & Ahaotu, 2021).

The nature and dimensions of insecurity in Nigeria extend beyond physical violence to include psychological, institutional, and socio-economic disruptions. Schools have been subjected to attacks, abductions, and forced closures, resulting in the displacement of both learners and educators.

According to UNICEF (2022), thousands of schools have been affected by insecurity, with millions of children experiencing interruptions in their education. These disruptions are not only temporary but often prolonged, creating gaps in learning continuity that are difficult to recover. In computing and digital education, where learning requires sustained engagement and progressive skill development, such interruptions significantly undermine educational quality.

One of the most direct effects of insecurity is the limitation of access to computing and digital education. Access, in this context, goes beyond physical presence in school and includes the availability of digital infrastructure, instructional time, and learning support. When schools are closed or attendance is reduced due to fear of attacks, students lose opportunities to engage with computing resources such as computers, internet connectivity, and software tools. Ogunode and Ahaotu (2021) argue that insecurity has led to a decline in school participation rates, particularly in conflict-affected regions, thereby limiting students' exposure to digital learning environments.

Insecurity also disrupts teaching and learning continuity, which is essential for developing computing competencies. Programming and digital skills require consistent practice, iterative learning, and cumulative understanding. However, frequent school closures, irregular attendance, and displacement interrupt this process, resulting in fragmented learning experiences. Teachers in insecure environments may also experience absenteeism or relocation, further reducing the availability of qualified instructors (Shehu, 2022). As a result, students are often unable to progress from basic digital literacy to more advanced computing skills.

Beyond physical disruptions, insecurity affects the availability and sustainability of learning resources. Educational infrastructure, including computer laboratories and digital equipment, may be damaged, abandoned, or rendered inaccessible due to conflict. In addition, investment in digital education is often deprioritized in insecure regions, where immediate security concerns take precedence over long-term

educational development (World Bank, 2020). This situation creates a structural barrier to the delivery of quality computing education, particularly in rural and conflict-prone areas.

The implications of insecurity for educational quality and equity are significant. Quality computing education depends on consistent access to learning resources, qualified teachers, and stable learning environments. However, insecurity creates unequal conditions in which students in safer regions have greater access to digital learning opportunities, while those in conflict-affected areas are left behind. This disparity contributes to widening educational inequality and reinforces the digital divide within the country (UNESCO, 2023).

Furthermore, the psychological impact of insecurity on learners and teachers cannot be overlooked. Exposure to violence, fear of abduction, and uncertainty about safety can affect students' concentration, motivation, and overall engagement with learning. In computing education, which requires logical reasoning and sustained cognitive effort, such psychological stress can significantly reduce learning effectiveness. Similarly, teachers operating under insecure conditions may experience reduced morale and diminished instructional effectiveness (Shehu, 2022).

In response to these challenges, digital learning has been proposed as a potential alternative for sustaining education during periods of insecurity. Online learning platforms, remote instruction, and AI-supported tools offer opportunities to maintain educational access when physical classrooms are inaccessible. However, the effectiveness of these solutions remains uneven in Nigeria due to infrastructural limitations, including unreliable electricity, poor internet connectivity, and limited access to digital devices (World Bank, 2020; UNESCO, 2023). As a result, while digital education has the potential to mitigate the effects of insecurity, it may also exacerbate inequalities if access is not equitably distributed.

Overall, the literature demonstrates that insecurity significantly constrains access to quality computing and digital education in Nigeria. Its effects extend

beyond school closures to include disrupted learning continuity, reduced instructional quality, limited access to digital resources, and increased educational inequality. These challenges highlight the need to examine how insecurity interacts with emerging technologies such as artificial intelligence, as both factors collectively shape the development of computing competencies in the Nigerian context. This interaction is explored in the following section.

#### Combined Effects of Artificial Intelligence and Insecurity on Computing Competency Development

The simultaneous presence of artificial intelligence (AI) and persistent insecurity creates a complex educational environment that significantly shapes the development of computing competencies in Nigeria. While AI introduces new opportunities for enhancing learning through personalization, automation, and adaptive feedback, insecurity disrupts access, continuity, and the conditions necessary for effective learning (OECD, 2023; UNICEF, 2022). The interaction between these two forces does not simply produce additive effects; rather, it creates compounded challenges that influence how learners acquire computing knowledge and skills within unstable learning environments (UNESCO, 2023; World Bank, 2020).

One key dimension of this interaction is the relationship between AI use and disrupted learning environments. AI-driven tools are most effective when learners have consistent access to digital infrastructure, stable instructional environments, and continuous engagement with learning activities (Holmes et al., 2022; Zawacki-Richter et al., 2019). However, insecurity undermines these conditions by causing school closures, displacement, and irregular attendance, particularly in conflict-affected regions of Nigeria (UNICEF, 2022; Ogunode & Ahaotu, 2021). As a result, students in insecure regions may be unable to fully benefit from AI-supported learning, even when such technologies are available, thereby limiting the overall effectiveness of digital learning interventions (World Bank, 2020; UNESCO, 2023).

Another critical issue arising from the combined effects of AI and insecurity is the risk of reduced problem-solving competence and superficial learning.

AI tools, particularly generative systems, can enable students to complete programming tasks quickly by generating code or providing ready-made solutions (Kasneeci et al., 2023; Cotton et al., 2023). While this may improve task completion rates, it can reduce opportunities for learners to engage in deep cognitive processing and independent problem-solving (Acosta-Enriquez et al., 2024; Holmes et al., 2022). When this is combined with disrupted learning caused by insecurity—such as irregular instruction, reduced contact hours, and limited practice time—students may fail to develop essential computing competencies, including algorithmic thinking, debugging skills, and logical reasoning (Grover & Pea, 2020; Wing, 2020). In such contexts, learning becomes fragmented, and reliance on AI may further weaken independent thinking and long-term skill acquisition (Kasneeci et al., 2023; Acosta-Enriquez et al., 2024).

The interaction between AI and insecurity also intensifies inequalities in access to quality digital learning opportunities. AI technologies typically require reliable internet connectivity, access to digital devices, and stable electricity supply (OECD, 2023; World Bank, 2020). However, insecurity disproportionately affects regions where such infrastructure is already limited or disrupted, thereby restricting access to AI-enabled learning tools (UNICEF, 2022; UNESCO, 2023). Consequently, students in safer and more technologically advanced areas are more likely to benefit from AI-enhanced learning, while those in conflict-affected regions are excluded (Ogunode & Ahaotu, 2021; World Bank, 2020). This uneven access creates a layered digital divide in which both insecurity and technological inequality reinforce disparities in educational quality and learning outcomes (UNESCO, 2023; Ibitoye & Abdullahi, 2025).

Furthermore, the psychological effects of insecurity may influence how students engage with AI tools and learning processes. Exposure to violence, fear, and instability has been shown to negatively affect learners' concentration, motivation, and cognitive engagement (Shehu, 2022; UNICEF, 2022). In computing education, which requires sustained attention and logical reasoning, such psychological stress can significantly reduce the effectiveness of

learning (Grover & Pea, 2020). Under these conditions, students may resort to using AI tools as shortcuts for completing tasks rather than as aids for understanding concepts, particularly when instructional support is inconsistent (Cotton et al., 2023; Kasneci et al., 2023). This behavior further contributes to superficial learning and weak competency development.

The combined effects of AI and insecurity also have important implications for the long-term development of computing skills in Nigeria. If learners are unable to engage consistently with structured learning while simultaneously relying heavily on AI-generated outputs, there is a risk of producing graduates with limited practical competence despite exposure to digital technologies (OECD, 2023; World Bank, 2020). This outcome undermines the core objectives of computing education, which include developing problem-solving abilities, computational thinking, and the capacity to design and implement technological solutions (Wing, 2020; Grover & Pea, 2020). As emphasized in the literature, the presence of digital tools alone does not guarantee skill acquisition; meaningful learning depends on how these tools are integrated within stable, supportive, and well-regulated educational environments (Holmes et al., 2022; UNESCO, 2023).

Overall, the interaction between artificial intelligence and insecurity creates a dual constraint on computing competency development in Nigeria. While AI offers significant potential to enhance learning through personalization and automation, insecurity limits access to the conditions necessary for its effective use. At the same time, unregulated or excessive reliance on AI may further weaken learning quality, particularly in already disrupted environments (Acosta-Enriquez et al., 2024; Cotton et al., 2023). These combined effects highlight the need for strategic interventions that address both technological integration and contextual challenges in order to sustain quality computing and digital education.

Strategies for Sustaining Quality Computing and Digital Education

Addressing the combined challenges posed by artificial intelligence (AI) and insecurity requires

deliberate and context-sensitive strategies aimed at sustaining the quality of computing and digital education in Nigeria. These strategies must not only harness the benefits of AI but also mitigate its risks, while simultaneously responding to the disruptions caused by insecurity. Achieving this balance requires coordinated efforts across policy, pedagogy, infrastructure, and institutional practice (OECD, 2023; UNESCO, 2023).

One critical strategy is the guided and ethical integration of AI into instructional practices. Rather than allowing unrestricted use of AI tools, educators and institutions should adopt structured approaches that define how AI can support learning without replacing critical thinking. This includes designing tasks that require students to explain, justify, and modify AI-generated outputs, thereby ensuring active cognitive engagement (Kasneci et al., 2023; Cotton et al., 2023). In addition, clear ethical guidelines should be established to regulate the use of AI in academic work, particularly in relation to plagiarism, data privacy, and responsible usage (Acosta-Enriquez et al., 2024). Such frameworks help preserve the integrity of learning while still leveraging the benefits of AI.

Closely related to this is the need for capacity building among computing educators. The effective integration of AI depends largely on teachers' ability to use it pedagogically. Educators must be trained not only in the technical use of AI tools but also in designing learning experiences that promote independent problem-solving and critical thinking. Holmes et al. (2022) and OECD (2023) emphasize that without adequate teacher preparation, AI may be used in ways that undermine rather than enhance learning quality. Professional development programmes should therefore focus on equipping educators with digital competencies, AI literacy, and strategies for managing AI-supported classrooms.

Another important strategy is the development of structured and resilient assessment models that preserve learning quality. Given the growing concerns about academic integrity, traditional assessment approaches that rely solely on take-home assignments or unsupervised coding tasks may no longer be

sufficient (Cotton et al., 2023). Alternative assessment methods such as supervised practical sessions, oral examinations, project-based evaluations, and continuous assessment can provide more reliable measures of students' actual competencies (Kasneci et al., 2023). These approaches ensure that students demonstrate genuine understanding rather than relying on AI-generated outputs.

In the context of insecurity, there is also a need to develop resilient digital learning models that can sustain education during disruptions. Blended learning approaches, which combine face-to-face instruction with online learning, can provide flexibility and continuity when physical attendance is not possible (UNESCO, 2023; World Bank, 2020). In addition, the use of low-bandwidth technologies, offline digital resources, and mobile learning platforms can help extend access to learners in conflict-affected or resource-constrained areas. Such adaptive models are essential for ensuring that computing education continues despite instability.

Improving digital infrastructure and equitable access is another critical strategy for sustaining quality computing education. The effectiveness of both AI and digital learning depends on access to reliable electricity, internet connectivity, and appropriate devices. Governments and educational stakeholders must therefore prioritize investments in digital infrastructure, particularly in underserved and conflict-affected regions (World Bank, 2020; Ibitoye & Abdullahi, 2025). Expanding access to digital tools can help reduce inequalities and ensure that more learners benefit from AI-supported education.

Furthermore, policy development and institutional regulation play a key role in guiding the integration of AI in education. Clear national and institutional policies are needed to define acceptable uses of AI, protect student data, and ensure ethical practices in digital learning environments (OECD, 2023). In Nigeria, where AI integration is still emerging, the absence of such frameworks may lead to inconsistent practices and reduced educational quality. Establishing comprehensive policies can provide direction for educators, learners, and institutions, thereby promoting responsible and effective use of AI.

Finally, there is a need to promote learner-centered approaches that emphasize active engagement and skill development. Computing education should focus not only on content delivery but also on developing competencies such as critical thinking, problem-solving, and creativity. AI should be used as a support tool to enhance these skills rather than replace them. Encouraging collaborative learning, problem-based tasks, and reflective practices can help ensure that students remain actively engaged in the learning process, even when using AI tools (Holmes et al., 2022; Grover & Pea, 2020).

Overall, sustaining the quality of computing and digital education in Nigeria requires a holistic approach that integrates technological innovation with pedagogical reform and contextual adaptation. While AI offers powerful tools for enhancing learning, its effectiveness depends on how it is guided, regulated, and supported within the educational system. At the same time, addressing the challenges posed by insecurity requires flexible and resilient learning models that ensure continuity and equitable access. Together, these strategies provide a pathway for strengthening computing education in the face of evolving technological and socio-environmental challenges.

## II. CONCLUSION

Artificial Intelligence and Insecurity have emerged as two significant factors shaping the quality of computing and digital education in Nigeria. While AI offers opportunities to enhance learning through personalization, adaptive support, and increased access to educational resources, its unregulated use may undermine cognitive engagement, problem-solving ability, and assessment integrity. At the same time, insecurity continues to restrict access to quality education through school disruptions, limited infrastructure, and unequal learning opportunities. The interaction between these challenges creates additional barrier to the development of essential computing competence among learners. Therefore, sustaining quality computing and digital education in Nigeria requires a balanced approach that promotes the responsible integration of AI, strengthens digital infrastructure, supports educators, and ensures

resilient and equitable learning environments capable of fostering meaningful skill development despite prevailing security challenges

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