# AIED For Self-Learning in Nigeria: Implications for Curriculum and Instruction

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https://doi.org/10.56201/ijee.v12.no.3.2026.pg350.359

***Abstract:***
*The advent of Artificial Intelligence in Education (AIED) has opened new pathways for self-directed learning, particularly in contexts where access to qualified and competent teachers remains uneven. This paper examines the implications of AIED-supported self-learning for curriculum design and instructional practice, making Nigeria as a case of study. Drawing on a structured review of AIED literature, self-directed learning theory, and empirical studies from Nigerian educational contexts, the paper identifies three core tensions: the promise of personalized adaptive systems versus infrastructural deficits; the demand for learner autonomy versus the preference for teacher-directed instruction; and the urgency of AI literacy versus the need for ethical governance frameworks. The analysis suggests that Nigeria's curriculum must shift from content-coverage models toward competency-based, AI-augmented frameworks, while instruction must move toward blended facilitation that positions the teacher as a learning architect rather than a sole knowledge source. The paper concludes with a research agenda addressing theoretical and empirical gaps in AIED-supported self-learning in Nigeria.*

***Keywords:***
*AIED, self-directed learning, self-regulated learning, curriculum, instruction, Nigeria, adaptive learning.*

## 1.0.Introduction:

Globally; the expansion of Artificial Intelligence in Education (AIED) has altered assumptions about how learning will be reorganized, delivered, and assessed, AIED research cover intelligent tutoring systems (ITS), adaptive learning platforms, automated assessment, learning analytics, and generative AI tutors, each promising to individualize instruction at scale (Zawacki-Richter et al., 2019). For Nigeria as a concern, where access to qualified teachers and instructional resources remains (in most cases) uneven, AIED appears to offer opportunities to expand learning support beyond conventional classroom boundaries.

A critical but underexplored dimension of this development is the relationship between AIED and self-learning, self-directed learning (SDL), associated particularly with Knowles (1975), describes a process in which learners take initiative in diagnosing learning needs, setting goals, identifying resources, selecting strategies, and evaluating outcomes. This means in digital environments, AIED tools may potentially support these processes by providing immediate feedback, adaptive learning pathways, explanations, recommendations, and

opportunities for repeated practice. Recent meta-analytic evidence provides support for this potential. Achuthan's (2025) systematic meta-analysis of 32 empirical studies involving 3,029 participants reported a statistically significant positive effect of AI-based interventions on self-regulated learning and a positive effect on self-directed learning. Furthermore; the study also found substantial heterogeneity across interventions and contexts, indicating that AI does not produce uniform effects across all learners or learning environments. For Nigeria, therefore, the important question is not simply whether AI can support self-learning, but under what curricular, instructional, infrastructural, cultural, and ethical conditions AIED can contribute meaningfully to learner autonomy.
This paper addresses the question:

**How does AIED-supported self-learning reshape curriculum design and instructional practice in Nigeria?**
The paper reviews relevant literature and synthesizes implications for Nigerian curriculum and instruction, with particular attention to learner autonomy, teacher roles, AI literacy, equity, and ethical governance

**1.2.Methodology:**
This paper adopts a structured literature-review approach to examine the implications of AIED-supported self-learning for curriculum and instruction in Nigeria. Relevant literature was identified through searches of major academic databases and scholarly sources using combinations of terms including *artificial intelligence in education*, *AIED*, *self-directed learning*, *self-regulated learning*, *adaptive learning*, *intelligent tutoring systems*, *curriculum*, *instruction*, and *Nigeria*.
The review considered conceptual studies, empirical research, systematic reviews, meta-analyses, books, policy documents, and relevant institutional literature, particular attention was given to research addressing the relationship between AI and learner autonomy, the role of teachers in AI-supported environments, curriculum transformation, and the Nigerian or sub-Saharan African educational context. Recent evidence is especially relevant. For example, Achuthan (2025) synthesized 32 empirical studies involving 3,029 participants and found significant positive effects of AI interventions on both self-regulated and self-directed learning. However, the substantial heterogeneity across studies indicates that these findings should not be interpreted as universally transferable to every educational context.

**2.0 Literature Review:**
**2.1 Artificial Intelligence in Education: Concept and Development**
Artificial Intelligence in Education is an interdisciplinary field situated at the intersection of artificial intelligence, education, cognitive science, learning sciences, and educational technology the early AIED research focused substantially on intelligent tutoring systems designed to provide individualized instruction and feedback, over time, the field has expanded considerably, the concept is gradually making its way into the education field. Initially, it was known as AI literacy refers to the ability to understand, use, monitor, and critically reflect on AI applications without necessarily being able to develop AI models themselves (Long and Magerko, 2020). Contemporary AIED includes: adaptive learning systems (ALS), learning analytics, automated assessment, recommender systems, conversational agents, natural-language-processing applications, and generative AI this expansion has shifted attention from simply automating instructional tasks toward using AI to personalize learning, support teachers, analyze learning processes, and provide learners with individualized assistance. The use of AI in this field may be traced back to the 1970s when

LOGO programming and Turtle robots were introduced to young learners.
However, those tools focused more on computational thinking or programming concepts instead of AI. In 1995, a book named "Artificial Intelligence: A Modern Approach" was published and is considered the most standard textbook in the field of AI for computer science undergraduates (Russell and Norvig, 1995). Accordingly, and it remained limited to the field of computer science only. Later the concept of AI in education evolved as the integration of AI into the education management system which facilitates teaching, learning, and decision-making, as well as providing virtual assistance for self-leering. (Dignum, 2021; Hwang et al., 2020). A particularly important development is the emergence of conversational generative AI. Unlike earlier systems that operated primarily within predetermined content structures, generative AI can interact with learners through natural language, provide explanations, generate examples, ask questions, and respond dynamically to learner input. These capabilities create new possibilities for self-directed learning, knowing that, the educational value of AI depends on its pedagogical design. AI should not be treated as traditional educational merely, because it is technologically sophisticated, and its effectiveness depends on how its capabilities are connected to learning objectives, instructional strategies, assessment, learner characteristics, and teacher support.

### 2.2 Self-Learning in the Digital Era

Self-directed learning refers to a process through which learners assume responsibility for significant aspects of their learning, Knowles (1975) describes self-directed learners as individuals who take initiative in identifying learning needs, formulating goals, locating resources, selecting strategies, and evaluating outcomes.
It becomes relevant in digital learning environments because learners now have unrestricted access to information and educational resources, virtual (online) courses, open educational resources, digital libraries, educational videos, learning-management systems, and AI assistants allow learners to continue learning beyond formal classroom boundaries.
Nevertheless, access to information does not automatically create self-directed learners. Learners require metacognitive skills, motivation, information literacy, critical thinking, and the ability to evaluate sources. AI therefore creates both an opportunity and a challenge: it can reduce barriers to learning while simultaneously making it easier for learners to become dependent on automated answers. Recent empirical synthesis strengthens the case for carefully designed AI-supported self-learning; Achuthan (2025) found a large positive effect of AI interventions on self-directed learning, with a reported Hedges' $g$ of 1.111.
The same study reported a large overall effect on self-regulated learning ($g = 1.613$), although the high heterogeneity indicates that results vary considerably across contexts and interventions. Thus, AIED should be conceptualized as a scaffold for self-learning rather than a replacement for learning itself.

### 2.3 AIED and the Enhancement of Self-Learning

AI can support self-learning (SL) through several mechanisms; The Achuthan (2025) recent meta-analysis provides empirical support for the following possibilities:
**1. Adaptive learning:** AI systems can analyze learners' responses and adjust the difficulty, sequence, or type of learning material. Instead of requiring every learner to follow an identical instructional pathway, adaptive systems can provide differentiated learning experiences.

**2. Immediate feedback:** AI can provide immediate responses to learner questions and activities. Feedback can help learners identify errors, understand misconceptions, and revise

their work without waiting for teacher intervention (Pardo & Siemens, 2014).

**3. Personalized learning plans:** AI systems can assist learners in setting goals and organizing learning activities. Conversational AI can help a learner divide a large learning objective into manageable tasks and suggest resources for achieving them.

**4. Metacognitive support:** AI can encourage learners to reflect on what they know, what they do not know, and what strategies they are using. This is particularly important because self-directed learning requires more than independent access to resources; it requires learners to monitor and evaluate their own learning.

**5. Continuous learning:** AI-supported learning can extend educational support beyond classroom hours. For learners who have limited access to teachers, this capacity may be particularly important. The Achuthan (2025) recent meta-analysis provides empirical support for these possibilities. Its findings indicate positive effects across several aspects of self-regulation, particularly cognitive/metacognitive and motivational/affective regulation, and when it comes to behavioral regulation, it showed considerably greater variability, suggesting that AI may be more effective in helping learners plan and think about learning than in changing their broader study habits and environments.

**2.4 AIED in the Nigerian Educational Context**

Nigeria presents a particularly important context for examining AIED because of the combination of educational demand, demographic scale, teacher shortages, infrastructural limitations, and growing digital transformation. The National Artificial Intelligence Strategy (NAIS), published in 2024, represents Nigeria's most comprehensive governmental commitment to AI development to date. The strategy articulates five pillars which are:

a. infrastructure development,
b. AI governance and ethics,
c. talent and skills development,
d. research and innovation, and
e. Sector transformation (Jenna, 2024).

However, independent analysis of the NAIS has identified significant implementation gaps. Jenna (2024) concludes that the strategy 'is more optimistic, out of touch, and inadequate for the tasks ahead' specifically because it lacks actionable, time-bound implementation plans, sustainable funding mechanisms insulated from electoral cycles, and institutional design capable of coordinating AI deployment across the fragmented Nigerian educational governance landscape. The establishment of the National Centre for Artificial Intelligence and Robotics (NCAIR) (Nucamp, 2025) provides an institutional vehicle currently equipped with approximately 2,500 virtual CPUs and approximately one petabyte of storage capacity but its mandate and resources remain significantly below what systematic secondary school AI integration would require. Significantly AI could potentially support learners who have limited access to qualified instructors by providing additional explanations, practice opportunities, formative feedback, and learning resources.

**However, several barriers must be addressed as follows:**

**1. Digital infrastructure remains uneven:** Reliable electricity, internet connectivity, and access to suitable devices are necessary for many forms of AI-supported learning.

**2. Teacher AI literacy is critical**: Teachers need to understand not only how to operate AI tools but also how to evaluate their outputs, integrate them pedagogically, and identify their limitations.

**3. Language and cultural relevance matter**: Nigerian learners operate in multilingual and culturally diverse environments. AI systems designed primarily around foreign educational contexts may not adequately reflect Nigerian curricula, examples, languages, or cultural realities.

**4. Data protection and ethical governance are increasingly important:** AI systems in education often rely on vast amounts of data, raising concerns about student privacy, consent, and the possibility of data misuse. Therefore; Nigerian policy must establish guidelines for the ethical use of AI-driven data, collection and ensure that all AI tools used in schools protect students' personal information, (A S Sdiq et; al 2024).

The Nigerian context requires an approach to AIED that is not simply based on importing technologies developed elsewhere but requires context-sensitive AIED development and curriculum integration.

### 2.5 Implications for Curriculum:

The integration of AIED-supported self-learning has significant implications for curriculum design.

#### 2.5.1 From Content Coverage to Competency Development:

Nigerian curriculum content must be adapted to reflect the role AI will play in both education and broader society. This includes teaching students not only how to use AI tools but also how to think critically about the ethical dimensions of technology. Educators must be trained to use AI effectively without sacrificing the essential role of human interaction and mentorship in learning, (A S Sdiq et; al 2024).

Consequently, Nigerian curricula can place greater emphasis on:

a. critical thinking;
b. problem-solving;
c. communication;
d. digital literacy;
e. AI literacy;
f. creativity;
g. collaboration;
h. metacognition; and
i. Lifelong learning.

The objective should not be to teach students to depend on AI, but to develop learners who can use AI critically and independently.

#### 2.5.2 AI Literacy Across Disciplines

AI literacy should not be restricted to computer science programs only, students in education, humanities, social sciences, sciences, business, and professional programs increasingly need to understand how AI works at an appropriate level, what its limitations are, how to evaluate AI-generated information, and how to use AI ethically.

For curriculum and instruction, this means AI literacy can become a cross-curricular competency.

### 2.5.3 Flexible Learning Pathways

AI-supported personalization challenges the assumption that every learner must progress through exactly the same sequence at exactly the same pace; curriculum can establish common competencies while permitting differentiated routes toward those competencies.
For example, learners struggling with a mathematical concept could receive additional explanations and practice, while advanced learners could move toward more complex applications. This may require a distinction between curriculum standards and learning pathways. Standards can remain common while pathways become increasingly personalized.

### 2.5.4 Localization

AI provides opportunities for curriculum localization; educational systems can potentially incorporate Nigerian examples, local histories, cultural contexts, and indigenous languages into learning resources. Such localization is particularly important if AIED is to contribute to educational equity rather than reproduce imported assumptions.

### 2.5.5 Constructive Alignment

Personalization should not lead to curriculum fragmentation, learning outcomes, learning activities, AI-supported learning experiences, and assessment must remain aligned. The curriculum should therefore specify clear competencies and progression while allowing AI systems to personalize aspects of the route through which learners develop those competencies.

## 2.6 Implications for instruction:

Implications for Instruction AI-supported self-learning also changes the instructional role of the teacher, teacher's role should not disappear. Instead, it can become more complex.
The teacher increasingly becomes:

a. **Learning designer:** designing learning experiences that combine human and AI support.
b. **Facilitator:** helping learners interpret and apply knowledge.
c. **AI literacy educator:** teaching students how to use AI responsibly.
d. **Critical evaluator:** helping learners identify inaccurate or misleading AI outputs.
e. **Learning coach:** supporting goal setting, reflection, and independent learning.
f. **Ethical guide**: addressing privacy, academic integrity, bias, and responsible AI use.

This represents a movement from the teacher as the sole source of information toward the teacher as a designer and facilitator of learning, AI can take responsibility for some routine activities, including basic explanations, practice questions, formative feedback, and personalized recommendations. This can potentially give teachers more time to focus on activities that require human judgment, including discussion, collaboration, creativity, ethical reasoning, mentoring, and socio-emotional support. However, this transformation should not be interpreted as evidence that AI can replace teachers; rather, the appropriate model is one of human–AI complementarity.

## 2.7 Challenges and Ethical Considerations

### 2.7.1 Digital Inequality

The most immediate concern in Nigeria is unequal access, when some students have reliable internet, personal computers, smartphones, and AI subscriptions while others do not, AIED could increase existing educational inequalities, (Awofiranye, 2024; Pedro, Subosa, Rivas, and Valverde, 2019). This is because many individuals do not have equal access to technology which can create a disadvantageous position for such individuals. For example, many students in rural eras do not have access to a smartphone or internet connection which

can put them in a disadvantageous position compared to those who have such facilities. Therefore, AIED policies should include equity measures such as:

a. offline or low-bandwidth resources;
b. school-based access points;
c. affordable connectivity;
d. shared devices;
e. teacher-mediated access; and
f. Publicly supported educational AI resources.

### 2.7.2 Accuracy and Misinformation

Generative AI can produce convincing but inaccurate information. Self-directed learners may be particularly vulnerable because they may not have a teacher immediately available to correct errors.AI literacy must therefore include verification skills.

Learners should be taught to ask:

a. What is the evidence?
b. Where did this information come from?
c. Can the claim be independently verified?
d. Does the answer agree with authoritative sources?
e. Could the AI have generated an inaccurate response?

### 2.7.3 Cognitive Dependency

A major danger is excessive dependence on AI, learners routinely ask AI to solve problems, write assignments, summarize texts, or generate answers without engaging with the underlying learning process, technology may weaken rather than strengthen learner autonomy. The purpose of AIED-supported self-learning should may be be to increase the learner's capacity to learn independently, not to eliminate the need for cognitive effort.

### 2.7.4 Data Privacy

AI-supported learning frequently involves the collection of learner information, students must interact with the AI-based system which can limit their privacy through aspects such as facial recognition and recommender system (Akgun and Greenhow, 2022). Student privacy can also be compromised if data captured by AI-based education systems lands in the wrong hands such as hackers. (Dignum, 2021; Kuleto, Ilic, Dumangiu, Rankovic, Martins, Paun, and Mihoreanu, 2021). Therefore, educational institutions may need clear policies concerning:

**a.** what data are collected;
**b.** why data are collected;
**c.** who can access them;
**d.** how long they are retained;
**e.** whether they are shared with third parties; and
**f.** how learners can exercise their rights.

Nigeria's data-protection framework provides an important foundation, but institutional implementation and enforcement remain essential.

### 2.7.5 Algorithmic Bias

AI systems can reproduce biases present in their training data or design, and for Nigerian education, this raises questions about whether AI systems adequately represent Nigerian learners, cultures, languages, educational goals, and social realities; Consequently, local evaluation and testing are necessary before large-scale deployment.

### 2.8 Gaps in the Existing Literature

Several important gaps emerge from the literature.

First; although international and international evidence increasingly demonstrates a positive relationship between AI and self-regulated or self-directed learning, Nigeria-specific intervention research remains limited.

Second; many Nigerian studies focus on attitudes, perceptions, adoption, or readiness rather than measuring changes in actual learning behavior.

Third; relatively little research examines how AIED-supported self-learning interacts with Nigerian cultural and institutional contexts.

Fourth; there is insufficient empirical research examining how AI-supported self-learning should be incorporated into Nigerian curriculum frameworks.

Fifth; there is a need for longitudinal studies. Short-term improvements in performance do not necessarily demonstrate long-term development of learner autonomy.

Finally; more research is needed on the relationship between AI use and the teacher's changing professional role.

These gaps create opportunities for research in curriculum and instruction, educational technology, teacher education, and learning sciences.

## 3. Discussion:

The literature supports three major conclusions concerning AIED-supported self-learning in Nigeria.

### 3.1. AIED Can Support Learner Autonomy, but Context Matters

Evidence from the broader international literature indicates that AI can strengthen important components of self-regulated and self-directed learning.

Achuthan's (2025) meta-analysis provides particularly strong evidence, reporting positive effects for both SRL and SDL; however, the high heterogeneity reported in the meta-analysis is important.

This means that, the size of the effect varies substantially according to learners, interventions, contexts, and design characteristics.

Therefore, Nigeria should avoid treating evidence from other countries as automatically transferable.

The appropriate question is not: *Does AI work?* but rather: *Which AI-supported learning approaches work, for which Nigerian learners, under what conditions, and for which learning objectives?*

### 3.2.Curriculum Transformation Must Accompany Technological Adoption

Introducing AI into classrooms without changing curriculum design is unlikely to produce meaningful transformation, and when curriculum objectives continue to prioritize memorization while AI systems are introduced merely as additional information sources, the technology may reinforce existing practices rather than transform them.

An AIED-supported curriculum should instead emphasize on the following:

**a.** competency development;
**b.** inquiry;
**c.** problem-solving;
**d.** learner autonomy;
**e.** AI literacy;
**f.** critical evaluation of information;
**g.** creativity;
**h.** collaboration; and

i. lifelong learning.

The central curriculum shift is therefore from "What information should students memorize?" toward "What should learners be able to understand, evaluate, create, and do independently?"

### 3.3.Instruction Should Become Human–AI Collaborative

The evidence does not support conceptualizing AI as a substitute for teachers; meaning AI can assume some functions that are repetitive or highly individualized, while teachers focus on the human dimensions of education.

A possible Nigerian model can therefore be represented as:

a. **AI → personalization, practice, feedback, explanations, learning analytics**
b. **Teacher → facilitation, mentoring, critical thinking, collaboration, ethics**
c. **Learner → goal-setting, inquiry, reflection, application, self-regulation**

This creates a three-part instructional ecosystem in which AI supports the teacher and learner without eliminating either.

## 4. Conclusion:

AIED-supported self-learning presents an important opportunity for Nigerian education, particularly in a context where educational resources and instructional support are unevenly distributed.

Current evidence indicates that AI-based interventions can positively influence self-regulated and self-directed learning. A recent meta-analysis found significant positive effects on both constructs, although substantial variation between studies indicates that outcomes depend on intervention and contextual factors,

As a case of Nigeria, the implications extend beyond technology adoption. AIED requires reconsideration of curriculum design, instructional practice, teacher preparation, assessment, digital equity, and educational governance; Curriculum should increasingly emphasize competencies, learner autonomy, AI literacy, critical thinking, and lifelong learning. Instruction should move toward human–AI collaboration in which teachers function as facilitators, learning designers, mentors, and ethical guides, infrastructural inequality, data privacy, algorithmic bias, misinformation, and cognitive dependency must be addressed.

The central principle should therefore be: AI should strengthen the learner's capacity to learn independently, not replace the learner's responsibility to learn. For Nigerian education researchers, this creates a significant research agenda. Future studies should move beyond descriptive surveys and investigate AIED-supported self-learning through experimental, longitudinal, design-based, and implementation research. Particular attention should be given to Nigerian schools and universities, local languages, teacher education, curriculum integration, learner autonomy, and equitable access.

The ultimate goal should not be the digitalization of education for its own sake. Rather, but it should be to develop an educational system in which technology expands access while curriculum and instruction continue to develop independent, critical, ethical, and lifelong learners.

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