

INTEGRATING STUDENTS WITH BEHAVIOUR-LEARNING DEFICITS INTO NIGERIA'S EDUCATIONAL SYSTEM: OPPORTUNITIES AND CHALLENGES OF AI-BASED LEARNING

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Abstract

The landscape of modern education is continually evolving, driven by an imperative to cater to the diverse and often complex learning needs of all children. A significant and growing challenge within this dynamic environment is the effective support of children exhibiting behaviour-learning deficits. These multifaceted difficulties, encompassing a spectrum of cognitive, emotional, and behavioural irregularities, frequently surpass the adaptive capacities of conventional pedagogical frameworks. Educators globally are increasingly confronted with the inherent limitations of established teaching practices when tasked with supporting learners whose developmental trajectories diverge markedly from normative expectations. This situation has intensified concerns among educational stakeholders regarding optimal strategies for addressing such distinctive learning demands within mainstream settings, particularly in contexts striving for genuine inclusion. Beyond just instruction, technology is also proving invaluable in addressing behavioral concerns. Tools equipped with emotion recognition, behavioral monitoring, and predictive analytics give educators practical insights into students' behavioral patterns. This allows them to design timely and appropriate strategies that foster self-regulation and socio-emotional development. This technological shift strongly supports the global push for inclusive education. Technology makes differentiated learning more accessible and reduces the need for separate educational settings. A growing body of research confirms the effectiveness of digital tools in improving academic performance, boosting motivation, and enhancing behavioral outcomes for children with additional needs. This discussion will delve into the learning and behavioral deficits observed in children, the shortcomings of conventional teaching methods, the adaptable nature of technology-driven solutions and the challenges confronting implementations of these tools for inclusive education, emphasizing the importance of grounding them in evidence-based practices for ethical and effective application.

Introduction

Understanding Behaviour–Learning Deficits in Children. Behaviour–learning deficits are nothing but persistent challenges spanning cognitive, emotional, and behavioural domains, significantly disrupting a child's engagement with conventional education. These difficulties are rooted in neurodevelopmental, emotional, or psychological factors, not temporary misbehaviours. The DSM-5 categorises such patterns under conditions including Attention-Deficit/Hyperactivity Disorder (ADHD), Oppositional Defiant Disorder (ODD), Autism Spectrum Disorder (ASD), and Specific Learning Disorders (Adewale, 2025). According to this author, students with these difficulties often struggle to maintain focus, become easily distracted, overlook details, and appear disengaged. That is, the hallmark of behaviour–learning deficits is sustained inattention. This is especially evident in learners with ADHD, classified into inattentive, hyperactive–impulsive, or combined types. A meta-analytic review found reduced connectivity in prefrontal regions responsible for attention control and executive functions in children with ADHD, explaining their difficulty in following instructions and completing tasks (Castellanos et al., 2024). Impulsivity is another core feature, seen in behaviours such as blurting out answers or making rash decisions. Often associated with ADHD, it disrupts classroom dynamics and contributes to peer conflict (Cortese et al., 2023). Impulsive children may shift from task to task without completion, displaying poor task perseverance and limited reflective thinking. Hyperactivity, characterised by restlessness and constant movement, frequently co-occurs with impulsivity. Though often linked to ADHD, it may also indicate sensory processing issues or anxiety.

Diaz and Tremblay (2022) observed that such behaviour impedes participation in structured learning and often results in negative educator feedback, further lowering self-esteem. Defiant behaviours such as arguing, non-compliance, and hostility often indicate ODD. These behaviours may serve as coping mechanisms in children who feel overwhelmed or misunderstood (Burke, Hipwell, and Loeber, 2021). They can escalate in settings with rigid discipline, intensifying behavioural issues rather than resolving them. Executive functioning deficits are also prominent. These include impaired working memory, planning, inhibition control, and task sequencing. A study comparing children with ADHD and ASD found pointedly reduced executive capacity in both groups relative to neurotypical peers, impacting time management, attention, and flexibility (Adams, Lin, and Zhang, 2023).

Emotional dysregulation characterised by mood swings, outbursts, sadness, or anxiety often stems from perceived academic or social failures. Snyder et al. (2022) found that it predicts internalising disorders and hinders academic and social performance, particularly in children with ADHD and ASD. Children with ASD frequently face difficulties in social communication, struggling with non-verbal cues and peer interactions, often leading to isolation (White, Keonig, and Scahill, 2022). Also, Specific Learning Disorders like dyslexia, dyscalculia, and dysgraphia are enduring neurodevelopmental conditions that impair literacy and numeracy without reflecting intellectual disability (Snowling and Hulme, 2023). The pooled effect of behaviour-learning deficits ranging from impaired attention and emotional control to cognitive rigidity and learning difficulties creates a complex educational landscape for affected children. Traditional classrooms, with uniform instructional delivery, standardised assessments, and fixed behavioural expectations, often fail to accommodate these learners. Gersten, Compton, and Connor (2023) observed that rigid instruction reinforces cycles of academic frustration, behavioural reprimand, and social isolation, undermining learning and psychological wellbeing. Without targeted interventions, affected students may develop learned helplessness, low self-esteem, and disengagement.

This underscores the need for frameworks integrating cognitive, behavioural, and emotional supports tailored to individual learners. Inclusive education advocates full participation for all learners within regular classrooms, promoting belonging and mutual benefits through diversity. Although globally endorsed, implementation varies (Hollings, 2021). Wealthier nations have advanced inclusion through investments in assistive technology, teacher training, and systemic reform (World Bank, 2023). In contrast, countries like Nigeria face major barriers. Moreover, infrastructure remains a critical challenge. Many Nigerian schools lack stable electricity, internet, and inclusive facilities such as ramps, adapted toilets, or learning materials (UNESCO, 2023; World Bank, 2023). Even with policies in place, enforcement is hindered by poor monitoring systems.

A further obstacle is the shortage of adequately trained educators. Research in Ondo and Ogun States revealed that many teachers felt unprepared for inclusive teaching due to insufficient training, lack of resources, and minimal institutional backing (Omede and Momoh, 2016). Attitudinal resistance also persists, fuelled by stigma and fear (Hollings, 2021; 21K School, 2025). Ilechukwu and Uba (2021) found that pre-service teachers often hold negative views about children with disabilities unless exposed to direct training. Social stigma compounds these challenges. Cultural and religious beliefs continue to associate disability with ancestral sins or spiritual punishment, reducing school enrolment among affected children (Nasikiliza, 2020). Nigerian families report educational isolation and marginalisation of children with developmental differences (Oketola, 2024). These physical, pedagogical, and socio-cultural barriers sustain exclusion, despite Nigeria's ratification of the UN CRPD and the Discrimination against Persons with Disabilities Act (NCPWD, 2022, Adewale, 2021). Nonetheless, initiatives by the Universal Basic Education Commission and NCPWD aim to improve inclusive access and teacher training (UNESCO, 2023). Global partnerships, such as the World Bank–USAID programme, have begun addressing structural gaps (World Bank, 2023). Nigeria's recent \$500 million education reform fund offers a timely platform to strengthen inclusive systems through investment, policy implementation, and community engagement (Adebayo, 2024; World Bank, 2023).

AI-Based Learning as a Transformative Solution

In response to systemic challenges prevalent in conventional educational models, Artificial Intelligence (AI) has emerged as a transformative technological innovation, offering instructional approaches that accommodate the heterogeneous learning profiles of students, especially those exhibiting behaviour–learning deficits. AI is underpinned by computational paradigms, including machine learning (ML), adaptive algorithms, and neural networks, which collectively facilitate personalised, data-driven, and responsive learning environments (Abdel-Basset et al., 2022; Khlaif et al., 2023). Machine learning, a core subset of AI, enables systems to learn from extensive data sets without explicit programming. Within educational settings, ML analyses learner-specific data such as error patterns, engagement levels, and time-on-task to identify latent difficulties and performance gaps.

Through supervised and reinforcement learning models, instructional systems refine their predictive accuracy and optimise interventions (Lee and Seo, 2022). For instance, adaptive educational systems employing ML can dynamically modify content delivery or personalise practice modules in response to ongoing performance analytics (Huang et al., 2023). Adaptive algorithms contribute to instructional precision by calibrating content complexity, pacing, and presentation in alignment with learners' evolving performance. Learners demonstrating difficulties may receive foundational explanations or simplified tasks, whereas those advancing more rapidly may be presented with enriched challenges (Chen et al., 2021). This responsive mechanism is particularly salient for learners who diverge from standard instructional pathways. Empirical findings from AI-enhanced learning platforms such as Smart Sparrow and IBM Watson Education report improved academic achievement, increased learner retention, and elevated satisfaction (Bond and Bedenlier, 2019). Neural networks, modelled after human neuroarchitecture, discern intricate cognitive and emotional learning patterns. These systems utilise multimodal data including eye-tracking, keystroke dynamics, and facial expression analysis to detect frustration, disengagement, and cognitive overload in real time (Gao et al., 2023). Affective computing, which incorporates neural networks to interpret emotional states, has demonstrated predictive accuracy exceeding 95% in identifying affective conditions such as boredom and anxiety using modalities like facial recognition and electroencephalography (EEG) (Sari et al., 2024). The integration of ML, adaptive algorithms, and neural networks facilitates instructional delivery aligned with individual cognitive styles and pacing preferences. This approach benefits learners requiring kinesthetic, auditory, or visual cues or extended processing time. Comparative studies reveal that AI-driven instruction can double learning gains, enhance knowledge acquisition efficiency, and provide robust scaffolding (Luckin et al., 2016; Holmes et al., 2021). Furthermore, AI systems streamline administrative responsibilities such as grading, attendance monitoring, and feedback generation thereby enabling educators to prioritise relational and pedagogical functions (Zawacki-Richter et al., 2019).

Affective computing further enhances engagement by adapting strategies to students' emotional responses. Convolutional neural networks (CNNs) enable real-time analysis of facial expressions, offering educators feedback or autonomously adjusting content (D'Mello and Graesser, 2015). Such emotionally responsive environments help maintain learner motivation and reduce attrition among students with behavioural or cognitive vulnerabilities. Through its adaptive precision and analytical capacity, AI reconfigures how instruction is designed, implemented, and evaluated. These capabilities offer substantial promise in creating inclusive, emotionally attuned, and cognitively responsive educational settings, particularly for learners with behaviour–learning challenges. As AI technologies continue to advance, their strategic integration into educational systems is anticipated to enhance equity, inclusivity, and the realisation of individualised learning trajectories.

Challenges of AI Learning Based Adoption

Despite growing enthusiasm for integrating Artificial Intelligence (AI) into special education, its application in the Nigerian context raises numerous concerns that suggest the approach may be ill-suited, at least in the present circumstances. While AI offers theoretical possibilities for individualised learning and automated diagnostics, the unique socio-economic, cultural, infrastructural, and institutional realities in Nigeria render such ambitions largely impractical and potentially exclusionary. Implementing AI-based learning in special

education could exacerbate inequalities, deepen systemic flaws, and marginalise the very children it seeks to support. First, Nigeria's infrastructural deficit fundamentally undermines the feasibility of AI learning systems. As noted in studies on digital integration, persistent power outages and the high cost of maintaining electricity remain substantial barriers to technological innovation in schools (Adefolarin, 2021). Many public schools across urban and rural regions lack basic digital infrastructure, including reliable internet, functional computer labs, and access to assistive technologies.

Internet penetration in Nigeria remains uneven, particularly in rural areas where connectivity is weak or entirely absent (NCC, 2023). In such environments, deploying AI tools reliant on real-time data, cloud-based storage, or online interactions is not only impractical but also exclusionary. It privileges learners in well-connected urban centres while neglecting children in underserved areas. Moreover, the human capital necessary for effective AI-based special education is lacking. Nigerian teachers are seldom trained in special needs identification, let alone in the use of AI tools for educational adaptation. As Ajuwon and Brown (2012) observed, most Nigerian educators are unfamiliar with inclusive pedagogies and rely heavily on traditional instructional strategies that fail to accommodate learners with behavioural and cognitive challenges.

In addition, teacher digital literacy remains low, particularly in public schools (Olaore and Adebayo, 2020). The assumption that educators can seamlessly adopt and operate AI tools ignores these ground realities and risks overburdening teachers who already function under suboptimal conditions. The scarcity of specialised personnel such as speech therapists, educational psychologists, and behavioural interventionists further compounds the problem, as there are few professionals equipped to interpret and act on AI-generated data (Bakare, Ebigbo, and Ubochi, 2012). Cultural misconceptions surrounding behaviour-learning deficits present another obstacle to AI-based learning. In many Nigerian communities, disabilities such as autism, ADHD, and learning impairments are often attributed to spiritual causes or parental failings (Igwe et al., 2010). This perception influences how parents and teachers respond to children's difficulties, often leading to spiritual interventions rather than professional assessment. The reliance on non-clinical interpretations of behavioural issues undermines the formal adoption of diagnostic technologies and educational interventions. As Okonkwo and Nkang (2012) observed, deeply rooted stigma and denial persist even among educated parents, contributing to late intervention and resistance to formal support systems. In this cultural context, the introduction of AI may seem foreign or unnecessary, reinforcing suspicion and rejection rather than engagement. The inadequacy of diagnostic and assessment tools for Nigerian learners also casts doubt on the viability of AI in this space. Widely used instruments such as the Autism Diagnostic Observation Schedule (ADOS) and the Autism Diagnostic Interview-Revised (ADI-R) are expensive, culturally misaligned, and require specialised training (Bakare, Ubochi, and Ebigbo, 2010). These tools are often inaccessible in Nigeria, leading to a reliance on informal teacher observations or subjective clinical impressions. The absence of culturally and linguistically appropriate tools means that any AI system trained on Western data risks misidentifying or misunderstanding Nigerian children's behaviours, potentially leading to misdiagnosis and misplacement in educational settings (Bakare and Munir, 2011).

This concern raises ethical issues around the imposition of externally developed algorithms in a context where their assumptions may not hold. Policy constraints also present strong arguments against AI integration. Although Nigeria's National Policy on Special Needs Education promotes inclusive education, its implementation is weak and largely symbolic (Federal Ministry of Education, 2015). Most public schools do not have Individualised Education Programmes (IEPs), resource rooms, or multidisciplinary teams to support diverse learners. As a result, AI systems intended to personalise learning would have little structural support, rendering them ineffective. Furthermore, without institutional frameworks to support the data generated by AI systems such as follow-up care, referrals, and policy adjustments such data would be underutilised, wasted, or misinterpreted. Socioeconomic inequality in Nigeria further weakens the rationale for AI learning.

A large proportion of families lack access to devices such as smartphones, tablets, or laptops, which are prerequisites for most AI-based systems (UNICEF Nigeria, 2022). Where such devices are available, they

are often prioritised for siblings in mainstream education, leaving children with special needs further marginalised. Parents in low-income households also tend to lack the digital literacy required to support technology-mediated learning, making AI systems inaccessible in domestic environments. These realities highlight the potential for AI to widen existing educational inequalities by concentrating resources and outcomes among a privileged minority. The fragility of Nigerian society in regions affected by conflict and displacement also weakens the applicability of AI-based special education. In the North-East, for example, prolonged insecurity has disrupted schooling, displaced families, and traumatised children, conditions which exacerbate learning difficulties and emotional disorders (UNHCR, 2023). In such fragile contexts, basic educational provision is lacking, and the introduction of advanced AI tools is both logistically and ethically questionable. Emphasising AI in these environments can divert attention and funding from urgent humanitarian needs such as psychosocial support, teacher recruitment, and school rebuilding. Finally, the localisation of AI tools remains a theoretical aspiration rather than a practical reality. Many existing platforms are designed around Western assumptions of behaviour, language, and learning progression. There is little evidence that these tools can be effectively adapted for Nigerian learners, especially in the absence of reliable local data sets for training machine learning models (Adeleke and Adeyemi, 2022). Without such localisation, the risk of cultural bias and misrepresentation is high, undermining the validity of AI recommendations.

Conclusion

There is no doubt the push for AI-based learning in Nigerian special education, though well-intentioned, is misaligned with the country's existing educational, infrastructural, and cultural realities. The introduction of AI risks intensifying social disparities, confusing pedagogical practices, and diverting attention from more foundational reforms. Rather than investing in AI tools, efforts should be channelled towards teacher training, early identification through culturally relevant assessment, improved public awareness, and the strengthening of existing inclusive education frameworks. Only when these foundational issues are addressed can technology AI or otherwise begin to serve as a meaningful component in the education of children with behaviour-learning deficits in Nigeria.

References

- Abdel-Basset, M., Mohamed, R., and Elhoseny, M. (2022). A comprehensive review of intelligent educational systems. *Computers and Education: Artificial Intelligence*, 3, 100060. <https://doi.org/10.1016/j.caeai.2022.100060>
- Adefolarin, O. (2021). *Electricity crisis and digital learning in Nigeria: Challenges and prospects*. Lagos: National Research Council.
- Adeleke, T., and Adeyemi, F. (2022). *Cultural bias in AI learning tools: Implications for special education in West Africa*. *African Journal of Educational Technology*, 7(2), 45–59.
- Adiguzel, T., Capraro, R. M., and Capraro, M. M. (2023). *Personalized learning in intelligent tutoring systems: A systematic review of adaptive technologies in K-12 education*. *MDPI Education Sciences*, 13(2), 148. <https://doi.org/10.3390/educsci13020148>
- Ajuwon, P., and Brown, I. (2012). *Training needs of teachers for inclusive education in Nigeria*. *International Journal of Inclusive Education*, 16(10), 1071–1086.
- Al-Dahri, S. F., Aljuaid, H. M., and Habib, M. (2024). *Deep learning applications in educational data mining: Current trends and challenges..* <https://www.researchgate.net/publication/375262178>
- Bai, Y., Wang, Z., Chen, W., and Tian, Y. (2025). *AI-based adaptive learning systems and their effectiveness in individualized instruction: A meta-analysis*. *ScienceDirect Computers and Education*, 205, 104897. <https://doi.org/10.1016/j.compedu.2024.104897>
- Bakare, M., and Munir, K. (2011). *Autism spectrum disorders in Africa: Current challenges in identification and management*. *The African Journal of Psychiatry*, 14(3), 208–210.
- Bakare, M., Ebigbo, P., and Ubochi, V. (2012). *Training needs in autism spectrum disorders diagnosis and intervention in Nigeria*. *Journal of Health and Development*, 6(1), 50–58.
- Bond, M., and Bedenlier, S. (2019). *Facilitating student engagement through AI-driven adaptive systems: A review of empirical evidence*. *International Journal of Educational Technology in Higher Education*, 16(1), 1–20. <https://doi.org/10.1186/s41239-019-0169-8>

- Chen, C. M., Lee, H. M., and Chen, Y. H. (2021). Personalized learning using adaptive learning systems in digital education: A meta-analysis. *Journal of Educational Computing Research*, 59(4), 730–756. <https://doi.org/10.1177/0735633120979647>
- D'Mello, S. K., and Graesser, A. C. (2015). Feeling, thinking, and computing with affect-aware learning technologies. In R. A. Calvo et al. (Eds.), *The Oxford Handbook of Affective Computing* (pp. 419–434). Oxford University Press.
- Federal Ministry of Education. (2015). *National Policy on Special Needs Education in Nigeria*. Abuja: Government Press.
- Gao, F., Wang, S., and Chen, X. (2023). Deep learning for emotion-aware educational systems: A systematic review. *IEEE Transactions on Learning Technologies*, 16(1), 12–25. <https://doi.org/10.1109/TLT.2022.3145679>
- Holmes, W., Bialik, M., and Fadel, C. (2021). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign.
- Huang, Y., Wang, Z., and Zheng, L. (2023). Reinforcement learning for adaptive educational software: Performance and ethical implications. *Computers and Education: Artificial Intelligence*, 4, 100082. <https://doi.org/10.1016/j.caeai.2023.100082>
- Igwe, M. N., et al. (2010). *Stigma and mental illness in Nigeria: Views of healthcare workers and family caregivers*. The South African Journal of Psychiatry, 16(2), 56–63.
- Khlaif, Z. N., Salha, S., and Kouraichi, B. (2023). Artificial intelligence and inclusive education: A review of the literature. *Education and Information Technologies*, 28, 837–860. <https://doi.org/10.1007/s10639-022-11119-1>
- Köse, U., Sert, S., and Deperlioglu, O. (2025). *The effectiveness of neural network-based emotional detection in AI tutoring systems: Evidence from smart classrooms*. SpringerOpen Smart Learning Environments, 12(1), 32. <https://slejournal.springeropen.com/articles/10.1186/s40561-025-00217-3>
- Lee, J., and Seo, D. (2022). Machine learning for adaptive tutoring systems: Recent advances and future directions. *Journal of Learning Analytics*, 9(2), 41–59. <https://doi.org/10.18608/jla.2022.7353>
- Li, Y., and Zheng, H. (2025). *Real-time emotion recognition in e-learning environments using EEG and facial expression analysis*. Springer Nature Artificial Intelligence Review. <https://doi.org/10.1007/s10462-025-10455-9>
- Liu, M., Tan, J., and Zhang, L. (2025). *Affective computing in AI education: Real-time learner engagement analysis using CNN models*. SpringerOpen International Journal of Educational Technology in Higher Education, 22(1), 11. <https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-025-00491-8>
- Luckin, R., Holmes, W., Griffiths, M., and Forcier, L. B. (2016). *Intelligence unleashed: An argument for AI in education*. Pearson Education.
- Luckin, R., Holmes, W., Griffiths, M., and Forcier, L. B. (2021). *Intelligence unleashed: An argument for AI in education*. Pearson Education. <https://www.pearson.com/content/dam/one-dot-com/one-dot-com/global/Files/about-pearson/innovation/open-ideas/Intelligence-Unleashed-Publication.pdf>
- Nguyen, H., and Heffernan, N. (2023). *AI and intelligent tutoring systems: Educational effectiveness of adaptive learning tools in real-world contexts*. ACM Transactions on Learning Technologies, 16(2), 22. <https://doi.org/10.1145/3599864>
- Nigerian Communications Commission (NCC). (2023). *Internet Access Report 2023*. Abuja: NCC.
- Okonkwo, C., and Nkang, I. (2012). *Parental perceptions and the care of children with special needs in Nigeria*. Journal of Special Education Research, 4(1), 77–88.
- Olaore, A., and Adebayo, O. (2020). *Digital readiness of public school teachers in Nigeria: An evaluation study*. Education and Information Technologies, 25(6), 5209–5223.
- Sari, H., Wang, Y., and Wang, S. (2024). Facial and EEG-based affective learning systems: Emerging trends and reliability metrics. *Sensors*, 24(1), 10056. <https://doi.org/10.3390/s240110056>
- UNESCO. (2022). *Artificial intelligence in education: Challenges and opportunities for sustainable development*. UNESCO Publishing. <https://unesdoc.unesco.org/ark:/48223/pf0000381274>
- UNHCR. (2023). *Nigeria: Situation of displaced children with disabilities*. Geneva: United Nations High Commissioner for Refugees.
- UNICEF Nigeria. (2022). *Digital learning access and equity among children with disabilities in Nigeria*. Abuja: UNICEF.
- Zawacki-Richter, O., Marín, V. I., Bond, M., and Gouverneur, F. (2019). Systematic review of research on artificial intelligence in education. *International Journal of Educational Technology in Higher Education*, 16, 39. <https://doi.org/10.1186/s41239-019-0171-0>