

# Revolutionizing Nursing Education in Somalia: Recommendations for Integrating AI and Deep Learning in Outcome Based Assessments to Enhance Knowledge, Practice, and Graduate Competence

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**Abstract:** Artificial intelligence (AI) and deep learning hold significant potential to strengthen outcome-based assessment in Somali nursing education. Somalia's nursing education system faces critical challenges including inadequate standardization, uneven competency assessment, urban–rural disparities in access, limited faculty capacity, and weak governance. Outcome-based education offers a governance mechanism to define and measure graduate competencies, but its full benefit depends on robust assessment tools. This commentary examines how AI and deep learning can strengthen outcome-based assessment frameworks in Somali nursing schools, identifies the most impactful applications including adaptive learning platforms, AI-enhanced simulation, and automated formative assessment, maps these to Somalia's documented structural constraints, and proposes context-adapted recommendations for phased, faculty-supervised, and ethically governed implementation. The central argument is that AI and deep learning add the most value when introduced as low-bandwidth, contextually appropriate tools that directly address existing gaps in standardization, feedback, and equitable access rather than as stand-alone technologies.

**Keywords:** artificial intelligence, deep learning, nursing education, outcome-based assessment, Somalia, health professions education

## Introduction

Somalia's health professions education system has expanded rapidly, yet regulation, quality assurance, and equitable distribution have not kept pace. A 2024 study identified 112 health professions schools, 54% of them in Banadir, and described major urban–rural disparities in both training opportunities and workforce deployment.<sup>1</sup> The same study found that schools have often operated without consistent standards for training length or competencies, that credentials frequently function as proxy licenses because licensing examinations are lacking, and that students themselves want more practical training and stronger regulation.<sup>1</sup> For nursing education, these gaps matter because competency in medication safety, documentation, communication, infection prevention, triage, and bedside decision-making cannot be assumed from classroom attendance alone.<sup>1</sup> A recent review further highlighted that nursing and midwifery education in Somalia continues to face challenges related to inconsistent curricula, shortages of qualified faculty, weak accreditation systems, and limited clinical training opportunities, all of which affect workforce preparedness and quality of care.<sup>2</sup>

The wider Somali education environment reinforces these constraints. Somalia's 2022 Education Sector Analysis described the sector as affected by weak governance, limited access to high-quality social services, and low public investment, noting that public expenditure on education was only 5% of national expenditure in 2020, far below UNESCO's benchmark of 20%.<sup>3</sup> The report also emphasized inequities by geography, and infrastructure, all of which make it difficult to deliver consistent higher education quality across institutions and regions.<sup>3</sup> In practical terms, nursing schools must often teach growing numbers of learners with limited faculty development, constrained teaching materials, and variable clinical placement quality.<sup>2,3</sup>



Outcome based education (OBE) is therefore not merely a curricular preference in Somalia; it functions as a governance instrument. In a system where graduate competence may vary across schools, outcome based assessments provide a mechanism to define what every nursing student should be able to do and to measure those skills repeatedly through written, simulated, and workplace based tasks.<sup>1–5</sup> This approach aligns closely with the National Health Professionals Council (NHPC), which enforces quality assurance for health education through inspection and regulation.<sup>5</sup> This commentary examines how AI and deep learning can strengthen these assessment frameworks, maps key applications to Somalia’s documented constraints, and proposes context adapted recommendations for implementation.

## AI Applications in Outcome Based Nursing Assessment

The most immediate AI application in Somali nursing education is personalized and adaptive learning. A 2025 umbrella review of AI in nursing education and practice found that AI driven educational tools can support personalized learning, immediate feedback, and curriculum reform, while also helping identify barriers and facilitators to adoption.<sup>4</sup> For Somali nursing students, this could mean Mobile First platforms that adjust question difficulty, repeat weak topics such as dosage calculation or maternal emergency assessment, and build competency portfolios linked to defined program outcomes rather than one-off end of course examinations.<sup>5</sup>

A second application is AI enhanced simulation, including virtual patients, conversational cases, and scenario-based training. The same umbrella review found that AI tools such as large language models, virtual reality, and simulation systems are being used to strengthen critical thinking, decision-making, and clinical judgment in nursing education.<sup>4</sup> This is especially relevant in Somalia, where access to standardized clinical placements and training supplies is uneven; a rapid assessment of midwifery education reported that although all seven assessed schools met competency based standards, only three had the necessary training supplies and only two had available clinical practice guidelines.<sup>6</sup> In such settings, simulation cannot replace bedside learning, but it can narrow the gap between theory and practice when repeated exposure to real patients is limited.<sup>7</sup>

A third application is automated assessment support. International nursing reviews describe AI uses in immediate feedback, predictive analytics, virtual avatars, and learning dashboards that can help faculty see which students are falling behind and where they are struggling.<sup>4</sup> In Somalia, this could be used first for low stakes tasks such as automated marking of quizzes, structured feedback on care plans, triage scenarios, and digital OSCE checklists, with faculty retaining final authority over grading.<sup>4</sup> Deep learning would be most useful behind the scenes, recognizing patterns across repeated student performances, flagging weak clinical reasoning, and supporting early warning systems for at-risk learners.<sup>4</sup>

Table 1 maps these application domains to Somalia’s documented structural constraints and illustrates how each AI and deep learning response addresses a specific barrier.

**Table 1** Somali Educational Constraints and Corresponding AI/Deep Learning Outcome-Based Assessment Responses

Somali Constraint	Why It Matters for Nursing Assessment	Potential AI/DL Response
Training institutions are heavily concentrated in Banaadir, with marked urban–rural disparities. <sup>1</sup>	Students outside major centers may have less access to standardized teaching, supervision, and assessment. <sup>1</sup>	Low-bandwidth adaptive modules, remote case discussions, and shared digital assessment banks can extend standardized formative assessment beyond urban hubs. <sup>3,4</sup>
Schools have lacked consistent standards for competencies, accreditation, and licensing examinations. <sup>1</sup>	Completion of a course does not reliably prove clinical readiness. <sup>1</sup>	Competency dashboards, structured simulation scoring, and faculty-moderated digital portfolios can document achievement of explicit outcomes. <sup>4,5</sup>
Public education spending is low and governance capacity remains limited. <sup>2</sup>	Faculty time and institutional resources are stretched, making repeated high-quality feedback difficult. <sup>2</sup>	Automated quiz marking, templated feedback, and early-warning analytics can reduce repetitive workload while preserving human oversight. <sup>4</sup>
Internet access remains uneven, even as research-network infrastructure has improved. <sup>3</sup>	Fully online solutions risk widening inequities between well-connected and poorly connected programs. <sup>3</sup>	Offline-first systems, cached content, device-light platforms, and phased deployment through connected nursing schools can reduce exclusion. <sup>3</sup>

## Benefits of AI Integrated Outcome Based Assessment

If implemented carefully, AI supported outcome-based assessment could help solve several Somali problems at once. First, it can improve consistency across schools by linking assessment to shared competencies, which is important in a context where institutions have differed in training standards and graduate competencies.<sup>1</sup> Second, it can reduce faculty workload by automating parts of formative assessment, generating rapid feedback, and organizing learner data into dashboards that help educators focus their time on remediation and clinical coaching rather than repetitive marking alone.<sup>4</sup> Third, it can increase student engagement because adaptive systems and simulations make learning active, repetitive, and feedback rich rather than purely lecture based.<sup>4</sup>

The access argument is equally important. Somalia's health professions schools are concentrated in urban areas, while the health workforce and service needs are much more widely distributed, leaving rural and peripheral areas underserved.<sup>1</sup> The World Bank has noted that Somali students have long faced one of the world's lowest levels of internet penetration, which severely inhibits learning, yet it also documented that the Somali REN connected 19 institutions and delivered a 155 Mbit/s connection to seven universities, showing that targeted digital education infrastructure is possible when partnerships are built around higher education needs.<sup>3</sup> For nursing education, this suggests that AI should be deployed through a hybrid model: online where bandwidth allows, offline first or locally cached where connectivity is weak, and always paired with practical skills teaching.<sup>3</sup>

The competency benefits are substantial. Somalia continues to face major shortages of physicians, nurses, and midwives, with only 7073 professionals in those three categories identified in one national workforce analysis against a minimum WHO based need of roughly 29,900.<sup>1</sup>

In such a workforce constrained system, the country cannot afford graduates who have passed traditional examinations but remain underprepared for clinical duties. AI enabled OBA could support frequent checks of competence, earlier remediation, and better alignment with national accreditation and global competency expectations.<sup>1,4,5</sup>

## Challenges and Contextual Limitations

The case for AI in Somali nursing education is strong, but the limitations are equally real. Infrastructure is the most obvious barrier: the World Bank described low digital connectivity as a major inhibitor of learning in Somalia and saw expansion beyond Mogadishu as a continuing need.<sup>3</sup> If AI tools are designed for constant high speed internet, expensive devices, or cloud only computing, they will favor already better resourced institutions and deepen the divide between urban and rural learners.<sup>3</sup>

Faculty preparedness is another major constraint. The umbrella review found that AI integration in nursing education is limited by lack of standardized AI education, resistance to adoption, and the need for new competencies among educators themselves.<sup>4</sup> Somali regulation research similarly found insufficient team capacity, inadequate training, and minimal budgets for IT and staff development within the broader health education regulatory environment.<sup>1</sup> An institution that introduces AI without preparing nurse educators to interpret dashboards, validate outputs, and redesign assessments risks producing more confusion than improvement.<sup>4</sup>

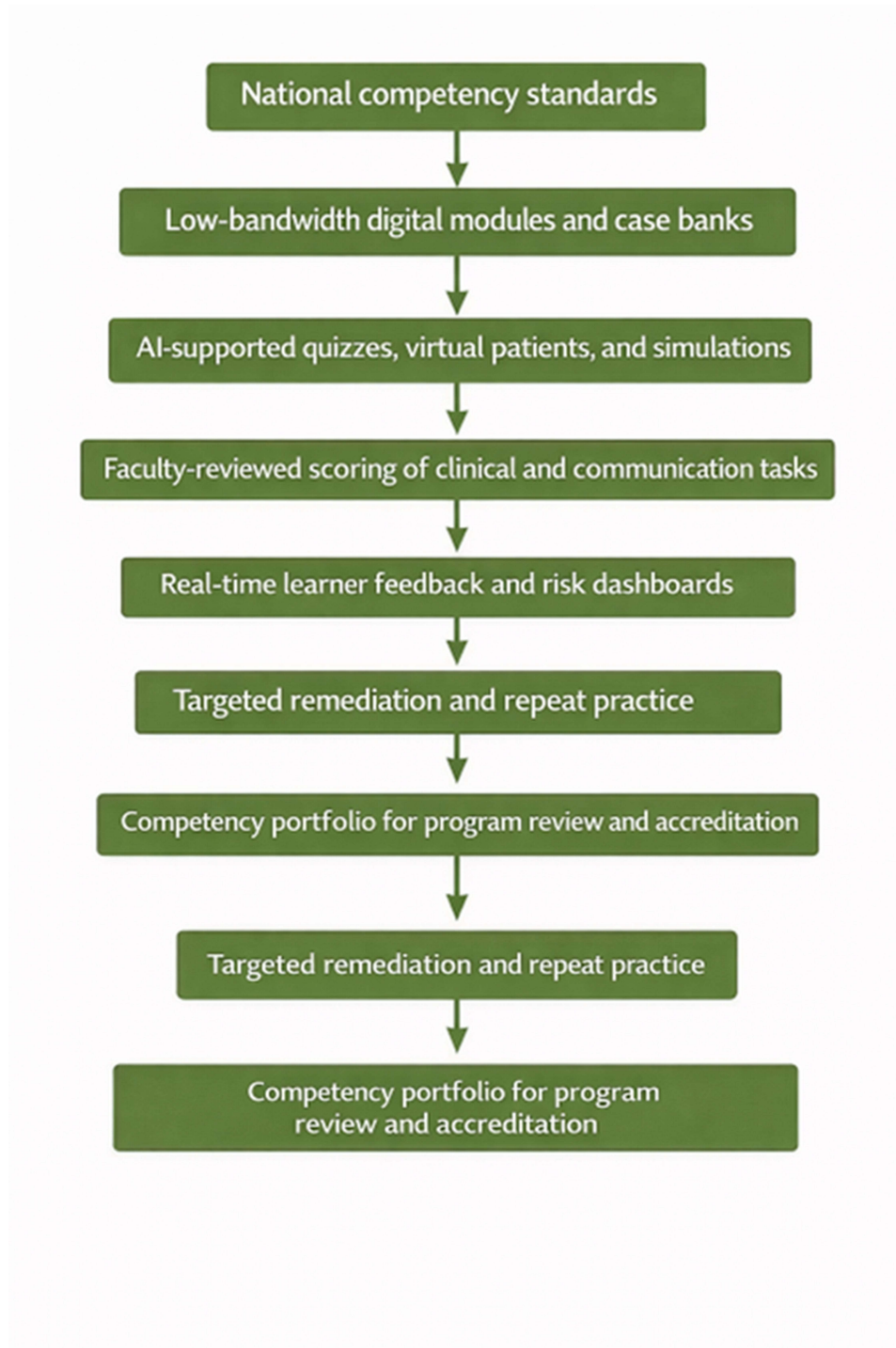
Ethics and governance must also be treated as core design issues, not afterthoughts. Reviews of AI in nursing consistently identify data privacy, algorithmic bias, transparency, accountability, and equitable access as central concerns.<sup>4</sup> These concerns are especially important in a fragile or unevenly regulated context because opaque systems may reproduce unfair grading, misclassify learners, or expose sensitive student data without adequate safeguards.<sup>1,4</sup> There is also a pedagogic risk: if AI is used carelessly, students may become better at responding to systems than at communicating with real patients, and nursing education could lose some of its human, relational core.<sup>4</sup>

A final challenge is cultural and linguistic fit. International nursing education reviews note language barriers and limited realism in AI tools designed for other settings.<sup>4</sup> Somali nursing programs need platforms that work in both Somali and English, use locally relevant case scenarios, reflect the country's referral patterns and disease burden, and avoid importing clinical assumptions from high-income settings that do not match Somali practice environments.<sup>1,4</sup>

## Recommendations

Somalia should begin with tightly scoped pilot programs rather than a national rollout. A sensible first step would be to test AI supported OBA in a small number of nursing schools in Mogadishu and at least one regional institution, focusing

on a limited set of outcomes such as medication safety, communication, maternal–newborn emergencies, infection prevention, and documentation.<sup>1,3,5</sup> These pilots should be formative before they become high stakes, so that faculty can compare AI generated feedback with human judgment and adjust the system before using it for progression decisions.<sup>4</sup> The proposed pathway for implementing AI enabled outcome based assessment in Somali nursing education is illustrated in Figure 1.



**Figure 1** The proposed pathway for AI-enabled outcome-based assessment in Somali nursing education.

Faculty development should receive as much investment as software. Nurse educators need training not only in using platforms but also in outcome mapping, rubric design, simulation debriefing, data interpretation, and AI ethics.<sup>4</sup> At the policy level, the NHPC, ministries of health and education, and nursing schools should define minimum standards for data minimization, human oversight, audit trails, bias monitoring, and student appeals before AI supported assessment is embedded into accreditation or licensure pathways.<sup>1,5</sup>

## Conclusion

AI and deep learning can help transform nursing education in Somalia by making outcome-based assessment more continuous, more standardized, and more responsive to student needs, especially where faculty time, clinical placements, and quality assurance are constrained. Specific AI tools including adaptive competency tracking, automated formative feedback, simulation based clinical reasoning training, and early warning analytics for at-risk learners offer direct solutions to Somalia's documented assessment gaps. Their real value lies not in replacing educators, but in helping Somali institutions ensure that graduates demonstrate verifiable clinical competence aligned with national and international standards.

## Abbreviations

AI, artificial intelligence; DL, deep learning; OBA, outcome-based assessment; OBE, outcome-based education; NHPC, National Health Professionals Council; OSCE, Objective Structured Clinical Examination; WHO, World Health Organization; REN, Research and Education Network.

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## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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The authors declare no competing interests in this work.

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