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Analysing ICT Integration Tools in Tanzanian Early Childhood Education: Policy, Constraints, and Frameworks

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Abstract

The integration of Information and Communication Technology (ICT) into Early Childhood Education (ECE) has received increasing global attention; however, research on the suitability of standardised tools for evaluating ICT integration in Tanzanian ECE remains limited. This study aims to critically examine existing standardised evaluation tools and develop a contextualised framework appropriate for Tanzania's resource-constrained educational environment. A critical literature review design was employed, drawing on policy documents, national education statistics, teacher education curriculum documents, international frameworks, and scholarly literature addressing ECE quality, digital pedagogy, teacher competence, and ICT integration. The reviewed sources were analysed using thematic content analysis. The findings indicate that no single standardised instrument adequately captures the multidimensional nature of ICT integration in Tanzanian pre-primary education. Existing tools, including child-outcome instruments such as MELQO and IDELA; classroom-process tools such as Teach ECE, CLASS, and ECERS-3; teacher-competence frameworks such as UNESCO ICT-CFT and UNICEF digital competence frameworks; and system-readiness indicators each assess important but partial dimensions of ICT integration. The review further demonstrates that meaningful ICT integration depends on the

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interaction among infrastructure readiness, teacher digital capability, pedagogical mediation, and children's learning opportunities and outcomes. This study contributes to the literature by proposing a contextualised ecological-capability framework that integrates these dimensions within a unified analytical model. It concludes that evaluating ICT integration in Tanzanian ECE requires a layered, multidimensional, and context-sensitive approach rather than reliance on individual instruments. The proposed framework provides practical implications for policymakers, teacher educators, and researchers by offering a more comprehensive basis for assessing digital integration in resource-constrained pre-primary settings, while also highlighting the need for future empirical validation across diverse educational contexts in Tanzania.

Keywords: Digital Competence; Early Childhood Education; ICT Integration; Pre-Primary Education; Standardised Evaluation Tools

INTRODUCTION

The use of Information and Communication Technology (ICT) in Early Childhood Education (ECE) is a global issue that has raised many concerns about its implications for educational quality, equity, teacher development, and system change. Digitalisation in ECE has become more than just technological devices and is increasingly recognised by international organisations. When used purposefully and developmentally appropriately, digital technologies can be used to support communication, pedagogy, professional learning and service quality as argued by OECD (2023). Likewise, WHO (2019) recommends balancing digital use with play, movement, sleep and social interaction. UNESCO (2018) also shows that the competence of teachers, pedagogical judgement and institutional support are conditions necessary for meaningful integration of ICT. The views imply the ICT integration process is the learning process that is contextual, capacitive and mediated.

ICT integration in Tanzania has taken centre stage due to the shift towards competence-based learning and digital literacy in education. Digital transformation in education is emphasised in the Education and Training Policy (2014, 2023 Edition), National Digital Education Strategy 2024/25 – 2029/30, National Digital Education Guidelines for Schools and Teacher Colleges, and the ICT Competency Standards for Teachers (MoEST, 2023; MoEST, 2025a, 2025b, 2025c, 2025d). Implementing, however,

takes place in a setting that is defined by infrastructural inequities, teacher shortage and unequal digital readiness. The scale of the subsector and the challenge of quality in a range of settings is illustrated from national statistics showing that there were 1,656,726 pre-primary learners, 21,696 pre-primary teachers and 20,988 pre-primary classes in 2025 (PO-RALG-BEST, 2025).

This study posits that assessing the integration of ICTs in Tanzania's pre-primary education goes beyond access to devices or infrastructure. The interaction between infrastructure readiness, teacher digital competence, pedagogical mediation, and children's learning opportunities is what leads to the effective integration of ICT. This means that there is not one evaluation tool that can reflect all aspects of ICT integration. It is therefore crucial to have an understanding of what each tool measures and what it doesn't capture, to develop meaningful evidence to inform policy and practice.

The existing literature has focused more and more on digital pedagogies and teacher mediation than on the availability of technology. Guided interaction and pedagogically meaningful use of technology are key, as highlighted in Mantilla and Edwards (2019), Li et al. (2024) and Plowman and Stephen (2007). Timotheou et al. (2023) also show that the contextual factors, leadership and teacher capability are pivotal in digital transformation. Research has been conducted on ICT skills, teachers' ICT readiness, education inequalities and policy implementation in Tanzania (Kihoza et al., 2016; Lubuva et al., 2022; Tandika & Ndijuye, 2020; Kambona, 2024; Kambona & Ndibalema, 2025). There is, however, a gap in the literature between the limited research investigating the appropriateness of commonly used instruments for assessing the integration of ICT in pre-primary education and the conceptual and methodological evolution.

The novelty of this study is the critical analysis of various widely used standardised tools for the assessment of the integration of ICTs in ECE and the development of a contextualised framework applicable to Tanzania. It is based on an ecological-capability approach to ICT integration that treats it as a result of the interplay between infrastructure, teacher competence, pedagogy and children's development outcomes.

In this study, the relevance and suitability of the use of the standardised tools used to assess the integration of ICT in Tanzanian pre-primary education will be explored. Specifically, it examines the dimensions of the different tool categories and suggests a contextualised framework that can connect the infrastructure readiness, teacher digital

competencies, pedagogical mediation, and learning opportunities that children can access in Tanzania's resource-challenged educational context.

METHODS

This paper is a result of a critical literature review rather than a formal systematic review governed by a narrow protocol. The intention is not to evaluate studies but to give clarification of various concepts, examine the appropriateness of measurement tools, and provide interpretation of those tools against Tanzania's policy and institutional realities.

There are three bodies of evidence brought together in this paper. The first is Tanzanian policy and planning documentation, including the ETP 2014, 2023 Edition; the ESDP 2025/26–2029/30; the National Digital Education Strategy 2024/25–2029/30; the National Digital Education Guidelines for Schools and Teacher Colleges; the ICT Competency Standards for Teachers in Tanzania; Dira 2050; BEST 2025; and the 2023 Diploma in Early Childhood Teacher Education curriculum (MoEST, 2025a, 2025b, 2025c, 2025d; National Planning Commission, 2025; MoEST, (2023). The second body of evidence is focused literature on pre-primary quality, inequality, school readiness, teacher preparation, and ICT integration in Tanzania (Kambona, 2024; Kambona & Ndibalema, 2025; Kihoza et al., 2016; Lubuva et al., 2022; Mtahabwa & Rao, 2010; Ndijuye, 2023; Ndijuye & Rao, 2018; Ndijuye et al., 2020; Tandika & Ndijuye, 2020). The third is the international literal works on ICT and digital pedagogy in the Early Childhood Education and on standardised tools for child outcomes, classroom quality, teacher digital competence, and system monitoring (Alelaimat et al., 2020; Li et al., 2024; Mantilla & Edwards, 2019; OECD, 2023, 2025; Plowman & Stephen, 2007; Save the Children, n.d.; Timotheou et al., 2023; UNESCO, 2018; UNICEF, 2022, 2026; UNICEF Tanzania, 2019; World Bank, 2021; WHO, 2019).

The review is logical in two senses. First, it examines not only what a tool claims to measure, but also the views it informs about classrooms, teachers, infrastructure, and pedagogy. A psychometrically respectable tool may still be contextually weak if it assumes stable electricity, abundant devices, small class sizes, or well-supported teachers. Second, it differentiates between policy aspiration and classroom realities. Tanzania's policy frameworks are very ambitious and increasingly coherent, but they do not demonstrate classroom transformation. Accordingly, this paper reads policy texts in line with national

data and empirical studies rather than treating policy design as a proof of implementation. That difference is important to explain digital education, where policy visibility can easily develop an impression of rapid progress that is different from the realities of teacher training, infrastructure, or school-level support.

RESULTS

Tanzania's policy and system context

Tanzania's current policy and planning environment is good to consider ICT integration in education. Education and Training Policy (2014, 2023 Edition) encourage students to learn for competence, have digital literacy, and possess 21st century skills (MoEST, 2023). This direction is also supported by the National Digital Education Strategy 2024/25-2029/30 which places emphasis on the use of ICT for teaching and learning improvements, and considers digitalisation to be in the context of a wider educational improvement system and not solely a technology-driven initiative (MoEST, 2025b). In the same way, the National Digital Education Guidelines for Schools and Teacher Colleges emphasize infrastructure, digital content, assessment, inclusive education, teacher capacity building, ethics of digital technology, and education data systems (MoEST, 2025c). In addition, the ICT Competency Standards for Teachers in Tanzania also recognizes that there are implementation challenges which need to be addressed and the policy has not been implemented with a clear understanding of teacher digital capability (MoEST, 2025d).

These reforms are also part of Tanzania Development Vision 2050 that establishes digital transformation as a tool for human capital development, productivity, research and national competitiveness (National Planning Commission, 2025). This vision, however, needs to be considered in the context of the continued problems in access, quality, staffing, infrastructure and governance in the pre-primary subsector.

The Education Sector Development Plan (ESDP) 2025/26–2029/30 reveals the aspirations for reform and current limitations. It points to the gaps in access, inclusion, quality, programme management, and programme monitoring and evaluation systems and recognises that current systems fall short of being robust enough to measure the effectiveness of programmes (MoEST, 2025a). The plan aims to improve planning, accountability and monitoring systems, showing that good governance reforms are still on the agenda. It also outlines the targets of improving pupil/teacher ratios and significant

funding of pre-primary education, but these objectives will reflect persistent issues of overcrowding, a shortage of teachers, and lack of resources (MoEST, 2025a).

These realities are further exemplified by evidence collected from PO-RALG-BEST (2025). The report highlights that well-trained teachers, good infrastructure and sufficient teaching and learning resources are essential for quality education. It monitors various indicators including electricity access, classrooms, textbooks, ICT infrastructure, disability category, and vulnerable learners, and shows that infrastructure readiness is still a key policy concern (PO-RALG-BEST 2025). The report also mentions that the current policy implementation is under the old 1995 policy framework as well as the new 2023 policy framework, which indicates a policy transition in implementation, impacting policy expectations (PO-RALG-BEST, 2025).

The National Digital Education Guidelines reiterate infrastructure and support systems. They highlight power ready devices, offline and online access to digital content, assistive technologies, and the integration of ICTs into curriculum delivery, assessment and teacher resource centres (MoEST, 2025c). The provisions are just a few examples of digital integration that goes beyond devices to accessibility, pedagogy, content and data systems.

Tanzania's commitment to digital competence is further evidenced by teacher preparation policies. ICT is regarded as a fundamental competency in the 2023 Diploma Curriculum for Early Childhood Teacher Education, and it is related to communication, collaboration, critical thinking and problem-solving skills (MoEST, 2023). Furthermore, the curriculum emphasizes competency-based assessment through portfolios, project work, practical activities, and observation, suggesting that teacher digital competence must not only be tied to national education goals but also reflect the practices of national education. (MoEST, 2023)

In general, Tanzania has a strong policy environment, with three key features: the key policies are clearly expressed and have a multi-faceted digital agenda; there are ongoing challenges to policy implementation, including infrastructure, human resources, and support systems; and there are continuing reforms taking place in the pre-primary subsector. Tanzania is an important context for exploring ICT integration and the appropriateness of assessment tools in these circumstances.

Reframing ICT Integration in ECE.

Recent literature indicates that debates on the integration of ICT in ECE have moved from the use of devices to the use of pedagogical mediation. The idea that students would automatically benefit from the use of the computer or tablet or access to the internet has long been offered as a controversial premise. Mantilla and Edwards (2019), in their systematic review, claim that pedagogy, relationships and meaningful interactions are the foundations of healthy digital practices. Likewise, Li et al. (2024) notes that digital pedagogy should be considered as the relationships between teachers and children and technology, not technology. Plowman and Stephen (2007) agree with this, by way of the notion of guided interaction, which identifies the importance of adults for setting boundaries on children's digital experiences.

The viewpoints place teachers at the center of digital learning as a mediator. Technology cannot achieve meaningful language learning outcomes: outcomes are the byproduct of how teachers use digital resources to promote language development, collaboration, creativity, inquiry, and play. Thus, the use of ICTs must be seen as a pedagogical process and no longer as a technological intervention.

In low-resource settings, this is a critical argument. Timotheou et al. (2023) show that the educational effect of digital technologies is not just about the hardware; rather, it is about leadership, staff capacity and context. Digital tools can create entirely different learning experiences, depending on how they are utilized. A tablet can be used for rich discussion and collaborative learning, or passive viewing, in one classroom and also in another. Hence, the mere provision of technology cannot be used to assume educational value.

Developmental appropriateness also is emphasized in the literature. The National Association for the Education of Young Children and Fred Rogers Centre (2012) state that interactive media and technology should be considered as tools to be used purposefully and carefully by adults. Similarly, WHO (2019) considers digital technology as part of a wider picture and reminds us to 'balance time spent on screens with time spent moving, playing, sleeping, and engaging in social interaction'.

Combined, these studies indicate that the positive impact of using ICTs in ECE is not a straightforward one. The focus is on the developmental appropriateness, interactivity, social nature, and inclusion of technology in a more comprehensive learning context.

Therefore, the evaluation instruments for the integration of ICTs into ECE need to evaluate more than just access to ICTs and how often they are used, but also the quality of mediation, the appropriateness of the use and the education context which the ICTs are embedded in.

What standardised tools measure and what they miss

At this point, a measurement problem becomes visible. The tools identified in discussions of ICT in ECE do not all measure the same hypothesis. They can be organised into four broad families. The first family aspect deals with measuring children's learning and development. The second focuses on assessing classroom processes or environment quality. The third aspect is based on teacher digital competence. The fourth addresses institutional or system readiness. Looking at these tools as if they were similar brings confusion because a strong result in one domain may coexist with weakness in another. A school may have prepared well-trained teachers, but few infrastructures; a classroom may have strong interactions but not tools; a child-outcome measure may indicate improvement without showing whether technology played a crucial role. This mismatch is not a fault of the individual tools, but it is a feature of the problem itself. ICT integration is not a single-dimensional phenomenon, and evaluation must, therefore, resist one-dimensional solutions.

Table 1. Summary of major tool families relevant to ICT evaluation in Tanzanian early childhood education.

Tool family	Examples	Primary construct	Main strength	Main limitation in Tanzania
Child outcomes	MELQO; IDELA	School readiness and development	Keeps focus on children's learning and transition to primary school	Does not directly explain how digital tools are used or mediated
Classroom process	Teach ECE; CLASS; ECERS-3	Teaching practice, interaction, and learning environment quality	Makes pedagogy and interaction visible	Requires contextual adaptation to avoid penalising low-resource classrooms
Teacher competence	ICT-CFT; EDC; Pathways; Tanzania ICT standards	Teacher digital capability	Clarifies what teachers should know and be able to do	May overstate classroom readiness even if infrastructure and support are weak
System readiness	BEST; ESMIS-linked indicators; digital guidelines	Infrastructure, governance, data, access	Shows enabling conditions and regional inequality	Cannot substitute for classroom or child-level evidence

Source: UNESCO (2018), UNICEF Tanzania (2019), Save the Children (n.d.), World Bank (2021), UNICEF (2022, 2026), MoEST (2025d), and PO-RALG (2025).

Child development and school-readiness tools

Child-development and school-readiness tools are suitable at the starting point because they give attention based on their importance in ECE: children's learning opportunities and developmental outcomes. MELQO is specifically relevant to Tanzania. UNICEF Tanzania (2019) informed that Tanzania was the first country to introduce a national MELQO study, and explained MELQO as a worldwide initiative focusing on feasible, accurate, and useful measurement of children's development and learning at the beginning of primary school and of the quality of pre-primary learning contexts. This is crucial because it indicates that early learning measurement can be nationalised and made policy-relevant in a low- and middle-income country. The Tanzania MELQO work also indicates that children begun Standard I were not yet consistently getting the quality of pre-primary school experience required for strong school readiness (UNICEF Tanzania, 2019). That finding is significant in the present discussion because it reveals that the problem limiting Tanzanian ECE is not the absence of technology per se, but uneven the quality more broadly.

Despite the strengths identified in MELQO, there is a challenge. MELQO is not an ICT integration tool in a narrow sense. It can inform researchers whether children's readiness and learning vary across groups or settings, and it can tell those outcomes to features of learning environments, but it does not directly indicate how teachers integrate digital resources, whether those resources are age-appropriate, or whether children's experiences are being moulded by meaningful pedagogical interventions. MELQO is, therefore, useful understood as an outcome and environment anchor. It is necessary, but not sufficient. IDELA executes a similar function. Save the Children defines it as a difficult and adaptable tool for measuring early learning and development in children roughly aged 3.5 to 6 years (Save the Children, 2019). Like MELQO, IDELA can support the identification of developmental patterns and compare groups, but it does not independently resolve the issue of classroom digital practice. These tools are the strongest when paired with classroom and teacher measures rather than taken as stand-alone indicators of ICT quality.

Classroom quality and process tools

The second major family of tools put more attention on the classroom process and environmental quality. Here, Teach ECE, CLASS, and ECERS-3 are among the tools which are especially relevant. Teach ECE is perhaps the most attractive and relevant for Tanzania because it was developed by the World Bank (2021), it frees classroom observation tool for children aged 3-6 in diverse and often low-resource contexts. It focuses on observable teaching practices rather than expensive structural inputs, aligns well with Tanzania's need for scalable process-quality monitoring. In the context of a competence-based curriculum, Teach ECE appears to be useful because it focuses on what teachers actually do. However, it is not ICT-specific. Its value for digital integration depends on the adaptation. Without descriptors that assess whether digital tools or devices are teacher-guided, language-rich, inclusive, brief, and integrated with non-digital activities, Teach ECE may under-measure the real mediation process that matters most.

CLASS brings a varying emphasis. Teachstone's official account presents CLASS as an observation framework based on the quality of educator-child interactions (Pianta et al, 2008). This is practically important because digital technologies should improve rather than weaken the interaction. In principle, a classroom where technology is well used should indicate stronger instructional discourse, emotional support, attention management, and feedback rather than a decrease in relational quality. CLASS, therefore, provides a suitable ground for evaluating whether digital tools are working as pedagogical supports or as relational substitutes. Its main challenges in Tanzania lie less in the theory than in the implementation. Consistent use of CLASS often requires extensive training, adjustment, and resources. It is, thus, more suitable for focused research or demonstration work than for routine large-scale monitoring unless adapted and adequately resourced.

ECERS-3 adds still another aspect. It is a broad process-quality tool covering environment, routines, activities, and interactions for children aged 3-5 (Harms et al 2014). Its scope is attractive because ICT is often inserted into an existing classroom ecology. A digital resource has varying implications in a classroom that is crowded, poorly ventilated, materially scarce, or weakly organised than in one that already supports investigative play, communication, and inclusion. ECERS-3 can, therefore, give a broad understanding of classroom environments into which technology is introduced. Yet it also demonstrates the risk of contextual measurement error. If a tool assumes a density of materials, space,

furniture, or routines common in high-resource contexts, then low scores in rural Tanzanian classroom settings may show structural scarcity as much as pedagogical weakness. This does not imply that such tools are unusable. It means their hypothesis's validity in Tanzania depends on the adaptation, cautious interpretation, and the triangulation with other data.

Teacher digital competence frameworks

The third family of tools addresses teacher digital competence. For Tanzania, these frameworks are possibly the most significant because they address the conversion problem directly between access and educational use. UNESCO's ICT Competency Framework for Teachers (ICT-CFT) was developed specifically for pre-service and in-service teachers and consist digital competence in areas like pedagogy, curriculum, assessment, administration, and professional learning (UNESCO, 2018). Its significance is based on treating technology not as a different technical skill but as part and parcel of the broad work of teaching UNICEF's Educators' Digital Competence Framework and clearly state digital competence as a source of quality and inclusive education (UNICEF, 2022). UNICEF's more recent Pathways framework is relevant because it is explicitly developed for sub-Saharan African countries and with more emphasis on areas with low-resource, offline, low-connectivity, and infrastructure-constrained contexts (UNICEF, 2026). In the context of Tanzania, pathways are especially attractive to areas marked with uneven power supply, variable internet access, and resource disparities because it does not assume that effective digital pedagogy begins from stable high-tech conditions.

Tanzania's own ICT Competency Standards for Teachers extend this teacher-centred discussion in a nationwide grounded agenda. The standards state that while Tanzania has introduced a policy framework for ICT in education, its execution is still constrained, and teachers need clearer, nationally aligned expectations for digital capability (MoEST, 2025d). For research conducted in ECE, this matters because it gives a clear picture of understanding digital competence. A national framework can be linked to teacher training curricula, inspection systems, continuous professional development, and local policy language more easily than an imported framework alone. The improved Curriculum for Diploma in Early Childhood Teacher Education supports this interpretation by explicitly treating ICT as an important competence package expected of

teachers and through continuous assessment methods such as project work and portfolios that can accommodate digital and inquiry-based professional learning (MoEST, 2023).

Despite the observed prospects, teacher-competence frameworks have their limitations. They are usually the strongest at explaining what teachers should understand and be able to do, but weaker at showing what happens in the classroom under difficult conditions. A teacher may know digital pedagogy theoretically, and still work in a school under a constrained environment with no electricity, internet, maintenance support, and overcrowded classrooms. Various international studies on pre-service teacher preparation support this argument. Alelaimat et al. (2020) found that pre-service teachers can value technology integration while still having the feeling of unpreparedness to implement it. Also, Kulaksız and Toran (2022) revealed that skills for ICT integration to teachers develop through daily practice and are supported by good preparation rather than through declarative knowledge alone. Similarly, Papavlasopoulou et al. (2024) recommended that the preparation for using digital technology with children remains uneven across programmes and institutions. These findings are extremely appropriate to Tanzania context because they give caution against reading framework alignment as if it were equivalent to classroom capability.

System readiness and governance tools

The fourth family of tool focuses on system readiness and governance. This aspect is often ignored because it does not look like an "ICT tool," but it is crucial in the context of uneven infrastructure. OECD's efforts on digitalisation in ECEC and TALIS Starting Strong (2024) both consider digital technologies as part of a broader workforce, leadership, and institutional support environment rather than stand-alone innovations (OECD, 2023, 2025). Tanzania's ESDP and BEST do the similar role at the system level. The ESDP deals with monitoring, evaluation, and learning framework based on key performance indicators, data-quality assessment, and the Education Sector Management Information System (ESMIS), which produces BEST as the national statistical abstract (MoEST, 2025a). In the other context, BEST monitors electricity, hardware, disability, classrooms, textbooks, and teacher ratios (PO-RALG-BEST, 2025). This implies that Tanzania already possesses part of the infrastructure for a system-readiness layer. What remains underdeveloped is the deliberate integration of these readiness indicators with classroom observation and teacher-capability tools in ECE.

Tanzania-specific evidence on ECE quality, inequality, and ICT readiness

In the context of Tanzania, there is specific empirical literature that offers a necessary corrective to overly technical views of digital reform. The study conducted by Mtahabwa and Rao (2010) is significant because it examined pre-primary classrooms' realities in urban and rural Tanzania. The findings revealed that there are strong differences in space, group size, teacher-pupil ratios, resources, and teacher qualification in most of the preprimary schools. Their study is significant because it concluded that the professional qualification of the teacher influenced interaction quality more strongly than context and resources alone. This does not mean material conditions are irrelevant; it implies that teacher competencies and contextual conditions interact with each other in a complex way. In the aspect of digital integration, the lesson is clear: technology introduced into environments with low resources will be mediated not only by infrastructure but by the professional capability of the teachers, and both need to be measured.

Ndijuye et al. (2020) deepened the Tanzania literature in complementary ways. Their study found that various stakeholders view ECE in Tanzania as insufficiently developed and emphasised the need for stronger quality, teacher support, and stakeholder involvement. Also, Ndijuye and Rao (2018) examined policy through the lens of newly naturalised refugee children, stating that policy frameworks usually lacked the specificity and implementation planning which are very useful to meet actual educational needs. Furthermore, Ndijuye (2023) asserted that school readiness for some of the children with refugee backgrounds is mediated by the socioeconomic status of their families, showing that educational learning outcomes are linked to social context as much as to school provision. Thus, these studies recommend that digital integration in ECE enters a field already structured by inequality, uneven capacity, and gaps between policy expectations and operational detail.

Recent literature on inequality supports that conclusion. Systematic review conducted by Kambona and Ndibalema (2025) indicates shortage of qualified teachers, uneven provision, limited resources, and other disparities as major factors leading to inequalities in the provision of ECE in Tanzania. Kambona's (2024) review on early-grade teacher colleges, while not focused only on pre-primary education, is highly relevant because it indicates that tutors understand ICT integration as limited by scarce professional development, limited technological resources, weak technical support, unreliable internet,

and other practical challenges. Similarly, Lubuva et al. (2022) revealed uneven ICT pedagogical competence among tutors in the field of teacher education, and Kihoza et al. (2016) showed that classroom ICT integration in Tanzania is conditioned by the interplay between technology, pedagogy, and context. Tandika and Ndijuye (2020), one of the few studies which directly focus on the pre-primary teachers, prove that readiness to integrate ICT in teaching and learning is still limited. Bringing together all these studies proposes that Tanzanian evidence is stronger on teacher readiness and structural constraints than on thorough observing digital mediation in pre-primary classrooms themselves.

DISCUSSION

The review shows that the simplicity of technology availability is not enough to understand how ICTs are integrated in ECE. A comparison of standardised tools shows that there are various dimensions captured by the tools, such as aspects of system readiness, teacher competence, pedagogical quality and child developmental outcomes. This finding suggests an important insight that ICT integration is not a simple measureable construct, but rather a multi-dimensional phenomenon. The educational value of technology is also demonstrated in the review as the readiness of the infrastructure conditions the teacher's digital competence, which then influences the pedagogical mediation, which in turn influences the learning opportunities and developmental outcomes for children. The findings directly answer the study objective, which was on the relevance and suitability of the use of the standardised tools in evaluating the level of ICT integration in pre-primary education in Tanzania.

The results also indicate that conclusions about a teacher's use of ICTs based upon access measures could be incomplete and misleading. A school could have digital devices but not have reliable electrical power, Internet access, technical support or trained teachers. Likewise, teachers could have some basic ICT competencies and have no opportunity to apply these competencies to the effective use of ICTs in teaching. Thus, the review emphasizes the need to consider the process of the integration of ICT as a transformation process of ICT resources into learning opportunities. The policy aspirations and the pervasive inequalities in infrastructure, teacher deployment and educational resources are especially significant in Tanzania.

The results are robustly in favour of the sociocultural theory of learning, in which learning is mediated by tools, language, and social interaction. The review shows that technology is not a teaching agent but is valuable for educational purposes when teachers lead, interpret and incorporate it into learning experiences. This is in line with the research of Li et al. (2024), Mantilla and Edwards (2019) and Plowman and Stephen (2007), which all highlight the role of teacher mediation as the keystone in connecting digital tools and children's learning outcomes. The results thus reinforce the argument that the quality of the use of ICT is the most crucial factor, rather than the availability of ICT, for effective integration.

The review also falls under Bronfenbrenner's ecological systems theory. The results suggest that there are complex systems that affect the integration of ICT, such as in the classroom, the school, teacher education institutions, the community, and the country policy environment. This corroborates other findings indicating that the digital transformation of education is not only a matter of technology, but also depends on institutional and contextual influences. The ecological nature of ICT integration in Tanzania is further confirmed by the importance of the contexts that should be taken into account, including rurality, poverty, language environment, school leadership and disability. The results are in line with the findings of Mtahabwa and Rao (2010), Ndijuye (2023), and Kambona and Ndibalema (2025), who reported significant disparities in educational provision between settings.

The results add to Sen's Capability Approach. The review shows that the acquisition of digital resources does not ensure that they result in significant educational gains. Instead, the outcomes are a result of the capacity of individuals and institutions to turn available resources into effective education. This discovery comes on the heels of other research that separates access to technology from actual digital participation and educational value.

Research implications

The study is theoretically significant because it proposes a contextualised ecological-capability framework that combines the three theories into one analytical model to support the understanding of ICT integration in ECE. The framework offers a more holistic understanding of the interdependencies of infrastructure, teacher competence,

pedagogical mediation, and outcomes of technology use in resource-limited contexts compared to current frameworks that focus on one or a few dimensions of technology use.

In practical terms, the results imply that policymakers would do well not to make ICT integration the sole technology procurement activity. Rather, infrastructure, teacher development, pedagogical support, inclusive education and monitoring systems should all be tackled at the same time. The results also suggest that the tools currently available, such as MELQO, IDELA, Teach ECE, CLASS, ECERS-3, UNESCO ICT-CFT and UNICEF frameworks, should not be considered interchangeable, but complementary, since they all focus on one aspect of ICT integration. The teacher training is a key point for practice. The results indicate that enhancing teacher digital competency can be more beneficial than simply providing more devices, especially in environments with poor infrastructure and connectivity.

Limitations and directions for future research

The study has some limitations in that it is based on secondary information, policy documents, and not on empirical data from the classroom. Therefore, the proposed framework has not been piloted in various educational contexts in Tanzania. Furthermore, the review will be based on standardised tools and may not adequately reflect local practices in the integration of ICTs.

Additional studies are needed in the future to confirm the ecological-capability framework using empirical studies in a wide variety of educational settings. Classroom observations, teacher competency ratings, system readiness indicators, and child development assessments would be more comprehensive if used in a mixed-method design with the above. There is also a need to investigate the adaptation of ICT tools to multilingual learning environments, children with disabilities and remote and resource poor schools in future studies. This kind of research would help increase the contextual relevance and applicability of evaluation frameworks for ICTs in low-resource contexts such as Tanzania.

CONCLUSION

The focus of this study was to assess the applicability of the conventional tools for assessing ICT integration in Early Childhood Education (ECE) in the context of Tanzania.

The major problem identified in the review was the lack of a coherent and context-sensitive framework that ties the various aspects of ICT integration. The results revealed that current tools measure various aspects of the phenomenon, such as children's learning and developmental outcomes, the quality of classroom processes, teacher digital competence, and system readiness. Each tool provides useful information, but none of them is able to capture the complex interaction between infrastructure, teacher capability, pedagogical practice and children's learning opportunities. The review also showed that meaningful integration of ICTs is more than access to technology; it requires conditions that help technology to be effective in education. Therefore, the integration of ICT in Tanzanian ECE should be seen as a multidimensional process that is influenced by contextual, pedagogical and institutional factors.

The study joins the rapidly expanding body of literature on the integration of ICT in ECE, and extends the discussion on the device-centred approaches to discussions of the importance of a multi-layered approach to the evaluation of ICT. Conceptually, the study contributes by developing an integrated analytical framework of a contextualised ecological-capability framework that incorporates system readiness, teacher digital capability, pedagogical mediation and child developmental outcomes. Methodologically, it shows the importance of considering standardised tools as complementary, and not interchangeable, for a more complete evaluation of ICT integration in the context of education, where resources are limited. The framework provides a structured set of categories for understanding the integration of ICTs in the changing educational landscape in Tanzania, in a practical way.

The proposed ecological-capability framework should be validated empirically in a variety of educational settings in Tanzania. Teachers' competence, system readiness and child development data, collected using mixed-methods (classroom observation, teacher competence evaluation, system readiness and child development data), would offer a more comprehensive view on the process of ICT integration. Additionally, more studies are required to explore the impact of the context of the school, including factors such as rurality, language diversity, disability, socioeconomic status, and school leadership, on the relationship between technology availability and educational outcomes. Also, comparative research could help to build an understanding of the impact of different implementation contexts on the performance of evaluation tools and lead to the development of more context-sensitive evaluations of the use of ICTs in ECE.

REFERENCES

Alelaimat, A. M., Ihmeideh, F. M., & Alkhawaldeh, M. F. (2020). Preparing preservice teachers for technology and digital media integration: Implications for early childhood teacher education programs. *International Journal of Early Childhood, 52*(3), 299–317. https://doi.org/10.1007/s13158-020-00276-2

Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Harvard University Press. https://doi.org/10.4159/9780674028845

Harms, T., Clifford, R. M., & Cryer, D. (2014). *Early childhood environment rating scale (ECERS-3)* (3rd ed.). Teachers College Press. https://www.tcpress.com/products/early-childhood-environment-rating-scale-ecers-3_9780807776131

Kambona, W. (2024). Tutors' perspectives on the integration of information and communication technology in early-grade teacher colleges in Tanzania. *Educational Technology Quarterly, 2024*(4), 434–455. https://doi.org/10.55056/etq.795

Kambona, W., & Ndibalema, P. (2025). Examining inequalities in provision of early childhood education in Tanzania: A systematic review. *Cogent Education, 12*(1), Article 2439161. https://doi.org/10.1080/2331186X.2024.2439161

Kihoza, P., Zlotnikova, I., Bada, J., & Kalegele, K. (2016). Classroom ICT integration in Tanzania: Opportunities and challenges from the perspectives of TPACK and SAMR models. *International Journal of Education and Development Using Information and Communication Technology, 12*(1), 107–128. https://eric.ed.gov/?id=EJ1099588

Kulaksız, T., & Toran, M. (2022). Development of pre-service early childhood teachers' technology integration skills through a praxeological approach. *International Journal of Educational Technology in Higher Education, 19*, Article 36. https://doi.org/10.1186/s41239-022-00344-8

Li, H., He, H., Luo, W., & Li, H. (2026). Early childhood digital pedagogy: A scoping review of its practices, profiles, and predictors. *Early Childhood Education Journal, 54*(1), 263–284. https://doi.org/10.1007/s10643-024-01804-8

Lubuva, E. E., Ndibalema, P., & Mbwambo, E. (2022). Assessment of tutors' level of ICT competencies in teaching in teacher education in Tanzania. *Journal of Learning for Development, 9*(3), 436–454. https://doi.org/10.56059/jl4d.v9i3.705

Mantilla, A., & Edwards, S. (2019). Digital technology use by and with young children: A systematic review for the Statement on Young Children and Digital Technologies. *Australasian Journal of Early Childhood, 44*(2), 182–195. https://doi.org/10.1177/1836939119832744

Ministry of Education, Science and Technology. (2023a). *Diploma curriculum for pre-primary teacher education*. Tanzania Institute of Education. https://moe.go.tz/sw/nyaraka/nyaraka-za-sera-ya-elimu-na-mafunzo-ya-mwaka-2014-toleo-la-2023-mitaala-iliyoboreshwa-na

Ministry of Education, Science and Technology. (2023b). *Education and training policy 2014, 2023 edition*. Government Printer. https://www.moe.go.tz/sw/nyaraka/education-and-training-policy-2014-2023-edition

Ministry of Education, Science and Technology. (2025a). *Education sector development plan 2025/26–2029/30*. Government Printer.

https://www.moe.go.tz/sw/nyaraka/education-sector-development-plan-202526-202930

Ministry of Education, Science and Technology. (2025b). *ICT competency standards for teachers in Tanzania*. Government Printer.

Ministry of Education, Science and Technology. (2025c). *National digital education guidelines for schools and teacher colleges*. Government Printer. https://moe.go.tz/sw/nyaraka/national-digital-education-guidelines-strategies-202425-202930

Ministry of Education, Science and Technology. (2025d). *National digital education strategy 2025–2030*. Government Printer. https://moe.go.tz/sw/nyaraka/national-digital-education-guidelines-strategies-202425-202930

Mtahabwa, L., & Rao, N. (2010). Pre-primary education in Tanzania: Observations from urban and rural classrooms. *International Journal of Educational Development, 30*(3), 227–235. https://doi.org/10.1016/j.ijedudev.2009.10.002

National Association for the Education of Young Children, & Fred Rogers Center for Early Learning and Children's Media at Saint Vincent College. (2012). *Technology and interactive media as tools in early childhood programs serving children from birth through age 8*. National Association for the Education of Young Children. https://www.naeyc.org/resources/topics/technology-and-media/resources

National Planning Commission. (2025). *Tanzania development vision 2050*. Government of the United Republic of Tanzania.

Ndijuye, L. G. (2023). School readiness and pre-primary learning experiences of children of refugee backgrounds in Tanzania: The mediating role of family socio-economic status. *European Early Childhood Education Research Journal, 31*(3), 454–469. https://doi.org/10.1080/1350293X.2022.2108098

Ndijuye, L. G., Mligo, I. R., & Machumu, M. A. M. (2020). Early childhood education in Tanzania: Views and beliefs of stakeholders on its status and development. *Global Education Review, 7*(3), 22–39. https://files.eric.ed.gov/fulltext/EJ1272578.pdf

Ndijuye, L. G., & Rao, N. (2018). Pre-primary education policy in Tanzania: Does it meet the educational needs of newly naturalised refugee children? *Global Education Review, 5*(4), 36–54. https://files.eric.ed.gov/fulltext/EJ1200227.pdf

OECD. (2023). *Empowering young children in the digital age*. OECD Publishing. https://doi.org/10.1787/50967622-en

OECD. (2025). *TALIS Starting Strong 2024 conceptual framework*. OECD Publishing. https://doi.org/10.1787/f49228be-en

Pianta, R. C., La Paro, K. M., & Hamre, B. K. (2008). *Classroom Assessment Scoring System (CLASS) manual, Pre-K*. Paul H. Brookes Publishing.

Plowman, L., & Stephen, C. (2007). Guided interaction in pre-school settings. *Journal of Computer Assisted Learning, 23*(1), 14–26. https://doi.org/10.1111/j.1365-2729.2007.00194.x

President's Office–Regional Administration and Local Government. (2025). *Basic education statistics in Tanzania (BEST) 2025*. Government Printer.

Save the Children. (2019). *The international development and early learning assessment (IDELA)*. https://resourcecentre.savethechildren.net/document/idela-the-international-development-and-early-learning-assessment

Sen, A. (1999). *Development as freedom*. Oxford University Press.

Tandika, P. B., & Ndijuye, L. G. (2020). Pre-primary teachers' preparedness in integrating information and communication technology in teaching and learning in Tanzania. *Information and Learning Sciences, 121*(1–2), 79–94. https://doi.org/10.1108/ILS-01-2019-0009

Timotheou, S., Miliou, O., Dimitriadis, Y., Villagrá Sobrino, S., Giannoutsou, N., Cachia, R., Martínez Monés, A., & Ioannou, A. (2023). Impacts of digital technologies on education and factors influencing schools' digital capacity and transformation: A literature review. *Education and Information Technologies, 28*(6), 6695–6726. https://doi.org/10.1007/s10639-022-11431-8

UNESCO. (2018). *UNESCO ICT competency framework for teachers* (Version 3). https://unesdoc.unesco.org/ark:/48223/pf0000265721

UNICEF. (2022). *Educators' digital competence framework*. https://www.unicef.org/eca/reports/educators-digital-competence-framework

UNICEF. (2026). *Pathways: Digital competency framework for educators in sub-Saharan Africa*. https://www.unicef.org/digitaleducation/reports/pathways-digital-competency-framework-educators-sub-saharan-africa

World Bank. (2021, March 18). *Teach ECE: Helping countries track and improve teaching quality in early childhood education*. https://www.worldbank.org/en/topic/teachers/brief/teach-ece-helping-countries-track-and-improve-teaching-quality-in-early-childhood-education

World Health Organization. (2019). *Guidelines on physical activity, sedentary behaviour and sleep for children under 5 years of age*. https://www.who.int/publications/i/item/9789241550536