

# Tutors' perspectives on the integration of information and communication technology in early-grade teacher colleges in Tanzania

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**Abstract.** This study aimed to explore college tutors' perspectives on the integration of Information and Communication Technology (ICT) in teaching pre-service early-grade teachers in teacher colleges in Tanzania. The study was guided by two research objectives: (1) to investigate the professional learning support tutors receive and (2) to examine the factors impeding the integration of ICT in teaching pre-service early childhood teachers in the classroom. The purposive sampling technique was employed in sampling the four teacher colleges and four principals, while the convenience sampling technique was used to sample the 41 tutors who participated in this study. A collective case study design was used to explore participants' perspectives on the deployment of ICT integration in their daily teaching. Data collected from the participants were thematically analysed. The study findings show that the majority of tutors had limited regular professional training opportunities on the integration of ICT in teaching. The study findings revealed several factors hindering tutors from integrating ICT in their teaching, including limited technological resources, lack of technical support, unreliable internet, absence of integration guides, insufficient digital security knowledge, lack of familiarity with learning management systems, low digital competence, and outdated technological devices. The study, therefore, concludes that inadequate integration of ICT among tutors exacerbates limited acquisition of the necessary digital literacy skills among early-grade pre-service teachers. In this regard, the study recommends that the government should engage tutors in regular training on the use of ICT in classroom practices. Furthermore, ICT tools and devices should be available in teacher colleges for tutors to utilise in their instructional practices for pre-service early childhood teachers.

**Keywords:** early-grade, early childhood education, e-learning, digital competence, pre-service teacher, digital literacy

## 1. Introduction

ICT in education has become increasingly prevalent worldwide, offering valuable tools and resources to enhance teaching and learning [1, 38]. This is particularly important in the training of pre-service teachers, who need to develop the necessary skills and knowledge to integrate ICT into their future classrooms effectively [17, 21, 63]. Many nations around the world have adopted technology as a tool to improve learning practices among pre-service teachers [33, 46]. Although many countries have taken considerable reforms by introducing ICT policies in education, questions persist regarding the extent to which these reforms have actually improved

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educational practices [26, 41, 45]. For example, despite the prevalence of ICT educational policies and strategies, many countries experienced the complete closure of teacher education colleges during the COVID-19 outbreak [43, 49]. In some cases, instructors were forced to switch to online distance teaching without adequate preparations and preparedness among students to adapt to new learning delivery [14]. This could be an indication that reforms are more evident on paper than in practice.

Although the incorporation of technology in teaching early-grade classrooms is of increasing interest to educators, the effective integration of ICT in early childhood learning remains uncommon in many countries [15]. Additionally, there is limited research evidence about the integration of ICT among tutors in classroom instruction to pre-service early-grade teachers. Given this context, the study aimed to explore tutors' perspectives on the incorporation of ICT into their daily instruction of pre-service early-grade teachers. In this study, ICT refers to technological tools and devices that enable educators to create, access, and communicate information through digital and electronic means in their instructional practices. These tools and devices include laptops, desktop computers, digital cameras, digital games and toys, media players, smartphones, digitised video, and televisions, among others [15]. Moreover, in this study, early-grade, which is interchangeably used with Early Childhood Education (ECE), refers to education provided to children under the age of eight.

### 1.1. Literature review

Recently, nations all over the world have been paying attention to the use of ICT in ECE [48]. Research shows that integrating ICT into ECE settings enhances children's self-esteem, motivation, curiosity, and critical thinking skills [54, 65]. Given the importance of ICT in ECE, teachers play a crucial role in ensuring it is integrated into the classroom. Yildiz Durak [66] suggests that the most crucial stage in which teachers learn how to incorporate ICT into their classroom teaching is during pre-service training. However, the literature indicates that beginning early-grade teachers rarely integrate ICT into teaching [1, 19]. This may be due to tutors' limited knowledge and skills in the full utilisation of digital solutions in their instruction, compounded by the lack of technological facilities in teacher education colleges [44].

It is imperative, therefore, for teacher colleges to equip pre-service ECE teachers with ICT skills by empowering tutors to integrate it into their teaching. Nevertheless, the use of ICT among tutors in their instructional practices is of paramount importance for pre-service early-grade teachers' ICT competencies. It is significant to note that tutors' utilisation of ICT in their instructional practices may determine the extent to which pre-service ECE teachers continue to use it in their future teaching practices [1, 27, 34]. However, studies show that ICT integration in teacher colleges remains challenging, leaving pre-service teachers unprepared to use it in their future teaching [29, 34].

For example, in Sweden, a number of initiatives have been done to improve early-grade teachers' competence in utilising ICT in teaching, such as extensive investment in ICT, devising comprehensive policies and supporting its implementation in teacher training programmes [18, 34]. However, evidence shows that, in spite of the efforts put in place, the teacher training colleges in Sweden do not adequately prepare pre-service teachers to incorporate ICT in their future teaching exercises [9, 34]. As a result, pre-service early-grade teachers fail to develop

adequate ICT competencies. Similarly, in Greece, despite several government initiatives to promote digital use across various educational levels, challenges persist, including Cisco's Webex video conferencing platform, 'e-me', and 'e-class' platforms, among others; findings indicate that most teachers do not incorporate them in their lesson [64]. It was noted by Tzavara et al. [64] that teachers had limited knowledge and skills on how to integrate them into teaching.

In developing countries, tutors in teacher colleges use technology insufficiently, hindering pre-service teachers from developing ICT competencies for future teaching. For example, in Pakistan, tutors were found unable to effectively integrate ICT into teaching, focusing instead on basic computer fundamentals rather than the pedagogical application of ICT [5]. Similar experiences have been noted in Sub-Saharan African countries where integration of ICT into classroom practices is challenging. Jimola and Oso [25] found that pre-service teachers in Nigeria were not adequately prepared to incorporate ICT into their teaching, highlighting the importance of teacher technology training. Similarly, in Ghana, despite tutors' positive attitudes toward ICT, they rarely integrated it into their daily classroom practices due to a lack of pedagogical skills [4]. Furthermore, in Uganda, Besigomwe, Opata and Kisilu [8] noted that tutors were scarcely integrating ICT into their instructional practices. Besigomwe, Opata and Kisilu [8] highlighted the significant gap in pre-service teachers' ICT competencies for classroom instruction. To address this issue, professional development in ICT is essential for tutors to impart the necessary knowledge and skills to their learners effectively.

In the context of Tanzania, teacher colleges play a crucial role in preparing early-grade teachers for the country's basic education system [57]. There have been some initiatives in Tanzania, such as the introduction of Teachers' ICT competence standards framework and digital learning strategy, which emphasise the integration of technology to embrace students' learning, assessment and content pedagogy and the use of problem-based teaching methods as well as digital [58, 62]. While ICTs have been introduced in the education systems of most African countries, including Tanzania, their widespread adoption remains slow due to ineffective ICT policies and a long-run supporting ICT infrastructure (e.g., electricity, internet, software, and hardware devices), teacher capacity, and financial resources [7, 50]. While some efforts have been made in Tanzania to integrate ICT into teacher education, there have been some concerns about the unsatisfactory adoption of digital technology in teaching and learning.

As indicated by Chirwa [11], Tanzanian teacher colleges are characterised by a dearth of ICT facilities and unreliable internet connectivity. The study further revealed that a mere 12.5% of respondents reported daily use of the internet for academic purposes, emphasising the pressing need for improvement in this area. Other recent studies indicate that the majority of pre-service teachers have lower satisfaction with ICT despite having some ICT infrastructure due to tutors' limited ICT integration, which also limits their ICT pedagogical competence [32, 55]. Although some subjects exhibit integration of ICT, the innovative application of technology, especially web-based video conferencing, is constrained by a lack of robust support and training for tutors [30, 32]. Collaborative engagement in teaching and learning through technology in teacher colleges is also constrained by limited internet connectivity in teachers' colleges [31]. Similarly, limited technological infrastructure and lack of digital skills among instructors has resulted in limited development of the 21<sup>st</sup> century skills among pre-service teachers who are expected to teach in the digital learning environment in the future [52].

It makes sense to note that inadequate early-grade pre-service teachers working in the digital

environment could affect their future prospects of meeting national expectations. Evidence indicates that even after they graduate from teachers' colleges, they keep on relying on traditional teaching methods [44]. As a result, there is minimal acquisition of the 21<sup>st</sup> century skills among children [56]. In fact, the readiness of pre-service teachers to integrate ICT into their teaching is impeded by a confluence of factors, including inadequate pre-service training, insufficient ICT infrastructure, limited digital skills, and a dearth of technological support in most primary schools in Tanzania [6, 33, 57].

Notwithstanding these challenges, the precise mechanisms by which tutors are expected to implement the framework and develop the digital skills of pre-service early-grade teachers remain unclear. Their perspectives towards the integration of ICT for learning among pre-service early-grade teachers are under-researched despite the fact that early-grade is an important stage for laying the foundations of learning in upper levels of education. The extant literature on tutors' competencies primarily focuses on pre-service teachers at the upper primary and secondary levels of education [30–32], with little attention paid to pre-service ECE teachers. Thus, this study explored tutors' perspectives on the integration of ICT among pre-service ECE teachers in Tanzania. The findings are expected to improve tutors' knowledge and skills on how to incorporate ICT in their instructional practices, hence improving pre-service early-grade teachers' ICT competencies. In this regard, the study was guided by two research questions.

## 1.2. Research questions

1. What professional learning support do tutors receive to develop their ICT integration skills?
2. What factors limit the integration of ICT by tutors in the classroom?

## 1.3. Theoretical framework

A Concern-Based Adoption Model (CBAM) was used as a theoretical framework to guide this study. The CBAM, which Hall and Hord [20] developed, focuses on how people, such as tutors and pre-service early-grade teachers, respond to change [28, 47]. The CBAM outlines seven stages of ICT adoption: awareness, information, personal concerns, management, consequence, collaboration, and refocusing [20, 47]. Awareness entails an understanding of the proposed innovation and its rationale, while information gathering involves acquiring knowledge about ICT and making preliminary assessments of its efficacy. Personal concerns focus on the individual impact of the innovation [28], and management involves the implementation of the innovation. On the other hand, consequence involves the development and refinement of usage patterns, while collaboration emphasises working in partnership with colleagues to enhance teaching and learning, and refocusing involves the pursuit of continuous improvement [47]. These levels are essential for tutors to adopt ICT in their instructional practices for the pre-service early-grade teachers.

The CBAM was relevant in guiding this study because it is used to describe tutors' perspectives on professional learning supports and barriers facing them in integrating ICT into their instructional practices among pre-service ECE teachers. For successful integration of ICT into classroom practices among pre-service teachers, tutors need to have adequate knowledge about

ICT and how to integrate it into their classroom instructions. Tutors' knowledge and skills about the usage of ICT in the classroom may be improved through ongoing professional support and the availability of updated ICT tools and devices. By improving tutors' ICT competencies, the CBAM can help them effectively transfer knowledge and skills to pre-service ECE teachers.

## **2. Methodological considerations**

### **2.1. Research approach and design**

A qualitative approach was used to explore tutors' perspectives on integrating ICT into ECE teacher education. This approach seeks to understand, describe and interpret human and social behaviour experienced by participants in a specific social context [3]. The approach was deemed to be important in this study as it helped to understand and describe tutors' professional learning support received and factors that impede their incorporation of ICT into their classroom instructions [39]. This approach was instrumental in eliciting participants' authentic experiences with ICT integration in their natural classroom settings [12]. Of the three types of case study design, namely, intrinsic, instrumental and multiple or collective case study [3], the study employed a collective case study. The collective case study design was employed in the attempt to explore multiple bounded systems (cases) over time through detailed, in-depth data collection [13]. This research design focuses on using multiple cases to examine and better understand a phenomenon [3]. In this study, cases were ECE teacher colleges and tutors. The design was appropriate to this study as it helped the researcher to obtain rich and detailed insights from tutors and principals on their perspectives on the usage of ICT among tutors to pre-service ECE teachers in some selected teacher colleges in Tanzania. In this regard, the use of multiple data sources (triangulation) such as tutors, principals and selected teacher colleges ensures the credibility of the findings [16]. In other words, data gathered from tutors were triangulated using data from principals. Additionally, data from one college were triangulated with data from other colleges that were sampled.

### **2.2. Participants, sample and sampling methods**

This study was conducted in four teacher colleges from four regions, including Lindi, Kilimanjaro, Singida, and Morogoro, on the mainland of Tanzania. The study participants were tutors and principals. A purposive sampling technique was used to sample teachers, colleges, and principals who participated in the study. Purposive sampling was employed to select participants based on the specific needs of this study [12]. This sampling technique is considered suitable for gaining maximum insights and understanding of the phenomenon under investigation [3]. In this regard, four colleges were selected based on the criteria that they were offering ECE programmes to pre-service teachers. Since the study aimed at exploring tutors' perspectives on the integration of ICT with pre-service early-grade teachers, it was necessary to sample colleges that offer ECE programmes. On their part, principals were sampled based on the criteria that their colleges were chosen to be involved in the study. In addition, principals were chosen because they exercise pedagogical leadership to ensure that tutors integrate ICT with pre-service early-grade teachers. Therefore, it was assumed that principals had rich and detailed information regarding

tutors' professional learning support and barriers hindering them in the deployment of ICT to pre-service teachers.

Nonetheless, a convenience sampling technique was employed to sample tutors who participated in the study. Convenience sampling focuses on selecting participants who are available and willing to participate in the study [12, 60]. The convenience sampling technique proved to be significant in this study as it helped the researcher obtain research insights from tutors who were readily available and willing to engage in the study actively. Tutors were selected as they were deemed to possess rich and detailed knowledge about professional support and barriers to ICT integration in classroom practices. Data saturation was achieved when data collection yielded no new insights or codes, indicating sufficient data for analysis [53]. Consequently, the study managed to obtain 41 tutors and four principals, making a total sample size of 45. Participants' demographic characteristics are summarised in table 1.

**Table 1**

Participants' demographic characteristics.

Category	Gender		Total	Academic qualification				Total
	Male	Female		Bachelor degree		Above		
				Male	Female	Male	Female	
Principals	4	–	4	–	–	4	–	4
Tutors	23	18	41	3	5	20	13	41
<b>Global total</b>	<b>27</b>	<b>18</b>	<b>45</b>	<b>3</b>	<b>5</b>	<b>24</b>	<b>13</b>	<b>45</b>

### 2.3. Data collection process

The data from tutors and principals was collected through interviews to explore the participants' views regarding tutors' integration of ICT in their instructional practices. Interviews were conducted in a bid to understand informants' lived experiences and the meaning they make of that experience [59]. Specifically, semi-structured interviews with open-ended questions were conducted with 41 tutors and four principals to gain insights into their perspectives on professional support and barriers to ICT integration in the classroom. Semi-structured interviews, a common qualitative research method, are grounded in a framework that is typically focused on the main research objectives while allowing for flexibility and exploration [51]. In this study, the researcher prepared interview guides for tutors and principals with questions that focused on exploring professional learning support and barriers to integrating ICT into the classroom among tutors in ECE teacher colleges.

The semi-structured interview was relevant to this study because it is a flexible method that allows the researcher to ask follow-up questions during the interview based on the participants' responses [51]. That is, in addition to the questions prepared in the interview guides, the researcher was able to ask other questions, which helped to gather rich and detailed data on professional support and barriers facing tutors in employing ICT for teaching pre-service early-grade teachers. Thus, the interview method of data collection was sufficient to obtain in-depth information about the study under investigation [51]. Face-to-face interviews were conducted

with tutors and principals to gather in-depth information. Private interviews were scheduled at the participants' convenience, lasting approximately 40-60 minutes each. Data was collected using both a field notebook and an audio recorder to ensure comprehensive documentation of participant responses. Therefore, an audio tape recorder was helpful in filling in the missing information that was not noted in the field notebook.

## **2.4. Ethical issues**

The researcher obtained ethical clearance from relevant authorities such as the University of Dodoma (UDOM) and the Ministry of Education, Science and Technology (MoEST) to conduct the study in the four selected teacher colleges. Before data collection commenced, participants were informed about the study's purpose and their role, emphasising their voluntary participation. Participants were assured of data confidentiality and anonymity. Pseudonyms (e.g., Tutor, Principal) were used to identify participants, while colleges were designated by letters (College A, B, C, and D).

## **2.5. Trustworthiness of the findings**

Several strategies were employed to enhance the rigour and credibility of the study. Firstly, data triangulation was utilised by gathering information from multiple sources, including tutors, principals, and four different colleges. Secondly, two researchers independently coded the data to ensure inter-rater reliability. Thirdly, the study provided a detailed description of the participants and research procedures to promote the transferability and dependability of the findings [3]. Fourthly, during the interview sessions, the researcher paid more attention to the participants rather than interrupting them. This made participants freely provide reliable data regarding the professional learning supports and factors affecting tutors to integrate ICT into their instructions. Lastly, reflexive journaling was used to ensure that the researcher's pre-conceived experiences regarding ICT integration in ECE teacher colleges do not influence the data collection process and the interpretation of the findings. In this stance, the researcher engaged in critical reflection throughout the study to avoid biasing the findings.

## **2.6. Data analysis**

Data collected from the tutors and principals were thematically analysed. Inductive analysis was employed in this stance. Specifically, the themes were developed from the two research questions, while sub-themes were derived from the data collected from participants. The data analysis process began with familiarisation, involving repeated reading and review of transcribed data from field notes and audio recordings. Initial codes were generated by labelling selected text segments. These codes were then critically analysed and categorised into potential themes, such as infrastructure, individual, and contextual challenges. The final stage involved reviewing and refining codes, calculating the frequency of responses within each theme, and producing the main findings. Throughout the coding process, a consistent coding scheme was applied to ensure reliability. For the purpose of ensuring quality data, two coders (researcher and data enumerator) were involved in the coding process, where the inter-coder reliability

was calculated using Cohen's kappa reliability coefficient formula. The results demonstrated a strong level of agreement, with a value of 0.78.

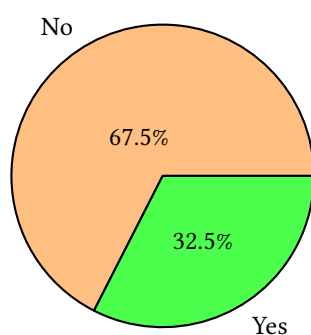
### 3. Results

This section presents the findings of the study conducted in four teacher colleges in Tanzania mainland regarding tutors' perspectives on using ICT in their classroom teaching. The results are presented in two subsections, aligned with the study's objectives: investigating professional learning opportunities received by tutors on ICT usage and exploring the obstacles they face in integrating technology into their instruction.

#### 3.1. Tutors' professional learning support on integration of ICT in the classroom

This objective aimed to investigate the professional learning support received by tutors on the utilisation of ICT in the classroom among pre-service ECE teachers. The findings indicated that tutors had varied experiences regarding access to professional learning opportunities related to ICT. When asked about the regularity of such opportunities, their responses diverged. Their responses indicated that most of them did not have an opportunity (67.5%), while few of them (32.5%) agreed to have had regular opportunities to attend (figure 1). This implies that few tutors attended professional training on how to utilise ICT in the classroom, while the majority did not. Tutors underscored the significance of regular ICT training in enhancing their skills and capacity to prepare pre-service teachers for the demands of digital classrooms. On this matter, one of the tutors was quoted saying:

We need regular training that will make us more competent than a one-time event. We also need adequate time and support to understand our problems and identify possible solutions to teaching in the digital learning environment. (Tutor, college C)



**Figure 1:** Status on ICT-based professional development among tutors.

However, tutors expressed concern about the limited mentorship opportunities available to support their active participation and reflection on their teaching practices. As one tutor noted:

Through training, we get an avenue to reflect on our teaching. Technology-enhanced teaching needs more practice and support, but this has not been happening in our college. If we really need to transform our teaching, deliberate efforts should be made to ensure that there are systems in place to support regular professional growth on the use of technological solutions for teaching. (Tutor, college A)

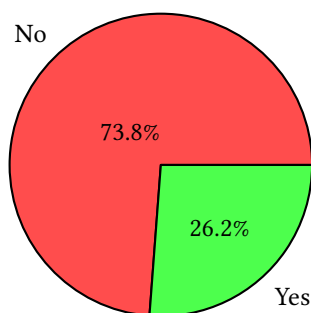
Another tutor remarked that:

Regular professional development programmes on the use of ICT for teaching would help us increase knowledge on how to access and adopt technological solutions in teaching and also make our profession easier and enjoyable. So far, I am aware of the software that can help me design and develop digital content for my students. This is because I attended one training, but my fellow tutors are not aware of this because they were not part of the training. (Tutor, college D)

The preceding quotes suggest that tutors may feel excluded from training opportunities, potentially leading to a sense of disconnection from new technological solutions designed to enhance pre-service teacher education. In this situation, some tutors may be reluctant to adopt and implement the use of ICT tools in their teaching, as they may not fully understand the purpose or potential benefits.

However, the findings suggest that tutors require additional training in digital lesson preparation, as a significant number expressed a lack of such skills. When they were asked if they had sufficient technical skills in digital lesson preparations, most of them disagreed (73.8%), with only a few of them (26.2%) agreeing (figure 2). Participants further explained that their ability to develop digital lessons was hindered by a lack of adequate professional training opportunities related to ICT pedagogy. In relation to this, one of the tutors noted:

I have been teaching in this college for 17 years, but I only attended a seven-day training session on using ICT to enhance teaching during those seventeen years. You can imagine now, how do I become competent within seven days? Although the government has installed some IC facilities at our college, we still need comprehensive training on how to integrate these technologies into our teaching. (Tutor, college A)



**Figure 2:** Tutors' preparation of digital lessons.

Another tutor from another college also noted:

I attended at least three workshops in the last two years, but none of them focused on the use of ICT in teaching and learning. (Tutor, college B)

The participants pointed out further that they needed to be exposed to regular training about the use of technology for teaching so as to be effective in promoting the same to the pre-service teachers they were teaching. In connection to the foregoing argument, during the interviews with the principals, one of them narrated:

I am sure our tutors are interested in integrating ICT into their teaching, but the problem is when this tutor faces technical challenges, and no one is available to help. Some are likely to give up, but if there is someone to respond to their technical queries, the integration will be possible. (Principal, college C)

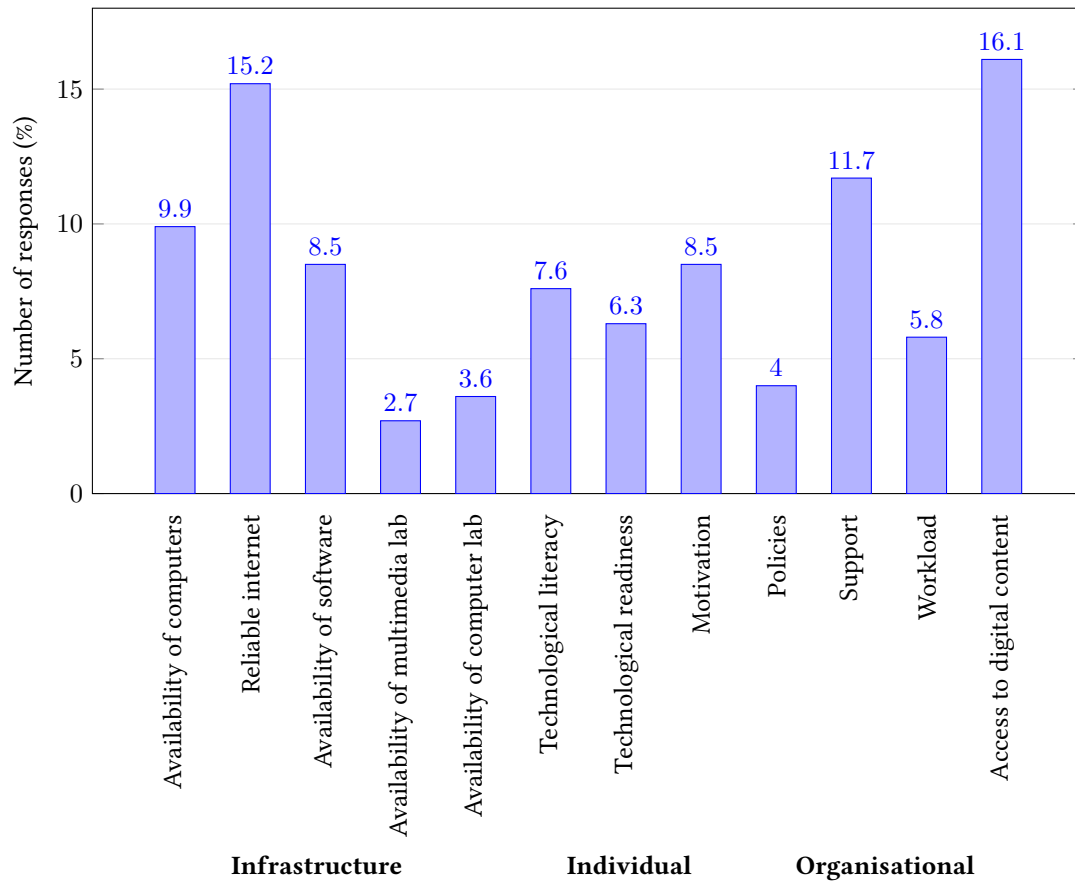
The findings show that tutors' limited technical skills hinder their ability to create a digital learning environment for their learners. Participants' responses emphasise the need to prioritise the development of digital skills among tutors responsible for preparing early-grade teachers.

### **3.2. Barriers that limit the integration of ICT in teaching among tutors**

This objective was aimed at exploring barriers that impede tutors from integrating technology into their classroom instructions. Data collected from tutors and principals revealed several factors that hinder tutors from utilising ICT in their classroom practices. Their responses are summarised in figure 3.

Data in figure 3 indicate that participants had a diverse view regarding the barriers facing tutors in integrating ICT in the classroom. The findings revealed that access to digital content was a significant barrier to ICT integration in teaching (16.1%). The participants reported that they had no opportunity to access content through virtual platforms. It was also established that limited access to digital resources was exacerbated by infrastructural challenges, which included limited access to reliable internet (15.2%). The visited colleges reported inadequate infrastructure, including computer labs, projectors, and reliable internet access, limiting tutors' ability to develop digital solutions to support their teaching. It was noted further that, sometimes, some tutors were exposed to training on ICT pedagogical practices, however, their continuity was compromised by inadequate ICT infrastructure such as computers, projectors and digitalised contents. To ensure the sustainability of ICT-based training for tutors, it is crucial to provide them with access to necessary resources, including computer hardware and software, to practice and apply their acquired skills. Pertaining to this, one of the tutors illustrated:

I had an opportunity to attend the ICT-based training organised by the Ministry of Education out of this campus. The training was wonderful, as we were exposed to the most recent software for developing multimedia content and running e-learning courses. Unfortunately, what we learned lacks continuity as we don't have a multimedia lab to support the development of what we learned. (Tutor, college C)



**Figure 3:** Participants' responses on factors that hindered tutors from integrating ICT into the classroom instructions.

Findings, however, indicate that some tutors lacked adequate technological literacy skills (7.6%), which are essential for teaching in the 21<sup>st</sup> century. Tutors also reported that training on ICT usage often lacked critical follow-up support from organisers, hindering the sustainability of their learning and limiting the development of their digital literacy skills. The comment made by one of the tutors supports this:

I attended the training on using ICT for pedagogical development for two weeks in the past three years, but no follow-up has been made since that workshop. Conducting the training without evaluating its impact may be a waste of resources. I would suggest that future workshop organisers establish a mechanism to observe whether their training package related to the use of ICT has any impact or not. (Tutor, college D)

Participants expressed concerns about the sustainability of ICT training programs. They pointed out that previous training initiatives often lacked follow-up mechanisms, limiting the practical application of newly acquired skills. In connection with this, participants pointed

out the need for a specialised help desk that would respond to the participants' inquiries after training and provide the required support to the trainees.

It was further evident that although some colleges had some computer facilities and infrastructure, their safety was questionable. Participants reported that some colleges had old and unsecured buildings in which, even if tutors were to be provided with personal computers, such gadgets would not be safe. Therefore, colleges must be supported in creating an environment conducive to the use of ICT equipment in teaching and learning. In connection to this, one of the tutors was quoted saying:

I agree that we have the computer lab, but the computers in houses are outdated. They have been here for many years. For example, some software, especially for multimedia design, cannot be installed on these old versions of computers. Again, we don't have licensed computer security software, which makes our computers more vulnerable to viruses and scams. (Tutor, college A)

Likewise, principals who participated in this study reported that due to outdated facilities and equipment in their colleges, some tutors lacked adequate motivation to be involved in integrating technology into their teaching. Regarding this, one of the principals stated:

Some tutors have attended training on using multimedia software, but the training they have received is not compatible with our computer versions. These tutors would wish to apply the skills they learned, but it is very difficult for them to do so. As a college, we are struggling to ensure that we acquire new devices that are compatible with the software tutors are being trained for. (Principal, college D)

Principals noted that some tutors were reluctant to integrate technology into their teaching practices because their courses did not explicitly mandate its use. They emphasised the urgent need for curriculum reform to ensure that all courses incorporate and reflect current technological advancements. The principals advocated for revising the curriculum to integrate ICT-based components across all subjects rather than limiting them to ICT-specific courses. On the same note, one of the principals urged that there was a need to enforce competency-based learning (CBL) in all subjects through technology. When probed on the same, one of the principals remarked:

Competence-based learning through technology is inevitable and should be the mission of every tutor regardless of the subject of specialisation if we want to move to an industrial economy. We also need support from the Ministry of Education to achieve this. The internet must be reliable, and computer labs and other facilities must be strengthened. (Principal, college B)

Tutors also pointed out that collaborative learning through the Moodle Learning Management System (LMS) at colleges had not been possible due to a lack of reliable internet and the lack of skills to develop e-learning content. It was noted with concern that the colleges fully owned the LMS, making it their responsibility to ensure that all tutors actively participated in the platform to support pre-service teachers' learning. However, achieving this goal has proven challenging

due to various obstacles. Additionally, the absence of system administrators to provide essential support in managing the LMS further compounded these difficulties. Reacting to this, one of the tutors was quoted saying:

In this digital era, we need to be competent in managing the LMS, especially in handling students' information and supporting learning. We wish to engage our students in online assessment, but this is not possible at our college. I agree that we have the Moodle LMS, but very few of us use it for online assessment. For those few who sometimes use Moodle LMS for teaching, do it at their own discretion, but not because we have specific guidelines on it. (Tutor, college A)

Despite the availability of the LMS in colleges, principals observed that some tutors appeared to lack awareness of its existence or functionality. Making a connection to this, one principle is illustrated:

We wish that all tutors were aware of using Moodle LMS to support their teaching, but this has not been possible at my college as some tutors lack interest and awareness in this area. Some think that using Moodle LMS for teaching is only for tutors in the ICT department. However, we are struggling to ensure that every tutor is supported to become conversant with using Moodle LMS for teaching. (Principal, college B)

Based on the findings highlighted above, it is evident that tutors lack adequate technological skills to engage pre-service early-grade teachers in a digital learning context effectively. This conclusion is supported by the fact that most interviewed tutors seldom mentioned how they integrated technology into their teaching practices. Additionally, principals confirmed that a digital culture had not been fully embraced in their colleges. Some principals noted that even the available LMS were not widely utilised by tutors.

The study established that technological readiness among tutors was among the barriers facing them in employing technology in the classroom for early-grade teachers. Participants expressed the view that, despite the availability of technological tools and the training provided, some tutors were still unwilling or reluctant to utilise ICT in their teaching practices. This was confirmed when the principal from college D expressed the following:

In my college, I have a number of tutors who don't like to use projectors while teaching. You may find a class with a projector, but tutors often teach traditionally. When you ask why they don't use projectors, they respond that they feel comfortable using tradition over ICT. (Principal, college D)

The aforementioned quotation illustrates that tutors' readiness to apply ICT in their instructional practices for pre-service ECE teachers is minimal despite the available technological devices. This indicates that tutors' preparedness to use ICT in teaching is insufficient, highlighting the need for regular training on integrating technology into teaching practices. Such training would help enhance their readiness and confidence to incorporate ICT into their daily classroom instruction effectively.

## 4. Discussion

### 4.1. Tutors' professional learning support on integration of ICT in the classroom

The findings indicated that ICT integration in teaching and learning can be well achieved if tutors are adequately capacitated to develop digital learning solutions. The findings reveal that tutors lacked adequate digital skills, largely due to insufficient professional training and support on effectively using technologies in teaching. This is contrary to the Teachers Continuous Professional Development (TCPD) framework, which emphasises the need for tutors to utilise technological opportunities to improve teaching and learning processes and practices in teacher colleges [61]. It should be noted that limited professional development opportunities for educators are a common challenge in many developing and low-income countries, including Tanzania. These opportunities are often sporadic, unsustainable, and frequently lack a strong foundation in current research [5, 22, 25, 34].

It is possible that tutors' ability to improve their teaching skills and stay up-to-date with the best technological teaching practices is compromised by inadequate professional training opportunities. In the absence of adequate professional training opportunities, tutors may struggle to effectively deliver the curriculum, employ engaging instructional methods, and support pre-service ECE teachers' learning. Consequently, this can negatively impact the learning outcomes of early-grade learners. Literature indicates that several factors hinder the development of tutors' digital competence, including institutional culture, accessibility and availability of resources, governance and leadership challenges, insufficient technical and pedagogical support, and heavy workloads [9, 34, 35]. This leads the study to propose that teacher colleges should be equipped with adequate technological devices in conjunction with regular training opportunities for tutors to integrate technology effectively in the classroom.

### 4.2. Barriers that limit the integration of ICT in teaching among tutors

The study findings revealed various obstacles facing tutors in utilising ICT in their instructional practices. These include a lack of accessible digital content due to unstable and poor internet facilities, which was the prominent barrier to ICT utilisation among tutors. As the participants of this study reported, it was also noted by Kulaksız and Toran [29] and Masoumi and Noroozi [35] in their studies that tutors did not effectively integrate ICT in their instructions due to a shortage of ICT infrastructure. Although there are some indicators of the increased use of technology in some teacher colleges in Tanzania [55], the adoption of digital tools and platforms in teacher education colleges has not been fully accompanied by robust digital safety measures. The prevalence of outdated computers, which often result in slow systems, can lead to increased stress and frustration, negatively impacting users' mental well-being.

Additionally, the lack of digital safety procedures at colleges exposes pre-service teachers to various risks, including cyberbullying, data breaches, and online privacy violations. While Tanzania's digital education strategy emphasises the importance of establishing safe and reliable ICT infrastructure, these issues remain critical challenges [62] as none of the colleges involved in this study reported to have the digital safety guideline. This suggests that pre-service teachers are prone to safety concerns. Since pre-service teachers are often unaware of digital safety

measures and how to incorporate them into their future teaching practices, it would be beneficial for college tutors to emphasise this topic. By doing so, they can help cultivate future generations with essential digital safety skills.

Moreover, it was revealed that the available technological systems (such as Moodle LMS) to support collaborative learning were not frequently used in all four colleges. The inability of tutors to utilise ICT in the classroom was also observed by Asare et al. [4] and Besigomwe, Opata and Kisilu [8] as they noted that tutors in Ghana and Uganda did not utilise technology in their classroom instructions due to insufficient pedagogical skills. One of the implications here is that pre-service teachers who were supposed to teach in the digital learning environment after graduation could not do so. In this sense, children who were expected to be taught by these prospective teachers would be deprived of opportunities to acquire digital skills. Saimon, Lavicza and Dana-Picard [52], however, found that 21<sup>st</sup> century skills are inadequately developed among pre-service teachers due to the prevalence of large class sizes, poor technological infrastructure, and lack of facilities.

Some literature [10, 26, 40, 42, 43] also support the view that collaborative learning through LMS in many educational institutions in sub-Saharan African countries is compromised by several factors such as limited internet access, unavailability of relevant digital content, prevalence of outdated ICT infrastructures and limited digital skills among educators. While these authors agree that deliberate efforts are needed to ensure Sub-Saharan African education institutions adopt technological solutions for collaborative learning and 21<sup>st</sup> century skills development, Tanzania, as one of these countries, must improve ICT infrastructure in teacher colleges to promote collaboration among pre-service ECE teachers and ultimately enhance early childhood teaching and learning.

In spite of the Tanzania government's efforts to reform the curriculum, which stresses the need to utilise technology to develop digital literacy, creativity, innovation skills and collaborative learning among learners [23, 24], the integration remains low [33]. This was also witnessed during the outbreak of the COVID-19 pandemic, where all educational institutions in Tanzania experienced complete closure because of inadequate investments in technological solutions [10, 26, 43]. Many education institutions, including teacher colleges in Tanzania, were unable to transition to online learning due to a lack of readiness and preparedness among both tutors and pre-service teachers [37]. Additionally, the migration to online learning was compromised due to inadequate online learning resources, the absence of e-learning policies and inadequate digital competence among college educators and universities [2, 36, 55]. Despite the government's emphasis on integrating ICT into teaching, digital skills among educators and students remain underdeveloped. This, in turn, results in graduates at all levels of education, including early-grade pre-service teachers, lacking the essential skills required for the modern workplace.

### 4.3. Study limitations

The methodological procedures employed in the lens of multiple case study design provided a deeper understanding of ICT integration perspectives in teacher education colleges. Nevertheless, limitations to this study design exist. One of the limitations is the generalizability of the findings across populations. It makes sense to note that tutors' perspectives addressed in this study are intended to shed light and thoughts on ICT integration in teacher education colleges

in Tanzania. Since the study's context is Tanzania, the applicability of the findings to other colleges in other regions or countries with different educational frameworks, ICT infrastructure and digital culture may not be possible. Furthermore, the sample size of this study may not be representative of the broader population of tutors in Tanzania or other countries, limiting the generalizability of the findings. Additionally, the study's focus on tutors' inherently subjective perspectives may introduce personal biases. Their individual experiences and beliefs might not accurately reflect the views of all tutors and educators at other educational levels. Given the short duration of the study, it was not possible to capture long-term trends or changes in tutors' perspectives on ICT integration. Future longitudinal studies could explore the impact of emerging technologies, such as artificial intelligence, and evolving educational policies and reforms, potentially rendering the current findings less relevant over time. Generally, other factors such as funding, demographics, and socio-economic conditions that may influence tutors' perspectives may have been overlooked by the study participants and may not have been adequately addressed in the study. Thus, future studies may focus on establishing the association of these factors with the integration of technology among tutors to enhance learning among early-grade tutors in Tanzania.

## 5. Conclusion and recommendations

Generally, the findings of the study reveal that tutors have limited professional development support for ICT utilisation in the classroom; thus, they inadequately developed competencies for pre-service early-grade teachers. These findings underscore the crucial role of continuous professional development programs in enhancing tutors' ICT knowledge and skills. Participants emphasised the necessity of ICT integration in pre-service ECE teacher education to foster effective teaching practices and 21<sup>st</sup> century skills. However, the study identified several obstacles hindering ICT integration, including limited access to digital materials, unreliable internet connectivity, inadequate pedagogical skills, and insufficient technical support. It is unrealistic to expect tutors to effectively integrate technology in the absence of these essential resources and support systems. In this regard, addressing these barriers would maximise the possibility of tutors deploying ICT in teaching pre-service ECE teachers.

Based on the study findings, the following recommendations were made: Given the limited professional training opportunities reported by tutors, educational authorities, such as MoEST, should prioritise providing continuous professional development programs to improve tutors' ICT competencies. Enhancing the ICT infrastructure in teacher colleges is crucial to ensuring effective ICT use in the classroom. The study also recommends that educational policymakers ensure that the devised policies on ICT use in the education sector are effectively implemented.

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