

Enhancing inquiry-based learning skills with ICT to pre-service teachers in Tanzanian teacher colleges: constraints and mitigating strategies

Vicky Mrosso, Placidius Ndibalema and Abdon Ephrem

*Department of Educational Foundational and Continuing Education, College of Education,
The University of Dodoma, 1 Benjamin Mkapa Rd., 41218 Iyumbu, Dodoma, Tanzania*

Abstract. This study aimed at enhancing inquiry-based learning skills with ICT to pre-service teachers in Tanzanian teacher colleges. The study employed a qualitative research approach along with a hermeneutic phenomenological design to explore participants' in-depth information about the phenomena. The purposive sampling strategy was employed in the selection of the participants who provided pertinent data through interviews and focus group discussions as methods for data collection. A total number of 56 participants were involved in the study, including 4 college principals, 20 tutors and 32 pre-service teachers. Inductive thematic analysis was also used to analyse the data collected. The study found that tutors encounter several constraints in integrating ICTs to foster IBL skills, including limited internet connectivity, insufficient ICT facilities and limited understanding of IBL methods for developing IBL skills. Moreover, the findings revealed that tutors had limited exposure to specific ICT tools that may foster IBL skills. In that regard, the study asserted a number of mitigating strategies to address the constraints, such as the use of offline resources, zero-rating internet, sharing of available digital devices, and institutional support. Furthermore, the study has recommended that there is a need to ensure that the resources are mobilised; there should be in place a critical investment in ICT infrastructure coupled with explicitly integrating IBL skills in the curriculum, thereafter organising tailored professional development training to expose tutors with ICT tools in order to foster IBL skills among pre-service teachers.

Keywords: tutors, information and communication technologies (ICTs), inquiry-based learning (IBL) skills, pre-service teachers

1. Introduction

In modern education, inquiry-based learning (IBL) has recently emerged as a popular pedagogical method that encourages students' critical thinking, creativity and active problem-solving [11, 55]. Unlike the traditional method, IBL promotes curiosity and deep participation, which makes learners ready to face 21st century challenges [11]. Besides, in an inquiry-based learning environment, learners are encouraged to be active, interactive, explorative and engaging in making valid conclusions. Importantly, along similar lines, IBL cultivates essential skills such as promoting learners' ability in questioning, rational thinking, analytical skills and ability to solve real-life problems effectively [51]. It is from this perspective that IBL skills are considered to be important in the education system.

Quite a good number of studies, such as the study carried out by Dobber et al. [17] and Hrast and Savec [23], have indicated that ICT plays a transformative role

ORCID: 0000-0002-6836-7437 (V. Mrosso); 0000-0002-9119-4255 (P. Ndibalema); 0000-0002-1222-8219 (A. Ephrem)

Email: vickymrosso1@gmail.com (V. Mrosso); placidius.ndibalema@gmail.com (P. Ndibalema); abdonkimario@gmail.com (A. Ephrem)

Google Scholar: <https://scholar.google.com/citations?user=rALU7e0AAAAJ> (V. Mrosso);

UDOM: https://www.udom.ac.tz/staff/staff_profile?id=VDBSaIBRPT0= (P. Ndibalema)



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in fostering IBL skills, allowing teacher-educators to develop dynamic and student-centred learning environments. Thus, in the process of promoting IBL skills, ICT plays a vital role in searching, capturing, analysing and presenting information [23]. Moreover, the use of ICTs in classrooms spurs learners questioning abilities [4]. Based on this significant role, the present study aims to explore how tutors are constrained from using ICTs in order to foster IBL skills among pre-service teachers and, on the other hand, the strategies they use to address the challenges.

1.1. Objectives of the study

This study investigated the enhancement of IBL skills with ICT to pre-service teachers in selected Tanzanian teacher colleges. Thus, this paper has attempted to answer two main questions. First, what constraints do tutors encounter when using ICTs to promote IBL skills? Second, what are the mitigating strategies used by tutors to address constraints when using ICT to develop IBL skills? Grounded on Transformative Learning Theory (TLT) and by critically analysing the interrelated aspects, the study proffers useful insights for policymakers and educators in Tanzania and potentially other countries with related educational milieus.

2. Theoretical underpinning

This study is grounded on Transformative Learning Theory (TLT) developed by Mezirow [35], which was built from constructivist learning theory's assumptions developed by Piaget [50] and Vygotsky [63] that humans are better able to understand the information they have constructed by themselves. All in all, the theory has the following assumptions: individuals have a frame of reference, which is a set of beliefs, attitudes and assumptions which are shaped by their daily experiences, culture and interaction with others [35]. Thus, learning and transformation begin with a “disorienting dilemma” that occurs when an individual makes a critical reflection on the existing assumptions to inquire about the validity of their perspectives [35, 36]. Further, open dialogue and institutional collaboration are central to transformation [13]. According to Mezirow [37], experiential learning is the foundation of learning among adult learners; thus, transformation is central to changing individuals' perspectives of the worldview.

The theory is relevant to the current study in the sense that “disorienting dilemmas” may refer to technological barriers that college tutors encounter in promoting IBL skills, including inadequate ICT infrastructures and limited tutors' competencies. In addressing the disorienting dilemmas, transformative learning emphasises critical reflection on which tutors are likely to challenge their cognitive and pedagogical limits and adopt new strategies to develop IBL skills. Besides, the aspect of inclusive dialogue and institutional collaboration may play a critical role in overcoming institutional constraints regarding the use of ICT to promote IBL skills since, for effective learning and the assumption of experiential learning, tutors may engage the pre-service teachers in hands-on activities to engage them practically in using ICT to develop IBL skills.

2.1. Literature review

In responding to the quest of adopting technology in education, the majority of developed nations have implemented ICT policies into their educational curriculum to foster creativity, critical thinking, problem-solving, and IBL skills [19, 26, 30]. For example, in the United States, policy initiatives have led to the adoption of plans such as the “Bring Your Own Device” program, which provides pre-service teachers with technological devices. Besides, the government also introduced online courses to tutors in order to equip them with knowledge and skills to efficiently use ICTs in problem-solving tasks [62].

Similarly, in Germany, the curriculum insists on the use of inquiry-based activities such as web quests and anchored instruction to develop pre-service teachers' IBL skills [34]. Despite such initiatives, there are some challenges which persist in implementing ICT so as to develop IBL skills in developed countries, including but not limited to limited facilities, mean facilitation methods, limited ICT competencies among tutors, limited time to plan, practice and evaluation IBL activities due inflexible curriculum structures [59, 62].

However, a study conducted by Lim and Khine [32] in Singapore highlighted several strategies in order to mitigate and manage barriers to ICT integration, such as the use of appointment of technical support among the staff, collaboration among teachers in preparing ICTs mediated lessons and the use of exemplary ICT mediated lessons. This is on the view of the fact that constraints facing tutors not only hinder the seamless integration of ICT into IBL-focused teaching practices but also impact pre-service teachers' analytical skills, communication, collaboration and confidence in solving complex problems [56].

In the context of African countries, South Africa, Zimbabwe, Zambia and Kenya have made significant efforts to introduce ICT policies in education so as to align their educational systems with global trends [9, 45, 53, 54]. For instance, South Africa is relatively advancing in technology adoption since many teacher colleges have access to technology infrastructures, and in addition, tutors implement ICT into their teaching practices [49]. Although the South African curriculum emphasises the promotion of IBL skills among the pre-service teachers [2], its promotion through the use of ICT has remained inconsistent [53].

In contrast, Zambia has revised the ICT policy of 2006 and developed the new ICT policy of 2023, which intends to ensure that tutors integrate ICT into their teaching activities, transforming and equipping pre-service teachers' mindset with 21st century skills [54]. On the same note, Zimbabwe has formulated its national ICT policy, which marks a basis for ICT integration in teacher education programs [18]. However, in spite of having such aspirations, the use of ICT by tutors in order to promote IBL skills in Zambia and Zimbabwe is at the early stage [5, 9]. The prevailing situation shows that, although in many African countries, efforts have been made to support tutors' integration of ICT in teaching, there is still a gap in using the relevant ICT to enhance IBL skills.

Along the same lines, in one of the East African countries, Tanzania in particular, both the government and a proliferation of authors emphasise the use of ICT in teacher education programs [10, 25, 39, 60]. In integrating ICT in pre-service teacher colleges, the government has taken several initiatives in collaboration with educational partners such as the Swedish International Government Agency (SIDA) and Teacher Education Support (TESP) to ensure that the programs for ICT integration in teacher colleges are implemented [1, 21]. The said programs were designed to ensure that tutors were well trained and equipped with knowledge and skills for integration of ICT into their teaching practice along with making sure that ICT facilities are in place in all teacher's colleges [1, 57].

Nevertheless, although the curriculum documents emphasise the promotion of all aspects related to IBL skills, including critical thinking skills, curiosity, creativity and problem-solving skills [39, 61], it is unlikely that the tutors' use of ICT to promote IBL skills among pre-service teachers in teachers colleges is unsatisfactory and disappointing [25, 28, 29, 33]. In the same vein, it is not well known to what extent tutors address the existing challenges and teach through the use of Information and Communication Technologies (ICT) to equip the pre-service teachers with IBL skills as stipulated in the 2014 Tanzania Education Policy and its amendments in 2023.

Besides, the existing studies on tutors' use of ICT in fostering inquiry-based learning

skills among pre-service teachers reveal significant gaps in the view of the fact that they have focused on the extent to which IBL is featured in curriculum documents and challenges faced by teachers in implementing IBL skills in science subjects in secondary schools [28] and an assessment on the opportunities and challenges in implementing IBL approach, which is likely to influence development of IBL skills among secondary students [28, 40]. From this perspective, the present study anticipated exploring the constraints encountered by tutors when using ICT in fostering inquiry-based learning skills among pre-service teachers, along with the mitigating strategies employed to address the situation.

3. Research design and methodology

The current research study employed the qualitative research approach coupled with hermeneutic phenomenological design [24] to collect detailed and pertinent information regarding the enhancement of IBL skills with ICT to pre-service teachers in selected Tanzanian teacher colleges. The approach and design were preferred due to their ability to offer a rich and appropriate understanding of the complex educational phenomena within their natural settings, allowing in-depth exploration of the constraints and successes experienced by each teacher college. Besides, the design was important in this study since it helped the researcher to gather in-depth and rich information from study participants on the issue under study.

3.1. Research sites and participants' selection

This study was carried out in four purposively selected teacher colleges in Tanzania (that is, TC₁, TC₂, TC₃ and TC₄), located in four regions; specifically, Mwanza, Morogoro, Dodoma and Iringa. The selection indices included colleges with at least five years' experience in using ICT in teaching, having a good number of ICT facilities with reliable internet connectivity [1, 20], in addition to their geographical convenience in order to facilitate data collection process. Besides, the technique was used to purposively select a total number of 56 study participants, namely 4 college principals, 20 college tutors from 5 core departments based on their roles of being heads of departments in each teacher college (TC), and 32 pre-service teachers who were likely to yield appropriate and useful information in harmony with the specific objectives of the study. Further, amongst the pre-service teachers, 8 were selected based on the criterion that they were the best-performing students from the first and second-year diploma courses. Given the qualitative nature of the study, the sample was determined by data saturation rather than a fixed total population [15].

3.2. Data collection process

Multiple data collection methods were employed to collect information from college principals, college tutors and pre-service teachers. Initially, semi-structured interviews were employed with teachers, college principals and tutors in order to collect in-depth information about their lived experience on the issue under study [14]. The use of semi-structured interviews helped the researcher to be flexible and allow significant information to be obtained [16]. On a similar note, this method helped the researcher gain a deeper understanding of the participant's perceptions of the use of ICT for IBL by asking follow-up questions in order to ensure that nuanced responses are obtained. The interviews were arranged within the participants' convenience time, taking approximately 40-60 minutes as supported by Harvey [22] who put forward that taking so long time in an interview session may lead to the participants withdrawing from the study.

However, Focus Group Discussions (FGD) were used to collect data from the pre-service teachers. This method facilitated the interactive discussion and provided

room for the study participants to build on each other's argument, thus leading to detailed insights into their views on constraints facing college tutors in using ICT to foster IBL skills to pre-service teachers, along with their mitigating strategies. In addition, the data collection process involved systematic recording and documentation of participants' responses by using digital voice recorders and notebooks. The use of FGD helped the researcher to collect a large amount of data in a relatively short period of time and thus gain an in-depth understanding of social issues [48]. A total number of 4 FGDs, each one with at least 8 participants, 1 FGD session in each TC (that is, TC₁, TC₂, TC₃ and TC₄).

3.3. Thematic analysis process

This study employed the inductive thematic analysis, which is applicable and effective in educational research. The six steps by Braun and Clarke [3] were used to analyse the raw data to generate themes. The process began with the familiarisation of data, which involved transcribing the data and repeatedly reading the data from field notes and audio recordings. Initial codes were generated by highlighting text, sentences or phrases. The codes were critically analysed so as to create categories that were further developed to create potential themes [7]. Thereafter, potential themes such as inadequate ICT facilities and ICT training were formed. The final stage involved reviewing, defining, and naming the themes to ensure coherence. The process entailed verifying whether the codes accurately aligned with the generated themes and whether each theme meaningfully addressed the research questions. Furthermore, the themes were inferred, reported, analysed, and interpreted in accordance with the existing literature, which was supported by direct quotations from participants' voices.

3.4. Ethical consideration

Ethical approval for this study was obtained from relevant authorities, namely, the Tanzania Commission for Science and Technology (COSTECH), the University of Dodoma, and the Ministry of Education, Science, and Technology (MoEST). The research permission was granted so that the four teacher colleges could be visited and thus served to secure the participants from potentially harmful situations [12]. The researcher took into account moral considerations such as anonymity, safety, confidentiality and informed permission. Participants signed an informed consent form endorsing their voluntary participation in the study before any data were collected. Pseudonyms were used to safeguard participants' identities and provide them with the assurance that their names would remain anonymous in order to maintain confidentiality. To ensure safety, participants were assured that there would be no physical or emotional harm and that their privacy would be ensured by creating a conducive environment where participants felt free to express themselves.

3.5. Trustworthiness of the findings

Several strategies were used to address the issue of trustworthiness so as to ensure data credibility. The study, therefore, used multiple data sources such as teacher college principals and tutors coupled with pre-service teachers during interviews and focus group discussions for triangulation purposes. The study provided detailed descriptions of participants, the research context, and research procedures to allow for the transferability and dependability of the findings. Besides, during the coding process, two researchers were involved in coding the transcript independently to ensure inter-rater reliability [24]. Lastly, the reflexive journals were used to ensure the researcher's pre-conceived feelings, thoughts, and perceptions regarding the topic under study did not affect the data collection process and interpretation of the findings. In that regard, the researcher made critical reflections and recorded any conceivable

actions that appeared to influence participants' findings throughout the data collection process in order to avoid personal biases.

4. Results

4.1. Constraints encountered by teacher college tutors in using ICT to foster IBL skills

The section presents the data collected with regard to constraints encountered by the TC's tutors in using ICT to foster IBL skills through interviews as presented in figure 1.

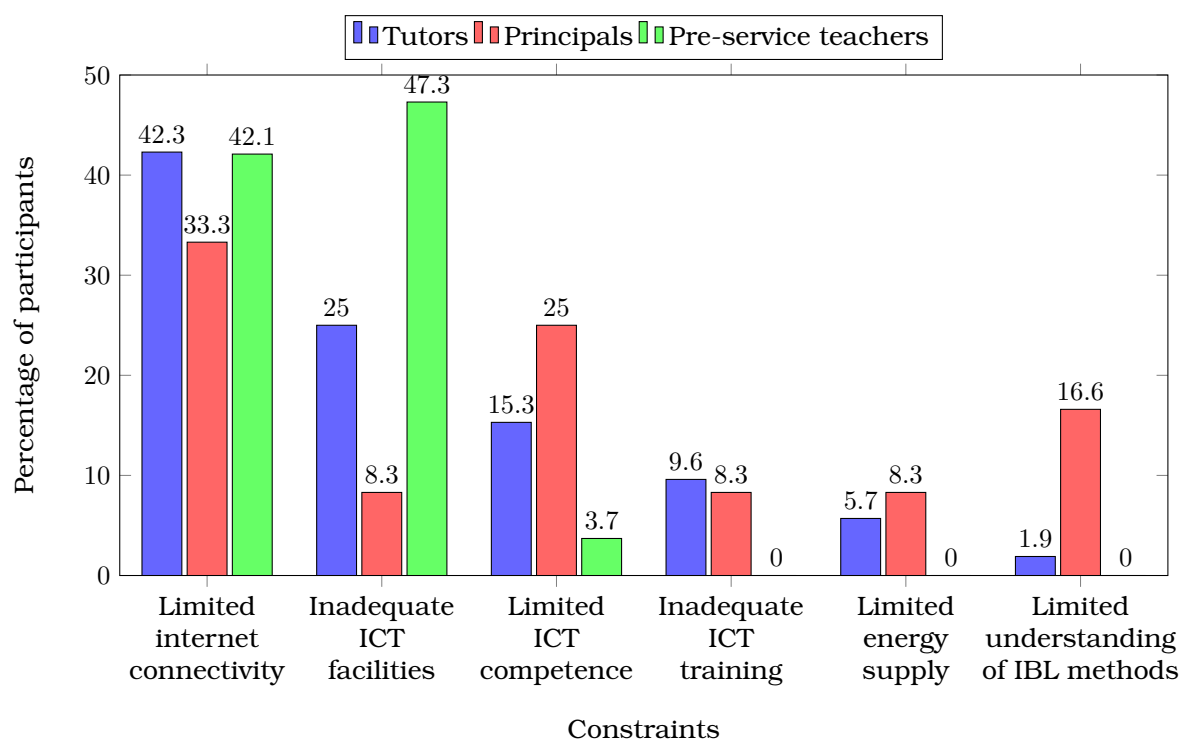


Figure 1: Constraints encountered by teacher college tutors in using ICT to foster IBL skills.

The study findings revealed that TC's tutors encounter several constraints when using ICT to foster IBL skills in pre-service teachers, including limited internet connectivity, limited ICT facilities, insufficient tutors' ICT competence, inadequate ICT training, limited energy supply, and insufficient understanding of Inquiry-Based Learning Methods.

4.2. Limited internet connectivity

The study participants, equivalent to 42.30% of TC's tutors, 33.30% of TC's principals and 42.10% of pre-service teachers, pointed out that internet connectivity is the most dominant constraint which encounters TC's tutors to efficiently implement the integration of ICT to develop IBL skills to pre-service teachers. With regard to participants' views, internet connectivity covers both access, the slow pace of the internet, and access to ICT programs that require payment. For example, one tutor from TC₃ asserted that:

In my view, the main challenge is inadequate funds to procure a viable internet bundle since most ICT tools require sustainable internet connectivity. I remember that, some years back, the MoEST used to provide us with an internet bundle, but nowadays, things have fallen apart, and we depend on the college itself. (Interview with the tutor from TC₃ in 2024)

Similarly, one pre-service teacher confirmed that:

In our college, the administrative block is connected to the internet network via a router. Sometimes, we connect our mobile phones and laptops to Wi-Fi, but the challenge is that when the number of internet users escalates, the connectivity slows down. (FGD with the pre-service teachers from TC₂ in 2024)

The participants' voices imply that TC tutors encounter not only financial constraints to procure internet bundles but also unpredictable internet connectivity. In that regard, the effective integration of ICT to develop IBL skills is compromised.

4.3. Inadequate ICT facilities

With regard to the ICT facilities' inadequacy, the study participants had mixed views on highlighting this aspect as one of the constraints that hinder TC tutors from promoting IBL skills through ICTs. While the pre-service teachers, equivalent to 47.30% of the participants, highly ranked this challenge, TC tutors, equivalent to 25%, ranked it the second, and the college principals, equivalent to 8.30% of the participants, ranked it as the lowest. Through the interviews with the tutors, one TC tutor remarked that:

I think in order for us to promote inquiry-based learning skills, we need to engage our students in a wide range of activities that will engage them in hands-on practice by guiding them to design digital content like preparing cards or conducting explorative projects, which will need evidence from real-life situations. But, you see, when it comes to ICT tools like digital cameras, we only have one in place. To be honest, we lack ICT tools to design inquiry-based learning activities. (Interview with the tutor from TC₁ in 2024)

Similarly, during FGDs, one pre-service teacher asserted that:

Sincerely, if someone is not keen enough, he or she may assume that there are a lot of computers in the computer laboratory. But in reality, quite a good number of them normally learn theoretically unless we bring our laptops with us. Personally, I think this hinders TC tutors from teaching us well and engaging us in different activities related to inquiry-based learning through ICT. (FGD with the pre-service teachers from TC₃ in 2024)

The quotations imply that TC tutors failure to design the inquiry-based learning activities has been a result of a limited number of ICT tools to support learner-centred methods. However, the available ICT resources require major maintenance to function properly. Along similar lines, the study findings indicate that, although the study participants possess general knowledge with regard to the use of ICT facilities such as projectors and computers in promoting IBL skills, they appear to have limited knowledge on how specific ICT tools such as online platforms and simulation could enhance inquiry-based learning. For that reason, there is a need for regular training through workshops, seminars, and symposiums so that they can be equipped and updated with current knowledge on ICTs.

4.4. Limited understanding of inquiry-based methods

Despite the fact that both TC tutors, equivalent to 1.90% of the study participants and college principals, equivalent to 16.60% of the study participants, identified TC

tutors' understanding of inquiry-based learning methods which promote IBL skills as a critical challenge that tutors to foster IBL skills through the use of ICTs effectively, the study findings revealed that this least mentioned aspect seems to be the major a challenge. In supporting the study findings, one TC principal had the following to say:

The biggest challenge that quite a good number of TC tutors have is the limited understanding of IBL skills, as most of them do not know how these skills are promoted. We have been provided with some ICT facilities by the government, such as computers and projectors, but I am not sure if teachers can use them to teach IBL skills since I have never seen anybody using them anyhow. So, I sincerely suggest that the TC tutors should be provided with indoor training with regard to the IBL skills and tools that can enhance their promotion. (Interview with the principal from TC₃ in 2024)

In the same vein, another tutor from TC₂ remarked that:

I think most tutors struggle with technical know-how, not knowing exactly what methods favour inquiry-based learning skills. Personally, when you speak about inquiry-based learning skills, candidly, I know nothing about them. Honestly speaking, although there are some ICT facilities in our college, it is very hard for me to use them, and I cannot say boldly that I use them to support the IBL skills. (Interview with the tutor from TC₂ in 2024)

Although the findings indicated that tutors had limited knowledge and understanding of the inquiry-based learning methods, on the contrary, the pre-service teachers were not aware of the inquiry-based learning methods and their impact on teaching, which is why nobody amongst them pointed out that aspect. Besides, the findings revealed that TC tutors have little awareness of the ICT tools that can be used to develop IBL skills among pre-service teachers, as evidenced by one of the participants.

4.5. Tutors' mitigating strategies to address challenges of promoting IBL skills through ICT

This section presents the findings regarding the strategies used by TC tutors in responding to the challenges they encountered in using ICTs to promote IBL skills among pre-service teachers. The study findings were collected from the college principals, tutors and pre-service teachers through interviews and focus group discussions as depicted in figure 2.

The data presented in figure 2 depict that, mitigating strategies employed by TC tutors in addressing constraints encountered by them in fostering IBL skills through the use of ICTs include the use of personal internet bundle, the use of traditional method, the use of offline resources, organising ICT training, using alternative energy, sharing of digital devices and seeking of donor and other well-wishers support.

4.6. Use of personal internet bundle

With regard to the use of personal internet bundle, TC tutors, equivalent to 42.8% of the study participants, college principals, equivalent to 40% of the participants and the pre-service teachers, equivalent to 27.5% of the participants, prevalently identified the use of personal internet bundle, as the main solution used to address constraints in using ICT to promote IBL skills though sometimes they were using the Wi-Fi hotspot for tethering during the learning process. During the interview discussion with TC tutors, one of them commented that:

In our college, the administrative block is connected to a router, but unfortunately, it is not possible to access the internet while in the classroom.

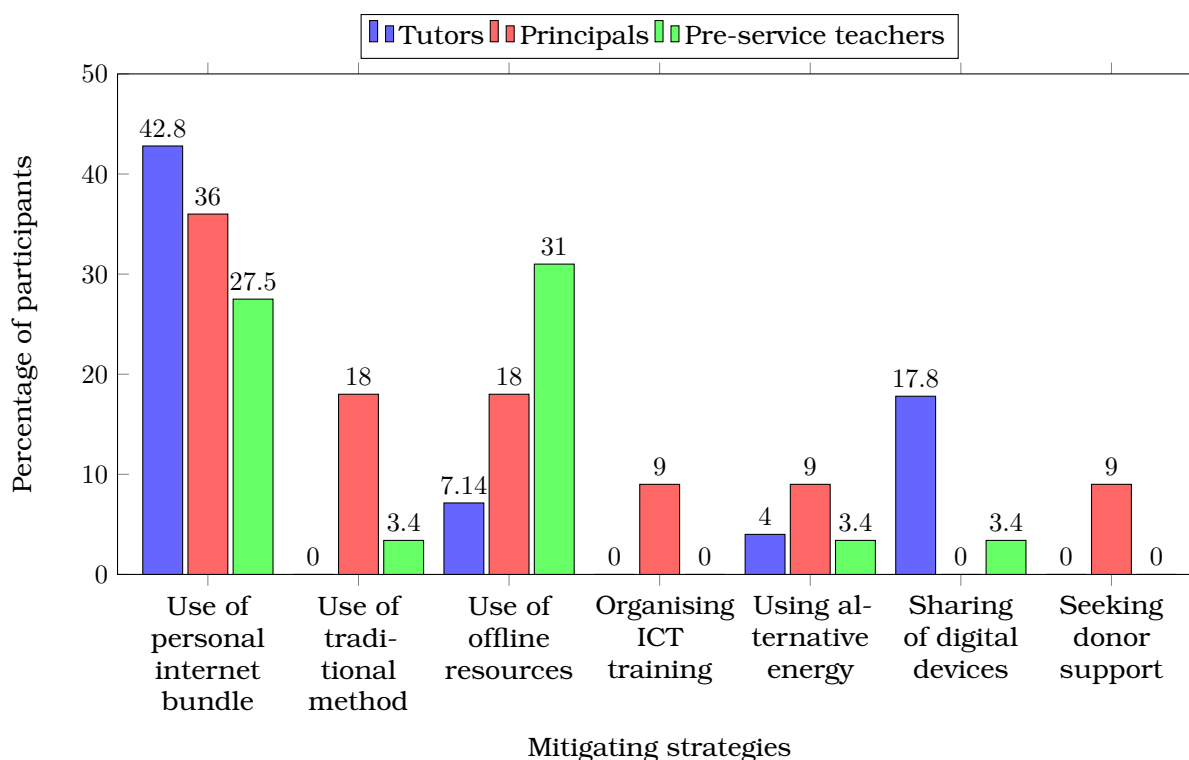


Figure 2: Mitigating strategies employed to promote IBL skills through ICTs.

For that reason, we are forced to use our personal internet bundle while in class. I normally encourage my students to connect with a Wi-Fi hotspot when I want them to search or learn something on the internet. This is due to the fact that most of our students cannot afford to buy the internet bundle. (Interview with the tutor from TC₁ in 2024)

Similarly, during FGDs, another pre-service teacher added:

Honestly speaking, it is not possible for us to buy the internet bundle every now and then, which is why unreliable internet connectivity is the biggest challenge in our college. For example, when our teachers share learning materials on WhatsApp groups or guide us to browse any search engine or to download online materials via links through our smartphones, we normally use our personal bundle and sometimes Wi-Fi hotspots. (FGD with the pre-service teachers from TC₄ in 2024)

The study findings revealed that, apart from using personal bundles, the participants, both tutors and pre-service teachers, have limited skills in identifying relevant ICT tools that seem to foster IBL skills. This indicates doubt about whether the solution used can effectively promote IBL skills through leveraging the opportunities of ICTs. Moreover, across all study participants' categories, the study findings reflect a gap in institutional support for internet access.

4.7. Sharing of digital devices

The study findings depict that TC tutors, equivalent to 17.8% of the participants and the college principals, equivalent to 10% of all the study participants, pointed out the sharing of digital devices such as projectors, laptops and alike as a mitigating strategy to address the issue of limited ICT facilities. Notably, none of the pre-service teachers

mentioned the sharing of digital devices as a solution to address the challenge of limited facilities. One tutor from TC₁ stressed that:

Regarding the issue of using the projectors, since they are limited in number compared to tutors, we usually borrow from the academic office whenever a tutor wants to use them for teaching and thereafter return them. Besides, I sometimes encourage my students to share smartphones with their peers whenever there is a task, or they are searching for online materials. (Interview with the tutor from TC₁ in 2024)

The study findings imply that, to some extent, TC tutors and college principals actively use the resource-sharing strategy to address constraints of limited resources in teacher-education programs. However, the pre-service teachers' lack of assertion may imply that they either lack awareness of the strategy or have limited knowledge regarding ICT usage.

Surprisingly, the findings revealed a strategy which seemed to be irrelevant in addressing the challenge of using ICT in fostering IBL skills of which only one college principal, equivalent to 10% of the participants, identified the use of donor support as a strategy to effectively foster IBL skills after commenting that

I think we need to be very creative in writing a fundable proposal to seek donor support for the provision of ICT resources, as the LYRA foundation did when they donated the computer facilities for the computer laboratory. (Interview with the principal from TC₂ in 2024)

The quotation suggests that college principals recognise the strategy of seeking donor support, indicating awareness of their leadership roles in institutional resource mobilisation, but the rest of the participants did not mention it at all.

5. Discussion

The purpose of the present study was to explore the enhancement of inquiry-based learning skills with ICT to pre-service teachers in Tanzanian teacher colleges. The study findings have shown that the use of ICTs by TC tutors in order to foster IBL skills is constrained by limited internet connectivity, insufficient ICT facilities to support inquiry-based learning skills and limited understanding of IBL methods pertaining to IBL skills. However, the participants' confinement to general ICT tools suggests missed opportunities in fostering an effective IBL environment, which appears to be linked to limited studies which focus on exploring the issue under study in the context of Tanzania [28, 33] consequently, showing less attention on the use of ICTs to facilitate IBL to pre-service teachers' colleges in the country.

Similar to other East African countries, the government of Tanzania has experienced some milestones in integrating ICT in teacher education programs [1, 39, 47, 60]. For instance, the national education digital strategy emphasises the use of ICT and shows that all 35 teacher education colleges in the country were installed with the National ICT Broadband Backbone (NICTBB) in order to facilitate teaching and learning process through ICT [58]. Despite the efforts made to install the NICTBB, the results of the current study have found that there is limited internet connectivity in pre-service teachers' colleges. The majority of teacher colleges are installed with a router system, which was mostly used for administrative purposes rather than teaching.

The findings of the present study align with the study by Kweka and Ndibalema [31] and Lubuva, Ndibalema and Mbwanbo [33], which asserted that the majority of tutors integrate ICTs in the teaching and learning process due to the limited ICT facilities such as projectors and computers. Apart from highlighting inadequate ICT

facilities, participants' identification of the general ICT facilities, such as computers and projectors, indicates their limited awareness of a wide range of specific ICT tools that can enhance IBL skills for pre-service teachers. Besides, studies by Mtebe, Fulgence and Gallagher [43] as well as Ramli and Borhan [52] have identified specific ICT tools that can foster IBL skills commonly referred to as simulation software such as PhET, collaborative tools and gamification in fostering engagement, collaboration and critical thinking skills. Similarly, Mtebe [42] stressed the use of online platforms in the teaching process, including the use of Moodle and Google classrooms to foster engagement, explanation and access to teaching and learning materials.

Furthermore, the findings of the current study concur with the studies conducted by Kinyota [28] as well as Mkimbili and Ødegaard [41], which put forward that the majority of tutors are constrained from implementing IBL skills due to limited knowledge of the relevant IBL methods. Although all participants had limited knowledge of IBL, the pre-service teachers had relatively lower knowledge. This is closely linked to the reason that the majority of African countries' tutors use the teacher-centred approach in their teaching [8, 44].

Similarly, in the Tanzanian context, tutors rarely employ participatory teaching methods [38]. As a result, pre-service teachers struggle to improve their proficiency in both teacher-centered methods and IBL. This trend highlights the need to motivate tutors to consistently use IBL methods in teacher training colleges in order to enhance both their own skills and the knowledge of the pre-service teachers who are future teachers. Reflecting on Transformative Learning Theory, the pre-service teachers and tutors are required to make self-reflection on their assumptions and challenging experiences [36] to implement IBL skills through ICTs effectively.

The study findings suggest that among many mitigating strategies used by tutors to address the constraints of using ICT to foster IBL skills, include but are not limited to the use of their money to purchase personal internet bundles and the sharing of digital tools. The findings of the current study align with the study conducted by Chachage and Thakrar [6], which revealed that, although some teachers use their personal internet bundle to navigate through the LMS, the cost of the internet bundle appeared to be too expensive for most of them. This indicates uncertainties on whether the use of personal internet bundles is a sustainable mechanism to address the technological challenges for tutors to use ICT to foster IBL skills effectively.

On the same note, in countries like Uganda, teachers were reported to purchase internet bundles, but the approach depicted less effectiveness due to the high costs of the bundle [27]. In line with this argument, Kibirige [27] proposed the need for offline support materials such as video and simulation to enhance the IBL under-resourced environment. Moreover, Chachage and Thakrar [6] proposed the use of zero-rating internet to address the challenge of internet connectivity in educational settings. The study findings indicate that, for tutors to manage technological barriers such as unreliable internet connectivity, the government, through its responsible organs, should ensure the provision of offline materials and zero-rating internet so that tutors can efficiently enhance IBL skills. With these solutions, tutors can leverage the opportunities of online platforms such as Moodle and simulation software so as to engage the pre-service teachers in interactive classroom activities and thus enhance engagement, critical thinking and problem-solving skills [4, 52].

The findings of the current study also found that TC tutors and college principals gave less attention to the sharing of digital resources. Thus, the national framework for basic and teacher education emphasises the need for ensuring resource mobilisation in teacher education programs [39] though the majority of tutors appear to have limited awareness of resource mobilisation. In addition, the aspect with regard to resource mobilisation is in accordance with the study conducted by Chachage and

Thakrar [6], which indicated that the majority of teachers address the digital devices gap by using their own digital devices in teaching and learning process though, the approach of using their own devices such as smartphones is not reliable, as it depends on their accessibility and functionality [42, 46].

Correspondingly, less input regarding the sharing of digital devices from pre-service teachers shows their limited involvement in the decision-making of their learning, thus suggesting the need to concertise both the tutors and pre-service teachers on resource mobilisation through sharing the available digital devices in enhancing IBL skills which promotes collaboration and engagement, hence being essential in enhancing IBL skills [8]. However, the emergence of the response which was figured out as an irrelevant strategy, as pointed out by the college principals, which is donor support, indicates a lack of awareness amongst other study participants with regard to the college principals' responsibilities in addition to their primary responsibility as supervisors of the curriculum implementation [39]. The study findings depict that there is a need to ensure institutional leaders provide support in supervising ICT integrations, fostering IBL skills, and addressing ICT challenges.

6. Conclusion and recommendation

This comprehensive study explored the enhancement of inquiry-based learning skills with ICT to pre-service teachers in Tanzanian teacher colleges. The study findings revealed that the majority of TC's tutors encounter different constraints in promoting IBL skills among pre-service teachers, such as limited internet connectivity, ICT facilities favourable in fostering IBL skills and TC tutors limited understanding of IBL methods appropriate for developing IBL skills such as critical thinking skills, creativity, analytical and problem-solving skills. In addition, the findings revealed that TC's tutors had limited knowledge with regard to specific ICT tools like online platforms, collaborative tools and simulation software that may promote IBL skills. For that reason, the lack of required ICT knowledge thwarted TC's tutors' opportunity to leverage a wide range of ICT tools to foster IBL skills.

Despite the fact that tutors posed a number of mitigating strategies to address the constraints, one of them being the personal internet bundle and sharing of digital devices in the learning process, the study findings showed little sustainability of the strategy due to the high-cost implication. In that regard, the study suggests the use of zero-rating internet, offline materials (simulations), sharing of available digital resources in the teacher's colleges and the need for institutional support in the supervision of curriculum implementation. Further, the study proposes the setting up of regular training for both tutors and pre-service teachers on resource mobilisation and using ICTs to design inquiry-based learning activities in order to stimulate critical thinking skills, student engagement and problem-solving skills. On a similar note, tailored professional development training should be organised to equip TC tutors with specific ICT tools that enhance IBL skills, as well as explicitly identify IBL skills in the curriculum through policy directives.

The study further recommends that a critical investment in relevant ICT infrastructure to enhance the promotion of IBL skills is inevitable. The government, through the Ministry of Education, Science, and Technology, should ensure the completion of the NICTBB installation in most pre-service teachers' colleges to provide consistent and reliable internet connectivity. Lastly, institutions are encouraged to involve all key stakeholders, including tutors and pre-service teachers, in resource mobilisation efforts to strengthen ICT integration and foster IBL skills in pre-service teacher colleges.

6.1. Limitation of the study

Although the current study met its objectives, it had a number of shortcomings, such as time constraints. The study experienced time restrictions in view of the fact that, throughout the research process, several teacher-educators were invigilating the pre-national tests for the three-year pre-service teachers' diploma program. Besides, one TC's tutor hosted a seminar on the implementation of the new curriculum, while the other one attended the quality assurance officers from the Ministry of Education Science and Technology. Moreover, some teacher-educators expressed reluctance to be interviewed. Nevertheless, the researcher handled time constraints by rescheduling the data-gathering process at the study participants' convenience. On the other hand, the researcher addressed the teacher-educator's reluctance by explaining to them in detail the goal of the research project, hence being ready to participate in the study.

Data availability statement: The data supporting the findings of this study are available from vickymrossol@gmail.com upon reasonable request.

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