

Examining tutors' understanding of inquiry-based learning in teaching and learning practices in Tanzanian teachers' colleges: a reflection of 7E instructional model

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Abstract. The recent educational reforms in Tanzania advocate for the integration of inquiry-based learning (IBL) methods in pre-service teacher colleges. A critical factor in this integration is how tutors conceptualise IBL. The study is grounded on the 7E instructional framework coupled with the hermeneutic phenomenological research design in order to examine tutors' conceptualisation of IBL within the 7E instructional model in teaching and learning process. Data were collected from 56 participants through interviews and focus group discussions. Thereafter, the inductive thematic analysis was used to develop themes and categories, the findings of which revealed that tutors' conceptions with regard to IBL predominantly relied on the elicitation phase, specifically on prompting curiosity. Besides, tutors had limited knowledge of explanation, elaboration, exploration, and evaluation. However, the findings revealed that principals had relatively lower knowledge compared to tutors. In general, the limited awareness of the participants appears to be influenced by slight variations of meaning in some of the phases, such as the elaboration and extension phases. Furthermore, the study recommends an intervention study to create tutors' understanding of the IBL method in addition to the merging of elaboration and extension phases.

Keywords: tutors, pre-service teachers, inquiry-based learning (IBL), 7E instructional model

1. Introduction

Inquiry-based learning (IBL) pedagogies are profoundly anchored in constructivist educational theories, which put more emphasis on active engagement of learners in problem solving [32, 35]. This method was influenced by a number of educational think tankers such as John Dewey, Jean Piaget and Lev Vygotsky, who value the active learning, social engagement and critical thinking abilities [20, 31, 48]. Scholars have agreed that IBL skills are essential in developing critical thinking skills, creativity, innovation, collaboration, and active engagement [2, 35]. In addition, in an inquiry learning environment, learners are granted the opportunity to explore, question, construct their understanding and draw conclusions from the learning experiences [35].

Along similar lines, IBL methods not only enable learners to pass examinations, but also enable them to solve real-life problems [15]. Initially, IBL was believed to be promoted in science subjects' curriculum [30, 41]; on the contrary, currently, scholars

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*Educational
Dimension*



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have now put forward that IBL methods can be exercised across all educational levels in both science and social science subjects [35, 41]. It is from this perspective that the use of IBL methods has become necessary from the primary school level to higher learning institutions, specifically in teacher training colleges [3].

Given the perceived nature of IBL, which is likely to be promoted through employing constructivist methods to teaching, Voet and De Wever [47] argued that tutors' understanding and knowledge of IBL methods is a critical factor that influences the implementation of IBL skills in a real classroom context. This makes it important for the current study to explore tutors' conceptualisation of IBL methods and their role in real classroom practice. Scholars such as Lee and Shea [24], Pedaste et al. [30], and Dobber et al. [14] have indicated that there are variations among tutors in conceptualising IBL. For instance, Lee and Shea [24] have put forward that IBL approaches are mostly limited to asking and responding to questions. Thus, Dobber et al. [14] have shown that some tutors associate IBL with discussion making and demonstration during teaching and learning.

This study is therefore intended to offer useful insights for policymakers and educators in Tanzania and other countries with related educational settings with regard to tutors' understanding of IBL in teaching and learning practices in Tanzanian teachers' colleges. Thus, this paper was guided by one main research question: *How do tutors conceptualise IBL within the 7E instructional model?*

1.1. Objective of the study

The study aimed at exploring how tutors understand and implement IBL in their teaching and learning practice, using the 7E instructional model as a reflective framework. Specifically, it explored the integration of IBL methods in pre-service teacher colleges in relation to the educational reforms in Tanzania.

1.2. Theoretical underpinning

The study was guided by the 7E instructional model developed by Eisenkraft [16] in 2003, which includes seven phases involving elicitation, engagement, exploration, explanation, elaboration, and extension. Each phase of the model is related to the IBL method. Some scholars, such as Adesoji and Idika [1], view elicitation as a process where the teacher extracts and draws learners' attention to prior knowledge or understanding. In addition, Shaheen and Kayani [38] supports that elicitation enables learners to review their prior knowledge by linking it with the ongoing learning situation. In order to engage learners in reviewing their prior knowledge, elicitation anchors the need for asking questions and presenting scenarios [10]. Therefore, teachers can use question-and-answer techniques to foster elicitation skills among learners.

The second phase of the model is engagement. Balta and Sarac [5] submit that engagement involves the process of capturing attention, ensuring interaction and making learners take an active role in the lesson through videos, pictures, role playing and storytelling to enhance engagement. Besides, exploration is another phase, as explained by Suardana et al. [42], which involves giving learners an opportunity to observe, identify and analyse information patterns, and thereafter draw conclusions. In addition, Chikaluma, David and Nsengimana [10] put forward that the exploration includes making learners take an active role in investigation through exposing them to a problem-solving situation. This suggests a similar understanding to exploration, which is mainly inclined towards making investigations to satisfy learners' curiosity, which may be done by framing questions, suggesting approaches and providing feedback when necessary.

Moreover, at the explanation phase, learners try to clarify concepts or engage in

discussions about the exploration [1]. While explaining and engaging in discussions, learners provide their experiences linking them with the explored concepts [10]. Concerning exploration, Balta and Sarac [5] argue that teachers may use videos, mind maps and demonstrations in a way that learners can observe, investigate and discover particular information in the phenomena under study.

On a similar note, elaboration is another phase as presented by Balta and Sarac [5], which involves learners' opportunity to understand and use their understanding in new situations. This may involve the teacher raising new questions and hypotheses for learners to explore [1]. Besides, the evaluation phase entails the learners being evaluated by using various techniques so as to find out what learners know after the learning process [42]. The evaluation process can include both formative and summative evaluation [16]. Chikaluma, David and Nsengimana [10] suggest that teachers may use various techniques such as mind map, role play, quizzes, multiple choice questions and tests to carry out both formative and summative evaluation.

Furthermore, the last phase is referred to as the extension phase, in which the learners' ability to transfer their learning into a newer context, which is not limited to simple elaboration [1]. In this phase, learners are expected to extend and expand their understanding to everyday use experiences [5]. In general, the 7E instructional model is appropriate for the current study, which aims at examining tutors' conceptualisations of the IBL in view of the fact that it serves as an analytical framework, allowing an effective assessment of various conceptions provided by tutors.

1.3. Literature review

Silm et al. [39] have shown that some tutors link IBL with pre-service teachers' ability to form groups and participate in discussions of the questions provided. However, on a high note, the majority of tutors' conceptualisation of IBL skills is limited to developing curiosity skills only through asking questions [10, 24]. From these perspectives, it is therefore assumed that the majority of tutors have a naive understanding of IBL approaches in the teaching and learning process, thus indicating limited promotion of all required aspects of IBL.

Besides, the transformation of IBL in phases from different phases implicates the existing variations in understanding the IBL skills [7, 16]. For example, White and Frederiksen [49] developed the inquiry approach with five phases involving question, predict, experiment, approach and apply. However, the IBL phases highly relied on scientific inquiry and metacognitive knowledge through the process of scaffolding inquiry, reflection and generalisation. On the other hand, Bybee et al. [7] developed 5E phases which included engage, explore, explain, elaborate and evaluate. Nonetheless, the 5E was formulated to align with constructivism theories and active learning principles [7].

In addition, recently, the 5E IBL approach has been extended to 7E phases with other aspects such as elicit, engage, explore, explain, elaborate, evaluate and extend [16]. Conversely, the revised 7E phases added "elicit" which aimed at recognising the learners' prior knowledge as a point of departure along the learning process [36]. Along with, "extend" was added to ensure learners apply knowledge in the real world [1]. Subsequently, the added two phases entail examining the learners' prior knowledge, assessing the misconceptions and transfer of learning to a newer context [5]. Therefore, this transformation suggests the need for creating a common understanding among tutors to implement IBL into their teaching and learning practices effectively.

Recently, countries across the globe have made initiatives to integrate IBL skills in teacher education programs, so as to address the theory-practice gap [19, 40]. For instance, in Norway, the curriculum emphasises inquiry and scientific practices, which gives an open room for teachers to develop IBL skills in the process of planning

the lesson. However, although IBL is implemented among the pre-service teachers, it is given less attention than desired [19, 41].

Similarly, Spernes and Afdal [40] commented that tutors in Norway rarely design inquiry-based learning activities, because they lack understanding of IBL and the knowledge to design activities that could fully optimise the IBL method in the teaching and learning process. This is an indication that tutors' understanding of IBL is needed for them to implement IBL skills into their teaching practices successfully. Comparably, a country such as Indonesia is also encouraging tutors to promote IBL skills while implementing teacher education curriculum to increase learners' interests in STEM (Science, Technology, Engineering and Mathematics) subjects [17, 39].

Although IBL skills were found to be effective in Indonesia, one of the reasons that prohibits tutors from using the IBL approach is limited knowledge on IBL-supporting methods [30, 39]. This implies that, despite the struggles that have been made to include IBL skills in the curriculum, documents in the developing countries indicate that tutors promote IBL skills less than required due to their limited knowledge. Additionally, it appears that tutors in these countries highly believe that IBL skills are promoted in science subjects' curriculum, specifically STEM, thus suggesting their limited promotion in social science subjects.

In the context of African countries, the IBL approach is regarded as a student-centred approach which is aimed at enabling learners to understand scientific concepts and acquire scientific process skills [10, 37]. Countries such as South Africa, Zimbabwe and Malawi, in their quest to address relevance of education to meet the 21st century needs, have designed and developed a competence-based curriculum (CBC) where pre-service teachers develop understanding of the targeted competencies, including developing problem solving skills through an inquiry learning process [10, 34, 37]. For example, Chikaluma, David and Nsengimana [10] conducted a study on IBL to improve biology teaching in Malawi and found that the majority of tutors in Malawi were predominantly employing the lecturing method.

Moreover, reasons attributed to the failure of tutors to integrate IBL skills into the teaching practice included tutors' limited knowledge in designing inquiry-based learning tasks appropriately. Among other reasons are challenges of assessment, sufficient teaching and learning resources, and tutors' ability to manage group work in an inquiry learning process [39]. This suggests the need for tutors' training to improve their self-efficacy to integrate IBL skill [10]. Similarly, a study conducted by Ramnarain and Hlatswayo [33] in South Africa to explore tutors' beliefs about IBL and the whole classroom inquiry process found that the majority of tutors had positive attitudes towards IBL skills. However, they were less inclined to enact IBL skills in their lessons.

Tanzania is increasingly emphasising the use of inquiry-based learning approaches in teaching and learning [26, 43, 44]. Thus, various government documents emphasise CBC, which is closely associated with IBL [26, 46]. For instance, the National curriculum framework for basic and teacher education emphasises tutors to promote inquisitive skills among pre-service teachers through engaging them in investigation, designing, reporting results, expressing ideas and experimenting with different ways of problem solving [26].

Further, in Tanzania, both the diploma and certificate teacher education syllabi have emphasised the need for tutors to use constructivist learning approaches while teaching cognitive theories [44]. Despite such aspiration by the government, studies conducted by Mindey [25] and Ngao and Xiaohong [29] in Tanzania have shown that the majority of tutors in Tanzania predominantly rely on teacher-centred approaches, such as lectures and storytelling, with limited use of learner-centred methods. Therefore, it is not well known if tutors are well-versed with the prerequisite knowledge on

IBL methods in their teaching practices, which compelled the researcher to explore the issue under study in relation to teaching and learning practices.

The majority of studies conducted in Tanzania highly focus on exploring the status and challenges of implementing inquiry-based science teaching (IBST) approaches in Tanzania secondary schools, of which the findings revealed that IBL methods were less recognised and given less attention as important aspects to be integrated in teaching science subjects. The study proposed the necessity of addressing challenges such as large class sizes, sufficient time allocation, and overemphasis on content coverage to implement IBST efficiently. Further, the study conducted by Mkimbili, Tiplic and Ødegaard [27] on the role played by contextual challenges in practising IBST in secondary schools found that IBL was infrequently integrated into the teaching and learning process due to restrictions spelt out in conducting practical examinations for science subjects.

It appears that most studies carried out in Tanzania not only focused on exploring the status of IBL in secondary schools but also solely on science subjects. Arguably, it is not well known to what extent tutors understand the IBL methods to successfully influence their implementation in teaching and learning processes in pre-service teacher colleges. Limited tutors' understanding of IBL approaches is likely to hinder the promotion of critical thinking skills, creativity, communication skills and active pre-service teachers' engagement in solving complex problems to generate solutions [22, 35]. It is from this perspective that the researcher intended to explore tutors' understanding of IBL in teaching and learning practices within the 7e instructional model.

2. Research design and methodology

The current study employed the qualitative research approach [13] in order to collect detailed information from the participants' lived experiences. The study used the hermeneutic phenomenology research design to gather information from the college tutors, college principals and the pre-service teachers, aiming at examining, describing and interpreting human and social behaviour perceived by participants in their particular social setting [4]. The approach and design were singled out due to their ability to proffer a valuable and apt understanding of the multifaceted educational phenomena within their innate sites, thus permitting thorough investigation of the tutors' conceptualisation of IBL in reflection with the 7E instructional model in each teacher college.

2.1. Research sites and participants' selection

The study was conducted in four purposively selected teacher colleges in Tanzania mainland (that is, TC₁, TC₂, TC₃ and TC₄), found in four regions; specifically, Mwanza, Morogoro, Dodoma and Iringa. The study participants were 4 college principals, 20 college tutors and 32 pre-service teachers, thus making a total number of 56 participants. Purposive sampling strategies were employed to select teacher colleges, college tutors, college principals and the pre-service teachers, since the techniques are better when used to match the sample with the aims and objectives of the research [8]. Besides, the colleges were sampled based on the criterion that they were teacher colleges with a higher enrollment rate. In this regard, it was expected that colleges with a higher enrollment rate would have a diverse pool of teacher-educators, thus allowing the researcher to explore and compare their conceptualisation of IBL deeply.

On the other hand, the college principals were selected by virtue of their positions as they provided pedagogical leadership in the implementation of curriculum, whilst college tutors were selected based on their roles as heads of department in the core five departments within the teacher colleges. Finally, pre-service teachers were selected

based on their performance criteria. In view of the fact that the study is qualitative in nature, the sample was established by data saturation rather than a fixed total population [18]. The participants' demographic information is summarised in figure 1.

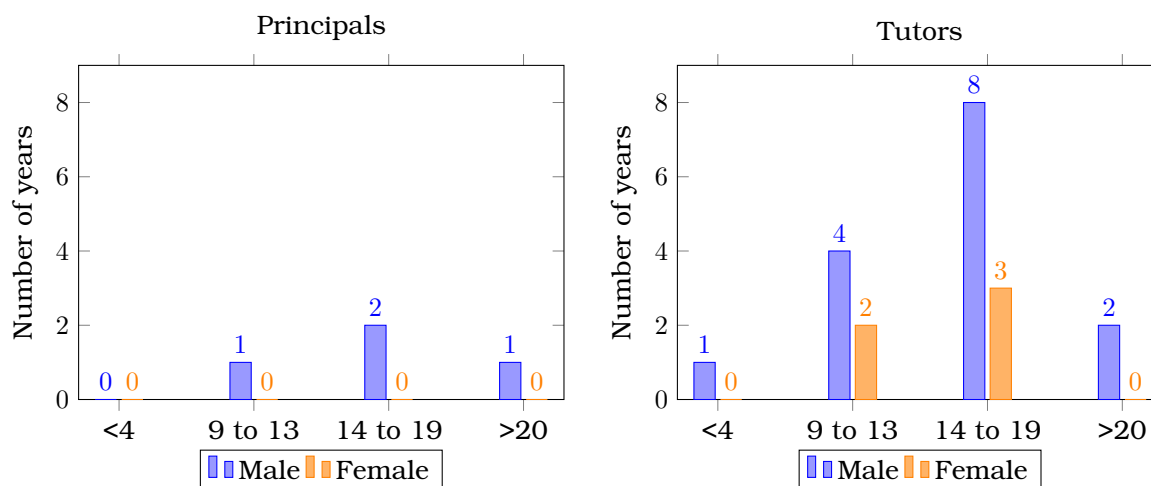


Figure 1: Demographic characteristics of principals and tutors.

The figure 1 presents the demographic characteristics of college principals and tutors, for which the analysis indicates the variation in their teaching experiences. However, all of them had an experience ranging from 9 to 20 years. In addition, all four college principals were males. Nevertheless, the majority of tutors were males, 15 in number, whilst 5 tutors were females. Besides tutors and principals, the study involved 32 pre-service teachers, including 16 males and 16 females, in 4 selected teacher colleges. Specifically, 16 pre-service teachers were in the first year of their study, and the other 16 were in the second year.

2.2. Data collection instruments

The current study used dual data collection methods to collect detailed information from the participants. Thus, interviews and focus group discussions were used as data collection methods. The interviews were used to collect data from tutors and college principals on the phenomenon under investigation, while the focus group discussions were used to gather information from the pre-service teachers. The study employed methodological triangulation to enhance the validity and credibility of research findings.

2.3. Data analysis plan

The collected data were analysed using inductive thematic analysis. The six steps of Braun and Clarke [6] were used to analyse the raw data so as to generate themes after familiarisation with the data collected, subsequently creating initial codes, theme searching, reviewing themes, defining and naming themes and report writing. After creating the inductive codebook, the transcribed data were divided into meaningful units and coded with precise descriptions. Thereafter, the process was followed by carefully identifying patterns in the data that addressed the research's main questions, which led to the development of codes. Further, the codes were used to create categories that were further developed so as to correlate with themes that led to the creation of potential groups [9]. Then, by identifying and classifying codes that had similar patterns and were pertinent to the study questions, themes were inferred, reported, analysed and interpreted with regard to the existing literature supported by direct quotations from the study participants' voices.

2.4. Trustworthiness of the data

Several approaches were used to guarantee the credibility of the study's findings. Firstly, the study collected data from various data sources, including college tutors, college principals and pre-service teachers. Secondly, in the coding process, three independent coders were used to ensure inter-rater reliability and coding agreement [12]. Thirdly, the study ensured a thorough description of the participants and the research procedures so as to ensure the consistency and aptness of the research findings in other contexts. Fourthly, the participants' conceptions of IBL were accurately represented through active listening to the audio, thus keeping clear records. Lastly, bracketing was ensured through reflexive journals in order to ensure that the researcher's pre-conceived experiences and perceptions regarding tutors' IBL understanding within the 7E instructional model did not affect data collection and the data interpretation process.

2.5. Ethical issues consideration

Ethical endorsement for this study was found from pertinent authorities, namely: 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 training colleges could be visited. The application of ethical considerations served to secure the respondents from potentially harmful situations [11]. The researcher took into consideration issues such as anonymity, safety, confidentiality and informed consent. The participants signed an informed consent form validating their voluntary participation in the study before data collection. Fictitious names were used to preserve participants' personalities and thus bestowed them with an assurance that their names would remain mysterious in order to uphold privacy. To guarantee safety, participants were assured of neither physical nor emotional harm. However, the participants experienced a conducive environment where they felt free to express themselves.

3. Results

This section presents pertinent data regarding the participants' conceptualisation of IBL in the reflection with the 7E model in pre-service teacher colleges. The data, as shown in figure 2, were collected through interviews and focus group discussions, which were administered to the college tutors, college principals and the pre-service teachers.

Figure 2 presents data regarding the participants' conceptualization within the 7E IBL phases being categorized into seven groups namely: elicitation (prompting of curiosity, stimulating learners' prior knowledge), engagement (promoting interactivity in the classroom, providing learners with opportunity to make investigation), exploration (giving learners an opportunity to observe, identify and analyse information patterns thereafter conclude), explanation (learners try to clarify concepts), elaboration (justification), evaluation (making analysis of information, engaging in reflection activities), extension (applying knowledge in a meaningful ways and engaging in self-directed learning).

3.1. Teachers' conceptualisation of elicitation

The study findings indicate that participants' conceptions of elicitation involved prompting curiosity, which is the ability to motivate the learners by making them ask questions so as to gain a deeper understanding of the subject matter, thus activating prior knowledge. Specifically, college tutors equivalent to 22%, college principals equivalent to 63% and pre-service teachers equivalent to 34.60% of all the

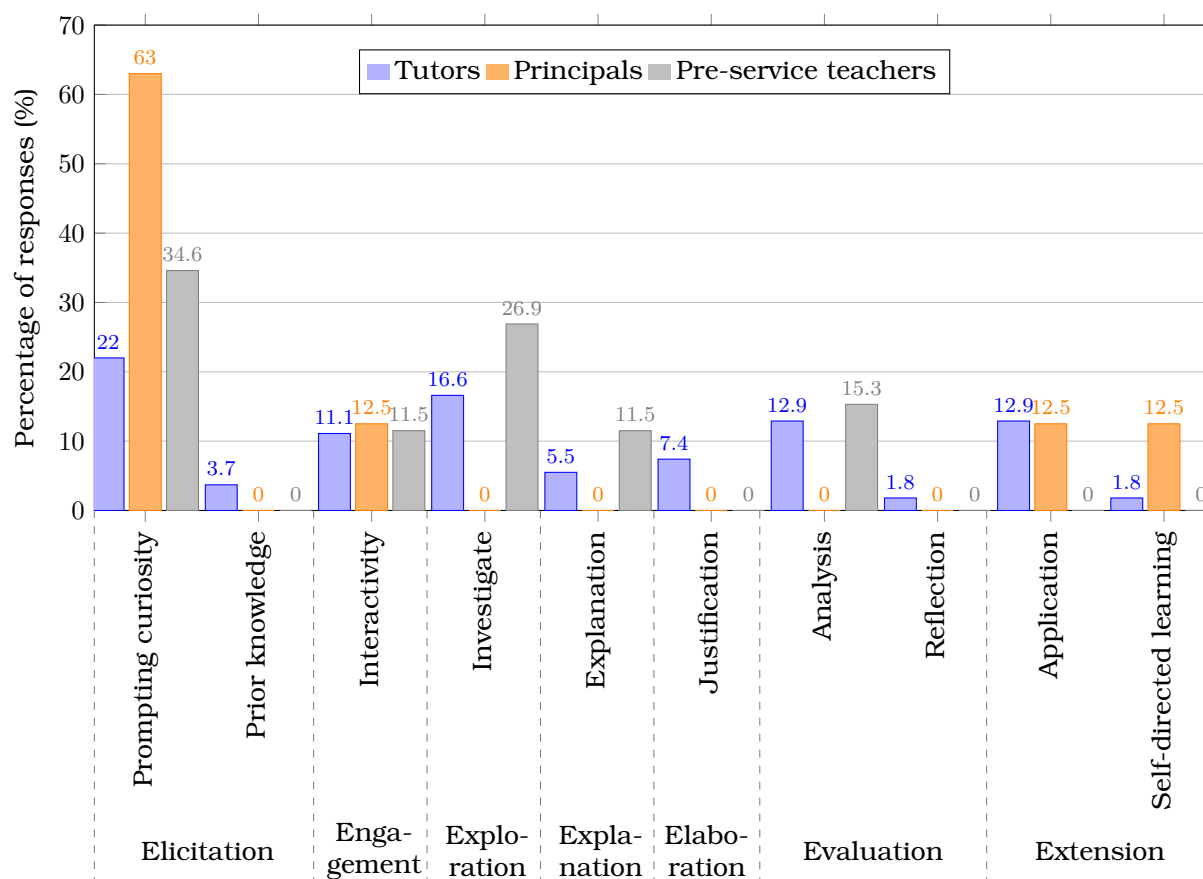


Figure 2: Tutors' conceptualization of IBL within 7E instructional model.

participants, highly recognised prompting curiosity as a defining attribute of elicitation. Thus, one tutor commented that:

In my view, I think the inquiry-based learning skills include the knowledge that a student has in asking questions, so as to get a deeper understanding of a particular concept. For instance, if you ask students a question, they may ask follow-up questions since they have the ability to ask more questions in order to learn more. (Interview with a tutor from TC₂, in 2024)

Similarly, in supporting the argument, one pre-service teacher was quoted saying,

Personally, I think IBL is the learning approach that inspires a student to learn more by asking questions or seeking information from various sources. (FGD with pre-service teachers from TC₁, in 2024)

On the contrary, another tutor had the following to say,

To my understanding, I think IBL is all about preparing the students for the lesson. For example, I can use multimedia content to present a certain concept, in order to capture students' attention in the lesson. (Interview with a tutor from TC₂, in 2024)

The study findings with respect to the quotations imply that the participants perceived the IBL approach as learning through asking meaningful questions and seeking alternative sources of information, thus promoting learners' ability to bring forth detailed information and during the teaching and learning process. While prompting

curiosity was highly referred to as the defining feature of elicitation, activating prior knowledge was less tallied by the informants since only teacher educators, equivalent to 3.70% of the responses, considered it as an aspect of elicitation.

It appears that the study participants strongly associated prompting curiosity with elicitation. This is not only due to the fact that curiosity is a core aspect of this method, but also given that in elicitation, teachers are expected to draw out learners' attention in order to generate responses by asking questions. Besides, the findings have revealed that, the college tutors from natural science department appeared to be more proficient in conceptualizing the term elicitation in relation to IBL whilst on the contrary, the quotation from a college tutor teaching courses related to educational discipline, indicates limited awareness among them in conceptualizing the term since they associated elicitation with engagement.

However, the study findings revealed that the participants considered less of other aspects of elicitation, including eliciting prior knowledge, consequently indicating their limited knowledge of elicitation skills. College principals indicated that they were not well informed on IBL skills, elicitation skills in particular. For that reason, the college principals could not be in a good position to supervise tutors' facilitation of IBL skills, including elicitation. Limited knowledge and supervision may likely affect college tutors' capacity to develop IBL skills among learners.

3.2. Teachers' conceptualisation of engagement

With regard to teachers' conceptualisation of the engagement theme, the informants also pointed out the aspect of interactivity as a defining feature of engagement, since both college tutors and pre-service teachers exhibited limited knowledge of interactivity. Each of the groups comprised 11.50% of the study participants. Notably, the absence of any remark from the college principals implies that they possessed relatively lower knowledge with regard to IBL methods compared to their counterparts. According to the participants, interactivity involves ensuring learners are taking an active role in the classroom by forming groups that allow interaction among themselves and their college tutors.

To affirm the argument, one college tutor asserted that:

From my perspective, I think the inquiry-based learning method is like promoting a participatory learning environment. Students should interact with their tutor and their fellow students in group discussions after being assigned a task for group discussions. (Interview with a tutor from TC₄, in 2024)

In addition, another college tutor from social sciences cemented arguably that:

Inquiry-based learning is a type of learning that actively engages the learners in the learning process. Thus, a teacher should provide learners with collaborative activities so that they can get a deep understanding of the subject matter. (Interview with a tutor from TC₃, in 2024)

The study findings indicate that interactivity was mentioned by only two categories of the study participants, thus suggesting limited understanding of interactivity as an aspect of engagement. Furthermore, the participants' limited knowledge of interactivity, ignoring other aspects of engagement such as capturing attention, appeared to hinder college tutors from using IBL methods in the teaching and learning process. Moreover, since a smaller number of participants insignificantly recognised both interactivity and capturing of attention by the pre-service teachers, it appears that having limited knowledge on the aspect affects their ability to demonstrate interactivity and take an active role in the classroom. Notably, the findings revealed that interactivity was not

given significant emphasis, in view of the fact that participants were not well informed on such IBL methods as acknowledged by college tutors from both the natural sciences and educational departments.

3.3. Teachers' conceptualisation of exploration

Regarding teachers' conceptualisation of exploration, the participants' responses specifically tutors equivalent to 16.60% and pre-service teachers equivalent to 29.90% of the study participants, highlighted investigation as a key aspect of exploration. While the pre-service teachers had relatively better understanding of the investigation aspect in relation to IBL compared to college tutors, the college principals' conceptions of IBL did not focus on investigation, as one college tutor commented that

To my understanding, inquiry-based learning methods are those that involve providing students with various activities for them to do, which can facilitate them to discover, invent or create something new. For instance, information search skills or observational skills. (Interview with a tutor from TC₃, in 2024)

Along the same lines, through focus group discussions, one pre-service teacher asserted that,

Honestly speaking and to the best of my knowledge, when we talk about inquiry-based learning, I think it is the learning approach that involves us seeking further information when learning a particular subject matter. (FGD with pre-service teachers from TC₄, in 2024)

Conversely, a college tutor from the language department argued that:

As far as I know, inquiry-based learning methods include skills to investigate, which may involve giving information to students that sparks their interest in the learning process. (Interview with the language tutor from TC₂, in 2024)

The study findings revealed that the investigation involves providing students with problem-based activities to research, observe and draw conclusions after gaining a deeper understanding of the subject matter. However, less recognition of the investigation aspect appeared to affect the implementation of the use of IBL methods, specifically when it comes to the issue of involving students in investigative activities. The relatively higher knowledge of investigation from pre-service teachers seems to indicate learners' interest when engaging in investigation to satisfy their curiosity. Besides, the quotation from the college tutor indicates that college tutors teaching natural sciences courses appeared to have relatively better knowledge in conceptualising exploration or investigation in teaching and learning practices compared to other fields. Nevertheless, the lack of recognition of the college principals may unequivocally hinder effective curriculum supervision in fostering the use of IBL methods to encourage learners' investigation.

3.4. Teachers' conceptualisation of explanation

Comparably, on a small note, 5.50% of the college tutors and 11.50% of the pre-service teachers pointed out explanation as an aspect defining IBL. However, the college principals did not focus on this. In addition, the study participants conceptualised explanation as the ability of learners to present their experiences and give descriptions of a particular topic after conducting an investigation. During an interview, one college tutor stressed that:

As far as I am aware, curiosity refers to a strong desire to know or learn something. In addition, I think students with inquiry-based learning skills can give explanations on what they know after carrying out an investigation. Imagine you are a teacher and your students do not speak at all, the lesson will definitely become boring. (Interview with a tutor from TC₃, in 2024)

In the same vein, another college tutor added that:

From my own perspective, I figure out that inquiry-based learning involves encouraging students to think critically, particularly after they have engaged in an experiment. In order to help students develop inquiry-based learning skills, the teacher may instruct them to demonstrate through an experiment. (Interview with a tutor from TC₂, in 2024)

While the study findings show that the informants had limited knowledge on associating explanation with IBL, the participants ignored the aspect of discussion in defining explanation, which implies that college tutors' limited knowledge of explanation and discussion may hinder the effective implementation of IBL. In addition, the informants' quotations indicate that explanation was much emphasised by college tutors teaching natural science courses. However, a lack of awareness among pre-service teachers with regard to the explanation aspect may affect the demonstration of presentation skills and discussion of various views and ideas in the learning process, which are necessary skills for IBL.

3.5. Teachers' conceptualisation of elaboration

Regarding teachers' conceptualisation of elaboration, the study findings indicate that the informants identified justification as an aspect that describes elaboration. Among all participants' categories, only 7.40% of college tutors' responses pointed out justification, which was attributed to the provision of pre-service teachers' opportunity to provide evidence-based examples and connecting the learning with their experiences after exploration of a particular subject matter. To affirm this, one college tutor argued that:

In my view, inquiry-based learning may involve asking students questions that require them to provide evidence of their arguments. They may provide examples by connecting their personal experiences with learning, hence developing critical thinking and problem-solving skills. (Interview with a tutor from TC₁, in 2024)

The study findings show that, although the participants' definition of elaboration relies on providing evidence-based examples to connect learning with real-life experiences, this suggests a narrow conceptualisation of elaboration. Therefore, a lack of explicit tutors' knowledge concerning the elaboration phase may hinder its effective implementation in the classroom. Similarly, the limited knowledge among pre-service teachers on the elaboration aspect may hinder the application of knowledge gained in both the classroom context and outside the classroom context for the enhancement of IBL.

3.6. Teachers' conceptualisation of evaluation

The participants viewed evaluation as engaging the students in analysing and reflecting on information. The informants, specifically tutors, equivalent to 12.90% of the participants and pre-service teachers, equivalent to 15.30% of the study participants, associated the evaluation aspect with the meaning of analysing the provision of problem-based activities, such as analysing results through an Excel spreadsheet,

summarising content and screening valid materials from various internet sources. Although a smaller number of participants recognised analysing information as an aspect associated with evaluation, the college principals hardly recognised the aspect. For example, one pre-service teacher asserted that:

Our teachers often provide us with a task to analyse particular information patterns. I think this is an inquiry-based learning. For example, sometimes they give us real students' results and tell us to arrange them from the first to the last. In my view, the ability to summarise the data can also promote critical thinking skills. (FGD with the pre-service teachers from TC₂, in 2024)

Similarly, one college tutor commented that:

I usually give my students a topic or sub-topic for them to work on by searching for materials from different sources on the internet. Thereafter, I normally instruct them to prepare a summary for a classroom presentation. Honestly speaking, through search, my students often manage to analyse what is valid and invalid material. It is really magnificent and encouraging to use IBL methods in the teaching and learning process. Frankly speaking, I know nothing about other tutors. (Interview with a tutor from TC₃, in 2024)

The study findings indicate that quite a good number of participants seldom provided students with tasks that involved analysing information and summarisation, which are essential for enhancing evaluation. However, few of them were providing tasks that appeared to be more formative, thus indicating less relative recognition of summative compared to formative evaluation, with the implication that there is a gap among college tutors in effectively administering assessments during the teaching and learning sessions. Besides, the participants associated analysis with evaluation because they regarded summative assessment as an aspect of evaluation and IBL in general.

Along similar lines, the lack of recognition among college principals, who are the main supervisors in the implementation of the curriculum, appears to decelerate the enhancement of evaluation in the overall implementation in pre-service teachers' colleges. On a small note, the informants, specifically college tutors, equivalent to 1.8% of the study participants, defined evaluation as making a reflection in the learning process. In reflection, college tutors believed that evaluation involves asking questions, which influenced the pre-service teachers to connect their learning with their real-life environment. Despite this conceptualisation, the informants indicated less whether the use of both analytical and reflection tasks was triggered towards formative and summative assessment, thus indicating the need for more understanding towards the evaluation phase reflecting on the 7E instructional model.

3.7. Teachers' conceptualisation of extension

The study findings disclosed that participants' conceptualisations of extension ranged from application to self-directed learning. The informants, particularly college tutors, equivalent to 12.10% of the study participants and college principals, equivalent to 12.50% of the study participants, highlighted the application of knowledge as a defining feature of extension. Although the informants' responses regarding application of knowledge were low, the pre-service teachers did not focus at all on this aspect. Moreover, when the informants were giving their conceptions, they associated application with the abilities of learners to use knowledge acquired in their classroom or daily life environment, as one college principal reported:

In my opinion, an inquiry-based learning may involve the real application of knowledge. If a teacher has taught the students about the uses of fertilisers, they should be able to use them accordingly in their farming activities. For example, we teach our students to improvise and prepare teaching aids, expecting that, after graduation, when they start teaching, they should prepare teaching aids for their students. Therefore, our role is to encourage them to apply the knowledge acquired. (Interview with the principal from TC₃, in 2024)

Similarly, one college tutor from the ICT department asserted that:

An inquiry-based learning involves equipping students with knowledge and skills in order to be innovative, and thereafter, teaching them to come up with new innovative products. For instance, we are used to teaching them to apply knowledge gained to prepare simple programs like voting programs and design invitation cards. (Interview with a ICT tutor from TC₂, in 2024)

Similarly, another tutor who is teaching educational courses added that:

To my understanding, students with inquiry-based learning skills can apply knowledge learnt in the classroom and respond to questions, along with solving any problem related to learning tasks. (Interview with a tutor from TC₂, in 2024)

The study findings revealed that, although the extension phase was given the least attention, college tutors teaching social sciences, natural sciences, and ICT acknowledged it. However, the findings suggest that there were misconceptions among study participants about the application of knowledge as an aspect of extension. The connotation of “application of knowledge” seems to be grounded on both the ability to apply knowledge gained in both the classroom and outside the classroom context, which led to college tutors’ misconceptions on how to differentiate the two terms, the elaboration and extension phases.

Furthermore, the findings revealed that the informants’ responses, specifically tutors, equivalent to 1.8% and principals, equivalent to 13% of all the study participants, under-recognised self-directed learning as an attribute of the extension phase. According to the participants, self-directed learning involved pre-service teachers developing the skills in order to carry out an independent study with limited guidance from their college tutors. While self-directed learning may not be directly related to the extension phase, it absolutely plays a crucial role in applying knowledge beyond the classroom context.

4. Discussions

Reflecting on the 7E instructional model, the findings of the current study have revealed that the majority of the participants highly conceptualised elicitation as a key defining feature of IBL. In defining elicitation, participants mainly pointed out the Socratic method of teaching, that is, asking questions, but showing less focus on activating prior knowledge. The current findings align with the study conducted by Lee and Shea [24] who argued that teachers’ conceptualisations of IBL were limited to asking questions, thus indicating a simplistic understanding of IBL. In asking questions, Lee and Shea [24] argued that teachers should ask open-ended questions that can lead students to ask their own questions.

Besides, the study findings indicate that, while the majority of teacher-educators highly recognised elicitation as the IBL phase within the 7E instructional model, which

involves asking questions, they were less likely to diagnose learners' prior knowledge in teaching and learning practices. The current study findings are in line with the study by Shaheen and Kayani [38], who affirm that the elicitation phase involves prompting students' prior knowledge through asking questions. Notably, currently, Tanzania is emphasising implementing the competence-based curriculum to promote inquisitive minds [46]. Therefore, the simplistic thinking of IBL may negatively impact the tutors' ability to implement IBL effectively. Significantly, this may limit learners' ability to acquire the essential 21st century skills such as curiosity, problem-solving and critical thinking skills [21].

It is worth mentioning that, although the national curriculum framework for basic and teacher education emphasises the role of diagnosing learners' prior knowledge [26]. The findings of the current study indicate less recognition of this aspect since it has revealed misconceptions in the way participants conceptualise extension and elaboration, which are the IBL phase within the 7E instructional model. For example, extension was associated with the application of knowledge within and outside the classroom context, whilst the phase entails the learners' ability to transfer their learning into a newer context, which is not limited to simple elaboration and is expected to expand their understanding to everyday use experiences [1, 5]. Similarly, elaboration was explained as a justification of knowledge in different contexts. This is contrary to studies reported by different scholars, such as the study by Eisenkraft [16] and Adesoji and Idika [1], who define extension as the application of knowledge gained into the newer context beyond simple elaboration.

In the same vein, Balta and Sarac [5] asserted that elaboration involves learners' opportunity to understand and use their understanding in new situations or new contexts. The critical analysis of the current study findings and the aforementioned scholars depict a slight variation between elaboration and extension, which suggests the need to remain in one phase, that is, the exploration phase, as it was also suggested by Bybee et al. [7].

Moreover, the study found that participants less conceptualised evaluation as a key defining attribute of IBL within the 7E instructional model. Although studies conducted by Adesoji and Idika [1], Balta and Sarac [5], and Chikaluma, David and Nsengimana [10] show that the 7E instructional model recognises evaluation as a meaning that is attributed to IBL, the participants less recognised this aspect. Significantly, in order to achieve quality and competitive education, UNESCO Office Santiago and Regional Bureau for Education in Latin America and the Caribbean [45] aspires that teachers should ensure monitoring and evaluation of learning outcomes through using innovative teaching methodologies, including IBL.

In the Tanzanian context, the national education framework for basic and teacher education and the education curriculum emphasise that college tutors should critically evaluate and assess pre-service teachers' learning [26, 46]. However, Mkimbili and Ødegaard [28] noted that college tutors encounter challenges in understanding and mastery of relevant IBL methods in order to evaluate the learning process, which suggests a sustainable intervention to create awareness of both formative and summative evaluation in the teaching and learning process.

However, various studies reported that neither most of the educators accorded evaluation due weight, nor did the current study inquire into the reasons for this aspect not being given due weight. On a similar note, the study by Chikaluma, David and Nsengimana [10] indicated that the reasons behind the evaluation not being given due weight can be associated with but not restricted to teachers' limited skills in evaluation. For that reason, it may be acknowledged that, limited knowledge on IBL methods to carry out evaluation, might be the reasons as to why the participants in the current study also put little emphasis on it which insinuates for an intervention

to create awareness amongst college tutors and principals on the application of IBL methods in the teaching and learning process, specifically on evaluation skills.

Although the findings revealed limited understanding among the participants, the college tutors had a slightly better understanding than the college principals. Comparably, college principals had a lower understanding of engagement, exploration, explanation, elaboration and evaluation, which are IBL phases as reflected in the 7E instructional model. It is worth stating that, in Tanzania, the policy statements recognise college principals as the main supervisors in the implementation of curriculum [46]. Therefore, their limited understanding of IBL methods is significantly affecting the facilitation of IBL in pre-service teacher colleges. Besides, the limited understanding of IBL among the participants underscores a gap in the way college tutors implement IBL into their teaching and learning practices.

Further, the findings revealed that the college tutors, particularly those teaching natural sciences, were the most proficient in conceptualising the various phases of IBL. The natural science tutors had a better understanding of elicitation, engagement, explanation and extension. The findings align with the study by Kinyota [23] and Strat and Jegstad [41], which asserted that, originally, IBL was a recommended approach for teaching science subjects; thus, the majority of tutors relied on the original perspective of IBL.

Notably, Pedaste et al. [30] and Kinyota [23] argued that IBL is particularly relevant to the science curriculum in subjects like chemistry, physics and biology in the view of the fact that the aforementioned subjects involve authentic scientific discovery through observation, experimentation and the generation of solutions. This suggests a gap with regard to college tutors' understanding of whether IBL applies to other educational disciplines or not. On the contrary, Sam [35] puts forward that IBL is not limited to the science field, but rather it can be used across a wide range of disciplines, including social sciences, ICT and language. The assertion implies that the need to conduct an IBL training to strengthen an understanding of IBL among college tutors teaching social sciences, education, ICT and language studies is inevitable.

All in all, the study participants had limited understanding of the way they conceptualised the IBL approach since they did not capture all phases of the 7E instructional model. Despite the least recognition shown by the participants, the majority of college tutors, especially tutors teaching natural science courses, had a better understanding of the IBL approach compared to college tutors from other fields. Besides, the current study's findings revealed misconceptions when the participants expressed their views on elaboration and extension. In that regard, the findings have indicated that the meaning of IBL was prominently associated with elicitation, specifically curiosity. The study participants did not recognise phases such as explanation, elaboration, and evaluation.

5. Conclusion and recommendations

The study found that the majority of the study participants had limited understanding with regard to the use of IBL methods in teaching and learning since their conceptualisations prevalently fell under the elicitation phase in accordance with the 7E instructional model. Although the majority of college tutors had limited knowledge on the IBL phases, comparably, the college tutors teaching social sciences, education, ICT, and language had relatively lower knowledge compared to those from the natural science department. Thus, their limited understanding of a wide range of phases appears to be shaped by the raised delusion between elaboration and extension. So, in relation to the findings, there is a need to create awareness amongst college tutors on how they can effectively apply the IBL methods in the teaching and learning pro-

cess, thus filling the gap in their teaching practices, which were structured towards enhancing IBL skills to pre-service teachers.

On a similar note, it is therefore recommended that the Ministry of Education, Science and Technology should initiate regular training for college tutors so as to equip them with the requisite knowledge on IBL methods, and the targeted tutors should be those teaching social sciences, ICT, education and language subjects. Besides, the study recommends that there should be an intervention study triggered towards enhancing college tutors' awareness of IBL phases such as engagement, exploration, explanation, elaboration and evaluation.

In general, the study recommends using the 6E framework model by merging the two phases, namely, the elaboration and extension phases, coupled with the enforcement of the policy through setting a specific implementation strategy to successfully implement IBL skills in the teaching and learning process in teacher colleges.

5.1. Limitations of the study

Despite the fact that the current study has attained its aims, it had some potential limitations. Principally, the study encountered time constraints during the study implementation process, in view of the fact that some teacher-educators were supervising pre-national examinations for the three-year pre-service teachers' diploma program. Further, one teacher-educator was presiding over a seminar on the implementation of the new curriculum, while another one was in a meeting hosted by the quality assurance officers from the Ministry of Education, Science and Technology. However, some teacher-educators portrayed a kind of resistance as they were not ready for the interview. The researcher addressed the time constraint challenge by rescheduling the data collection process according to the participants' expediency. Notably, the researcher addressed teacher-educators' resistance by elaborating the purpose of the study thoroughly, thereby agreeing to provide the required information.

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