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Message from Director

I am delighted to announce the second volume of the action research series of Battambang Teacher Education College. It is a step forward for BTEC teacher educators to publish this volume with very hard work and huge contribution. The action research series provides a compilation of various topics to share knowledge and new findings to student teachers and teacher educators in BTEC and other educational institutions in Cambodia.

One of the three missions of BTEC is to promote a research culture among student teachers and make them accustomed to doing research. The guidelines and examples of building research are very significant for student teachers, and this volume provides a good example for student teachers to be a model of doing research. The purpose of implementing the Action Research is to improve the quality of teachers and promote professional development in line with the education reform of the Ministry of Education, Youth and Sport. Research has played crucial roles in promoting teaching and learning competency as well as enhancing the quality of education in Cambodia.

I would like to express my faithful thanks to BTEC teacher educators, BTEC management team, and all departments, especially JICA E-TEC who has supported us on the development of research as well as other parts of management and lecturers since the beginning of the project until now. I do hope that JICA will continuously support BTEC more and more in the future. Thank you.

Bin Chhom

Director

Battambang Teacher Education College

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Questioning Techniques in Learning English Grammar: A Case of Primary Education Student Teachers at Battambang Teacher Education College

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Abstract

This study aims to investigate student teachers' responses to the factual and conceptual questions and how this influences their learning involvement. A teacher-centered approach was implemented during instruction, but student teachers still received less time for practice. A total of 75 student teachers in Year 2 of the Primary Teacher Education Program at Battambang Teacher Education College participated in the study. The data was collected from three teaching sessions, and the video recordings were replayed and observed to examine the student teachers' responses and participation. The findings revealed that student teachers' responses to the factual questions were high, however, their responses to the conceptual questions were limited as these questions required more information and prior experiences. The findings also showed that student teachers participated in the class actively and critically when the teacher employed provocative questions, and the students were given the opportunities to discuss, practice the tasks, and express their ideas freely. Remarkably, it was found the Students Talking Time increased, while the Teacher Talking Time decreased when the teacher educator acted as a facilitator. The study suggests that teacher educators should consider applying questioning techniques by asking questions to help student teachers understand rather than simply know or remember the lessons.

Keywords: Questioning techniques; primary education; student teachers; Cambodia

1. Introduction

1.1. Background of the Study

Throughout the history of language teaching, the language teaching approaches have been unceasingly changed to ensure the betterment of English learners' outcome. Some of the teaching approaches include Grammar Translation Method (1800-1900), Direct Methods (1890-1930), Cognitive Approach (1970), Audio Lingual Methods (1950-1970), and an Eclectic Approach (Richards & Lockhart, 1994). Educators today seem to be faced with a choice: continue teaching centuries-old ways of teaching or throw them away in favor of innovation and creativity to move into a 21st century paradigm for teaching and learning. Questioning has been an inevitable tool to improve learner and teacher interaction as well as to promote learners' critical thinking skills. Teachers' questions have been at the heart of many researchers nowadays (Nunan, 1989), and questioning has been employed by teachers at any time and step (McTighe & Wiggins, 2013).

To accumulate students' interaction and development of thought, many effective questions are designed to facilitate students' responses towards the answers (Qashoa, 2013). In classroom interaction, teachers use questioning techniques to level up students' talking time. In this way, students practice the language by responding to their teachers' questions. By the same token, the students are expected to actively participate in learning grammar, and they are able to accumulate their critical thinking to some extent. The theoretical review on the taxonomy of questions is one of the most potential teaching approaches, and following best practices can improve the quality of education dramatically (Tofade et al., 2013). The use of the open-ended questions orally can help to entail learners' communication and also encourage students to think critically (Aziza, 2021). Although the open/closed questions and the displayed questions were dominant within questioning strategies, it still depends on the materials that the teacher transferred to the students in class (Sujariati et al., 2016).

Furthermore, teachers' questioning strategies are able to improve students' verbal responses in English as Foreign Language, since teachers' questioning skills are crucial for successfully engaging learners in classroom interaction, boosting students' verbal responses, and leading to lesson outcomes (Fitriati et al., 2017). Teacher's skills of using questioning definitely have an association with students' responses to the factual questions and the conceptual knowledge questions, and this shows that students could answer the factual knowledge questions correctly (Ilhan, 2019). However, they struggled to answer the conceptual knowledge issue, which was buried beneath the association and interpretation of the problem. Similarly, according to Al-Zahrani and Al-Bargi (2017), students actively participate in the learning process and provoke their critical thinking skills, and teachers use effective questioning during their teaching process. Teachers play crucial roles in using guiding questions to help learners reach the conceptual level of understanding (Erickson & Lanning, 2017). Using questioning contributes significantly to the learning outcomes of students in learning English grammar. For instance, they are

expected to participate actively in classroom interaction which will considerably affect their understanding of the lesson.

According to Tofade at al. (2013) the theoretical review on the taxonomy of questions offers tips for writing successful questions and discusses practical factors for increasing student involvement and encouraging critical thinking. They suggested that students' perceptions, motivation, and accomplishment of intended educational outcomes are influenced by the clarity, sequencing, and delivery of questions, and the psychological safety of the learning environment. Therefore, questioning is one of the most potential teaching approaches, and following best practices can improve the quality of education dramatically. Furthermore, Ilhan (2019) showed that students could answer the factual knowledge questions correctly. However, they had difficulty in answering the conceptual knowledge questions which ultimately lie under the association and interpretation of the problem.

Effective questioning in the classroom can help all students think at a higher intellectual level, entail learners' linguistic ability and motivate them to search for new knowledge. Questioning has played a key role in reducing reliance on rote learning. To determine students' understanding, essential questions are used to provoke and get to a subject's richness and complexity (McTighe & Wiggins, 2013). Questioning has played an important role in ensuring the smooth general learning and teaching process. It has as an inevitable tool to supervise the stream of interaction in the whole classroom (Gall, 1970). Questions asked can build up learners' confidence to produce language without taking risks or being afraid of having to initiate conversation (Kinsells, 1991). Teachers' questions can also give immediate feedback about their students' competency in language learning. Teachers can assess their students' ability in linguistic competency such as grammatical or phonological problems (Christenbury & Kelly, 1983).

1.2. Statement of the Problem

There have been many studies conducted to apply the questioning technique to examine its effect or effectiveness in teaching English. Tofade et al. (2013) offered tips for writing successful questions and discussed practical factors for increasing student involvement and encouraging critical thinking. The questioning strategies used by Sujariati et al. (2016) in English focused on second language instructions, so the open/closed questions and display questions were applied by the teachers in the EFL classroom. The examination of intermediate students to foster interaction in English as a Foreign Language classrooms evidently took place, and the questions that were deemed to promote classroom interaction and questions that failed to create classroom interaction were employed (Al-Zahrani & Al-Bargi, 2017).

Mustika et al. (2020) observed two teachers teaching, and the results were mostly about the four questioning strategies that have been asked; the researchers mentioned how teachers' questioning skills

were crucial to successfully promote students' engagement and classroom interaction, enhance their verbal responses, and their comprehension of the unit. The functions and types of teacher questions as well as the Bloom's Taxonomy of Questions were analyzed and discussed to help EFL classroom instructors gain a deep understanding of teacher questions and to help them know how to use higher order questioning to enhance EFL students' critical thinking ability (Feng, 2013). In addition, the study on how EFL teachers can design questions that can expand students' knowledge and promote creative thinking was implemented; however, the significant impact of the performance of teacher questioning in facilitating the process of learning can demotivate learners if it is carried out incorrectly (Fatmawati et al., 2020).

Although previous studies illustrated different findings and results, it seemed confusing to see the questioning types and techniques being applied in English grammar learning. Given the importance of the English grammar subject, it is integrated and required in the Battambang Teacher Education College, especially student teachers who are having the (12+4) program. Battambang Teacher Education College is a higher education institution that has been serving several programs which are related to teacher education. However, the learners are inactive in learning grammar, and they feel less confident in responding to questions asked by their lecturers, so the classroom interaction became low, and the Teacher Talking Time (TTT) appeared frequently in grammar lessons. This result illustrated the low level of language proficiency of the student teachers. Moreover, TTT still occurs in English grammar sessions according to the online survey conducted with the lecturers of BTEC (Lecturer Survey, 2020). It demonstrated how the lecturers usually talk much during teaching to get students to understand the content of each lesson. To achieve the aim of the study, this research attempts to simultaneously answer the two research questions. The first one is how the student teachers respond to questions asked in the 90-minute grammar instruction, and the second is how the student teachers get involved as the provocative question was employed.

2. Literature Review
2.1. Definition of Questioning

A question is a word, a gesture, or a statement that seeks information through a response. It indicates that the speaker asks a question when he or she says anything like words, phrases, or sentences that the interlocutor or listener must repeat (Sujariati et al., 2016). A question is a command or interrogative statement used to extract information or a response or to assess knowledge (Lynch, 1991). To put it another way, when people compose sentences to other people using command and interrogative language to obtain any information or replies, they are asking a question.

According to Long and Sato (1983), a question is a linguistic term used to make an information request, or a request made using such an expression. As a result, the requested information may be delivered in

the form of a response. Any statement with an interrogative form or function is a question (Cotton, 1989). Teachers' questions are instructional cues or stimuli that transmit to students the material items to be learnt as well as directives for what they will do and how they will accomplish it in a classroom setting (Cotton, 1989).

2.2. Questioning Strategies

Guest (1985) mentioned how questioning strategies are one of the crucial instruments to accelerate student learning and assist the instructor to develop their own techniques to improve students' work and thinking. In this case, teachers cannot ignore those techniques since they are very important for both the teachers and learners.

According to Harvey (2000), the most successful questioning method allows students to completely participate in the learning process. Teachers must consider the sorts of questions they would ask students while arranging the session. It should also be clear what the desired goals of the questions and answers are. It implies that the questioning approach will assist a teacher in properly planning a question-and-answer session when the instructor plays the questions depending on the students' needs and question kinds in order to encourage students' engagement.

One of the most significant aspects of teaching and learning, according to Fries-Gaither (2008), is questioning tactics. It allows tutors to learn what students know and comprehend while also allowing students to request clarification and assistance. It means that teachers can figure out what their pupils know and don't know by asking them questions. Teachers and students benefit from the use of questions in the classroom. Eble (1988) claims that instructors' questions may be used in three different ways: (1) at the start of the lesson, (2) in the midst of the lesson, and (3) at the conclusion of the lesson after the teacher has finished teaching. The questions are typically used towards the end of the session, but they are also utilized at the beginning and middle of the class. Furthermore, the functions are used to apply the questions in each segment.

Reasons for the Use of Questioning Strategies

According to (Sujariati et al., 2016), there are several reasons why teachers should ask their pupils questions, whether the inquiries are directed at a single student or the whole class. The teachers used a variety of questions and questioning types as a strategy in questioning not only to promote classroom interaction but also to encourage students to communicate in a real-life setting, to foster a closer relationship with the students, and to assist students that have issues in expressing themselves due to their limited vocabulary. The questions are usually utilized at the end of a class, but they are also used at the start and middle of the teaching and learning process.

Different researchers provide various explanations for why this is the case. Ellis (1992), for example, provides two reasons why teachers ask questions in their courses. To begin with, questions necessitate replies and so serve as a technique of requiring learners to participate in interactions. The replies of the students also give feedback to the teachers, which they may use to improve the content and expression of subsequent teacher talks. Second, questions are used to keep track of the progress of the interaction in which a lesson is delivered. Questions can be used to inspire students, revise, control, test or assess, investigate, explain, encourage students to focus on a certain topic, elicit information, and verify comprehension, as well as to regulate conduct (Richards & Lockhart, 1994). It indicates that questions asked by teachers are not only a way of forcing teacher-talk to direct students' attention, but also a way of adjudicating students to be more active and focused on a certain issue, allowing teachers to monitor and manage their comprehension.

Adler (1982, pp. 88–89) noted that "Teachers pose questions to pupils in order to engage them and inspire deeper-level thinking about the subject under discussion and the art of asking questions is one of the essential skills of excellent teaching." As a result, in order to assist learners to attain new levels of thinking, an educator must delve into the learner's hidden levels of knowledge and awareness when practicing the craft of successful teaching. It implies that instructors may use the skill of thoughtful asking to extract not only factual information, but also to assist students link concepts, make inferences, raise awareness, encourage creative and imaginative thought, support critical thinking processes, and more.

2.3. Questioning Techniques in Learning English Grammar

There are several questioning techniques in learning English grammar as the following closed/opened, inferential and display questions were used by the researcher to find out the effect of the questioning strategies on learners' activities (Sujariati, 2015). Similarly, the display and referential questions were also employed to explore recurring patterns of questioning behaviors and their interactive effects through non-participants observation. The other types of questions were used to see the effect of students' participation in the process of negotiation of meaning, and the coded/display and yes/no questions were discovered to be greater than the number of open/referential questions. Although it appeared that the usage of such questions was due to students' lack of proficiency, it was also shown that the learners' silence or apprehension to engage may have been caused by an inefficient questioning style (Farahian et al., 2012). The convergent and the divergent question types employed in the previous study showed that the lower-order, convergent questions rely on students' factual recollection of past information than higher-order, divergent questions. The taxonomy of questions and best practice tactics may help pharmacy educators generate a larger range of questions that demand learners to analyze, evaluate, and create in addition to recalling crucial factual, conceptual, and procedural information (Tofade et al., 2013). The factual knowledge includes the technical vocabulary used in a discipline and

the details extracted from reliable sources of information. Questions on the factual dimension of knowledge can be constructed to demonstrate understanding, prompt analysis, awareness of the interrelationships between the parts of a bigger system are part of conceptual knowledge. Based on the result of the observation, teachers frequently offer low-level cognitive questions that fail to inspire critical thinking during lessons in the classroom. It is not far different from the study by Phillips and Duke (2001) who showed that the lower-order questions popped up far more frequently than higher-order ones. In this study, we used various types of questions which were further distinguished from the aforementioned types of questions. More factual questions limit learners' critical thinking and less conceptual questions and provocative questions were posted in learning English grammar which focuses on presentation practice and production lesson.

2.4. Types of Questions

Factual Questions

Factual questions are locked in time, places, or situations, just as facts are locked in time, places, and situations. As what has historically happened when curriculums were written at the factual level, the factual questions had also been asked. To explore the answer which expresses observable, provable, or measurable events of nature in general, the factual questions have been applied. The following examples are factual questions (Stern, 2018). What are the indicators of environmental change? What factors contribute to food's impact on climate? What are effective individual and collective actions to mitigate future climate change?

Conceptual Questions

Conceptual questions transfer through time across cultures and across situations, just as concepts transfer across discipline. The study needs both factual and conceptual questions which can help learners reach a deep level of understanding that also transfers through time, across culture, and across situations. Teachers do not teach the students facts, but they should teach them how to use facts to reach the conceptual level of understanding. Conceptual questions are used to comment on the connection between conditions pertinent to subjects and are used with theories, diagrams, charts, maps, models, and tables (Ayvacı & Türkdoğan, 2010). The three sub-groups of conceptual knowledge are the knowledge of classifications and categories, the knowledge of principles and generalizations and the knowledge of theories, models, and structures (Ilhan, 2019). The following are the examples of conceptual questions according to Erickson et al. (2017). How do organisms interact with the abiotic features of an ecosystem? Why do many communities live in a particular ecosystem? How would the construction of a new subdivision affect the organisms in the ecosystem?

Provocative Questions

Provocative questions and debate questions refer to questions in which there is no right or wrong answer, and they are intellectually engaging and interesting. Since it is time consuming and may not lead to the required understanding for the unit, not many of these questions have been used, yet they are an important side of guided inquiry. It involves how to deal with the problem and how to use research methods, skills, procedures, techniques, and methods in this process. For example, what would happen to a population of organisms if it was suddenly displaced from its ecosystem? Can a population survive without the energy from the Sun? (Erickson & Lanning, 2017).

2.5. Conceptual Framework

The conceptual framework of this study deals with applying questioning techniques in English grammar instruction. The interaction between the lecturer and student teachers are enhanced; the lecturer asks three types of questions: factual questions, conceptual questions and provocative questions. In the learning English grammar session, the lecturer applies the questioning techniques, the thirty-two factual questions, seven conceptual questions and one provocative question in the teaching process. In order to promote the students' participation, the lecturer employs these kinds of questions into the new language lesson, namely (PPP) lessons. In the PPP procedure, there are three important stages. First, the presentation stage which is supported by the three sub-stages: present the new language, comprehension checking and highlight the target item. In this process, some factual and conceptual questions are asked to elicit the level of the student's understanding of the materials to deal with highlighting the new language form or the structure from the context. Second, the practice stage consists of two important tasks: they are controlled and less-controlled practices; the two types of questioning techniques were also asked to enhance the student's participation and critical thinking skill. Finally, the three types of questioning techniques played important roles to encourage the students to ask some questions, to make discussion, debate in the class by using provocative questioning.

Figure 1

Conceptual Framework
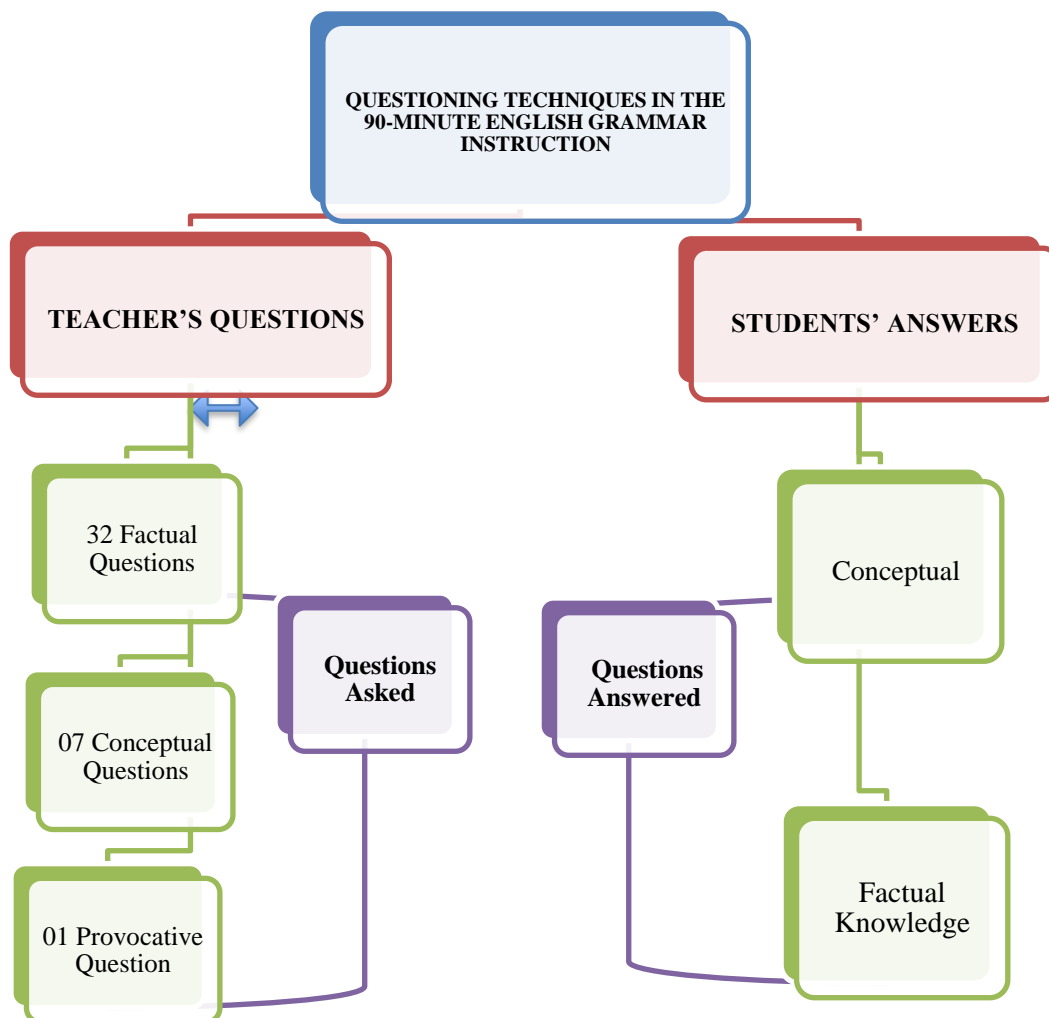
3. Research Methodology

3.1. Participants, Sample Size and Sampling Methods

Since this study attempts to investigate how the student teachers' responses to questioning techniques and their learning participation, quantitative research is adopted. This study employed the non-probability sampling, and used the convenient sampling technique. A total of 75 non-English major student teachers who are the student teachers of the Primary Education Program, and are currently studying in Year 2, Semester 2 in Battambang Teacher Education College (BTEC) participated in the study. The majority of the participants had different backgrounds of English proficiency as they did not experience taking the selection test of English prior to entering the teacher education program in BTEC. Around 75 % of the participants were between the ages of 18-21, 23% between 22-25, and 2% were over 25. Among them, 75% were female and 25% were male.

3.2. Research Instruments

Video Recording

Video recording was used to record teaching and learning processes. The videos were taped in three sessions with the time limitation of 90 minutes for each session. We replayed and paused the tape during observation to take note of the frequency of the types of questioning techniques and the students' responses to the questions which the teacher asked and evaluated the answer carefully.

Class Observation Checklist

The class observation checklists are used to categorize the questions the lecturer applied in the three particular sessions. The questions are classified into three main blocks: factual questions, conceptual questions, and provocative questions. Each block was filled during the replaying and observing videotapes, and the types of questions which were applied in the real class were recorded in frequency, and percentage.

Lesson Plan

In this study, three lesson plans were created for three different sessions, and all of them are the types of Presentation, Practice, and Production, that present the new language, practice the new language and produce the new language. The first stage is the presentation stage where the lecturer employs the effective strategies to present to the learners with the new language; for instance, these include dialogues, short reading texts, realia, listening or pictures. Then, the lecturer had to check the student's comprehension of what he/she had presented in order to elicit the level of understanding about the new structure. The second stage was the practice stage consisting of the controlled practice and the less-controlled practice. The controlled practice was used to improve the level of fluency of the new language or structure, and the less-controlled practice was to get the learners to be familiar with the new structure. In this stage, the lecturer focused on accuracy rather than fluency. Finally, the third stage was the free practice, namely, the production stage. For this stage, the lecturer asked the learners to use the language freely. As a result, the learners had much time to discuss, talk or demonstrate their idea with the class.

3.3. Data Collection

Presentation Stage

In the process of presenting the new structure in the comprehension checking task, nine factual questions (FQs) were introduced, and the two conceptual questions (CQs) were asked. Two types of the question techniques were chronologically applied during this session from FQs to CQs. Therefore, the

student teachers took time to answer the CQs, since they require connecting answers in FQs with the existing knowledge or experience to respond to each question asked. Another task is to highlight the new target item. In this task, the twelve FQs were employed, and three CQs were asked. Some FQs were asked to elicit the form of past continuous and past simple. Also, the lecturer tried to apply some factual strategic questions and two conceptual strategic questions to elicit the meaning for and the use of past continuous and past simple, namely, the concept checking task, so the lecturer used Yes/No questions for checking strategies. To differentiate the situation between the use of the tenses coincidently such as past simple with past simple and past continuous with past continuous, one CQ had been raised.

Practice Stage

Twelve factual questions were employed; two conceptual questions were applied, and one provocative question was used. In the controlled practice task, which normally was done with drill, it was replaced by one CQ with several FQs to ask the student teachers to look at the pictures and match. The understanding on how to use the "when" with the past simple and "while" with past continuous was not enough. However, student teachers' responses to the CQs in highlighting the new target item task was inevitable. In the less-controlled practice task, there was one FQ and one CQ that were used to critically think about their answers obtained with the reasons why they chose the answer.

Production Stage

The ultimate objective of the production stage was to assess the students' understanding of the holistic lesson. In this stage, the students had a chance to practice the language items through skills. Speaking and writing skills are normally used to improve language competency after learning the new language. In this stage, the teacher used a provocative question to encourage the students to discuss the given topic. To help the students to seek a solution, the teacher also employed some factual questions, which were the hints for the students to critically think, and they were helpful to produce the learning output for the session.

3.4. Data Analysis

To analyze collected data, the researchers replayed the video. While watching the three recorded videos, the researchers categorized the type of questions: factual questions, conceptual questions and provocative questions into three main blocks of the observation checklist. While observing, the number of the students' answers are noted, and the number of the accurate responses were analyzed accordingly. Moreover, teachers and learners' interaction had also been taken into account. Therefore, the primary data was finally processed by Microsoft Excel to investigate how the students respond to the three categorical types of the questions asked during the three sessions. Furthermore, the data on how the

learners were involved in the class were noted as the teacher applied the provocative question in the production stage in order to ensure the high level of class interaction.

4. Results

Table 1

Participants' information and English education background

Participant's profile	Frequency (n)	Percentage (%)
Gender		
Male	19	25.33
Female	56	74.66
Age Group		
18-20 years old	24	32
21-24 years old	49	65.33
25-30 years old	2	2.67
English Background		
Less than 1 year	43	57.33
1-3 years	21	28
Over 04 years	11	14.67

Table 1 shows the profile of the participants, among the 75 student teachers, the maturity of the participants (56 student teachers or 74.66%) were female, and the rest (25.33%) were male. Most of them were between 21-24 years old (65.33%), 24 ranged from 18-20 years old and the rest (2.67%) were between 25-30 years old. Regarding the English background of the student teachers, most of them (57.33%) had low language proficiency, in which they spent less than one year learning English. 28% of student teachers spent 1 to 3 years while only 11 (14.67%) student teachers possessed high language proficiency as they spent over 4 years learning the English language.

4.1. Questions Asked and Questions Answered in the Three Sessions

Table 2

The Number and Percentage of the Questions Asked in Each Session

Question Type	Number of Questions Asked	Percentage (%)
Factual Question	32	80
Conceptual Question	07	17.5
Provocative Question	01	2.5
Total	40	100

The research was conducted in an English grammar classroom, and the researchers observed the students' answers and recorded the correct responses at the same time. In this study, the teacher used the questioning techniques by employing 40 questions totally. There were 32 factual questions (80%), 7 conceptual questions (17.5%) and one provocative question (2.5%) for the three sessions in AP2, BP2, and CP2 of the student teachers in the primary education program (Table 2)

Table 3

Frequency of the Questions Asked and the Questions Answered for 3 Sessions

Questioning Techniques	Session 1		Session 2		Session 3	
	Total Q / Total A		Total Q / Total A		Total Q / Total A	
Factual	32	34	34	35	39	49
Conceptual	07	09	07	07	06	06
Provocative	01	01	01	01	01	01

As seen in Table 3, questions used in each session were different depending on the class situation. The study found that the factual and conceptual questions were increased from one session to another. The provocative questions remained the same in the three different sessions because this question was used to help learners discuss, as the same question had been used.

Table 4

Total Questions Asked and the Correct Answers

Question Types	Total Question	Average	Total Answer	Average	Total Correct Answer	Average	Percentage
1.Factual	105	35	114	38	86	29	75%
2.Conceptual	20	7	22	7	15	5	33%
3.Provocative	3	1	3	1			

Table 4 illustrates the total questions asked and the correct answers of the three teaching sessions. There are three questions asked: the factual, conceptual and provocative questions. It can be seen very clearly that the average of the three kinds of questions asked were 35 factual questions, 7 conceptual questions and 1 provocative question. Moreover, the average of the answers to each type of question ranged from 38 responses to factual questions, 7 responses to conceptual questions and only one response to the provocative question. Based on the percentage of the correct response for each type of questions, it was found that the correct responses to the factual questions (75%) was higher than the correct responses to conceptual questions (33%).

4.2. Student's Responses to Factual Questions

Figure 2

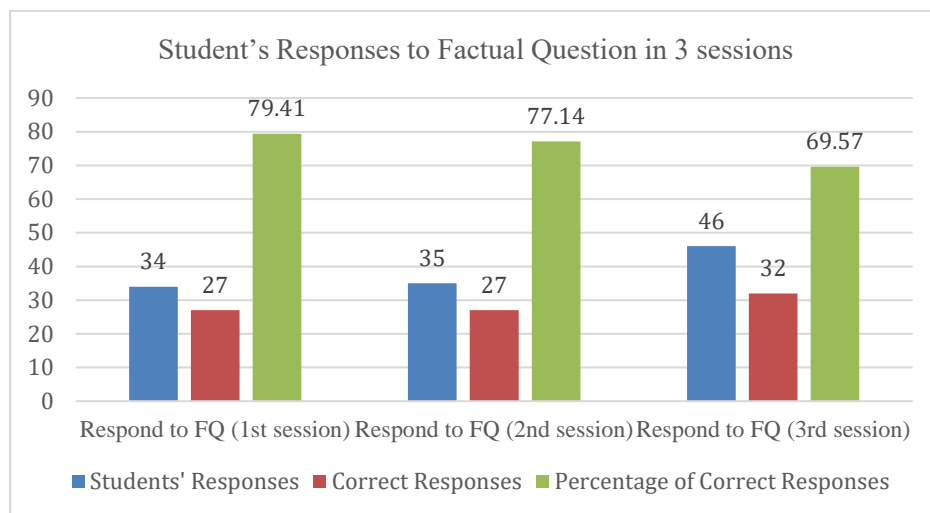*The students' Responses to Factual Questions*

Figure 2 illustrates the students' responses to factual questions, and shows the total responses, the correct responses and the percentage for each session. For the first session, there were 34 responses; 27 responses (79.41%) were correct in the first session. In the second session, the responses increased to 35; however, the correct responses remained the same the first session (27 responses). In contrast, the percentage of the correct responses decreased to 77.14 %. For the third session, the total responses increased to 46, and the correct responses were 32. But the percentage of correct responses remarkably fell down to 69.57% in the third session.

Figure 3

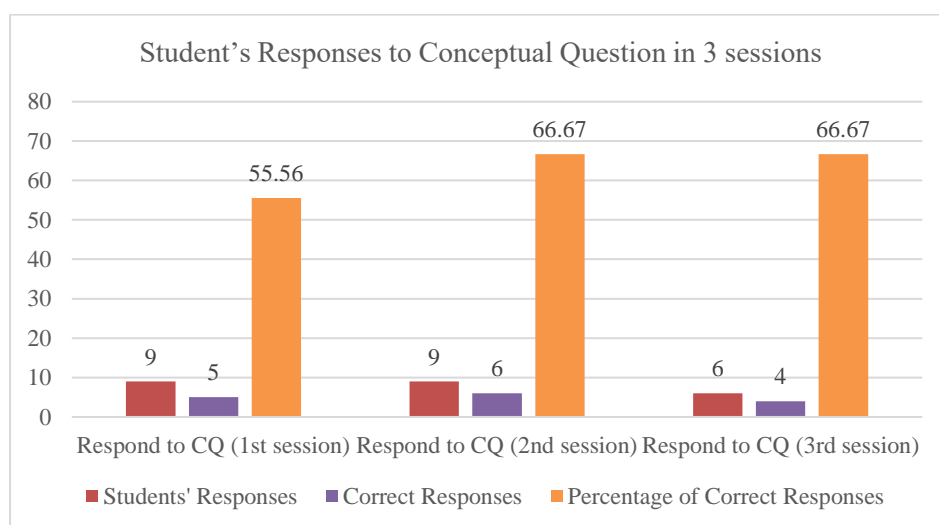*The students' Responses to Conceptual Questions*

Figure 3 presents the students' responses to conceptual questions of the 90-minute grammar instruction. In the first session, the total response was 9; there were 5 responses that recorded the correct answers (55.56%). In the second session, the total responses remained the same, that is, 9; however, the correct responses increased to 6 cases (66.67%). In contrast, the correct responses dropped consistently in the third session; there were 6 responses, and only 4 responses recorded the correct ones; however, it had the same percentage as the second session (66.67%). In short, the study found that the students' responses to the conceptual questions in the grammar instruction fluctuated, and the correct responses to the questions did not depend on the number of questions asked but the class situation, how clear the questions were asked, or the ability of the students to catch up with the lesson.

4.3. Provocative Questions and Students' Involvement

The provocative questions were promoted in the questioning technique in the three sessions. As seen in Table 4.2, the provocative question has been used in the practice stage in order to encourage the learners to discuss the topic given. Based on Tables 4.3, 4.4 and 4.5, the teacher employed only one provocative question to promote the students' involvement. The teacher also used the hints to support the students to think critically. The hints were the kinds of factual questions which were used to help learners to produce new responses about the new language items. Through the observation, the first thing they got when the teacher asked the provocative questions in class was that the learners were given the opportunity to observe the classroom and think about what the teacher did. Furthermore, during the discussion, the students used the hints which were given for discussion by using the language item they have just learned. During the discussion, the learners took turns to share ideas in their group for around five minutes. Finally, one of the group members was given three minutes to present their responses for the whole class.

The study found that the students were very active, and they were involved in the class, as they tried to think, discuss and share the idea within their group and class. As a facilitator, the teacher gave the instruction, checked the students' understanding and did the modeling. The provocative question also encouraged the learners to think critically and make the class more active; they paid more attention to the questions to seek the solution in each task cooperatively and responsively. Whenever provocative questions were asked, the learners had the opportunity to think individually, discuss, and present the team product.

5. Discussion

Based on the findings to the first research objective, it was found that the factual questions had been asked and got more responses, since the learners can respond to each question asked freely and individually, and each learner has their own answers. Moreover, the students had chances to share freely

in the class whenever they were given the permission to answer. Based on the real situation, one student may have all the answers to the factual questions asked, and the learners are able to give more and quick responses in each session. The study found some ways where teachers asked the conceptual questions to mostly elicit the concept of knowledge of the language item and to encourage the learners to critically think of the form, meaning and how to use the form in appropriate situations. The conceptual questions play an important function to help the learners to think critically by using the information in the lesson. They also have enough time to process the information and the content they learned from each session. However, the responses to the conceptual question are less than the learners' responses to factual questions. The research recognizes that the learners' responses to the conceptual question were challenging, since they need enough information and ability to infer the sources of materials.

As the findings showed, the teacher employed more factual and conceptual questions in the teaching process, allowing the learners more opportunities to think and give more responses because they feel free to form the answers whenever the teacher asks questions. These findings are similar to previous findings by Ishan (2019) who found that learners were able to give the correct answers to the factual knowledge questions that require a basic level of knowledge of geography; however, some students found it hard to answer the conceptual knowledge questions that require higher-order learning activities and skills (Fitriati et al., 2017). To reach a conceptual level of understanding, teachers play important roles with guiding questions to help the learners (Erickson & Lanning, 2017). According to Al-Zahrani and Al-Bargi (2017), questioning fosters the interaction in EFL classes, and they revealed how some types of questions have significantly urged the learners' interaction. Moreover, the results of this study showed that the students interacted with the classes in some ways; for instance, the teachers used the provocative question in the production stage of EFL classes in BTEC. The result infers the provocative questions encouraging the learners to think during learning, and the learner could answer to the hints. The students paid much attention to the questions in order to seek the solutions for each task cooperatively and responsively. Also, when the teacher asked provocative questions, the learners had the opportunity to observe the class and think of what the teacher contributed to the modeling with the students in the class. This finding is aligned with the findings by Erickson at al. (2017). That is, since the provocative question is time consuming and there is no right or wrong answer, there are not many provocative questions that have been raised.

6. Conclusion

Based on the results of the present study, students' responses through questioning techniques were high. The results showed that the involvement of the learners increased certain aspects such as response rates to questions, discussing in pairs or groups, and the interaction with the classes. Furthermore, it also showed via the camera recording that there was an improvement in thinking when the conceptual questions were asked. It can be seen that the student teachers were explaining in the forefront or with

the class. Therefore, the conceptual questions significantly advance the learners' critical thinking which was inevitable during the teaching process. The integration of the present finding, the three questioning techniques definitely play an essential role in stimulating classroom activities. The data analysis has proven that the frequency of asking the questions done by the teacher is still high. Therefore, it was really influential to the learners in learning English grammar that they have ample time to respond or interact with the teacher or their classmates. As in the previous discussion, the student teachers had the ability to answer the factual questions more than the conceptual questions. For provocative questions, the students critically seek the solution on the topic they are given by the teacher, and in this way, the students become the active learners with the opportunities given to answer questions, practice the task, explain and express their ideas freely. However, the three types of questions should be structured well in order to prepare the steps of the lesson in which the factual questions are initiated first, followed by conceptual questions and provocative questions last. This implies that questioning will definitely increase the learners' learning tasks in practicing conversation, questioning and participating actively.

7. Implications

Based on the results, the teachers are encouraged to apply the three important questioning techniques into the grammar instruction. When the instructors use more questioning techniques in the class, it promotes the student's responses and motivates the students to think critically and find more solutions to share with the class. This study suggested that the teachers should possess a great deal of knowledge in making these types of questions to encourage student involvement within the lesson. The teacher should consider asking the right questions which would then allow the students to understand rather than to know or remember. The conceptual and provocative questions can help provoke learners' critical thinking skills and to help them reach the level of conceptual understanding.

This study has limitations, however. The objectives and findings of this research do not represent other groups of participants. Thus, a different study may be needed to present different results according to the research sites, objectives or the sample sizes. In order to enlarge the sources of information to strengthen the quality of teaching capacity and learning grammar, there are some research topics that future researchers may consider:

1. The questioning techniques should be applied to subject matters in improving the student's critical thinking and level of student's participation in all forms of classes.

2. Even though these questioning techniques were applied with the particular participants, the student teachers of the primary teacher education program (12+4) at BTEC and the questioning techniques should be applied with English major classes to compare and contrast the result of the findings.

3. The results of the present study show that the questioning techniques can promote students' participation in the class. However, these techniques should be practiced with skill-focused lessons such as reading, listening, writing or speaking to evaluate the impact on the learners' learning outcome.

4. New findings from this research are important for stakeholders to test the questioning techniques in all forms of teachings. However, the results do not show to what extent the students are satisfied with how the strategic questions were applied.

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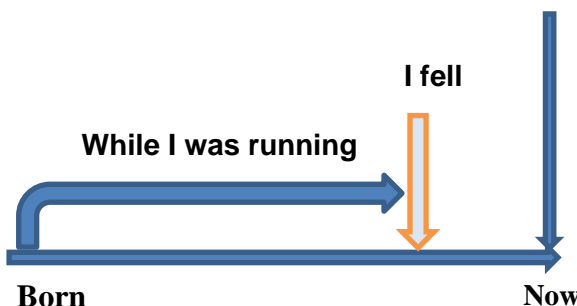
Appendix I

Lesson Plan

- **Instructor**: Hieng Sophon

- **Date:** _____

- **Subject**: English Language

- **Duration:** 2 hours

- **Aims**: The theme of this lesson is:

  1. To introduce past and past continuous in time clause: when clause and while clause.

  2. To distinguish the differences of using past simple and past continuous, past simple and past simple, past continuous and past continuous.

- **Objectives**: By the end of the lesson students will be able to

  1. describe how to use past simple and past continuous in time clauses accuracy
  2. apply past simple and past continuous in the exercise in an interactive way fluency and accuracy
  3. differentiate the situations: past simple and past simple, past continuous and past continuous

Lesson Description: The form of past continuous and past simple were elicited by the teachers after introducing the conversation. The use of past simple and past continuous were initiated by asking concept questions to elicit the answer from students. In each step of practice, students are able to interact with their classmates as well as their teacher.

Materials: Textbook (stretch), Timeline, Poster (chart of the present perfect form) and hand out: exercise section B and C.

Teachers' activities	Content	Students' activities
	Step 1 **Opening**	
Greeting and attendance	Teacher greets, checks attendance, and hygiene (3 mins)	Respond to the teacher

	Step 2 (Hook) (22 mins) **Introduce New target Item**	
Illustrates the picture and asks the ss to answer the question. 1- What do you see? 2- What do you think the weather is like? Why? 3- What is the conversation about? Do you think? 4- Have you ever had any accident while travelling? How do you deal with it? Tr asks ss to work in pair & practice the conversation then asks them some questions: 1- Why was Maria late? 2- What did she say when she was late? Why?	**Possible answer:** 1-Picture of people in the city. 2-It has been raining. People use umbrellas? 3-Answer will be varied. 4-Answer will be varied. 	Students look at the picture and answer the questions.
Ask them to identify the past simple and past continuous.	**Answer:** 1- Because she fell down and hurt her leg while she was running after a bus. 2- I'm sorry I'm late. To apologize and makes her partner feel comfortable and put them at ease.	Students work in pairs practicing the conversation and answering the questions.

	Highlight New target item Answer: *While I was running after the bus, I fell down*.	
Tr posts a poster on the board and illustrates the form of present perfect.	**Eliciting the Form** <table><tr><td>Pos</td><td>S</td><td>was/were</td><td>V-ing</td><td>(Obj)</td><td></td></tr><tr><td>Neg</td><td>**S**</td><td>**was/were**</td><td>**not**</td><td>**V-ing**</td><td>**(Obj)**</td></tr><tr><td>Yes/No</td><td>**Was/Were**</td><td>**S**</td><td>**V-ing**</td><td>**(Obj)**</td><td>**?**</td></tr><tr><td>Wh-que</td><td>**Wh.words**</td><td>**was/were**</td><td>**S**</td><td>**V-ing**</td><td>**(Obj)?**</td></tr></table>	Students listen and take note
Draw the timeline on the bb and ask some concept questions.	**Eliciting the use via concept questions** **While I was running after, I fell** **I fell** **While I was running** **Born** **Now**	Students answer the questions.
Tr asks concepts questions 1- Did she start running before she fell down? 2- Was the action in progress when she fell down? 3- Did she stop running? Why?	**Answer:** 1-Yes. 2-Yes. 3-Yes. Because she hurt her leg and she could not run. **Concept:** We use past continuous to talk about an activity	Students answer the questions and copy them into the notebook.

- How do we differentiate the situation in the chart given here.

that was in progress and interrupted by a single complete action in the past. It is made with past continuous and past simple and the words when or while

Sentence	First Event	Second Event
I was listening to music **while** I was jogging.	same time	same time
I was jogging **when** it started to rain.	I was jogging.	It started to rain.
I fell **while** it was raining.	It was raining.	I fell.
When I fell, I called for help.	I fell.	I called for help.

Ss work in pairs to answer the questions then share it to the whole class.

1- In a sentence with two past progressive clause and while the two events were happening at the same time.
2- In a sentence with two past simple clauses and when, the event after when happened first.
3- In a sentence with a past progressive and a simple past clause, the simple past event interrupted the past progressive event. The past progressive event started first and was already in progress when the past simple past event happened.

-Tr asks ss to look at the picture then asks the questions. Which sentence best matches picture 1 and 2? Why?

Write the sentence (a. or b.) that correctly describes each scene.
a. Rita was standing under a tree when it began to rain.
b. Rita stood under a tree when it began to rain.

1st: It began to rain.   **2nd:** Rita stood under a tree.
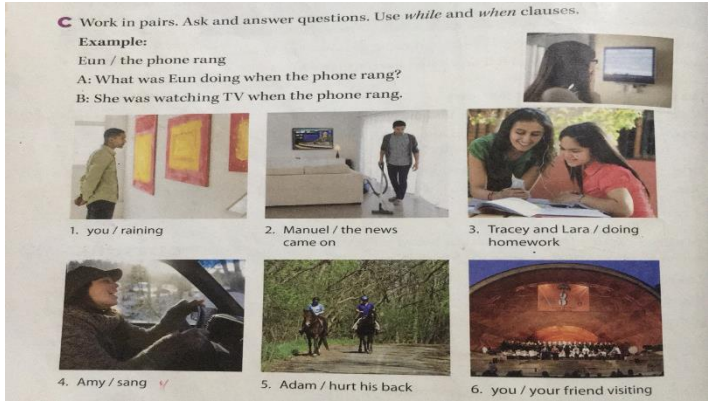1. _____

1st: Rita stood under a tree.   **2nd:** It began to rain.
2. _____

-Ss work in pairs to compare the answer.
-Listen and take note.

	Practice Task 1 (10 mins)	Students open the book and create the questions and answer the questions via looking at the picture.
Teacher asks student to do the exercise via looking at the given hand out. Tr asks them to check the answer with a partner then share the answer in class.		Students share the answer and correct the mistakes.
What is the answer to picture 1,2,3,4,5, 6. Tr asks ss to act out the conversation with partner.	**Answer:** 1- When did you go to museums? I went to museums while it was raining. 2- What happened while Manuel was cleaning the apartment? The news came on while Manuel was cleaning the apartment. 3- When did Tracey and Lara listen to music? They listened to music while they were doing homework. 4- What did Amy do while she was driving to work? She sang while she was driving to work. 5- When did Adam hurt his back? He hurt his back while he was horseback riding. 6- When did you go to a concert? I went to a concert while my friend was visiting.	Ss act out the conversation in pair
- Tr asks ss the question: What did you last week? - Tr asks them to write three sentences using past simple and past continuous.	Practice Task 2 (10 mins) For example: While I was playing football yesterday, It rained. While I was teaching, my students were listening to me. When I woke up, I took the bus.	Ss writes the sentences using past simple and past continuous. Ss share the answer to the class.

- Tr tells them that there is one sentence that is not true about you. - Tr asks them to read the sentences aloud then asks the other to identify the false sentence. Why is it false?		Students act out asking the questions with a partner.
- Tr asks the ss to write about their first day in BTEC: 1- What did you do? 2- What did you see? 3- Who did you meet? 4- Did you have any interesting experience? 5- How did you feel about this place? Tr asks them to share it to the class.	**Practice Tasks 3: Freer practice** (15 mins) Answer will vary	Ss answer the questions Ss share their answer to the whole class.

Wrap-Up: The main points of the lesson have been written on the board. **Self-evaluation:** Try to build learners' schemata in connection to the lesson they have learned.

Appendix II

Questions Asked in Each Step

Lesson Steps	Questions	Types of Questions
Introduce New Target Item	1- What do you see in the picture? 2- What is the weather like? 3- Who is in the conversation? 4- What is the conversation about? 5- Have you ever had any similar experience? How do you deal with it?	1-Factual 2-Factual 3-Factual 4-Factual 5-Conceptual
Comprehension Check	6. Why was Maria late? 2- How did the man respond? 3- What did she say when she was late? Why?	1-Factual 2-Factual 3-Conceptual
Highlight New Target Item	Who can identify the examples of past simple with the past continuous?	Factual

Eliciting the form:	1- Who can form the positive, negative, yes/no question and wh-question of past tense?	1-Factual
	2- Who can form the positive, negative, yes/no question and wh-question of past tense?	2-Factual
	3- What tense do we use after *While*?	3-Factual
	4- What tense do we use after *When?*	4-Factual
Eliciting the use by using concept questions and timeline	1- How many activities are there?	1-Factual
	2- Did she start running before she fell down?	2-Factual
	3- Was the action in progress when she fell down?	3-Factual
	4- Did she stop running? Why?	4-Factual
	5- Which one happened first?	5-Factual
	6- When do we use past simple with past continuous?	6-Conceptual
	7- How many examples are there?	
	8- What tense are there?	7-Factual
	9- How do you explain the situation of the tense in each column?	8-Factual 9-Conceptual

Controlled Practice	1- How many pictures are there?	1-Factual
	2- How do you explain the situation of each pictures?	2-Conceptual
Less-Controlled Practice	1-How many pictures are there?	1-Factual
	2-What is he doing in the first picture?	2-Factual
	3-Where is he?	3-Factual
	4-What are the answers for picture 1,2,3,4,5 and 6?	4-Factual
	5-What are the three activities you did? There is one activity which is not true about you?	5-Conceptual
Free-Practice	What was your first impression when you were at BTEC on the first day?	Provocative
	1-How did you feel?	1-Factual
	2-What did you see?	2-Factual
	3-Who did you meet first?	3-Factual
	4-What was your interesting experience?	4-Factual
Recap	What are the key points we have learned today?	5-Factual

Question Generation: An Analysis of Student Teachers' Practicum at Battambang Teacher Education College

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Abstract

This study aims to explore the extent of question generation based on the cognitive process dimension of Bloom's Taxonomy during a teaching practicum at Battambang Teacher Education College (BTEC), Cambodia. The study used a content analysis method to analyse the questions generated by 120 second- and third-year science student teachers majoring in Physics, Chemistry, and Biology. The data were analysed using the SPSS 26 program. It was found that most science student teachers could create questions in the Remember and Understand cognitive process dimensions but could not do well with the Apply and Analyse questions. However, there were not any science student teachers who could produce the Evaluate and Create questions. From these results, we can theorise

that science student teachers at BTEC could perform better on the factual recall questions compared to applying facts into other contexts and making connections or critically putting knowledge into a new situation. It is recommended that teacher educators should provide more learning activities and opportunities on how to acquire the knowledge and skills of Bloom's Taxonomy during the pre-service instruction. Moreover, teacher educators should pay attention to assessment and provide additional support to ensure that student teachers are able to apply the cognitive process dimensions in their real-life classrooms. It is also recommended that teacher educators should apply certain kinds of teaching methodologies, such as inquiry-based learning, project-based learning, problem-based learning, and other types of active learning approaches to stimulate and promote student teachers' ability to create questions with higher order thinking levels.

Keywords: Question generation; student teachers; Bloom's Taxonomy

1.Introduction

Questioning or the use of questions is an important part of classroom interaction that teachers use to assess students' performance, promote learning and encourage students to participate in classroom activities (Avdic et al., 2016; Sedita, 2018). Questioning is critical in assisting students in acquiring basic skills and knowledge to solve problems, as well as engaging in higher-order thinking skills (Feng, 2013; Tofade et al., 2013). The use of questions is the most common form of assessment that teachers can formulate and develop in teaching and learning activities (Caldwell, 2008). Sedita (2018) also stated that producing questions is a pedagogical form of teaching that plays an important role for

teachers and requires a good amount of practice and learning about the strategies to form questions.

Previous studies have indicated that the quality of teaching is strongly involved with the quality and types of questions that teachers use to assess their students' understanding of specific topics. The types of questions used have a correlation with the quality of thinking for students. This means that to improve students' thinking ability, formulating and preparing the types of questions in the lesson plans is very important to consider (Nappi, 2017). Das et al. (2021) stated that "question generation performs a significant role in educational assessment" (p. 2). Assessment itself is known to be the most crucial in all learning systems where individual learning gaps of learners would be enhanced in the progress of learning (Das et al., 2021). Hence, to improve assessment performance, teachers' knowledge about question application and preparation is strongly recommended during pre-service instruction. Bissell and Lemons (2006) stated that students can enhance and master the skills, concepts, and critical thinking skills through the use of Bloom's Taxonomy, and the taxonomy itself is being used to develop the six levels of assessment (Eber & Parker, 2007). Bloom et al. (1956) claimed that to better assess the assessment method is to use Bloom's Taxonomy of the cognitive domains approach that has six levels of thinking such as Remember, Understand, Apply, Analyse, Evaluate, and Create.

In Cambodia, Bloom's Taxonomy has been increasingly used as a tool for student assessment in learning. However, this model was being taught briefly in the bottom three levels in remembering, understanding and applying (Hang et al., 2016). In the Education Strategic Plan 2019-2023, one of the aims of the education reform is to strengthen learning assessments in national, regional and international assessments (MoEYS, 2018). However, the Program for International Student Assessment for Development (PISA-D) assessment results show that Cambodian students received low performance in scientific literacy

where most PISA-D participants are from lower secondary school (Heng, 2019; MoEYS, 2018). Questioning is one type of assessment, and it is taught to science student teachers in pre-service training who will become future teachers of lower secondary students. Battambang Teacher Education College (BTEC), one of the two teacher education colleges in Cambodia, aims to produce 21st century teachers (MoEYS, 2016). This aim has a strong correlation with higher order thinking skills, and it can be promoted with teacher's questioning (Mustika et al., 2020).

Bloom's Taxonomy is introduced and stated in the curriculum of the BTEC. This model has been found in both pedagogical course syllabus and in science syllabus teaching methodology courses (MoEYS, 2015). However, the model has been taught mainly about theoretical aspects, and there is no proper assessment on how much those science student teachers are able to understand and acquire the knowledge and skills to apply this model in their teaching instruction.

To fulfil the knowledge gap of assessment in the Battambang Teacher Education College and to fill the research gap on this topic in the Cambodian context, it is important to investigate the extent of question generation created by science student teachers during a pre-service training program at BTEC. To achieve this aim, this research seeks to answer the following question:

> To what extent are pre-service science student teachers able to apply the Bloom's Taxonomy model in their lesson preparation?

2. Literature Review

2.1. Question Generation

Question generation refers to the state of being able to create and raise a certain type of question formation. It has been used as an educational material and assessment (Heilman & Smith, 2010) and as a learning strategy for students to perform activities in order to comprehend content knowledge and critical thinking (Sedita, 2018). Question generation is an engine for generating questions involving pattern mining, predicting, selecting and ranking grammatical and semantic content in a given text (Das et al., 2021; Yuan et al., 2022).

Previous researchers have mentioned that good questions should focus on the appropriate intellectual activities ranging from common recall facts to problem solving, critical thinking and reasoning where it is being found in Bloom's Taxonomy with higher order thinking levels (Das et al., 2021). However, it is found that too often teachers pose lower order thinking in basic recall information that is limited for students to promote higher order and critical thinking which make students able to apply them in real life situations (Mustika et al., 2020; Nappi, 2017; Tofade et al., 2013). Moreover, it has been shown that most teachers could not formulate questions with higher order thinking which limits student's participation (Almeida, 2012; Mustika et al., 2020).

2.2. Bloom's Taxonomy

Heick (2022) defines Bloom's Taxonomy as "a hierarchical framework for cognitive and learning objectives" (p. 1). It is used with the numbers of purposes for creating assessments, planning the lessons, evaluating complication of tasks, designing curriculum maps, planning a project-based activity, and formulating individual assessment (Heick, 2022). Bloom's Taxonomy was designed by Benjamin Bloom in 1956 for classifying the learning objectives and learning

outcomes (Marzano & Kendall, 2007). The order of the original model of cognitive skills is Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation. This model of framework was modified by Lorin Anderson and David Krathohl in 2001, known as the revised Bloom's Taxonomy. The major considerable shift lies in the removal of Synthesis and the addition of Creation in the cognitive domain.

Bloom's Taxonomy is classified into six subdivided skills: (1) knowledge, (2) comprehension, (3) application, (4) analysis, (5) synthesis, and (6) evaluation. Knowledge and Comprehension are the first two levels which are classified as lower-order-thinking (LOT) skills and do not require critical thinking skills. However, application, analysis, synthesis and evaluation are classified as higher-order-thinking (HOD) skills which require critical thinking skills (Bissell & Lemons, 2006).

Bloom's Taxonomy is one form of question category that is useful for organising questions. It supports a scaffold for asking questions and a structure for teachers to develop complex thinking (Bloom et al., 1956). Mustika et al. (2020) pointed out that "a student's thinking level is strongly affected by the questions the teacher posed in class," and it is crucial to utilise Bloom's Taxonomy as an instrument to assess the level of thinking and construct an understanding of each level. However, the challenges for students and teachers are learning to formulate the question in relation to the learning question, the instruction question, the assessment question, and the alignment question (Anderson et al., 2001). It has been noted that most teachers cannot formulate questions with higher order thinking which limit students' participation (Mustika et al., 2020).

2.3. Research on Bloom's Taxonomy and Question Generation

Previous studies on Bloom's Taxonomy have been conducted about question items used in examinations (Kim et al., 2012; Sedita, 2018), defining levels of

thinking (Bissell & Lemons, 2006), assessing teaching activities and teachers' questions used in the classroom (Assaly & Smadi, 2015; Khan & Inamullah, 2011), learning outcomes in the class (Zorluoglu & Güven, 2020), and textbook reading and open-book resource question testing (Davies et al., 2021). Based on the purpose of the studies, those studies used different methods of data collection procedures. Document analysis, conversation analysis, observational study, survey, and item-centric analysis existed in previous studies. Additionally, those researchers applied different types of research instruments to observe and access. Assessment rubric, checklist, audio recording, observational guide, Bloom's grading rubric and so on were research instruments in their studies.

A study by Khan and Inamullah (2011) investigated the levels of questions which teachers posted in classroom instruction. By using observational and audio recording with 20 English teachers, the authors found that almost all of the questions were in low levels. The results revealed that those teachers could post examination questions in knowledge (67%), comprehension (23%), analysis (7%), synthesis (1%), and no question in the evaluation level. A similar study conducted by Zorluoğlu and Güven (2020) demonstrated a relationship between the level of 5th science course exam questions and the 5th class learning outcomes of the science curriculum in the revised Bloom's Taxonomy. The study used a document analysis method and revised Bloom's taxonomy for analysis. It was found that most of the questions were in remembering and understanding level in learning outcomes. Moreover, Assaly and Smadi (2015) studied the evaluation of the cognitive levels of questions on the reading text of the Master class textbook. The study used a checklist based on Bloom's Taxonomy as a research instrument to determine the cognitive level of questions. It was found that the cognitive process dimension levels were in knowledge (3.7%) and application (6%).

In the context of Cambodia, little research has been conducted to investigate how Bloom's Taxonomy is used in question generation. Our literature review revealed that the study that reviewed the level of critical thinking in Biology textbooks was based on Revised Bloom's Taxonomy in Grades 7, 8, 9 and 11. The study also compared the frequency and types of questions used in Grade 11 textbooks with Australian textbooks based on six levels of the Bloom's Taxonomy model. It was found that only three lower order thinking skills were identified in the Cambodian Biology textbook. Higher order thinking skills like analysing appeared less frequently. The results also revealed that Australian textbooks had high levels of thinking skills whereas Cambodian textbooks did not (Huot, 2014). Similarly, another study conducted by Hang et al. (2016) on Provincial Teacher Training Centre (PTTC) students showed that almost all PTTC students learned a short form of Bloom's Taxonomy in the lower level of thinking in remembering, understanding, and applying.

Aside from these studies, there appears to be no research that has been conducted on the cognitive process dimension based on Bloom's Taxonomy in lesson plan preparation in the context of pre-service science student teacher education during the teaching practicum in Cambodia. Therefore, this study aims to fill this gap by exploring the extent of question generation based on the cognitive process dimension of Bloom's Taxonomy in lesson plan preparation during teaching practice at Battambang Teacher Education College.

3. Research Methodology

3.1. Research Design

To achieve the research objectives and by drawing on data from previous research, this study used document analysis as a research design to review and analyse the printed documents collected from science student teachers. It is suggested that this research design analyses the data from documents without any requirements from other sources of data such as video recording, observing

or audio recording (Zorluoglu & Güven, 2020). The categories of each question based on the cognitive process dimension in Bloom's Taxonomy is used. Those questions are formulated in lesson plan preparation during the teaching practicum of the second and third year of science student teachers.

3.2. Population and Sampling

The total population of science student teachers was 149. This study used a convenience sampling technique to select the sample and collect the data with accessible lesson plans from individual student teachers. The data of this research study is science lesson plans prepared by science student teachers at Battambang Teacher Education College. The student teachers were in the second and third years in the science subjects including Biology, Chemistry and Physics with second- and third-year students in first and second promotion at BTEC in academic year 2020-2021 (see Table 1).

Table 1

The number of science student teachers in the second- and third year

Subjects	Year II		Year III	
	Male	Female	Male	Female
Physics	13	12	9	16
Chemistry	4	21	8	17
Biology	5	20	5	19
Total	22	53	22	52

3.3. Research Instrument

This study used the Bloom's Taxonomy Analytical framework rubric which is composed of a table with seven columns such as skill access, remember, understand, apply, analyse, evaluate and create (see Appendix 1). The first column contained the key skills access, while the next six columns contained one of the six cognitive levels of Bloom's Taxonomy placed in sequence from low to high. These research instruments were adopted and compiled from Anderson et al. (2001) and Stanny (2016). The rubric was accessed by key skills based on verbs used in each question, and it was ranked into six levels of cognitive process dimensions such as Remember (Level 1), Understand (Level 2), Apply (Level 3), Analyse (Level 4), Evaluate (Level 5) and Create (Level 6). Then, the rubric was given to three panels of teacher educators from Physics, Chemistry, and Biology to examine the verbs used in each cognitive dimension. Then, the tool was improved in terms of the language used, and some verbs classifications were rearranged within each cognitive process dimension model.

3.4. Data Collection Procedure

The data collection period took place from June 15, 2021, to July 14, 2021, at the Battambang Teacher Education College. Science lesson plans prepared by second- and third-year science student teachers were collected through online submission. Each student teacher in the sample was required to submit at least one lesson plan. Since there were 120 student teachers involved in the study, the number of lesson plans was 120. The data were collected from 120 lesson plans where there were 20 lesson plans from Physics, 20 from Chemistry, and 20 from Biology second-year student teachers. Then, the other 20 lesson plans were from Physics, Chemistry and Biology third-year student teachers.

3.5. Data Analysis

This study used the SPSS 26 program for data analysis. Thematic analysis was used to identify all questions generated by science student teachers from all science lesson plans. The cognitive process dimensions of Bloom's Taxonomy levels were scored based on the three main criteria: (1) assessment framework rubric in key verbs used in each question, (2) expected answer to each question and (3) learning activities of the questions.

To explore the extent of question generation in lesson plan preparation, the researchers use descriptive statistics to discover the frequency of each cognitive process dimension. The cognitive process of each dimension was coded with 1 to represent an existence of "Yes". In the case where student teachers used question generation in each cognitive process dimension and without any cognitive process dimension level, it was coded with 0 to represent "No". After confirming the level of science student teacher questions, questioning data were recorded onto a questioning chart regarding the level of each cognitive process dimension. Then, calculation was conducted for the frequency of each question posed by each science subject.

4. Findings

The sample of this study involved 120 science student teachers from the second and third year. Table 2 showed the number of the research participants who were involved in this study. It indicated the number of participants originated from each subject and grade level with the representation percentage of sample from the population.

Table 2

The number of the research participants

Subjects	Year II		Year III	
	n	%	n	%
Physics	20	80	20	80
Chemistry	20	80	20	80
Biology	20	80	20	83
Total	60	80	60	81

Note. Percentage (%) refers to the percentage of the total publication.

Descriptive Statistics on Question Generation Competence of the Second- and Third-Year Student Teachers

The results below showed the extent of question generation based on the cognitive process dimension of Bloom's Taxonomy in lesson plan preparation during the teaching practicum at Battambang Teacher Education College.

Figure 1

Cognitive process dimension of second- and third-year student teachers
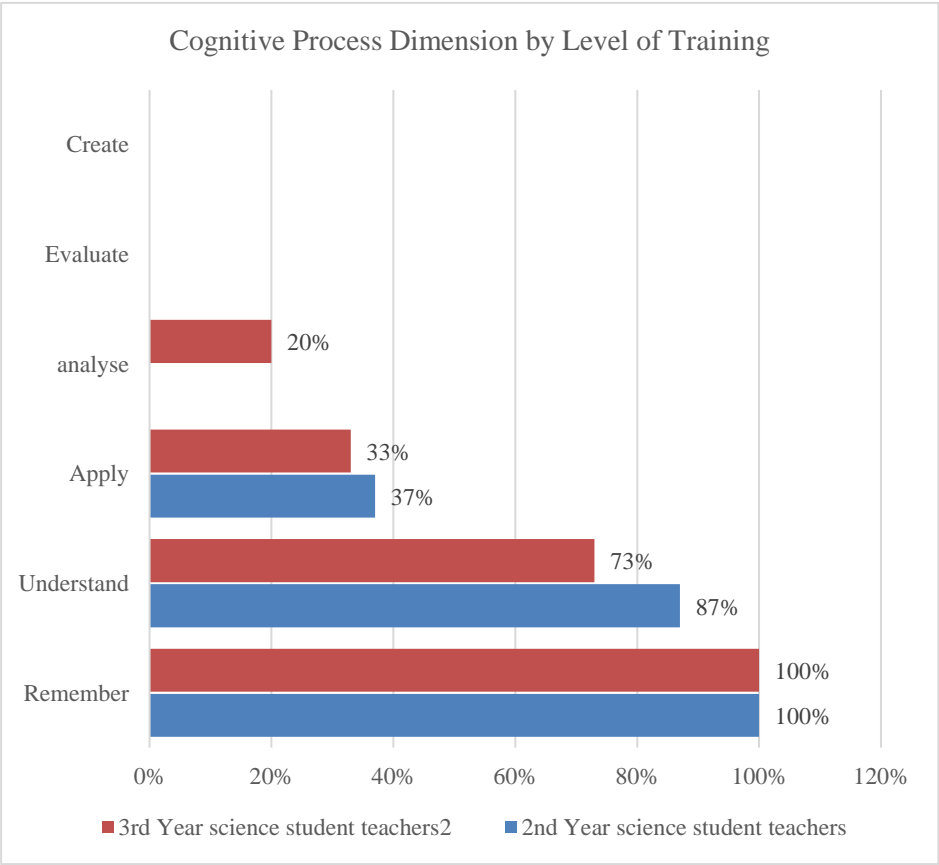
Figure 1 indicated the frequency of questions generated by second- and third-year science student teachers in the cognitive process dimension. The results of the data analysis of cognitive process dimension of second-year science student teachers revealed that most of the questions which were generated by second-year student teachers were in the Remember (100%) and Understand (87%) levels. The Apply question level had only 37% questions among 60 second-year science student teachers. All second-year student teachers were not able to raise any questions in the Analyse, Evaluate, and Create level.

The result of data analysis revealed that most of the questions which were generated by third year student teachers were Remember (100%) and Understand (73%) level. However, the Apply (33%) and Analyse (20%) question level were in the less majority. All third-year student teachers were not able to raise any questions in the Evaluate and Create level.

The result of the data analysis revealed that both second- and third-year science student teachers performed the same competence question generation in the Remember level (100%, 100%) and similar performance in the Understand (87%, 73%) and Apply (37%, 33%) level. However, in the Analysis (20%) level, only third-year science student teachers could generate questions within this level. Moreover, there were no second- and third-year student teachers who were able to raise any questions in the Evaluate and Create level.

Descriptive Statistics on Question Generation Competence Based on Subject Areas

Figure 2

Cognitive process dimension of Question Generation based on Subject Areas

Cognitive Process Dimension by Level of Training
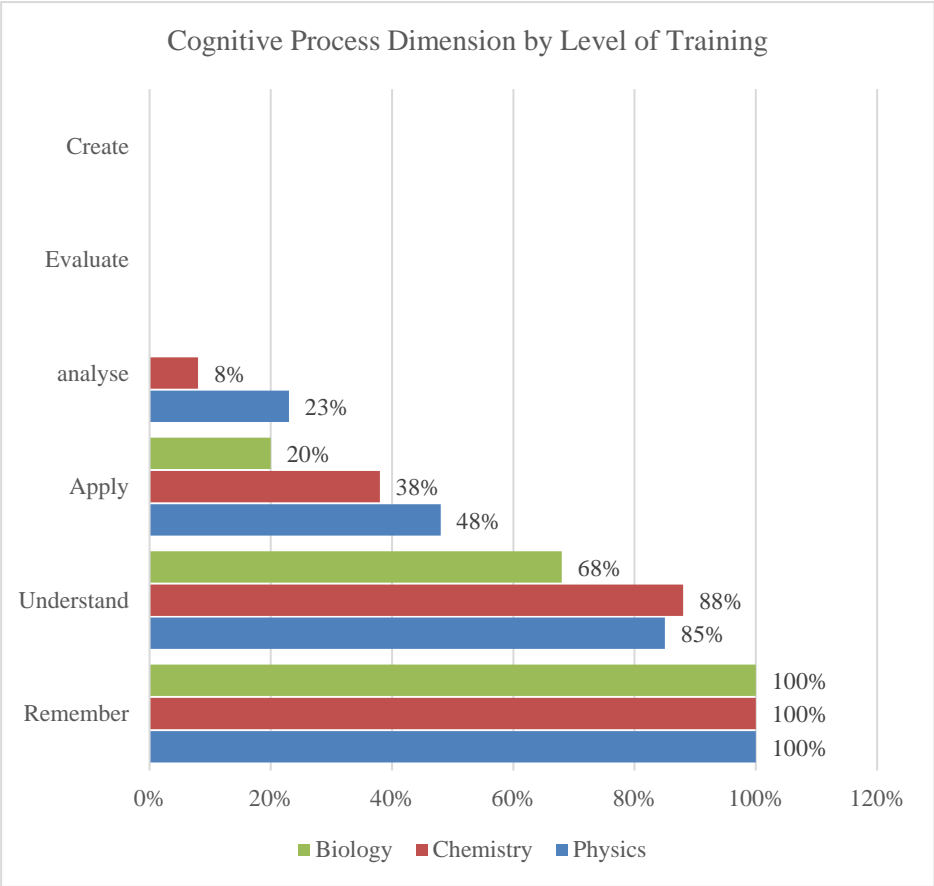
Figure 2 shows descriptive statistics on question generation competence based on science subject areas from Physics, Chemistry, and Biology in both second- and third-year science student teachers. It was found that Physics student teachers received high cognitive skills in the Remember (100%) and Understand (85%) levels. However, in the Apply (48%) and Analyse (23%) levels, cognitive skills were low. The Evaluate and Create cognitive skills were found to be absent

in question generation.

Figure 2 also shows that Chemistry student teachers got a high cognitive level in the Remember (100%) and Understand (88%) levels. However, there was a low cognitive level in the Apply (38%) and Analyse (8%) levels. Both Evaluate and Create cognitive levels showed how there was not any question formed. It was found that Biology student teachers got high cognitive skills in the Remember (100%) and Understand (68%) levels. However, in the Apply level, only 20% of student teachers had the ability to formulate questions. The Value and Create skills were found to be absent in question generation.

The results of this study revealed that all Physics, Chemistry, and Biology student teachers could generate the same question in the Remember level and similar question competence in the Understand (85%, 88% and 68%) level. It is also found that in Apply (48%, 38%, 20%) and Analyse (23%, 8%, 0%) levels, Biology student teachers had low performance.

5. Discussion

Even though these student teachers had already learned about Bloom's Taxonomy in the assessment method in their curriculum studies course, this study discovered that the extent of science student teachers who could generate questions are almost similar in the lower order cognitive process dimension. Both second- and third-year science student teachers can generate questions in the Remember and Understand dimensions, and a few of them could produce questions in the Apply and Analyse dimensions. However, there were no students who could generate the higher order thinking level of questions in the Evaluate and Create cognitive process dimensions.

The reason why student teachers received low performance in the cognitive process dimension might be due to the design of the core textbooks that were in

lower order cognitive dimensions and how they mainly focused on factual knowledge rather than thinking skills as mentioned by previous studies (Assaly & Smadi, 2015; Huot, 2014). It might also be because all science student teachers do not have enough time to acquire knowledge and skills fully during pre-service training. Moreover, those science student teachers were not given sufficient opportunities to learn how to make the assessment and evaluation after learning the course of Bloom's Taxonomy and question generation based on this model.

This study's results were consistent with the findings of Khan and Inamullah (2011) who explored the levels of questions teachers asked during teaching at secondary level using Bloom's Taxonomy. Their study showed that almost all questions which teachers posed were in lower order thinking level in the Remember, Understand, and Apply levels. It was found that the rate of higher order thinking was very low in the Analyse, Evaluate and Create question levels.

The results of this study are also consistent with another study by Kim et al. (2012). Kim and his colleagues studied the evaluation in Bloom's Taxonomy into multiple choice exam questions. Their study showed that Knowledge, Comprehension and Application were higher in frequency. This result of the present study is also in line with Assaly and Smadi (2015) who found similar results. For example, Assaly and Smadi evaluated the cognitive levels of questions followed by the reading texts and found that the majority of cognitive dimensions was Comprehension, Knowledge, and Application.

6. Conclusion

This study has shown that most science student teachers received high performance in the Remember and Understand question levels and low performance in the Apply and Analyse in cognitive process dimensions. There were no student teachers who could formulate higher order thinking in the Evaluate and Create levels. These results indicated that Battambang Teacher

Education College science student teachers could generate questions in lower order thinking skills (Remember, Understand) levels more than they could in higher order thinking skills question generation (Apply, Analyse, Evaluate, Create). Based on these results, it is possible to theorise that science student teachers perform higher on factual recall questions compared to generalising facts to other contexts and making connections or critically putting knowledge into new situations.

Recommendations

Since the study found that the majority of both second- and third-year science student teachers had low performance in question generation and cognitive process dimensions, it is recommended that teacher educators should provide more learning activities and opportunities on how to acquire the knowledge and skills of Bloom's Taxonomy practically during the pre-service training. Moreover, teacher educators should pay attention to the assessments and provide additional help to ensure that student teachers are able to apply the model of cognitive process dimensions in their real-life classroom. It is also recommended that teacher educators should apply certain kinds of teaching methodology such as inquiry-based learning, project-based learning, problem-based learning, team-based learning, and other types of active learning which can stimulate and promote student teachers' ability to create questions with higher order thinking levels.

Limitations and Suggestions for Future Research

The study has some limitations related to data collection procedures, sample size, analysis criteria, the relationship between demographic information and the cognitive process dimension, and course and content control. Recognizant of these limitations, this study makes the following suggestions for future study. First, future research should extend the sample size and investigate other fields

of the social or language department besides science subject areas. Second, further studies should focus on both cognitive knowledge dimensions and cognitive process dimensions of Bloom's Taxonomy. Then, they should make an analysis not only from the questions but also analyse individual learning activities, group work, and learning outcomes. Third, future studies should investigate the difference among demographic information such as gender, age, and English language proficiency to observe whether there is any statistically significant difference among this demographic information. Last, future researchers should control the course and content of the assessment because the differences in courses and content of the assessment might impact student teachers' ability to generate questions.

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Appendix1: *Bloom's Taxonomy Analytical Framework Rubric*

Level	1	2	3	4	5	6
	Remember	Understand	Apply	Analyse	Evaluate	Create
	Cite	Classify	Act	Analyse	Check	Generate
	Define	Compare	Apply	Compare	Judge	Plan
	Describe	Convert	Calculate	Classify	Assess	Compose
	Identify	Defend	Choose	Contrast	Debate	Develop
	Label	Describe	Compute	Attribute	Estimate	Create
	List	Discuss	Construct	Organize	Appraise	Invent
	Locate	Distinguish	Demonstrate	Deconstruct	Choose	Organize
	Match	Estimate	Dramatize	Categorize	Defend	Construct
	Memorize	Explain	Employ	Decompose	Evaluate	Produce
	Name	Express	Illustrate	Deduce	Verify	Prepare
	Outline	Extend	Interpret	Devise	Justify	Compile
	Recall	Generalize	Manipulate	Dissect	Monitor	Design
	Recite	Identify	Modify	Outline	Range	Rewrite
	Recognize	Infer	Operate	Structure	Critique	Schematize
Key skills	Record	Interpret	Practice	Subdivide	Conclude	Rate
assessed	Relate	Locate	Prepare	Prepare	Criticize	Revise
	Repeat	Paraphrase	Produce	Criticize	Reconcile	Combine
	Reproduce	Predict	Relate	Integrate	Set up	Modify
	Select	Recognize	Schedule	Experiment	Hypothesize	Formulate
	State	Report	Show	Inquiry	Rearrange	Devise
		Restate	Sketch	Diagram	Prepare	Assemble
		Review	Solve	Point out		Arrange
		Summarize	Use	Separate		
		Translate		Test		
				Select		
				Question		
				Differentiate		
				Infer		

The Use of Lecture-Based and Discussion-Based Teaching Methods to Generate Research Questions: A Case Study of Student Teachers at Battambang Teacher Education College

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Abstract

This study aims to examine the effects of lecture-based and discussion-based teaching methods on the ability to generate research questions from the research problem statements. The study was conducted using quasi-experimental research design informed by the result of a pre-test that showed how student teachers from two classes at Battambang Teacher Education College in Cambodia possessed relatively the same level of ability to write research questions before the experiment was conducted. In the experiment, the researcher divided the participants into two groups, each of which was introduced to lectured-based and discussion-based teaching methods. At the end of the experiments, the participants of each group were required to do a post-test to compare the mean scores and examine whether there was significant difference in terms of their ability to create research questions based on the two teaching methods. The results showed that the average means of student teachers who learned by the lecture-based method was higher ($M = 26.72$, $SD = 14.647$) than those who learned through the discussion-based method ($M = 21.20$, $SD = 12.679$). No significant differences were, however, observed between the two groups of student teachers when it came to writing research questions ($t = 1.425$, $p > 0.05$).

This study was unable to find the difference between the two groups based on the result of the post-test. However, the mean scores of the post-test implied that the lecture-based method was better than the discussion-based method.

Keywords: Lecture-based teaching; discussion-based teaching; research question formulation; student teachers; teacher education

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1. Introduction
1.1. Background of the Study

Student teachers enrolled in Battambang Teacher Education College (BTEC) are required to write their research report to fulfill the requirements of their Bachelor of Education. The student teachers are fundamentally required to write acceptable research proposals before they are allowed to collect and analyze data and finally present their research results. To achieve the above purpose, the student teachers should follow the steps of research report formulation such as the ability to write the abstract, the introduction section, research methodology section, research result section and discussion section. Writing the research question is seen to be the most challenging task for them (Weissberg & Buker, 1990). Abdulai and Owusu-Ansah (2014) noted that good research questions that emerge from issues or phenomena that existed and had not been researched before would directly lead to clear and achievable data collection and to methods to produce specific research tools. Fraenkel et al. (2012) also confirmed that research questions should prescribe the research method that the researcher used to conduct the study.

However, it has been seen that lecturers' leadership role during classroom discussion is critical to the student teachers' success; and lecturers should consider teaching using the discussion-based method because of its potential to improve student learning (Larson, 1997). Therefore, the purpose of this research is to compare the student teachers' ability to generate research questions based on lecture-based and discussion-based teaching methods by using the T-test analysis of the data collected from the student teachers' test on writing research questions based on research problem statements.

Before the classes started, the student teachers of two classes were assigned to do a pre-test to compare the mean scores and it was found that it was not significant to determine the ability to create research questions based on the research problem statements provided (t = 1.259, p > 0.05).

1.2. Research Questions

This study aims to examine the effects of lecture-based and discussion-based teaching methods on the ability to generate research questions from the research problem statements. To achieve this aim, the study seeks to answer the following question:

> What is the effect of lecture-based and discussion-based teaching methods on student teachers' ability to write research questions?

1.3. Hypothesis

This study is based on a hypothesis that student teachers who learn by participating in a discussion-based method will be able to formulate better research questions than the student teachers who learned by a lecture-based teaching method.

2.Literature Review

Lecture-Based Teaching Methods

Bruff (2010) claimed that the lecture-based classroom is a special type of communication in which the speaker's voice, gestures, movement, facial expression, and eye contact can either enhance or detract from the content. Regardless of what you are talking about, your delivery and way of speaking have a big impact on your students' attention and learning. Lecture-based teaching methods are among the oldest, and they may continue to be the most popular today and in the future. In lecture-based education, professors typically stand in front of the class and give students presentations, write on the board, or use LCD projectors as tools for students to see and record while listening. The lecture-based method is extremely cost-effective, and it can accommodate a large group of students at once. A laboratory, equipment, or supplies are not required. They are simple to maintain and change (Marmah, 2014).

Although the lecture-based teaching style is sometimes criticized, it is a fact that it has endured for so long despite numerous technological improvements (Kaur, 2011). Lectures are commonly used to teach organized bodies of knowledge that are an important part of the school curriculum at all levels, and they have remained a core style of instruction in colleges and universities at all levels of education. The instructor is required to transfer information and concepts in practically all classes or learning sequences. He needs to introduce subjects, emphasize the most significant aspects of the learning activity, and encourage more investigation. Lecture-based strategies are required for all of these activities. The lecture-based strategy, when used correctly, can pique students' interest and capture their imagination (Kaur, 2011).

Discussion-Based Teaching Methods

Dean (2011) explained that research questions were crucial because they defined what we aimed to achieve with the study, data we collected, and how we collected the data in order to answer the research questions. As a result, in order to construct an effective research question, researchers should separate the problem statement into subjects or issues, or groups of people, and use specific verbs "to describe, compare, evaluate, etc." the study design, such as qualitative or quantitative methods.

Research has shown that teachers use discussion as a teaching strategy to assist students by helping them create their own understanding of the content and introduce them to a variety of viewpoints (Larson, 1997). It has been proven that lecturers' role as a leader during classroom discussion is critical to the success of student teachers' learning; consequently, lecturers should consider using the discussion-based method because of its potential to improve student learning (Larson, 1997).

Research on Lecture-Based Teaching Methods

After the student teachers did the pre-test and were assigned as the group of lecture-based teaching method, during the process of teaching, the researcher used an LCD projector to present the lesson on how to create research questions from the different context of problem statements and how to develop strong research questions adapted from a YouTube video Dean (2011) and slide presentations in Scribbr (2020). Throughout the lecture-based teaching process, the lecturer stood in front of the class and gave the presentation in Khmer, but the slides were prepared in the English language. Firstly, the lecturer explained the four aspects of the phrases in problem statements, i.e., what the purpose of the study is, the verbs to be used to guide as a qualitative or quantitative approach, the groups of people they are going to compare, and describe or

evaluate, and the issues they are going to research (Dean, 2011). Then, the lecturer explained about the six parts of strong research question formulation adapted from Scribbr (2020). Finally, the student teachers of this group were assigned to do the post test.

Research on Discussion-Based Teaching Methods

In line with the pretest above, another class was assigned as the group of discussion-based teaching methods. During the process of teaching, the researcher divided the student teachers into three groups in which each group was provided with the handouts for noting down the research questions extracted from the YouTube video explained by Dean (2011) on the four aspects of the problem statements. The characteristics extracted from the YouTube video explained by Scribbr (2020) in the English language are focus, researchable, feasible, specific, complex, and relevant. Then, in the context of BTEC, the representative of each group did the presentation using the poster they had already discussed. Finally, the student teachers of this group were assigned to do the post test.

3. Research Methodology

Research Design

This research was conducted using the quasi-experimental research design, and the participants were selected based on the pre-test which was found to be not significant to determine the ability to create research questions based on the research problem statements. Then, at the end of the class, the participants of each group were required to do a post-test to compare the mean scores and to check whether it was significant to determine the ability to create research questions based on the same research problem statements.

The participants are required to create one good research question based on the

research problem statement assigned by the researcher after the two methods of teaching are applied. The independent sample T-test will be used to analyze and compare the mean scores on the ability to create research questions between both groups to see which method is more effective.

Sample and Sampling Methods

 Year 3 student teachers who learned the course on educational research in two different classes of 25 student teachers at BTEC were assigned to do a pre-test and it was found that they were not significant enough to determine the ability to write the research questions. Then 25 student teachers from each class were divided as samples for comparing both teaching methods by using a post-test.

Data Collection

Before the classes started, the participants of the two groups were assigned to do a pre-test to compare the mean score and found that it was not significant to determine the ability to create research questions based on the research problem statement provided. Then, the researcher categorized the participants into two groups of learning by lectured-based and discussion-based teaching methods. The 25 student teachers of one class were assigned to learn with lectured-based and the other with discussion-based methods.

The researcher provided a worksheet of research problem statements for the student teachers of both groups to read critically and to create their own research question. The student teachers' worksheets were divided into two parts. In Part 1, the student teachers were required to clarify the four key words or phrases in the problem statement, i.e., what the purpose of this study was, the action verbs about what they were going to do, the key words or phrases about who was going to be researched and what was going to be researched. Finally, in Part 2, the student teachers were required to write their own research question by dividing

the problem statement by topics or issues or by groups of people based on Dean (2011) and the characteristics of good research questions by Fraenkel et al. (2012) and Scribbr (2020). After all participants of Group 1 and Group 2 read the research problem statement critically, they were asked to create their individual research questions. The student teachers' task sheets will be collected, coded, and marked based on the criteria of a good research question which include characteristics like focus, researchable, feasible, specific, complex and relevant (Scribbr, 2020) by two lecturers. The scores will then be input into Microsoft Excel Sheet (HAD.17) for data analysis.

Data Analysis

After the data was cleaned and input into Microsoft Excel Sheet (HAD.17), the researcher conducted an independent sample T-test to analyze and compare the mean scores of the pre-test and it was found that the pre-test results of both groups were not significantly different. An independent sample T-test was used to analyze and compare the mean score of the post-test between Group 1 and Group 2 to see which group gained higher scores on the formulation of the research questions. An independent sample T-test was also used to analyze and compare the mean score of each group for post-test to see the effects of both teaching methods on the ability to write the research questions.

4. Results

Table 1

Comparison of mean scores on pre-test between the two groups

Teaching Method	N	M	SD	t	p
Lecture-based	25	15.20	15.10		
				1.259	0.214
Discussion-based	25	10.52	10.84		
Total	50	12.86	12.97		

Table 1 indicates that the average means of student teachers learned by lecture-based method was higher (M = 15.20, SD = 15.10) in comparison to the discussion-based group (M = 10.52, SD = 10.84). However, no significant differences were observed between the two groups of student teachers' ability in writing research questions (t = 1.259, p > 0.05) in this study. Thus, student teachers' ability to write research questions by pre-test confirmed that both groups possessed relatively the same level of capabilities before the two teaching methods were applied, and the results can be seen in Table 1.

Table 2

Comparison of mean score on post-test between the two groups

Teaching Method	N	M	SD	t	p
Lecture-based	25	26.72	14.647	1.425	
Discussion-based	25	21.2	12.679	0.161	
Total	50	23.96	13.663		

Table 2 shows that the average means of student teachers learned by the lecture-based method was higher (M = 26.72, SD = 14.647) in comparison to the discussion-based group (M = 21.20, SD = 12.679). However, no significant differences were observed between the two groups regarding student teachers' ability to write research questions (t = 1.425, p > 0.05) in this study. Thus, student teachers' ability to write research questions by the post-test confirmed that both groups possessed relatively the same level of capabilities after the two teaching methods were applied.

Figure 1

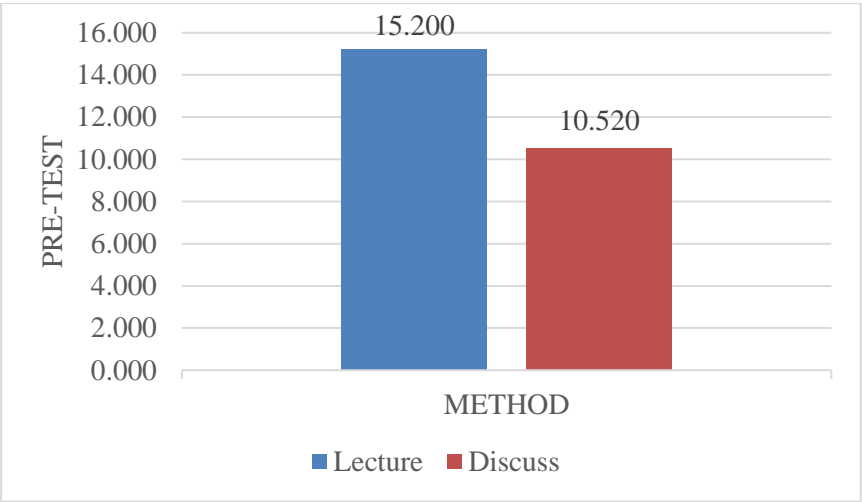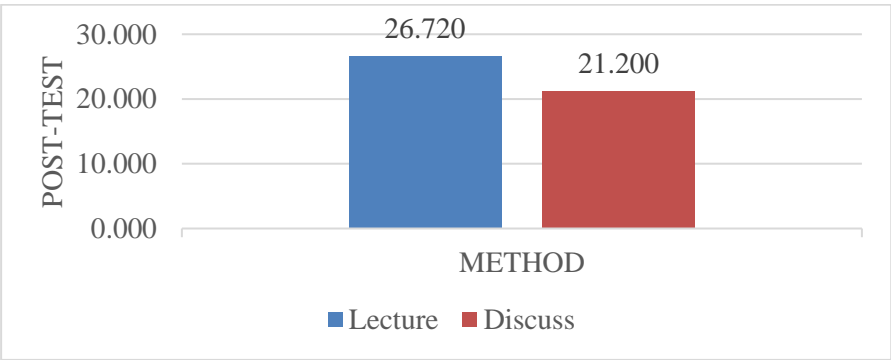*Lecture-based and discussion-based pre-test*

Figure 1 indicates that the mean score of the lecture-based method was higher than the discussion-based method. Therefore, there was no significant difference between the two groups, and the difference of mean scores implied that it happened by chance.

Figure 2

Lecture-based and discussion-based post test

As seen in Figure 2, however, the mean score for lecture-based method was higher than discussion-based method, so it means that the student teachers who learned by lecture-based method were able to write better research questions than those who learned through the discussion-based method, based on a mean score of 26.72 out of 50 compared to 21.20 out of 50 of the discussion-based group.

5. Discussion

These findings were rather difficult to interpret because the participants were not randomly selected. However, based on the pre-test results (see Table 1 and Figure 1), there was a non-significant difference between the ability to write the research questions of the two groups of student teachers. It was possible for the researcher to divide the participants into two groups for the comparison on the effect of lecture-based and discussion-based methods on the ability to create the research questions based on the problem statements by comparing post-test. The mean score for post-test as seen in Table 2 and Figure 2 was not consistent with the hypothesis the researcher set earlier. It stated that the discussion-based method was more effective than lecture-based method, but the average mean of lecture-based was larger than discussion-based. Therefore, it shows that the student teachers at BTEC preferred the lecture-based to the discussion-based method. These results were consistent with the findings of Marmah (2014) who found that the lecture-based method may continue to be the most popular method today and in the future. It seemed that it was not yet time to utilize the discussion-based teaching method in the context of BTEC even though the discussion-based method was recommended in many fields. The results of the present study were somewhat in line with Bruff (2010) who noted that the lecture-based method was not just a method of teaching in which the lecturer only did the presentation using an LCD projector, but this method encouraged the lecturer to communicate through voice, gestures, movement, facial expression, and eye contact which had the most potential to attract the student teachers' attention and enhance the

content. This claim was also consistent with Kaur (2011) who stated that when the lecture-based strategy was used correctly, the lecturer could attract students' interest and capture their imagination.

6. Conclusion

The most obvious findings to emerge from this study are that there was no significant difference between the lecture-based and discussion-based methods based on the statistical t-test, but the results of the investigation on the average mean score by post-test confirmed that the lecture-based method had a higher mean score than the discussion-based method. Since the main goal of the current study was to determine the effect of lecture-based and discussion-based teaching methods on the ability to generate research questions from the research problem statements, it would be appropriate to conclude that the lecture-based method was better than the discussion-based method in helping to improve the student teachers' ability to write research questions.

This research was conducted to compare the effectiveness of lecture-based and discussion-based methods on the student teachers' ability to formulate the research questions. However, the result of this study was still limited. Firstly, the study was conducted using two classes at Battambang Teacher Education College which cannot be generalized. Secondly, it was very difficult for the student teachers to learn the lesson in the English language, especially for the group of student teachers who watched YouTube videos in English and discussed in Khmer in spite of there being a research lecturer facilitator. This factor may affect student knowledge on the ability to create research questions, so this research may be replicated by preparing videos in the Khmer language for students in discussion-based methods, and the PowerPoint slides of the lesson should also be prepared in Khmer for the lecture-based method.

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