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Phnom Penh Teacher Education College

ប្រឹក្សាយោបល់

ការស្រាវជ្រាវប្រតិបត្តិ

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Message from Director

Welcome to the volume 3 of the action research series of Phnom Penh Teacher Education College. It is my great pleasure and honor to celebrate the launch of the third volume of the research publication at PTEC. Our action research series, which constitutes the first attempt to promote the sharing of knowledge, mainly focuses on teaching and learning in different disciplines to share knowledge with student teachers and teacher educators in PTEC and other educational institutions.

As a teacher education institution with the vision to become the leading teacher education institution in the 21st century, PTEC aims to promote a research culture to contribute to the quality improvement of teaching and learning within the institution, which is one of our core missions besides the provision of quality teacher education and community service. Notably, raising the quality and relevance of teaching and learning through action research has become one of our priorities to ensure quality education for our student teachers. This is also certainly in line with the education reform of the Ministry of Education, Youth, and Sport, whereby research has been emphasized in educational institutions to ensure quality education.

I would like to take this opportunity to congratulate the authors on their achievements in the second publication of our action research series. I would like to express my appreciation for the active cooperation and technical support from the Japanese professors and coordinators in the JICA project of Establishing Foundations of Teacher Education College (E-TEC). My sincere thanks will go to the authors, the PTEC management team, and the Department of Educational Research and Library to make the publication of this series happen.

Last but not least, PTEC is committed to an annual publication of the action research series so that an academic community can be initially created and sustainably developed, as a means to contribute to the quality improvement of education in Cambodia.

Set Seng, Ph.D
Director
Phnom Penh Teacher Education College

Contents

1. The Co-Teaching Implementation and Perceptions of Teachers in Phnom Penh Teacher Education Colleges: A Case Study Primary Science Subject, Year 1 Program
   SRIENG Kimsron, LOK Solinda, MOM Sopheap, NOT Sophal, SIENG Sokban 7
2. The Effect of Simulation-Supported Inquiry on Student Teachers' Understanding of Ionic Compound Dissociation
   CHHEANG Sophea, LY Soknay, SOK Tray, TANN Somalida, THIN Raksmey, BUN Syna 24
3. Implementation of Active Induction Method by Integration of Pattern to Improve 2nd Year Primary Student Teachers' Competencies on Basic Algebraic Expression
   EK Lim, SIN SoKunthea, CHUM Veasna, CHEA Soth, SOUS Sopheap, CHHEOUN Sambath, VINH Daroth, HAY Pahen. 40
4. Student Teachers' Difficulties in Identifying Action Research Topic: A Case Study (12+2)
   VONG Savoeun, SOK Saran, LEK Chumnor, SOK Thoeurn, and SET Sekkhapirath 55
5. Pre-service teachers' Attitudes to Learning English for Teaching at Primary Schools
   NGUONN Sam Ol, TEP Phirun 72
6. Promote Student-Teachers' Reading Habits and Reading Proficiency Through Reading Literacy Methods
   VEN Sizet 102
7. Using Logbook to Promote Student-Teachers' Autonomy in Conducting Research
   THOLTHOEUN Chanraksmey 120
8. The Implementation of the Less Responsibility Technique Incorporation with the Siop Model to Promote Pre-service Teachers' Content Knowledge and Lesson Planning Skill
   NGUON Sam OL 127
9. Implementing Self-Assessment to Improve Teaching Performances of Lecturers and Their Attitude Towards Self-Assessment: A Case Study of Lecturers at Phnom Penh Teacher Education College
   SANIT Meassnguon, HOU Saomoline 148
10. The Effectiveness of Student Team Achievement Divisions (STAD) in Cooperative Learning on Reading Comprehension at Phnom Penh Teacher Education College (PTEC): An Action Research with Student Teachers of Primary Education
    TEP Phirun, SOPHORN Sopheak, and SREY Soksaphat 166

11. Effectiveness of Integrating Mathematical sign (algebraic value of mirror focal length) -like-mirror Symbol Technique in Traditional Teaching Method on Problem-Solving Capability of Year II Student Teacher in Mirror Lesson
SAN Sokkhea, NA Dyna, CHEAM Am, and SIENG Sokhar 179

The Co-Teaching Implementation and Perceptions of Teachers in Phnom Penh Teacher Education Colleges: A Case Study Primary Science Subject, Year 1 Program

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ABSTRACT

Co-teaching has been played as an important approach to improve student learning outcomes in general education classrooms. The objectives of this study were i) to find out the impact of co-teaching implementation on student-teacher learning outcomes. ii) to explore the perceptions of lecturers on co-teaching. The study took place in Phnom Penh Teacher Education Colleges with the freshman students in primary program 12+4 in the academic year 2021-2022. There were 150 student teachers, 4 co-teachers, and 1 non-co-teacher (n=155) who joined this study. The data were collected from pre-tests, post-tests, and surveys. The result showed that the student-teacher learning outcome in co-teaching classes had been improved which was very significantly different from non-co-teaching classes (P-value=0.000). Furthermore, lecturers revealed positive perceptions about co-teaching. However, co-teachers also reported some challenges and suggestions as well in implementing co-teaching processes. The major challenge was time-consuming which caused them could not be well prepared for their co-teaching classes. Anyway, based on the result of the study, co-teaching presents as being an effective instructive teaching approach option for enhancing the learning outcomes of students as well as the development of the teacher profession.

Keywords: *Co-teaching, non-co-teaching, student teachers*

1. Introduction

Education is considered an important key to developing human capital to respond to rapid changes in the world and acts as the key to economic growth (Spring, 2012). The Royal Government of Cambodia (RGC) has put a wonderful emphasis on the

education sector by indicating in the National Strategic Development Plan (NSDP) 2014-2018 (RGC, 2014). The NSDP also wants to make sure that every child has an equitable go-to foundation of education free of charge according to education law (MoEYS, 2007). This law is significantly relevant to the Sustainable Development Goals of the United Nations in the part of education (SDG4), that willing to ensure inclusive, equitable, quality education and lifelong learning for all by 2030 (UN, 2018). With this approach, Cambodia's education curriculum has been revised to fulfill students' needs (Tan, 2007; MoEYS, 2019; Donaher & Wu, 2020). To enhance the quality of education in Cambodia, the Ministry of Education, Youth and Sport (MoEYS) has identified teacher educators as the key factor in strengthening of learning quality in the 21st century (Esther et al., 2020). Yet, the quality of learning mainly relies on the effectiveness of the knowledge, skills, and attitudes of the school syllabus as prepared in the instructional materials (Beatriz et al., 2008).

The MoEYS acknowledges that one of the five key pillars of the reform of the education sector is teacher quality improvement (MoEYS, 2019). With this approach, the two Teacher Education Colleges (TECs) of Phnom Penh and Battambang, in the northwest region of the country were established (RGC, 2017 cited in PTEC, 2023). These TECs aim to provide pre-and in-service training programs for primary and lower secondary school teachers based on the 12 + 4 formula and to implement educational research for keeping on the improvement of educational quality in the workplace (PTEC, 2018).

The curriculum was reformed, the course syllabus was also revised to the 12+4 formula, and all subjects were adjusted to be qualified as bachelor's degrees in education (MoEYS, 2019). The syllabus of science included physics, chemistry, biology, and earth science. Science lecturers had to teach all these subjects, despite not having full knowledge. As a result, many challenges were experienced by lecturers throughout all classes (PTEC, 2018). Similarly, primary student teachers struggled to succeed with science (PTEC-Primary Science Team, 2019).

1.1 Research Objectives

This study aims to build student-teacher learning outcomes through co-teaching for the first year of primary science classes. The research has two research objectives as follow:

i) to find out the impact of co-teaching implementation on student-teacher learning outcomes.

ii) to explore the lecturers' perceptions of lecturers on co-teaching.

1.2 Research Question

A good research question is important to help researchers control the main purposes of the study and to narrow down the tasks with specific focuses and goals (McCombes, 2020). The main research questions for this study are:

i) How is the impact of co-teaching on student-teacher learning outcomes?

ii) What are the lecturers' perceptions of lecturers on co-teaching?

1.3 Research Hypothesis

Research hypothesis refers to answers or statements of assumption or guesses that can be tested by findings of scientific research (McCombes, 2021). To conduct this research, the hypotheses are expected according to research objectives. The research hypotheses are

i) Student-teacher learning outcomes are improved through co-teaching

ii) Lecturers are interested in co-teaching

2. Literature Review

This study endorses Stein's (2016) definition of co-teaching as the practice of pairing teachers in a classroom who share the responsibilities of planning, instructing, and assessing students.

Co-Teaching is also defined as two teachers (teacher candidate and cooperating teacher) working together with groups of students sharing not only the physical space, but also the planning, organization, delivery, and assessment of education (Bacharach et al., 2004). Another definition of co-teaching implies an instructional delivery approach in which a classroom teacher and a special education teacher give classes to a group of students in the classroom (Friend & Cook, 1992).

Co-teaching became very well known in the late 1950s when Trump asked secondary school teachers to share responsibility for a huge group of students (Trump, 1996). In the following decades, the co-teaching was adopted by many teachers (Warwick, 1971). By the 1970s, co-teaching had been widespread in both primary and secondary schools (Meadows & Goeken, 1973).

Team teaching has become very popular among general education teachers and there is a technique often implemented in middle schools and some of them have been conducted in high school as well (Meadows & Goeken, 1973). This strategy i) shares students with a good individualized and diversified studying experience and ii) helps teachers to complete each other's skill or knowledge and expertise while sharing mutual support in the professional development system (Friend et al., 1993).

Co-teaching plays an important role in helping slow learners' students and facilitates the delivery of science subjects in general education classrooms (Hang & Rabren, 2009). Research shows that knowledge and skills students develop very significantly (Strogilos & King-Sears, 2019). The results in an increase in students' abilities as well as in teacher's expertise (Lofthouse & Thomas, 2017

3. Research Methodology

The quantitative research method has been used to collect data. The research design selected student teachers of the primary program (12+4) in Phnom Penh Teacher Education Colleges (PTEC) and it included a control group and one experimental group using a co-teaching strategy. There were three classes for each group to conduct this study.

A thorough review of literature and data have been reviewed as secondary data sources such as books, journals, websites, etc. Additionally, the study collects data directly with 1) pre and post-tests to assess student teachers' learning outcomes in both co-teaching and non-co-teaching classes. 2) one survey to explore the perception of lecturers involved in co-teaching and non-co-teaching processes. The survey explored lectures' opinions of and challenges in co-teaching and non-co-teaching classes. There were 150 student teachers, divided equally into experiment and control groups, pre and post-test (Fig. 1). Additionally, one non-co-teacher and 4 co-teachers were surveyed

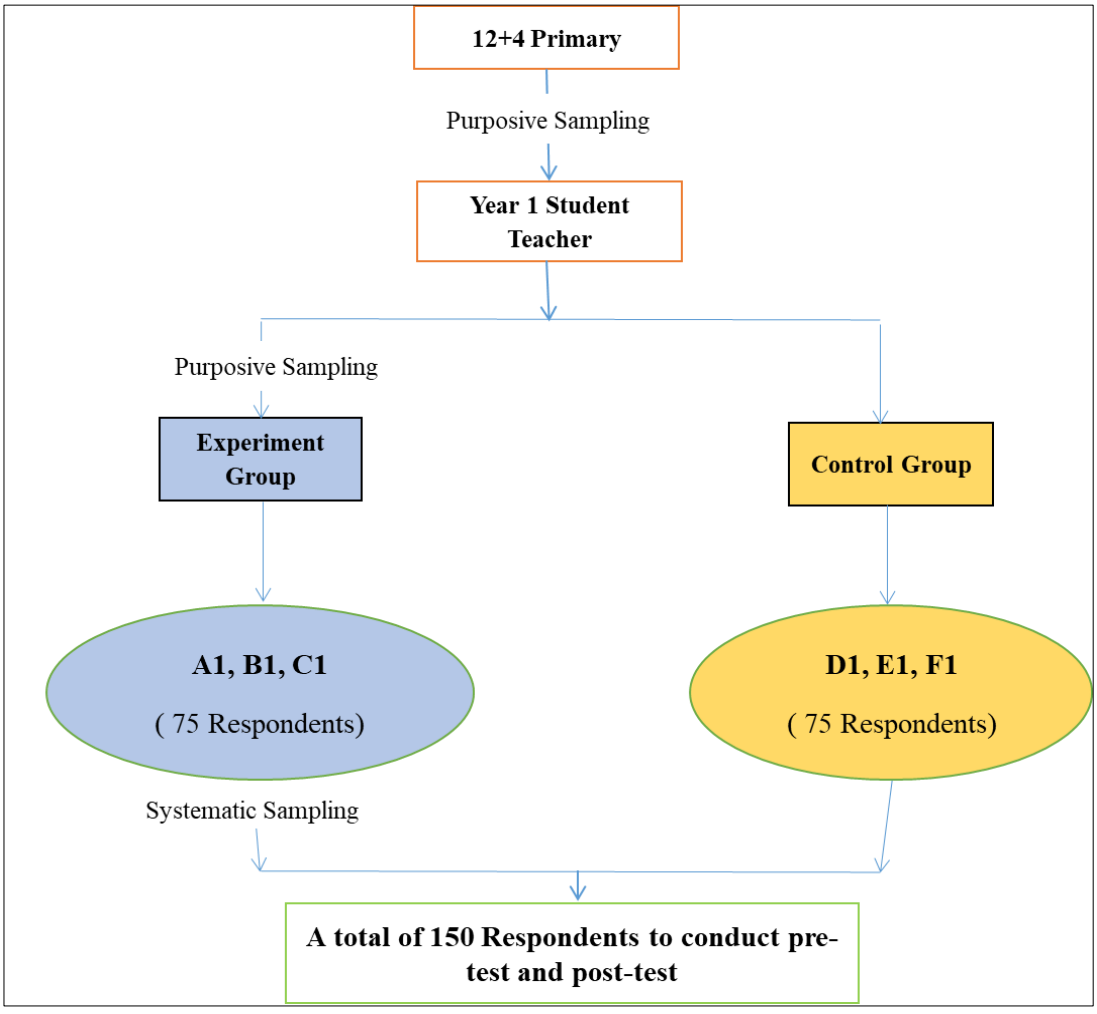

Figure 1: *Research design of the sampling used in the study.*

The study results of the assessment both pre and post-test data have been data analyzed with SPSS and by both descriptive and inferential statistics usage, statistics have been produced. to see mean and standard deviation (SD) and then inferential statistics Paired-Sample T-Test was applied to determine the significance of difference among control and experimental groups by the t-test. This was done to indicate statistical differences in academic achievement among student-teachers who have been involved with co-teaching and non-co-teaching. Furthermore, the Weight Average Index (WAI) was used for data analysis to see lecturers' perceptions of co-teaching processes.

4. Result and Discussion

4.1. Result

4.1.1 Participants and Co-Teaching Setting

This research included primary student teacher of the program 12+4 and their lecturers of science subjects for the primary 12+4 program in the Department of Sciences of PTEC. As shown in Table 1, besides students, the sampling includes co-teachers and one non-co-teacher.

Table 1: Demographic information of participants

Attributes	**n**	**Male**	**Female**
Classes (%)			
Experimental Group [ST]	75	26.7	73.3
Control Group [ST]	75	26.7	73.3
Co-teacher [Psc L]	4	25.0	75.0
Non-co-teacher [Psc L]	1	0.0	100
Total	155	26.5	73.5

Note: ST = Student Teacher; and Psc L = Primary Science Lecturer

Regarding to table above, there were 155 participants in this research divided into 4 main groups. The first group was an experimental group conducted with student teachers (n=75) where 26.7 % were male participants and 73.3% were female participants. The second group was a control group conducted with student teachers (n=75) where 26.7 % were male respondents and 73.3 % were female respondents. The student teachers who joined this study were holding year 1 in batch three in the academic year 2021-2022. The third group was co-teachers (n=4) 25.0 % were male and 75.0 % were female. There were different subjects for the four co-teachers such as Chemistry, Physics, Biology, and Earth Science. The last group was a co-teacher (n=1) and she was a female who specialized in Earth Science. Through this background, the participants were mostly female that was73.5 % while male was just 26.5 %.

4.1.2 Student-Teacher Academic Performance

Pre-Test

As the writers mentioned in the research methodology, this study was divided into two groups one was the control group and another was the experimental group. Before implementing the class, lecturers provided pre-tests to participants for both groups. The table below shows the pre-test result by sex of respondents.

Table 2: Pre-test results of non-co-teaching group by sex

Attributes	Male (n=20)	Female (n=55)	Overall (n=75)
Scoring (%)			
Below 6	65.0	70.9	68.0
6 to 9	35.0	29.1	32.0
10 to 12	0.0	0.0	0.0

Note: The maximum score is 12

According to Table 2, the result of the pre-test which tested participants (n=75) in the non-co-teaching group mostly failed (below 6 points) with 68.0 % by 70.9 % females and 65.0 % males. However, there was 32.0 % of them passed the (6 to 9 points) test 35.0 % male and 29.1 % female, and there was no one received more than 10 scores.

Table 3: The result of the Pre-test for the co-teaching group by sex

Attributes	Male (n=20)	Female (n=55)	Overall (n=75)
Scoring (%)			
Below 6	55.0	63.6	59.3
6 to 9	45.0	36.4	40.7
10 to 12	0.0	0.0	0.0

Note: The maximum score is 12.

Based on Table 3, the result of the pre-test which tested participants (n=75) in the co-teaching group mostly failed (below 6 points) with the number of 59.3 % 63.6 % female, and 55.0 % male. There were only 40.7 % of them who got a score from 6 to 9

points 45.0 % were male and 36.4 % were female. It is the same as the result of non co-teaching group while no one received more than 10 scores.

Table 4: Pair Sample T-Test for the result of Pre-Test for both groups

Attributes	N	Mean	SD	P-Value
Non-Co-Teaching	75	4.59	1.94	0.742
Co-Teaching	75	4.67	1.53	

*According to Pair-sample T-test, P=0.742 > 0.05. This meant that there was no significant difference between the mean scores of these two classes. *Significance at the 0.05 level; **Significance at the 0.01 level; and *** significant at the 0.000 level.*

Comparing pre-test results between the two groups (see Table 4) showed that the mean of the non-co-teaching group was 4.59 which is similar to the mean of the co-teaching group which was 4.67. Through the analysis by using a pair sample T-test for these pre-test results among the non-co-teaching group and the co-teaching group, the P-value = 0.742 was greater than 0.05 (P-value > 0.05). This value shows that there was no significant difference in the mean score of these groups before teaching

Post-Test

The post-test results showed that there was an increase in the average score of both groups compared to the pre-test. However, the average score of co-teaching was better than the non-co-teaching group. After conducting classes both groups registered a significant change not only in the result of learning but also in their learning activities.

Table 5: The result of the post-test for the non-co-teaching group by sex

Attributes	Male (n=20)	Female (n=55)	Overall (n=75)
Scoring (%)			
Below 6	15.0	5.5	10.2
6 to 9	65.0	74.5	69.8
10 to 12	20.0	20.0	20.0

Note: The maximum score is 12.

According to Table 5, the result of the post-test that was done by participants (n=75) in the non-co-teaching group mostly received fair scores (6 to 9 points) with the

number of 69.8 % 74.5 % female, and 65.0 % male. There was only 20.0 % of them passed the test with very good scores (10 to 12 points) 20.0 % were for both males and females. There are still some student teachers who received below-average scores counting 10.2 % 15.0 % were male and 5.5 % were female.

Table 6: The result of the post-test for the co-teaching group by sex

Attributes	Male (n=20)	Female (n=55)	Overall (n=75)
Scoring (%)			
Below 6	0.0	0.0	0.0
6 to 9	35.0	34.5	34.8
10 to 12	65.0	65.5	65.2

Note: The maximum score is 12.

Regarding Table 6, the results of the post-test in the co-teaching group showed that more than 65 percent of student teachers got very good (10 to 12 points), accounting for 65.5 % being female and 65.0 % being male. Anyways, there was 34.8% of them got a fair score (6 to 9 points) 35.0 % were male and 34.5 % were female, and there was no one failed the test.

Table 7: Pair sample t-test for the result of post-test for both groups

Attributes	n	Mean	SD	P-Value
Non-Co-Teaching	75	7.91	1.60	0.000***
Co-Teaching	75	9.95	1.03	

*According to Pair-sample T-test, P=0.000. This meant that there was a perfectly significant difference between the mean scores of these two classes. *Significance at the 0.05 level; **Significance at the 0.01 level; and *** significant at the 0.000 level.*

The data in Table 7 compared means of post-test between non-co-teaching and co-teaching. The mean of co-teaching was higher than that of non-co-teaching classes, 9.95 and 7.91 respectively. Similarly, the mode of co-teaching was 2 scores greater than non-co-teaching (10 and 8 respectively). According to mode value, the study could interpret that the capacity of students in co-teaching gain better knowledge and learning outcomes than in non-co-teaching classes. Regarding the Pair-Sample T-test, the mean

score of the co-teaching group was a perfectly significant difference from the non-co-teaching group as the P-value was at 0.000. This means that the co-teaching model has a positive impact on the learning outcomes of teacher-students.

4.1.3 Lecturer Perceptions of Co-Teaching

General Perceptions of Co-Teaching

This study also aims to explore the lecturer's perceptions towards the co-teaching implementation as shown in table 8 below. Overall, lecturers strongly agreed that co-teaching has improved students' results significantly. And they had also seen their improvement in terms of teaching skills and knowledge.

Regarding the data analyzed by using the mean Weight Average Index (WAI), co-teachers agreed that they had understood the goals or purpose of co-teaching programs assigned by the college. They were strongly agreed that shifting roles in teaching, while he/she has limited knowledge (or not confident about) on that subject/topic, was a good strategy. Moreover, involved in this process, lecturers acknowledge that they have learned and gained more knowledge and teaching skills from each other. For instance, all teachers strongly agreed that their knowledge, skills, and teaching methods have been developed through co-teaching. Lecturers have mentioned that they had received adequate support from their team.

In addition, they strongly agreed that they feel more confident in their abilities both in content knowledge and teaching methods when doing co-teaching. Furthermore, co-teachers strongly agreed that they had seen evidence of improved academic outcomes for students. According to the independent sample t-test, the perceptions of both groups (male and female lecturers) on co-teaching statements were provided, and the result was no significant difference between the two groups of sex due to $P > 0.05$. By using Cronbach alpha analysis to test reliability, it showed that there was very high reliability for the survey ($\alpha = 0.901$).

Table 8: Lecturer Perceptions on Co-Teaching

Attributes	Male Teacher (n=01)		Female Teacher (n=03)		Overall (n=04)		P-value
	WAI	OA	WAI	OA	WAI	OA	
I understand the goals/purpose of co-teaching programs.	0.75	A	0.75	A	0.75	A	1.000
I have respect for my co-teacher's expertise.	0.75	A	0.92	SA	0.83	SA	0.423
I received adequate support.	0.75	A	0.92	SA	0.83	SA	0.423
Good collaboration and collective work.							
I still managed to meet my co-teacher even though it was not originally in our plan.	0.75	A	0.67	A	0.71	A	0.667
Co-teaching is beneficial for students	0.75	A	0.83	SA	0.79	SA	0.667
I have seen evidence of improved academic outcomes for students.	1.00	SA	0.83	SA	0.92	SA	0.423
When a lecturer (s) has limited content knowledge, he/she functions as an instructional assistant in co-teaching classes.	0.75	A	0.83	SA	0.79	SA	0.667
My knowledge, skills, and teaching methods have been developed through co-teaching.	1.00	SA	0.92	SA	0.96	SA	0.667
I am very confident in my ability to teach academic content in my co-teaching class(es).	1.00	SA	0.83	SA	0.92	SA	0.423
I want to keep on co-teaching for another academic year.	0.75	A	0.83	SA	0.79	SA	0.667
I think all teachers should co-teach in PTEC.	0.75	A	0.83	SA	0.79	SA	0.667

*By Independent Sample Test, P>0.05. Notes: WAI = Weight Average Index measured on a four-point scale [Strongly Disagree (SD) = 0.00-0.25, Disagree (D) = 0.26-0.50, Agree (A) = 0.51-0.75, Strongly Agree (SA) = 0.76-1.00]; OA = Overall Assessment; *Significance at the 0.05 level; **Significance at the 0.01 level; and *** significant at the 0.000 level.*

In general, the findings of the study found the satisfaction of lecturers in implementing co-teaching as it helps to enhance lecturer capacity, and the improvement of student learning outcomes, particularly in primary science. As a consequence, all lecturers commit to continue their co-teaching for another academic year and strongly recommend that all lecturers in Phnom Penh Teacher Education College (PTEC) should join co-teaching.

Challenges on Co-Teaching

There, of course, were some challenges that lectures faced in implementing co-teaching. The main challenge was time-consuming. Based on their feedback, co-teachers spent a lot of time more than twice their original schedule in-class instruction and reflection. This issue may be related to the class schedule of each primary lecture assigned to responsible for at least two classes per semester besides co-teaching class(es). It seems that they have double work both in preparation and teaching as well as learning about new topics which were not their expertise. As a result of this, somehow, lecturers did not have enough time to prepare and discuss their lessons before classes.

Moreover, co-teachers also mentioned that the master plan (objectives, procedure, and responsibilities) for co-teaching was not clear; thus, it seemed difficult when start a co-teaching class. Co-teachers who joined this co-teaching program did not know well the types of co-teaching while they just went and helped the classes as possible as they could. It meant that co-teachers could not specify which level of co-teaching they performed in classrooms. This contributes to the implementation of co-teaching, and sometimes one of the lecturers worked very hard than the others. Another major problem was a lack of documentation while implementing co-teaching as most of the lectures were busy with teaching, seemed no one played a role in collecting documents for evaluating and assessing the progress. There was no single report has been produced so far. In this case, lectures in co-teaching might be prioritized on the preparation and instruction stage rather than doing reflection after class.

Suggestion for Co-Teaching

According to the respondents and based on some challenges, there were some suggestions from co-teachers that everyone involved in co-teaching classes could spend more time with the team to make more cooperation and comprehensive plan

preparation. They suggested that co-teachers should set a very clear plan consisting of clear objectives and procedures to conduct co-teaching classes. Moreover, teachers should work as a team be more helpful, and continue to join co-teaching as it is very beneficial to both teachers and students. They also suggested that every co-teacher should try to gain insight more into different types of co-teaching approaches.

4.2 Discussion

The first hypothesis formulated in the Introduction proposed that student-teacher learning outcomes through co-teaching are better than non-co-teaching. According to data in Table 7, the study's result of the co-teaching group was better than non-co-teaching. This means that co-teaching is effective as it improves student learning outcomes. Similar to Chanmugam and Gerlach's (2013) findings confirmed that the ability of student capacity was significantly developed through co-teaching. Another research also found that the content knowledge of students had increased resulting in their assessment being better (Cook & Friend, 1995).

The second hypothesis proposed that teachers' perceptions are likely interested in co-teaching. According to data in Table 8, co-teachers strongly agreed that their capacities, content knowledge, methods, and skills had been developed through co-teaching. Keeley (2015) also approved those teachers who joined co-teaching had better positive changes in terms of teaching skills. Austin (2001) also believed that co-teaching was very helpful to teachers and students. Another research stated that co-teaching was considered a double-edged sword which beneficial to both students and teachers (Seymour & Seymour, 2014). All in all, co-teaching is one of the effective approaches to enhancing the teacher profession and improving the learning outcomes of students.

5. Conclusion and Recommendations

5.1 Conclusion

Co-teaching is the practice of pairing teachers together in a classroom to share the responsibilities of planning, instructing, and assessing students. Co-teaching classes aimed to help student learning outcomes. The result showed from the study, that co-teaching played an important role in helping both students and teachers to develop their knowledge and skills. According to the post-tests in Table 8, the mean of non co-

teaching group was 7.91 which was good to accept, but the mean of the co-teaching group was 9.95 which was better than the mean of the non-co-teaching group. Most of the test results for the non-co-teaching group were 8.0, and the co-teaching group was 10. By this value, the study could interpret that the capacity of students in co-teaching groups was gained better than in non-teaching groups. According to the Pair-Sample T-test, the result (score) of the co-teaching group was very perfectly significantly different from the non-co-teaching group because the P-value = 0.000.

The lecturer's perspective was great on co-teaching. Co-teachers strongly agreed that they had seen evidence of improved academic outcomes for students. Co-teachers strongly agreed that their knowledge, skills, and teaching methods had been enhanced through co-teaching. They also acknowledge that they received adequate support from their team. In addition, they strongly agreed that their confidence gradually developed, especially in teaching academic content while joining co-teaching. Likewise, co-teachers strongly agreed that they wanted to continue co-teaching for another academic year and strongly agreed that all teacher trainers in Phnom Penh Teacher Education College (PTEC) should join co-teaching.

However, there some challenges have been found in this study. The main challenge was time-consuming. Another challenge was unclear planning preparation for co-teaching classes. Moreover, co-teachers who joined the recent co-teaching program did not know well the types of co-teaching while they just went and helped the classrooms as possible as they could. Reports and documents about the co-teaching program that had been implemented so far were not documented.

5.2 Recommendations

Nowadays, there are many modern teaching methodologies have been designed to help students get better results. Anyway, each teaching way is sometimes appropriate in some classroom contexts. Besides teaching methods, how teachers teach also influence student learning outcomes. According to this study, authors recommended teachers should try a co-teaching approach as this way could help not only students but also teachers. Writers strongly recommended that co-teaching classes would significantly improve rapidly teacher's knowledge, skills, teaching methods, confidence, and abilities so on.

Moreover, this co-teaching could improve student learning outcome and capacities, too.

As mentioned in the research objectives, due to time limitations, authors only studied general types of co-teaching and compared the student results within co-taught classes and non-co-teaching classes. In this connection, the authors suggest any future studies that researchers should study about types of co-teaching that co-teachers applied and then compare the student learning outcome between one type of co-teaching to another type of co-teaching. Furthermore, further researchers should follow up more about how co-teachers work.

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The Effect of Simulation-Supported Inquiry on Student Teachers' Understanding of Ionic Compound Dissociation

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ABSTRACT

This study aims to find out the effectiveness of simulation-supported inquiry learning on year-2 student teachers' understanding of ionic compound dissociations. The total participation was 45 science student teachers divided into two groups. The experiment group consisted of 23 student teachers who learned through inquiry-based plus simulation, while the control group consisted of 22 student teachers who learned through only inquiry-based learning. Ionic compound dissociation was selected to be the main topic to teach both groups. The data were collected through a pre-test, post-test, and questionnaire survey. Independent sample t-tests and descriptive statistics were used to analyze the data. As a result, the mean score of learners in the experiment group performed better than the mean score in the control group. The result of the pre and post-test indicated that the learners in the experiment group understood ionic compound dissociation more precisely than the learners in the control group. This point reflects that integrating simulation in inquiry-based learning improves a better understanding of science abstract concepts, especially how water and ionic compounds interact during dissolution. The questionnaire survey results indicated student teachers in the experimental group had a perception and experience of using simulation and scientific experiment inquiry. They had a good experience with simulation and positive perceptions toward this technology model.

Keywords: *Simulation, inquiry, student-teachers, and ionic compound dissociation*

1. Introduction

Dissociation is the process of the separation of a solid ionic compound into ions in an aqueous solution (Chang & Kenneth, 2016; Charles, 2018; S.Silberberg & Patricia, 2018; Stieff, 2011). For example, in table salt, NaCl(s) decomposes into Na^+ and Cl^- ions

in water. When students understand the concept of dissociation, they can identify the ionic and nonionic solutions. Dissociation is the basic concept (Abraham, Grzybowski, Renner, & Marek, 1992). It helps students learn about electrolytes, nonelectrolytes, and chemical equilibrium successfully, and students can properly interpret the phenomena in the aqueous solution. Because dissociation is an abstract concept, students fail to interpret the phenomena of dissociation in scientific ways. The potassium and hydroxide ions were formed when a potassium hydroxide solid was dissolved in water. In this case, students can only observe the solid disappear in water, producing an aqueous solution, and they cannot see the ions in the solution and the interaction between water molecules and solute compounds. When students were asked to explain why ionic compounds dissolve in water, they said that a solid of salt disappears because it is a solute; however, they did not explain using the intervention of water on the solute as the level of particles (Abraham et al., 1992). When students can not explain scientific phenomena scientifically, they lack scientific knowledge and misunderstanding; they then hold misconceptions because their ideas differ from scientific agreements (Yong, Kee, & Malaysia, 2017).

Dissociation exists in grade 12 in the Cambodian chemistry curriculum in upper secondary school and year 2 in the teacher education college curriculum for science students. Ouch, and Shimizu (2017) declared that Cambodian grade-7 students hold misconceptions about the abstract concept of atoms and molecules because they could not link their macroscopic and submicroscopic views by only focusing on what they saw. However, students need to combine both views with a symbolic view, as Johnstone's model, to describe the process of the interaction between water and ionic compounds in a scientific way (Barke, Hazari, & Yitbarek, 2008). Stieff (2011) found that students tended to use submicroscopic representations of chemical systems in explaining the phenomena when the teacher used computer simulation in the classroom. According to the researchers' teaching experience and a test survey about solutions, the results were reported that students partially understand the dissociation of ionic compounds in water because they did not utilize submicroscopic views to interpret the dissociation phenomena.

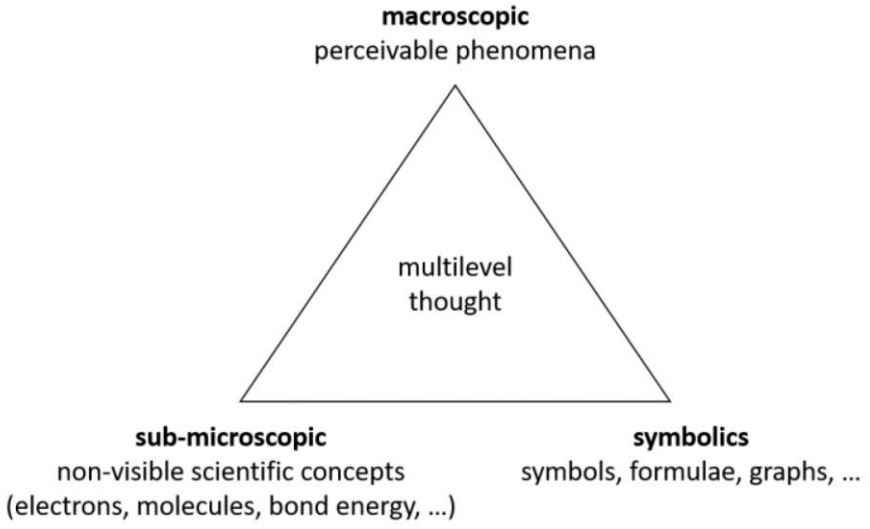

Figure 1: Three dimensions of learning chemistry
(Abels, Koliander, & Plotz, 2020; Johnstone, 1991)

The chemical laboratory at Phnom Penh Teacher Education College (PTEC) is available for teachers and students to conduct teaching and learning to improve their knowledge and skills. Therefore, teachers can utilize chemical experiments and suitable pedagogical presentations to help students understand abstract concepts, including ionic compound dissociation. Students may construct their in-depth understanding of ionic dissociation by using phone simulations and laboratory experiments. Computer simulations are programs that try to simulate a model of a particular system, which is effective and visible aids in science teaching with technology; as a result, students can interact by changing observation and develop inquiry skills in constructing their knowledge (Khan, 2011). An experiment is a process of producing scientific evidence for students to conclude the result scientifically. Therefore, an experiment and a simulation of ionic dissociation allow students to build up their knowledge effectively by understanding the abstract concept of chemical dissociation.

Most Cambodian science teachers utilize traditional teaching methods to teach students in the classrooms, and they do not care about students' prior knowledge and classroom activities (King, 2018; Sar, 2014; Walle, Uon, Cnudde, & Keo, 2010). According to the lecturing student teachers in PTEC, the chemistry lecturers observed

that student teachers thought the solution was only liquid, and they seemed unclear on this topic, so the group of chemistry lecturers surveyed to collect year-2 science-class students' knowledge and misconceptions on that topic. As a result of the preliminary survey, 90% of students did not use the dissociation theory in interpreting the ionic compound dissociation in water, 80% could not differentiate between saturated and unsaturated solutions, and 80% could not interpret the solubility graph properly.

Therefore, this study aims to identify the effectiveness of simulation-supported inquiry learning to increase students' understanding of ionic compound dissociation and students' perceptions and experiences of using simulation and scientific experiment inquiry.

Research questions

- What is the effectiveness of simulation-supported inquiry learning on year-2 student teachers' understanding of ionic compound dissociations?
- What are student teachers' perceptions and experiences of using simulation and scientific experiment inquiry?

2. Literature Review

Inquiry-based learning is a pedagogical approach that permits students to observe and analyze scientific phenomena to produce a question, experiment to answer the question, and conclude accurate results confidently based on experiments or activities (Anstey, 2016; TTD, 2016); after that, students gain knowledge and comprehension of concepts, principles, models, and theories (Council, 1996). There are four levels of scientific inquiry: demonstrated inquiry, structured inquiry, guided or teacher-initiated inquiry, and self-directed or student-initiated inquiry based on three sources posing the question, planning the procedure, and formulating the results (Llewellyn, 2013). The structured inquiry is suitable for students with little prior experience in scientific inquiry, and students are motivated to become more independent and involved in conducting their investigations. Llewellyn (2013) stated that the key questions, materials, and procedures of the experiment were provided to students through the textbook or teachers in structured inquiry. Still, students needed to conduct experiments to collect data and draw conclusions. Before class, the question and the plan or procedure are

prepared, and the expected outcome is also expected within 30 to 60 minutes of class. The teacher is a coach while teaching and learning in the classroom, and students are direction followers.

Simulation is a model experiment designed and created to represent the real phenomenon process (Banks, 1999; White & Ingalls, 2015). The Inquiry-based computer simulation increased scientific reasoning skills and conceptual understanding for students (Abdullah & Shariff, 2008). Teaching chemistry with simulation allowed students to observe the science process in more detail and visible than experimenting with real laboratory activities. Moreover, students can practice simulated chemistry software as often as they want (Jantrasee, 2022). The teacher uses simulations in the science classroom to a certain extent. It helps to reduce the number of misconceptions previously held by learners (Chen, Pan, Sung, & Chang, 2013; Ramnarain & Moosa, 2017). The questionnaire survey results indicated that learners in the experimental class had a positive experience using the simulations. They recognized that the simulations enhanced their visualization of abstract concepts in sub-microscopic views and reflected their efficacy in manipulating the simulation (Ramnarain & Moosa, 2017; Wang & Wang, 2021). In the electrochemistry subject, it is beneficial to students when a teacher uses a graphical simulation. The students can visualize observation of the synchrony between kinematic behavior and detectable signals behavior on electrodes (Wang & Wang, 2021). Simulation can result in higher critical thinking outcomes as learners learn through evaluating successes and failures rather than traditional learning (Samaras, Adkins, & White, 2022). It was found that simulation helps students develop high-order thinking skills (Laverie, Hass, & Mitchell, 2022).

To avoid risks, simulations can be used to represent dangerous actions, including fire safety training for students at school (Mystakidis et al., 2022). Firefighting might be complicated for teachers and students or lead to danger. It was recommended that computer simulation should be adopted for teaching hazardous chemistry concepts. Computer simulation should be employed in chemistry teaching to improve students' academic achievement and provide real-life experiments for dangerous chemistry practices (Nkemakolam, Chinelo, & Jane, 2018). Students who have a learning experience with simulation suggest including simulation in the course and study

curriculum (Henry, Kindzierski, Budin, Tryjankowski, & Henry, 2022; Maynard, 2021). This model also improved learners' confidence in their abilities after participating in simulation classes (Henry et al., 2022).

Inquiry-based learning allows students to construct knowledge by themselves using inquiry skills. Computer simulations provide an ideal environment to support students in scientific inquiry learning by participating in activities for investigating experiments to build scientific conclusions (Dunn & Ramnarain, 2020; Khan, 2011; Moore, Herzog, Perkins, & Practice, 2013). Therefore, integrating computer simulations helps students increase their conceptual understanding (Stieff, 2011). For example, studies reported that students increased their visualization of abstract concepts positively to comprehend atoms and molecular structures after they had been taught by interactive computer simulation through inquiry-based learning (Dunn & Ramnarain, 2020; Kalkanis, 2013; Moore et al., 2013). Moreover, another study found that computer simulation enhanced students' achievement in chemistry more than the lecture method (Okwuduba & Okigbo, 2018). To enhance scientific understanding effectively, teachers need to develop a well-designed computer simulation to integrate it into instruction for conceptual change.

3. Research Methodology

3.1 Methodology

This study employed a purely quantitative method, and the result was mainly based on pre and post-test questionnaires conducted among science student teachers of year 2 in PTEC.

3.2 Research sample

The samples of the current research were 45 year-2 student teachers who were randomly selected from biology class and chemistry class among three specialized subjects. Then, 23 biology-class students were chosen as the experimental group, and 22 chemistry-class students were in the control group. The students in the control group were treated by only the structured Inquiry teaching method. In contrast, the students in the experimental group were taught by structured inquiry plus simulation on the same topic of ionic compound dissociation that the study aimed to investigate.

3.3 Data collection instrument

There were two main instruments used in this study. The first instrument, researchers developed and validated the pre-and post-tests based on the textbook and curriculum to measure students' understanding of the content of ionic compound dissociations as open-ended questions. There were five questions in each test with a total score of 20 focusing on the levels of dissolved compounds in water, ionic chemical equations, determining the solution based on the figures, identifying solute and solvent and drawing dissociation process using particle models, and interpreting dissociation phenomena of ionic compounds in water. The second instrument, containing 11 items in 5 Likert-scale from strongly disagree to strongly agree, was adapted from another study (Baber & Qureshi, 2021).

Two assessment tools were adopted from the guideline book of Inquiry-Based Learning written by the Teacher Training Department (TTD) in 2011 (TTD, 2011) and used for evaluating the teaching materials and classroom teaching and learning activities. The first tool is the lesson plan improvement report, which aims to foster motivation in refining the lesson plan before teaching real students in the classroom and obtain the data self-decision in a properly improving lesson plan, contributing experiences, and learning from each other. The second tool is the teaching and learning observation report, which was used to motivate the teaching and learning activities and obtain the data for self-decision in properly improving teaching and learning and contributing experiences to each other. This tool is used to evaluate the teaching of colleagues and real students in the classroom.

3.4 Lesson plan

Following the lesson study model, the lesson plan, worksheet, whiteboard plan, experimental material, and simulation were designed to teach the ionic compound dissociations as a structured inquiry by integrating the experiment and simulation within 50 minutes. Then, all teaching materials were checked by a chemistry group of six lecturers and revised by the responsible lecturer. After revising the lesson plan in the lesson study procedure, the chemistry lecturer utilized the revised lesson plan in classroom teaching. After getting feedback from colleagues, the teaching materials wereimproved again. Finally, the latest modified materials were used to teach biology class

student teachers.

The main purpose of revising teaching materials is to ensure that the key question, the experimental material, and the simulation are suitable for students to conclude the results in a scientific way for achieving the learning outcomes.

Table 1 illustrates the main activities in the lesson plan.

Topic: Dissociation and solubility of ionic compounds in water

Learning objectives: (1) To be able to demonstrate the dissociation phenomena of ionic compounds based on experiments and particle models, (2) To be able to interpret the solubility levels of ionic based on experiments and particle models, (3) To be ready to use experiments and information and communication technology to understand abstract concepts and dangerous phenomena.		
Main activities	The teacher	Students
Showing the phenomena (Facing the problem)	• Shows chemical substances and has students write the chemical formulas. • Show lab tools and particle models and have them describe their use. • Asks proposed questions	• Answer the teacher's questions and ask the teacher some questions. • Describe how to use tools and construct compounds. • Answer and ask for a clearer.
Forming the key question	• Forms the key question by summarizing students' questions	• Link keywords to form a key question
Forming hypothesis	• Motivates students to answer.	• Predict the answers to the key question, including scientific knowledge, lack of knowledge, and misconceptions.
Planning the experiment	• Describes the materials and the experimental procedure and how to use the dissociation simulation.	• Listen and ask questions.
Conducting experiments and utilizing the ionic	• Facilitates and monitors each group	• Conducting experiments and using simulation

dissociation simulations		
Collecting and analyzing data	• Facilitates and monitors each group	• Collecting and analyzing data
Discussion	• Facilitates and monitors each group	• Answer questions based on the data
Drawing Conclusion	• Facilitates conclusion	• Answer the key question

Teaching intervention

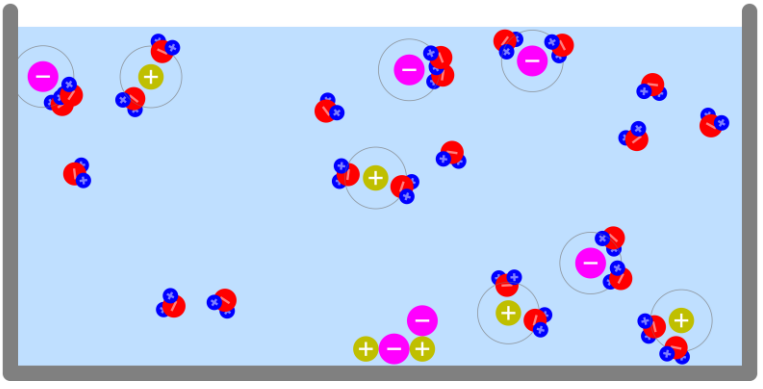

Figure 2: Dissolution process of NaCl by computer simulation.

(Source: https://javalab.org/en/dissolution_process_en/)

Data analysis

The data was imported into Statistical Package for the Social Science (SPSS) software, version 26 for Windows. To answer research question number 1, an independent sample t-test was used to check the statistically significant differences between two groups, the controlled group, and the experimental group. When the p-value was less than 0.05, it interprets that there is a statistically significant difference among the groups. To answer research question number 2, the researchers utilized descriptive statistics to find out student teachers' perceptions and experiences of using simulation and scientific experiment inquiry.

4. Result and Discussion

4.1 Result

Table2. Result of independence t-test for Experiment group and Control group

Group	N	Mean	SD	t	Sig.
Experiment group (EG)	23	12.52	3.616	1.55	0.023
Control group (CG)	22	11.14	2.122	1.57	

Table 2 shows the result of the t-test, which principally indicated a significant difference in the scores of both groups. These are the mean scores of the control group (M = 11.14, SD = 2.122) and experiment group (M = 12.52, SD = 3.616) on the understanding of ionic compound dissociation at $\propto = 0.023$ and df = 43. The result of this current study reveals that the experiment group has a significantly higher score than the control group.

Table3. Result of Mean and SD for student teachers' perception and experience

Items	Statements	Mean	SD
P01	I like learning new things while using simulation and scientific experiment inquiry.	4.27	0.46
P02	I spend my time during my learning experience solving my inquiry or wondering about the study of chemistry.	4.09	0.61
P03	I prefer learning through simulation and scientific experiment inquiry over ways I have been taught in the past.	4.18	0.66
P04	I think I would like to take more courses that use simulation and scientific experiment inquiry.	4.18	0.59
P05	I enjoy doing chemistry experiment activities in class using simulation and scientific experiment inquiry.	4.27	0.55
P06	I like chemistry experiments while using simulation and scientific experiment inquiry.	4.54	0.51
P07	I like to explore your chemistry experiment using simulation rather than look at the textbook.	4.36	0.58
P08	I think I will ask higher-order questions to extend my knowledge while studying chemistry.	4.13	0.47
P09	I think simulation and scientific experiment inquiry are the best ways of learning Chemistry.	4.27	0.70
P10	I like working by exploring the information with simulation and scientific experiment inquiry.	4.13	0.71
P11	I gained new knowledge of chemistry because of learning simulation and scientific experiment inquiry.	4.36	0.58

Table 3 shows the results of the mean range of 11 items from 4.13 to 4.54. The highest mean (Mean= 4.54) is on item P06, which states, "I like chemistry experiments while using simulation and scientific experiment inquiry." The second highest mean (Mean = 4.36) on two items, P07 and P11. Item P07 states, "I like to explore your chemistry experiment using simulation rather than look at the textbook. Item P11 states, "I gain new knowledge of chemistry because of learning simulation and scientific

experiment inquiry." The third highest mean (Mean= 4.27) on three items, P01, P05, and P09. Item P01 states, "I like learning new things using simulation and scientific experiment inquiry." Item P05 states, "I enjoy doing chemistry experiment activities in class using simulation and scientific experiment inquiry." Item P09 states, "I think simulation and scientific experiment inquiry is the best way of learning Chemistry." The lowest mean (Mean =4.09) is on item P02, which states, "I spend my time during my learning experience in solving my inquiry or wondering the study of chemistry." It can be concluded that all students agreed with the 11 statements shown about their perceptions and experiences of using simulation and scientific experiment inquiry. So, they agreed. So, they agree.

4.2 Discussion

The first research question aimed to find out the effectiveness of simulation-supported inquiry learning on science year-2 student teachers' understanding of ionic compound dissociations. This study results mainly focused on comparing the performance of science student teachers involved with structure inquiry and simulation-supported inquiry on the same topic. The finding reveals that student teachers in the experimental group performed better than those in the control group. This implies that integrating simulation to support inquiry in teaching ionic compound dissociations improves student-teacher understanding better than the control group.

The average score of 5 questions for the EG is M = 12.52, and CG is M= 11.14. These findings show that student teachers taught using simulation-supported inquiry got higher scores than those who taught using only inquiry. The result also reveals that there is a significant difference between the post-test mean scores of both groups ($t(21)=15.55$, $p<0.05$). This implies that integrating simulation to support inquiry in teaching ionic compound dissociations improves student-teacher understanding better than the control group. The results of this study concurred with previous studies (Arıcı & Yılmaz, 2020; Ezeudu, Ezinwanne, & Practice, 2013). However, this study is contrary to the study of Jantrasee (2022) study, which found that EG and CG had the same score on the post-test. The finding shows that the student teachers of EG had a better result than CG because simulation allows the student teachers in EG to Visualize and formulate a scientific explanation in a sub-microscopic view.

The second research question aimed to find out the student teachers' perception and experience of using simulation and scientific experiment inquiry. The result shows the results of the mean range of 11 items from 4.13 to 4.54. The result of research Q2 is the same as another study (Eryılmaz Toksoy & Bulut, 2023), which found that simulation provided the learners with a positive attitude toward the lesson and the learning topic and the advantages of learning the content. It is also beneficial in understanding the content, making the learning permanent, and developing a positive attitude towards the lesson and the learning topic.

5.1Conclusion and Implication

Based on the findings, it can be concluded that:

1. The simulation-supported inquiry enhanced Year-2 student teachers' CG better understanding of ionic compound dissociations than CG.
2. Most student teachers show agreement in responding to the Likert scale instrument survey and enjoy chemistry class with simulation inquiry as their perceptions and experience in learning chemistry using simulation inquiry.

This study suggests that:

- Chemistry teachers should be motivated to use simulation to support IBL for unobservable chemistry phenomena and dangerous experiments.
- Chemistry lecturers and student teachers should adapt or utilize simulations in specific topics in chemistry subject for dangerous experiments and abstract phenomena.

5.2 Limitations of the study

The results are the Effect of Simulation-Supported Inquiry on Student Teachers' Understanding of Ionic Compound Dissociation through once teaching. Therefore, more classroom applications with this technique should be practiced to gain more insights into Simulation-Supported Inquiry.

Additionally, to better frame the student teachers' perceptions and experiences through quantitative data analysis. Therefore, another qualitative study should be carried out to gain more understanding.

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Implementation of Active Induction Method by Integration of Pattern to Improve 2nd Year Primary Student Teachers' Competencies in Basic Algebraic Expression

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ABSTRACT

Teaching methodology and teaching methods are key components that teacher uses to help students in doing activities to acquire knowledge and skills for solving problems in daily life. The purpose of this study was to examine the effectiveness of using the active inductive method by integration of patterns to improve primary student teachers' ability to study basic algebraic expressions. To achieve the objective, the quantitative method was employed to compare the result of the experiment group (using an active induction method by integration of pattern) and control group (using the traditional method). The data were collected from a pre-test, and a post-test, which focused on the concept of algebraic expression and writing algebraic expression. Two different classes of second-year primary student teachers in cohort 3 were selected for this study. In total, there are 44 student teachers were taken from two classes one class consisted of 24 student teachers, and another class consisted of 20 student teachers. The sample was selected based on the lecturer's assessment result, who taught the topic of Further mathematics related to algebraic expression. For data analysis, the researchers used SPSS and Microsoft Excel to analyze independent sample t-tests by doing Bootstrap samples from 20 samples to 100 samples. Based on the results of the data analysis indicated that the experiment group obtained (M=6.62, SD=0.31) while the control group obtained (M=5.33, SD=0.43) and t (100) = 1.29 with df=198 ($p<.05$). It means that applying active inductive method improved student teachers's basic knowledge of algebraic expression. Thus, the active inductive method by integration of patterns is more effective than the traditional teaching method. This study encourages all teachers to investigate more about the active inductive method and apply it in teaching that can help students acquire knowledge.

Keywords: *inductive method, algebraic expression*

1. Introduction

Teachers in Cambodia will be trained to develop their professional abilities by receiving incentives, support, and provision of adequate training in the areas of subject matter knowledge and pedagogical content knowledge (MoEYSS, 2019). The development of the quality of teachers is very important in the education system in Cambodia, so the training of student teachers and in-service training teachers has played an important part in strengthening the quality of teachers. Furthermore, the previous studies in mathematics education also stated that the pre-service teacher education program aims to provide a conceptual understanding of mathematics and subject matter knowledge (SMK) to prospective teachers (Ma, 1999). In the educational system, the teachers' quality is considered the key factor and affective of students' performance (Sem & Hem, 2016; Phin, 2014; Song, 2015).

However, based on the result of the Cambodian National Assessment of Mathematics in 2013, revealed that sixth-grade students have insufficient fundamental skills in mathematics, and in which the result of the Algebraic domain earned only 41 percent. This result was related to the teacher's teaching and teacher's performance because teachers used too much theory and poor practice (MoEYSS, 2016; MoEYSS, 2015). Previous studies in Mathematics education found that student teachers had limited knowledge of the concept and were inability to make appropriate use of the models developed, specifically for the teaching of algebraic concepts (Çelik, & Güler, 2018).

Throughout teaching the second-year primary school student teachers the basics of algebraic expressions, we found that some student teachers were not clear on the concept of algebraic expressions and had problems in writing mathematics sentences and solving problems related to algebraic expressions. These issues can affect the results of their studies and it will affect the practicum of student teachers. In addition, it also affects students' learning outcomes when they will become teachers. To improve the subject meter knowledge of student teachers and to strengthen their pedagogical content knowledge in teaching algebra, this study aims to improve student teachers' knowledge of basic algebraic expression by utilizing an active-induction method by integrating patterns. To respond to the objective of this study the research question was

addressed as "Which is the most effective method for teaching basics algebraic expression if comparison of using an active-induction method by integration of patterns and using traditional method?"

2. Literature Review

In 1996, Cambodia launched an educational reform, developed a new curriculum, and wrote a new textbook and teacher guide textbook with implementation of teaching and learning focused on students' participation which was identified as the "student-center approach" (Song, 2015). The Ministry of Education Youth and Sports declared to all school levels in Cambodia to utilize teaching methods that refer to the student-center approach. The student-centered approach refers to the classroom in which students actively participate in doing activities. To achieve the learning goal, students have to actively observe, inquire, listen, explain, and ask questions (UNICEF, 2009 as cited in Song, 2015). Implementation of a student-centered approach, students form the concept of the lesson by themselves while teachers play as the facilitators. Students learn by themselves, they may learn as individuals, in pair work, as small groups, as or whole class, or outside the classroom (MoEYSS, 2006). Activities that refer to the student-center approach include observations in which students observe various phenomena to form rules or make conclusions, solving problems, questioning, learning from experiences, research activities, group work, debates, looking for patterns, and learning games, etc., (MoEYSS, 2006). Furthermore, the Inductive method is used in the learning and teaching process to respond to the student-centered approach, in which the inductive method provides the opportunity for students to observe, think, and analyze logically, and have a long memory about the rules and formulas. The active induction method is a student-led approach in which students actively interact student to student and student to teacher. Implementation of the inductive method, the teacher provides learners with examples to think critically and allows them to make conclusions or generalizations (MoEYSS, 2020). The inductive method is a great method to motivate students to learn, in which the teacher presents specific problems to the students, such as interpreting experimental data, analyzing case studies, or solving problems in daily life (Prince & Felder, 2007). In addition, the inductive method can be used in various forms such as inquiry-based learning, discovery learning, project-based learning, problem-based learning, case-based teaching, and just-in-time teaching (Prince & Felder, 2006).

The inductive method is the teaching and learning method that starts from concrete or pictorial to abstract, or from example to generalization or formula creation. This methodology aims to facilitate students' deep understanding, foster their problem-solving skills, and enable them to critically analyze and interpret significant mathematical concepts, theories, and principles. It encourages the acquisition of essential information and the exploration of key points independently, leading to an enhanced comprehension of underlying concepts (MoEYSS, 2020).

For instance: one pen costs 500 riels.

two pens cost 2×500 riels

three pens cost 3×500 riels

four pens cost 4×500 riels

if x pens cost x times00 riels, but in mathematics expression is written as 500x riels.

In the Cambodian mathematics textbook for grade 7, the notation of algebraic expression was introduced by three examples (Figure 1).

1. សញ្ញាណកន្សោមពីជគណិត

ឧទាហរណ៍ 1 គេមានកន្សោមលេខ $5-3\times7$ បើគេប្រើអក្សរ x និង y ជំនួសឱ្យ 7 និង 5 នោះគេបានកន្សោម $y-3x$ ហៅថាកន្សោមពីជគណិត ដែលមានពីរអថេរ x និង y ។

ឧទាហរណ៍ 2 ជីមួយកន្លែងមានរាងចតុកោណកែង ដែលមានបណ្តោយស្មើនឹង 15 ម៉ែត្រ និងទទឹងស្មើនឹង x ម៉ែត្រ ។ កំណត់បរិមាត្រនៃជីនោះ ។

តាមរូបមន្ត បរិមាត្រ = (ទទឹង + បណ្តោយ) $\times 2$

$= (x+15)\times 2 = 2x+30$

កន្សោម $2x+30$ ហៅថាកន្សោមពីជគណិត ដែលមាន x ជាអថេរ ។

សំគាល់ $2x$, $3x$ ឬ xy មានន័យថា $2\times x$, $3\times x$ ឬ $x\times y$ ។

ឧទាហរណ៍ 3 តារាងខាងក្រោមបង្ហាញពីចំនួនអថេរនិងចំនួនតួរបស់កន្សោមពីជគណិត

កន្សោមពីជគណិត	អថេរ	ចំនួនតួ
$7x$	x	1
$\frac{3}{2}a+5b$	a, b	2
$4n^2-7n+1$	n	3
$2x^3y-x^2+5z-3$	x, y, z	4

(Source: MoEYSS, 2014)

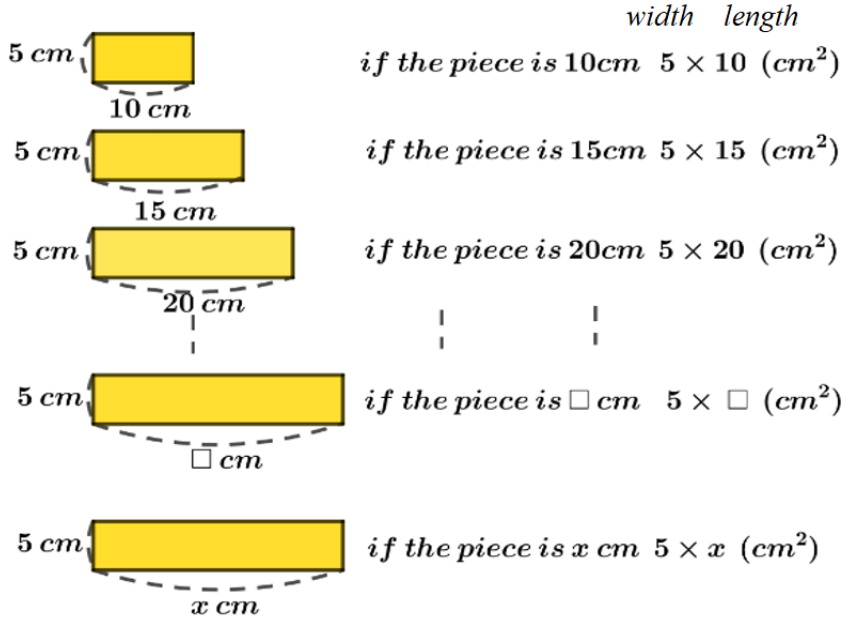
Figure 1: How algebraic expression is introduced in grade 7

The first example was introduced by replacing the variable with the number directly, the second example introduces algebraic expression by connecting real-life problem solving while the last example introduces the parts of algebraic expressions including the numbers of terms and variables.

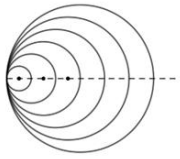
It seems like this introduction is abstract and if student teachers utilize this notation to teach the students directly without pattern or inductive method, it will be difficult for them to understand the concept of algebraic expression.

According to the course syllabus of topics in mathematics for primary education that was developed by the collaboration of Japanese professors and mathematics lecturers from Phnom Penh Teacher Education College and Battambang Teacher Education College, algebraic expression was introduced by pattern by giving two different examples (Figure 2). The first example, given a rectangle with a constant width is 5cm and variable length (10cm, 15cm, 20cm, ……, xcm). Then the area of a rectangle is also varied accordingly. The second example shows the relation between the diameter and circumference of a circle when the diameter is varied. These two examples show the basic concept of student thinking. It is reasonable to visualize by looking at each pattern and connecting it to algebraic expressions.

Example 1:



Example 2:



$$Diameter \times Pi = Circumference$$

$$If\ the\ diameter\ is\ 1\ cm \quad 1 \times 3.14 = 3.14\ (cm)$$

$$If\ the\ diameter\ is\ 2\ cm \quad 2 \times 3.14 = 6.28\ (cm)$$

$$If\ the\ diameter\ is\ 3\ cm \quad 3 \times 3.14 = \bigcirc\ (cm)$$

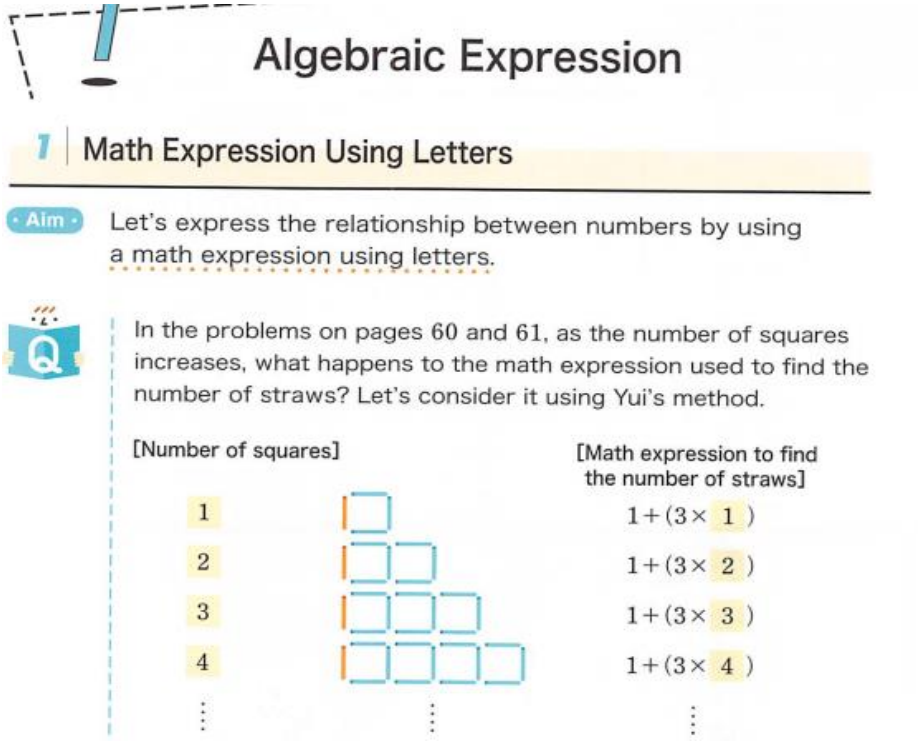
$$If\ the\ diameter\ is\ \square\ cm \quad \square \times 3.14 = \bigcirc\ (cm)$$

$$If\ the\ diameter\ is\ x\ cm \quad x \times 3.14 = y\ (cm)$$

(Sources: PTEC, 2021)

Figure 2: Teaching method of algebraic expression which utilizes patterns

The following figure 3 below shows how algebraic expression was introduced to students in grade 7. The relation between the number of straws and squares creates the pattern in which the algebraic expression can be formed by using these patterns.



Algebraic Expression

1 | Math Expression Using Letters

Aim · Let's express the relationship between numbers by using a math expression using letters.

Q In the problems on pages 60 and 61, as the number of squares increases, what happens to the math expression used to find the number of straws? Let's consider it using Yui's method.

[Number of squares]		[Math expression to find the number of straws]
1		1+(3× 1)
2		1+(3× 2)
3		1+(3× 3)
4		1+(3× 4)
⋮	⋮	⋮

Source: Junior high school mathematics 1 (M, Isoda, & D, Tall, Trans.)

Figure 3: How algebraic expression was introduced in the Japanese textbook

If we examine the notations of algebraic expressions in the above models, we see that each example has different features in creating algebraic expressions. However, each feature has a common inductive method of integrating patterns. Therefore, it comes to mind that using the inductive method by integrating patterns is an effective method to introduce algebraic expressions.

3. **Research Methodology**

To obtain actual data and to achieve the objective, a quantitative method was selected for this research. The researchers compared the results of the experiment group (using an active induction method by integration of pattern) and control group (using a traditional method). The instruments of data collection consisted of a pre-test, a post-test, and a lesson plan that focused on the concept of algebraic expression and writing math sentences of algebraic expression. Pre-test and post-tests were developed throughout the lesson study session (LS), in which the participants who participated in this session consisted of 12 lecturers of mathematics and 3 mathematics teachers from Obekaam Practice Secondary School. Design and development of item-tests in which we developed questions and solved word problems, each item-test based on Bloom Taxonomy level. The first item test focused on the rules and forms of algebraic expression, and the second item to the fifth item focused on writing algebraic expressions.

Two classes of second-year primary student teachers in cohort 3 were selected for this study. There were 44 student teachers taken from two classes one class consisted of 24 student teachers and another class consisted of 20 student teachers. The selection of student teachers for this study is based on the lecturer's assessment results who taught the topic of Further mathematics related to algebraic expression. The two class selections were the student teachers who had gotten a lower score among the six classes. The researchers analyzed the data through a Bootstrap t-test from 20 to 100 samples.

The data collections were divided into seven phases, with the first phase, researchers observed students' activities and students' participation in each topic of the series of mathematics syllabi for second-year primary level from week one to week fifteen. Passed throughout lecturing on the topic at week nine which related to algebraic

expression, student teachers had a slight participation in doing activities and responding to the lecturer's questions. On the other hand, when the lecturer evaluated their learning outcome about the concept of basic algebraic expression, they were not clear and they could not write algebraic expression. In the second phase, we discussed finding an appropriate teaching method to prepare lesson plans, teaching materials, and item test development based on basic algebraic expressions. In the third phase, we improved the lesson plan, teaching materials, and item tests. In the fourth phase, we conducted a 30-minute pre-test with one class of 24 student teachers and then we corrected and evaluated their pre-test to examine their understanding before lecturing. In the fifth phase, we lectured student teachers for one hour using an active induction method by integration of pattern, In the implementation of this method, student teachers actively worked as individuals and in groups, and they participated in observation, discussion, and explanation of the concept of basic algebraic expressions. In addition, they shared the process of problem-solving related to algebraic expressions. After one hour of lecturing, we conducted a 30-minute- post-test to examine the student teachers' abilities. In the sixth phase, we conducted a 30-minute pre-test with another class of 20 student teachers and then we corrected and evaluated their pre-test to examine their understanding before lecturing. In the seven phases, we lectured student teachers for one hour using the traditional method, In the implementation of this method, student teachers listened and noted the concept of an algebraic expression that the lecturer gave without doing any activity related to the development of the concept and problem solving of algebra expression. After one hour of lecturing, we conducted a 30-minute-post-test to examine the student teachers' abilities.

The collected data was entered into SPSS and Microsoft Excel to analyze the reliability through Cronbach Alpha before analyzing the descriptive statistics. With 20 and 24 samples per group (less than 30 ample), the researchers performed Bootstrap Samples from 20 to 100 Samples and analyzed the data using an independent t-test on the Bootstrap Sample to compare the mean of the two groups (active induction method by integration of pattern group) and (using traditional method group).

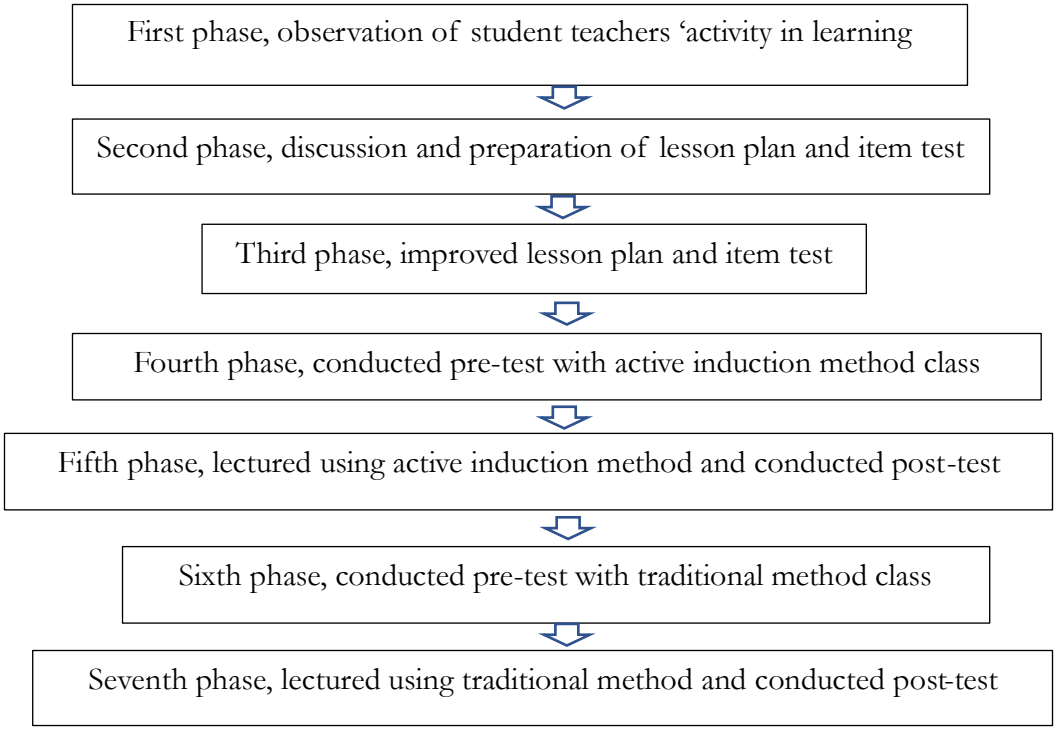


Figure 4: Data collection process

Figure 5: Data analysis process

4. Results and Discussion

4.1 Results

To determine the effectiveness of using an active induction method by integration of pattern, the researchers collected data from pre-test and post-test and analyzed the collected data by using a t-test to compare the mean score of both groups (an active induction method by integration of pattern group) and (using traditional method group).

In this section, the reliability of the item test and the results of the pre-test and post-test between the two groups were presented through descriptive statistics (mean, median, and standard deviation) and inferential statistics (t-test).

The table below shows that the pre-test results of the classroom lecture using the traditional method were (M = 5.25, SD = 1.98), Which was slightly better than the post-test (M = 5.15, SD = 1.85). According to the result of the pre-test, researchers had

assumed that some student teachers had cheated on each other during the pre-test conduct. To ensure the result of the research can be reliable, researchers have prohibited student teachers from cheating each other during the post-test.

Table 1: The result of the pre-test and post-test of the traditional method group

	n	Mean	SD
Pre-test	20	5.25	1.98
Post-test	20	5.15	1.85

Table 2 below presents the post-test of the classroom taught by using an active induction method by integrating of pattern (M=6.25, SD=1.51) was better than the pre-test (M=3.83, SD=2.66).

Table 2: The result of the pre-test and post-test of an active induction method by integration of pattern group

	n	Mean	SD
Pre-test	24	3.83	2.66
Post-test	24	6.25	1.51

To ensure the internal consistency of the test instruments, the value of Cronbach's alpha was also determined. The value of Cronbach's alpha of the pre-test and post-test that consisted of five items of both groups were 0.67 and 0.53 respectively. This implied that the internal consistency of the test instruments was still slightly low (Gliem & Gliem, 2003). This could be caused by the number of item tests and the number of participants was small while the fifth item was difficult for student teachers and most of them had not done it.

the number of participants (n=20 for TM and n=24 for IPM) was small, Shapiro-Wilk was determined to check the normality of the data distribution. The result showed that the data, as in Table 3, was not normally distributed (p=0.009). According to Tibshirani & Efron (1993), a Bootstrapping sample is a way of converting the data to be normally distributed by increasing the number of participants. Hence to compare the mean value of each group by using an independent sample t-test, the data was bootstrapped by increasing the number of participants from 20 to 100. More than that, before bootstrapping the sample, the researchers decided to reduce four participants in

an active induction method by integrating the pattern group due to the participants in this group (n=24) were four more than the traditional method group (n=20). The decision to reduce the four among the 24 participants was made due to the analysis of the correlation of each participant's item score. Since the items of the test were arranged in order from the easiest to the hardest, there were no more participants who had not done the first and second items correctly and did the fourth and fifth items correctly. So, the researchers decided to reduce those who had done the fourth and fifth items but had not done the first and second ones.

Table 3: Test of Normality

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Post-test	.202	40	.000	.923	40	.009

The result of the independent sample t-test revealed that there was a significant difference (p=0.005) between the mean score of post-tests of the class that implemented the traditional method (M=5.33, SD=0.43) and the class that was taught by using an active induction method by integration of pattern (M=6.62, SD=0.31) as in table 4. This indicated that the class that was taught by using the inductive method by integration of patterns was more effective than the class that was taught by using the traditional method.

Table 4: The Result of the Independent sample T-test of Comparing Post-Test

Groups	n	Mean	SD	df	p
Traditional Method Group	100	5.33	0.43	198	0.005
Inductive Method by Integration of Pattern Group	100	6.62	0.31		

4.2 Discussion

If we examine the results of the pre-test, Table 1 and Table 2 indicate that classroom taught by using an active induction method by integration of pattern earned average score(M=3.83) was smaller than the classroom taught by traditional method (M=5.25) and standard deviations of the classroom taught by using an active induction method by integration of pattern (SD=2.66) was bigger than the standard deviation of

the classroom taught by traditional method where (SD=1.98). If we examine the results of the post-test between classrooms taught by using an active induction method by integration of pattern and classroom taught by traditional method in Table, indicates the mean score of class taught by traditional method is (M=5.33) and the standard deviation is (SD=0.43) that is not better as the mean score and standard deviation of the classroom taught by using an active induction method by integration of pattern (M=6.62, SD=0.31).

Implementation of teaching traditional method, the teacher acted almost actively while student teachers were only followers, In the implementation of this method, student teachers were not active in participation, thought, discussion, exploration, explanation of reason, problem-solving, and sharing, they just recorded and memorized the theory. In the implantation of an active induction method by integration of pattern, student teachers actively participated in observation, thought, discussion, exploration, explanation of the reason, problem-solving, and sharing. The implementation of this method helped student teachers to improve both theory and application. Moreover, it helped student teachers
be able to solve problems in daily life.

Teaching and learning are the ways that teachers need to ensure that student teachers can acquire knowledge, skills, and attitudes so that they can become good teachers and accomplish the standard of teacher professional: professional knowledge, professional practice, professional study, and Professional ethics (MoEYS, 2016).

5. Conclusion and Recommendation

5.1 Conclusion

Based on the results of the quantitative data analysis above, we observed that the implementation of teaching an active induction method by integration of pattern and teaching traditional method is effective in helping student teachers for the improvement of their ability on basic algebraic expression, but teaching the traditional method helped student teachers to remember only theory while teaching an active induction method by integration of patterns helped student teachers to improve the concept, skills a, and problem-solving. Thus, it can be concluded that the implementation of teaching an active induction method by integration of patterns can improve student teachers' ability

to study basic algebraic expressions better than the implementation of the traditional method.

However, the result indicated that implementation of an active induction method by integration of pattern helped improvement of 2nd Year Primary Student Teachers' Competencies in basic algebraic expression in grade 7 is better than the implementation of teaching traditional method but researchers have some problems and some recommendations for other researcher and stakeholders

5.2 Recommendation

❖ Recommendation for Researchers

This study suggests that future researchers should examine more detail about the following points:

- To have clear knowledge about using an active induction method by integration of patterns for teaching basic algebraic expression or teaching any specific topic in mathematics or other subjects.
- Using an active induction method and mathematics pattern that is appropriate to classroom situation and appropriate arrangement of teaching activities for students to participate in observation, discussion explanation, and application.
- The Sample selected should choose 30% or 50% from every class.

❖ Recommendations for Teachers

This study suggests that the teachers should be concentrated on the following points:

- To have clear knowledge about using an active induction method by integration of patterns for teaching basic algebraic expression or teaching any specific topic in mathematics or other subjects.
- Using an active induction method and mathematics pattern that is appropriate to classroom situation and appropriate arrangement of teaching activities forstudents to participate in observation, discussion explanation, and application.
- To prepare lesson plans and teaching material suitable for teaching activities

- To have appropriate time for teaching learning and practicing on this topic
- Students should be taught how to solve problems and word problems on algebraic expressions as much as possible to increase students' knowledge.
- Should reduce the lecture method, in case teachers cannot avoid or reduce this method the teachers should use the partial lecture method and allow students to think and solve problems and word problems to improve practical skills.

❖ Recommendation for the Ministry of Education

This study suggests that the Ministry of Education should:

- Encourage, support, and motivate teachers to implement teaching constructivism as much as possible.
- Encourage and motivate teachers to minimize using instructional teaching.
- Finding Fun for training teachers to have the ability to use constructivism methods.

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Student Teachers' Difficulties in Identifying Action Research Topic: A Case Study (12+2)

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ABSTRACT

Action research has become essential to identifying challenges within educational institutions and finding solutions. This study investigated the difficulties that student teachers faced in identifying action research topics during their teaching practicum, as well as finding solutions to their problems in identifying action research topics. Qualitative data were collected from purposive sampling selected 23 ICT-English student teachers (12+2) at Phnom Penh Teacher Education College (PTEC) in Cambodia, using five participants for the semi-structured interviews and six participants per group for three focus group discussions in the academic year 2022-2023. The finding indicated that student teachers had insufficient time for educational research subjects for the training (12+2) program, low proficiency in English, lack of research resources in Khmer, and low conceptual clarity of action research significantly contributed to student teachers at all educational research processes. To address these challenges, the Departments of Educational Research and Library (DERL) should rethink the research subject syllabus and increase study time for the (12+2) program, so that student teachers can gain content knowledge of the research subject and keep going on the action research. Furthermore, educators should assess the student teachers' action research reports regularly and provide feedback in compliance with the action research regulations based on the specific type of research methodology. In addition, DERL should make research sample patterns available and publish an action research sample report in the Khmer language for student teachers to access the implementation of their action research.

Keywords: *Student teacher; Teacher educator; Difficulty; Action research; Topic*

1. Introduction

Phnom Penh Teacher Education College (PTEC) is located in Phnom Penh, Cambodia. It was established through the combination of the two campuses, Phnom Penh Regional Teacher Training Center and Phnom Penh Municipal Teacher Training College, by Sub-decree No.73 dated 22nd May 2017. The college offers teacher education programs that deliver generations of teachers who educate generations of pupils and students. The college's core mission is the vision of being a leading teacher education institution in the 21st century to produce highly qualified teachers for Cambodia (https://www.ptec.edu.kh/). PTEC has identified three main missions such as (1) to educate and develop student teachers with full competency, (2) to promote educational research to improve teaching and learning, and (3) to provide social services to contribute to in-service teacher development (Framework BA (Ed.) TEC, 2021, p.1).

Noticed action research themes include changes in classroom practice, the effects of program restructuring, new understanding of students, teacher abilities and competencies, new professional relationships, and new content or curricula (Pine, 2008). As a result, action research is a great approach for promoting educational research to improve teaching and learning. Through action research, a student teacher can become a reflective practitioner (Antoniou & Cooper, 2011). However, a few difficulties could impede the development of research. They included inadequate or late investments in educational institutions and university instructors' need for writing skills and experience for academic journal publications (Heng & Sol, 2021, p.8). In addition, the teacher educator who taught research subject to ICT-English class observed that student teachers need help developing action research themes when delivering a presentation to them on the action research topic. Because of this, action research is essential for discovering new knowledge, promoting innovation, and creating new settings for teaching and learning in the 21st century. Likewise, action research helps teacher educators adopt and craft the most appropriate strategy within their environments, achieving intended teaching-learning goals and outcomes. According to Creswell (2012), research is vital for three reasons. First off, it broadens our understanding of the challenges or issues that our society is facing. Through research, we may fully comprehend the issues and create procedures to deal with them. Second, new

recommendations, ideas, approaches, relationships, and evaluations from research can enhance implementation. Thirdly, research informs policy discussions because it provides policymakers with information about various viewpoints and ongoing discussions, enabling them to create better policies. Therefore, action research is essential for assisting student teachers in building their knowledge base as they adapt to the 4.0 industrial revolution's effect on digital teaching and learning environments (Roqobih & Rahayu, 2019).

The difficulties faced in Cambodia include low salaries for university lecturers, insufficient funding for research, a lack of reward systems and demands for research outputs, a lack of knowledge, expertise, and experience for conducting research, unclear policies, inadequate infrastructure and facilities for conducting research, low social acceptance of research, teaching-related overloads, and other challenges (Heng & Sol, 2021, p. 11-12). Otherwise, it needs to be made clear what kind of research is meant for teacher educators and student teachers in the context of teacher education in Cambodia. Teacher education has to become more responsive to the educational system's evolving needs. Teacher's jobs have become more difficult and technical as a result of new theories and materials. As a result, teachers must gain sufficient information, abilities, interests, and attitudes toward the teaching profession. As we all know, boosting teacher quality is central to our national endeavor to achieve success in the classroom (Em et al., 2021). Similarly, other challenges must be addressed in the education training college to properly prepare student teachers in areas such as educational research to fill the gap of a lack of action research while they are assigned to work in their school. Otherwise, teacher educators in the Department of Educational Research and Library (DERL) work hard to find a solution to the prevalent issue of student teachers having difficulty determining research topics during their training courses and pedagogical practicum before beginning their careers as teachers. As a result, action research can be used by student teachers to identify difficulties and solutions in their classrooms. Furthermore, when delivering a presentation on the action research topics module, the student teachers require assistance in establishing action research themes. As a result, it is necessary to define the type of study that is intended for teacher educators and student teachers in the context of teacher education in Cambodia.

1.1 Problem Statement

According to the ICT-English class of student teachers (12+2) program, the educational research subject in their second year as student teachers at PTEC in the academic year 2022-2023. One action research topic was identified by a group of student teachers who consisted of four or five members in each group while executing their practicum in their targeted cooperative schools. They faced difficulties in choosing their topic for undertaking their action research. Heiss (1970) pointed out that selecting a dissertation topic was a difficult task for many students. As a result, the teacher educator found that the student teachers are having difficulties in identifying which action research topics they should study during their teaching practicum. The study of Amean et al. (2019) discovered that lack of conceptual clarity, poor time management, and a lack of research culture were the key challenges experienced by novice LIS researchers when developing a topic in their study. Otherwise, identifying research topics can be difficult. Some of the difficulties in identifying research topics for student teachers could include a lack of experience in research, a lack of knowledge about research methods, and a lack of time-related to the curriculum for training 12+2 student teachers, which may be caused by the teacher educators themselves not paying close attention during training, and possibilities from self-taught teacher educators with limited knowledge in the field of educational research.

1.2 Research Objective

The purpose of this study was to investigate the difficulties that student teachers faced in identifying research topics during their teaching practicum, as well as to find solutions to the difficulties that student teachers face in defining research topics in response to specific contextual studies during the practicum. Thus, this study can find solutions to student teachers' challenges in determining research topics during their practicum.

1.3 Research Questions

In this study, teacher educators investigated student teachers' challenges that student teachers face when identifying action research topics.

1. What difficulties do the student teachers (12+2) face in identifying action research topics?
2. What kind of support do the student teachers need in identifying action research topics?

2. Literature Review

An extensive review of the literature revealed a lack of research focusing on the difficulties in identifying action research topics and the concerns that student teachers (12+2) experience when selecting research topics. The study of McKenna and McKenna (2000), stated that student-selected topics do not provide better results in quantitative or qualitative writing; yet, these difficulties should be examined even if allowing students to choose topics on their own is not the solution to poor research writing. As a result, they need to consult with their supervisors to ensure that they properly identify the research topics to apply the methodology they have experienced for conducting their research project properly. Likewise, the researchers should identify topics in various areas that they want to explore during the process of research topic selection, and the essential parts of this process are matching personal interests with existing knowledge and identifying knowledge gaps (Avan, 2000; Bhatti et al., 2012). According to Cohen et al (2018), a research topic can be derived from a variety of teacher motivational factors. For example, many teachers choose topics from their day-to-day work because they want to learn about the causes of the problem and how to solve it, and they may want to plan an intervention to see how well it addresses or solves the problem. Furthermore, Chinh and Sok (2018) advised researchers to brainstorm the research topic, list several research topics and find literature reviews, examine that the research topic is not too narrow or too broad, draft key terms from the topic, and define the key terms for the research project. Otherwise, the research topics will be too narrow, making it difficult for the researchers to obtain supporting documentation. In addition, the researchers should generate a list of potential research topics and begin searching for existing literature reviews.

Insufficient time is a common problem for student teachers when it comes to learning research subjects. There are numerous academic studies in the relevant literature focused on the relationship between time management and academic accomplishment. The linked literature revealed university students' time management attitudes and ability levels, as well as the effects of these skills on academic accomplishment (Nasrullah & Khan, 2015). Similarly, low motivation is linked to time management, which students have to deal with during their education. According to the

Center for Khmer Studies (2004), one of the most significant issues facing Cambodia's higher education system now is a lack of academic text in the Khmer language. In addition, according to the EF English Proficiency Index (EF EPI, 2022), Cambodia has a very low proficiency score of 434 compared to the global average score of 502.

Conceptual clarity is an important aspect of research. It helps researchers to cultivate research questions and then match the methodological aspects of the study with these questions. The conceptual framework helps align the analytic tools and methods of a study with the focal topics and core constructs as they are embedded within the research questions (Ravitch & Riggan, 2016). Although inadequate time management and a lack of research culture have been identified to be causes of conceptual clarity. It's time to revisit the phenomena that inform theories and models, as well as how they are conceptualized and measured (Bringmann et al., 2022). According to Heng (2021), the main issue that requires reform is Cambodian universities' and academic staff's insufficient research capacity. He pushes for higher education reforms that focus on three essential areas to promote research activity in Cambodian universities: research policies, institutional support for research, and university orientation. The research subject is still new for university students to study and then apply to thesis writing. They require the guidance of teachers' feedback on the research processes (Jiang & Yan, 2020).

In conclusion, the literature reviews showed that identifying research topics is difficult for students or student teachers in research studies on any topic related to the actual challenges in real work. The difficulties mostly faced such as during the process of selecting research topics, time management and academic achievement, low motivation, lack of academic text in the Khmer language, low English proficiency, and lack of conceptual clarity in research.

3. Research Methodology

3.1 Research design

The researchers used a case study with 12+2 student teachers to investigate the difficulty in identifying action research topics during the teaching practicum. A qualitative case study, according to Merriam and Tisdell (2015), is an in-depth, detailed investigation of a specific instance within the action research topics that the student teachers faced while performing their action research during the teaching practicum.

The researchers generated data by using semi-structured interviews and focus group discussions with student teachers (12+2) of the ICT-English Class.

3.2 Research setting and participants

The study was conducted at PTEC, and participants were selected from the ICT-English Class of student teachers (12+2) in May 2023. Furthermore, purposive sampling is a group of different non-probability sampling techniques (Rai & Thapa, 2015), and the sample recruited 23 student teachers in the second year of their final year of PTEC. The participants recruited as the participants are shown in Table 1.

Table 1: ICT-English student teachers

Participants	Interview	Focus Group Discussions
23 STs (12+2)	5/1F STs	3 FGD-18/8F (6 STs/G)

Note: STs (Student Teachers)

3.3 Data collection process

Semi-structured interviews were conducted with four male student teachers and one female student teacher to examine their perceptions and experiences of what they learned in the research class as well as the difficulties in identifying action research topics during the teaching practicum. Furthermore, the researchers conducted three focus group discussions with ten male and eight female student teachers to investigate their discussions during research class and how difficulties in identifying action research topics were overcome.

The article gathered data from focus group discussions and semi-structured interviews on their perceptions and experiences with identifying action research topics when they selected which topic to perform their teaching practicum. The interviews were conducted in Khmer, allowing participants to share their perspectives and experiences regarding the problems and challenges they had in identifying action research topics. The interviews lasted 35 to 45 minutes and were audio-recorded with some notes taken. All recorded interviews were performed in Khmer, and all data acquired were transcribed into English for coding and establishing themes for data analysis.

3.4 Data Analysis Process

The researchers examined word meanings and sentence structure to identify the subject matter in the text using theme coding. To identify the action research topics, the researchers utilized thematic coding to assess participants' perceptions and experiences of processing. Deductive coding was utilized in the coding technique (Fereday & Muir-Cochrane, 2006). The system was analyzed in the processes that followed after the interview section to identify the key themes and sub-themes of the data collection: transcribing, coding, thematizing, outlining, and data interpretation. Since this is a qualitative case study, it is critical to convert the information the researchers had recorded from the collecting data between the interviewers and interviewees, then enter the data into Microsoft Word documents. The interview transcripts were specifically examined and reread many times to find significant theme groupings. Last but not least, the researchers determined specific themes for combining the coding data to form concrete answers to both research questions, which primarily focus on the current practice of student teachers' difficulties in identifying action research topics and the support that student teachers need in identifying action research topics. Finally, the association with manual coding was an essential tool for researchers to compare and crosscheck with coding via Microsoft Word.

4. Result and Discussion

4.1 Result

1. Student teachers' difficulties in identifying the action research topics

The findings revealed that the main barriers to research were difficulty in identifying action research topics while the student teachers (12+2) chose the topics for their teaching practicum. The majority of participants underlined that action research involves searching for anything related to something we experience or do that has a problem, and we need to find a solution by setting a topic for study to find a solution to that problem. The researchers select three individuals' responses, two from the focus group discussion and the other from a semi-structured interview, as shown below:

> […] When we have a problem, we have to solve it, just like him. We encounter certain challenges during teaching practicum, for example,

student management problems, if students mess up, we do not manage students yet, what can we do to find out the good things we encounter during teaching practicum? […] (ST2, FGD2)

[…] We face problems when we encounter challenges in the classroom, thus we will study to find better solutions to manage classroom problems. […] (ST1, FGD3)

[…] Research that seeks classroom challenges, management, and teaching methodology to identify the problems that the teaching process and students face, such as lack of participation, is a problem for teachers and students. How to get students' attention so teachers can correct their problems and make them participate. […] (ST1, Semi-structured interview)

The points of view and experiences of action research participants seemed to be clear about the difficulty they faced throughout the teaching practicum. If they know what the problem is, they believe that action research can solve it. They managed to recognize the challenges of doing action research, but they were unsure about identifying action research topics when they were sure to solve the challenges during the teaching practicum. It should be noted that the participants can identify the challenges the students face with their study, but they still had difficulties identifying topics in their action research. Another participant stated that conducting action research can lead to new approaches to issue solving when he had taught students better than before:

[…] So that we have to conduct action research to know new approaches to solve the problems and we can teach better properly to give us new experiences…. As a condition, we have to learn to research to apply knowledge to solve problems when teaching. […] (ST6, FGD2)

Insufficient time for the research subject

The researchers noted that the teaching hours of the research subject are insufficient or inappropriate for student teachers to learn and apply for their action research because the subject is instructed for only one hour per week. As a result, the

student teachers' grasp of the content of the research knowledge is insufficient, making it impossible for them to apply what they learned from the study based on their perceptions and experiences, as indicated below:

> […] I found that the research subject I am learning is insufficient, so I feel it is hard to gain knowledge. […] (ST2 & ST3, Semi-structured interview)
>
> […] I feel that it was difficult to study the research subject because there was only one hour per week. […] (ST4, Semi-structured interview)
>
> […] It is very difficult, there is less time to study the research subject, and less understanding, unlike student teachers (12+4). […] (ST3, ST4 & ST6, FGD1)

Participants as student teachers (12+2) questioned this less critical perspective of research knowledge, stating that teaching hours of the research subject could not be equated with research content knowledge. They argued that the research subject hours for student teachers (12+2) should be increased as comprehension is relevant to conducting action research.

Proficiency in the English language

The analysis revealed that the responses of the student teachers were limited to the level of English competence, making it impossible to understand the content knowledge of research subjects in English. However, the majority of research resources are in English, making it difficult for student teachers to grasp the research subject as well. It should be highlighted that English knowledge is the key for student teachers to utilize or a technique for furthering the study of new knowledge that relates to the field. If they do not use English, they face the following consequences, as highlighted by the participants' focused experiences:

> [...] My English is not quite good so it is hard for me to read English documents. [...] (ST5, Semi-structured interview)
>
> [...] My English level is terrible. I think that English competency is required to study the research subject. [...] (ST1, FGD1)
>
> [...] Most of the research papers are written in English, which makes it difficult to understand! [...] (ST2, ST4 & ST5, FGD2)

Lack of reading resources in Khmer

According to the analysis, the main challenge for student teachers in studying research subjects is the lack of documents in the Khmer language, which makes them have difficulties in studying this subject. This challenge has already been mentioned that most of the research subject resources in English and Khmer are very limited or of poor quality, which limits the study of research content knowledge. Therefore, some participants raised concerns that:

> [...] I went to the library to search for resources related to my topic but I found that the research resources are mostly in English. [...] (ST2, Semi-structured interview)
>
> [...] I could see that there are not plenty of research resources in the library written in Khmer. [...] (ST5, FGD3)

Lack of research conceptual clarity

The researchers were interested in whether all participants agreed that they lacked research conceptual clarity for this issue. Given this, the responses of the participants were presented negatively. That is, they agreed to raise the issues that they weren't aware of how to conduct action research or how to adequately choose the topic, and they did not understand every phase of the action research.

> [...] I had no idea how to conduct action research or choose a topic… Where do I begin? How does it all end? ….. I had no idea how to formulate the research questions. [...] (ST3, Semi-structured interview)
>
> [...] I'm not sure how to identify the topic appropriately. I couldn't determine if the topic was good or not! (ST5, Semi-structured interview)
>
> [...] I do not understand each phase of the action research and do not know how to do it, therefore, the teacher educator can assist or guide me. [...] (ST5, FGD3)

2. Suggestion for the appropriate action research topic

Increase time for the research subject

In the interviews, the majority of participants generally mentioned that the research syllabus was limited to one hour per week. One hour of studying the research

subject is not enough for student teachers to understand and apply the research knowledge in real work. Research is an important subject for educating student teachers to conduct action research to solve challenges during the teaching practicum or in their schools in the future. According to the participant's responses, the researchers can analyze and notice that the research syllabus needs to increase the study time hours. For example, as shown in the following interviews and focus group discussions:

> [...] Because the research subject is difficult, I propose to PTEC to increase the number of teaching hours. [...] (ST5, Semi-structured interview)
>
> [...] We think that one hour per week is not enough for learning a research subject so more time should be provided for this subject. [...] (ST2, ST3 & ST4, FGD3)
>
> [...] I am aware that the research subject is important to solve the problem. It is good if the number of teaching hours is increased. [...] (ST3, FGD1)

These findings implied that the student teachers did not have an adequate grasp of the research subject since they experienced difficulty in identifying the action research topics for doing assignments or the teaching practicum. The research subject's critical perspectives on increasing time hours for student teachers may have influenced their improving knowledge and capacity to use it in real work.

Supervision and feedback from teacher educators

This study also discovered that receiving input from teacher educators on topic identification is critical for teaching student teachers and assisting them in finding the appropriate research topics. The researchers noted that student teachers who meet with teacher educators on a regular schedule, can improve their work and use research flowcharts properly. As a result, the participants also suggested that the designation of the research supervisor and finding action research topics should be studied from the first year for student teachers (12+2), the examples from the responses as shown below:

> [...] I want supervision and feedback for the teacher educator regularly! [...] (ST4, Semi-structured interview)
>
> [...] I want the teacher educator to give clear guidance on an action research topic step by step! [...] (ST6, FGD2)

> [...] We think that research topic identification should be done first in the first year and it gives us enough time to study. [...] (ST1, ST2, & ST3, FGD3)

Research sample pattern in the Khmer language

The researchers discovered ideas from participants to DERL for generating guidance research documents related to action research sample patterns in the Khmer language to put in the library, and they may help student teachers undertake action research appropriately, based on the interviews:

> [...] I propose that DERL prepare research sample guidance for help doing the action research topics. [...] (ST1, Semi-structured interview)
>
> [...] We suggest that DERL should select action research samples in Khmer to store in the library so that they may be easily found. [...] (ST3, ST4 &ST6, FGD1)

4.2 Discussion

As previously stated, the findings of this study clearly show that several factors impede student teacher's ability to identify research topics, including a lack of study time for the research subject, proficiency in the English language, a lack of reading resources in the Khmer language, and a lack of research conceptual clarity. These findings are consistent with the findings of Ameen et al (2018), who discovered that lack of conceptual clarity, poor time management, and a lack of research culture were the key challenges experienced by novice LIS researchers while defining a topic. Therefore, finding a study topic for an action research project can prove challenging for student teachers who lack research conceptual clarity.

Furthermore, the findings also found that the student teachers need help from the supervisors' feedback while processing the action research which completely agreed with Chinh and Sok (2018), who proposed many processes for developing a research topic. These include brainstorming research topics, identifying many research topics and finding the literature review, ensuring that the study topic is neither too narrow nor too broad, writing key terms from the topic, and ultimately defining the key phrases. Furthermore, student teachers require regular supervision and feedback from teacher

educators to receive precise guidance on action research topics step by step as they begin the research process, which confirms the study of Mills (2011), which stated that students who receive feedback from supervisors smoothly undertake their research and understand the process of doing action research properly (Jiang & Yan, 2020).

In summary, the discussion and analysis reflected the purpose of the investigation and two questions, which were challenging for the student teachers (12+2) to identify action research topics during their teaching practicum.

5. Conclusion and Recommendations

5.1 Conclusion

This study has revealed the difficulties in identifying action research topics by the student teachers (12+2). First, a limited understanding of English causes the student teachers to work hard in exploring relevant documents and papers in English. Most of the research papers are not available in the Khmer language, so the student will need to be able to access English competence to respond to the research demand. Second, limited time for research subjects is an additional difficulty for student teachers since they do not have sufficient time for learning research subjects, there is only one hour per week provided for the class (12+2). Student teachers will need 2 hours per week as 12+4. Third, the lack of research resources in the Khmer language is also one more difficulty raised by the student teachers. They are facing problems in searching for documents or papers that were written in Khmer. Those resources are hard to find in libraries as well as social media, online …etc. Fourth, comprehension of research topics is also a major issue that causes the student teachers are not clear and confident enough about what they are doing since what they have gained knowledge or concepts from year one and year two from lecturing was insufficient and the fundamental of student teachers in research is low conceptual clarity of action research.

In addition, this study is not without limitations. First, only one class of the year 2 secondary level (12+2) program participated in this research, and the rest classes of primary and secondary level (12+4) programs are not involved in this study. Second, the difficulty in identifying action research topics was only employed in the Educational Research class. Last but not least the difficulty in identifying action research topics in

this study was mainly about the student teacher's difficulty and their suggestion/support for this study.

To sum up, future research should cover more classes from (the 12+4) program to see whether there are different findings Moreover, the teacher educators may consider conducting an action research sample for the next novice researchers to study to support their understanding. Finally, other researchers are encouraged to investigate other difficulties deeply and find out appropriate solutions rather than only finding difficulties and suggestions from student teachers. On the other hand, Future research should also include a larger sample size and extend the scope of research to include student teachers in year 4 of Phnom Penh Teacher Education College (PTEC).

5.2 Recommendations

This study has some implications and recommendations as below:

1) It is recommended that the Department of Educational Research and Library consider how to increase the learning time of research topics for student teachers (12+2) in both year one and year two to meet the needs of their request.
2) Action research samples should be available and displayed in the PTEC library. It is very helpful for future researchers in doing their action research. This can be done by DERL teacher educators or by selecting the best sample from previous researchers.
3) Supervision and feedback from teacher educators should be done regularly to assist and reflect the student teacher's research on time.

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Pre-service teachers' Attitudes to Learning English for Teaching at Primary Schools

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ABSTRACT

MoEYS released a new curriculum framework that integrated English into primary education. TEC has implemented English courses and teaching methodologies for pre-service teachers. This new course is uncomfortable for them because, previously, they learned English as an elective course to meet the requirements of the studies but from now on, student teachers have to use it at primary school. This study aimed to explore difficulties, attitudes, and motivation in English language learning and teaching. This article is timely and relatively, especially, at the time when English is being needed as an obligatory major in the first cycle of primary education in Cambodia. The research was based on the qualitative approach using semi-structured interviews. Interview questions were distributed to student teachers of Phnom Penh Teacher Education College (TEC). There were 2 main issues in this research: (1) Attitudes towards learning and teaching English as a second language and (2) the profile of the pre-service teachers' language learning, difficulties, and need for support. The study demonstrated the findings of small-scale research that applied to a group of primary student teachers on their attitudes toward learning and teaching English. The results suggest that student teachers have moderately positive attitudes toward learning English but diverse attitudes toward teaching a foreign language. The findings of this study suggested that pre-service teachers are generally positive about the importance of learning English for teaching at primary school but they need some support and feedback. They believe that English is a valuable skill for students to have in the 21st century and that it could help student teachers succeed in school and life. They also believe that learning English can help students develop 21st-century including critical thinking, problem-solving, and collaboration. However, the study also found that student teachers have some concerns about learning English for teaching at primary school. These concerns include the lack

of qualified content knowledge and teaching methods of English in primary schools, the lack of resources for English learning in primary schools, and the pressure to perform well in English pedagogy. The study concludes that these concerns need to be addressed to improve English learning and teaching for primary school students. With the right support, pre-service teachers will be able to help make a significant difference in the English learning of primary school students

Keywords: *English as a foreign language; pre-service teachers, attitudes, motivation*

1. Introduction

In the teacher education program, English is a requirement subject from the primary program till the end of the 12+4 pre-service curriculum framework. Meanwhile, MoEYS (2012) released a new curriculum framework for primary schools in Cambodia. The Introduction of this curriculum framework, course syllabus, and textbook has sparked numerous discussions regarding the nature and impact of teaching the English language to young learners. Over the past two decades, there has been a growing interest in teaching the English language to increasingly younger learners, both in Cambodia (Igawa, 2008) and around the world (Brewster et al., 1992; Enever, 2014). The field of teaching the English language to young learners is now recognized as a district area of study, offering theoretical foundations and practical insights for professionals involved in teaching the English language to children. The present study focused on two crucial aspects within the realm of teaching young learners: attitude toward learning and teaching English as a second language (L2), and the role of the language teacher in the context of young learners (Silva Bratož, 2015). The 21st century is a time of rapid change and innovation(Bessant, 2013). To be successful in this new world, students need to be equipped with the skills necessary to think critically, solve problems creatively, and communicate effectively. English is a key language for accessing information and participating in a global society (Matear, 2008), making it an essential skill for 21st-century learners (Rotherham & Willingham, 2010).

In like manner, pre-service teachers are the future of education. They are the ones who will be responsible for preparing students for the challenges of the 21st century (Valtonen et al., 2021). As such, it is important to understand their attitudes towards

learning English for teaching at primary school. The 21st century is a time of rapid change and innovation (Rotherham & Willingham, 2010). To be successful in these new experiences, students need to be seriously nurtured with the necessary skills to think critically, solve problems creatively, and communicate effectively. English is a mechanism for accessing information and attending to global society, making it an important skill for 21st-century learners (Lambert & Gong, 2010). As such, it is important to understand their attitudes towards learning English for teaching at primary school in preparation for 21st-century skills.

Regarding its current status all over the world, teaching and learning English has gained importance in all aspects. Even oral and productive skills have also been key concepts for effective language teaching and learning (Ampa & Akib, 2019). The performance of the students and their enthusiasm to learn are significantly influenced by the teacher's attitude toward learning and teaching. In the field of teaching second languages, attitudes have been researched, particularly relevant to motivation and success in learning a foreign language (Ahmed et al., 2018). Only a small number of studies have addressed the attitudes of experienced or pre-service teachers, while most studies have concentrated on the attitudes and motivation of learners. According to (Gürsoy et al., 2013); and Walker et al. (2004) there is a void in the body of knowledge about the attitudes of trainee teachers toward the language, they will be expected to teach once they graduate.

By examining the primary student teachers' views on English language teaching and learning and its relation to respondents' report levels self-reported level of English language ability (Chan et al., 2021a), the current study seeks to close a gap in the literature by examining relevant prior studies on perceptions of learning and teaching foreign languages.

1.1 Research Questions

The following research questions are addressed in this study:

1) What is the most difficult thing in teaching a foreign language at primary school?
2) What is the student teacher's perceived ability and the essential factors that support English teaching in primary schools?

3) What are the student teachers' attitudes for learning English for teaching at primary school?

1.2 Significance of the Study

This study is significant for several reasons. First, it will provide valuable insights into the attitudes of pre-service teachers towards learning English for teaching at primary school in preparation for 21st-century skills. This information can be used to develop more effective English language teaching programs for pre-service teachers and to ensure that they are equipped with the skills necessary to teach English effectively in the 21st century. Second, this study will contribute to the growing body of research on the relationship between English language proficiency and 21st-century skills. This research is important because it can help us understand how English language proficiency can be used to promote the development of 21st-century skills in students. Finally, this study will provide a foundation for future research on the topic of student teachers' attitudes toward learning English for teaching at primary school. This research can help us to better understand the factors that influence student teachers' attitudes towards learning English, and how these attitudes can be changed or improved.

2. Literature Review

The pre-service learning attitude is the attitude toward learning that pre-service teachers have (Gil-Gómez et al., 2015). It is influenced by several factors, including their own experiences as learners, their beliefs about the importance of learning, and their perceptions of the teaching profession (Enever, 2014). Pre-service teachers with positive learning attitudes are more likely to be successful in their teacher education programs and their careers as teachers. They are more likely to be motivated to learn, to be open to new ideas, and to be willing to take risks (Ampa & Akib, 2019). They are also more likely to be effective teachers, as they are more likely to create a positive learning environment and to help their students learn effectively. Several things can be done to promote positive pre-service learning attitudes. In this study, we used "pre-service teacher and student teacher" interchangeably.

2.1 Importance of Learning English for pre-service teacher

English is an international language or a global language. It covers most

communications in terms of doing business, science, and research around the world, for example. Similarly, based on the research which was conducted by (Pinon, 2023) stated that English is now the common global language of communication. Therefore, learning English is very important to globalization.

In terms of educational studies, English plays a very crucial role in the development and progress of understanding of all subjects all over the world. As stated by (Igawa, 2008), all applicants must have a good command of the English language which is considered essential as it can ensure that academic progress will now be hindered by language difficulties and the students will be able to integrate socially during their terms at the university. Interestingly, in research journal by Kersten and Rohde (2013) argued that English for education has been a fundamental part of early forms of learning and teaching. Similarly, (Brewster et al., 1992) stated that documents in English are a very important contribution to teaching and learning in all fields.

2.2 Situation of the Four Macro Skills English Learning

When it comes to acquiring the English language, the process revolves around developing proficiency in the four fundamental skills: listening, speaking, reading, and writing. Learning English entails actively practicing the language and gaining insights into the culture and thought patterns of native speakers. Additionally, learners need to attain proficiency in both input skills, such as listening and reading, and output skills, such as speaking and writing (Weshah & Tomok, 2011). Significantly, Hsu et al. (2013) also mentioned that foreign language learning can be considered from the four aspects of listening, speaking, reading, and writing.

Speaking skill

Communication through speech serves as a means to connect individuals with society and establish a bridge of communication between the speaker and listener. As one of the four essential language skills, speaking is often regarded as the most challenging to acquire. By engaging in speaking activities, students have the opportunity to grasp concepts, expand their vocabulary, and comprehend the structure of the English language. Through oral communication, students can effectively convey their thoughts, share information, and express their emotions by utilizing both verbal and non-verbal forms of interaction with an audience (Turgunova & Abdurahimovna, 2023).

Speech is the prime means of communication and the structure of the society itself would be substantially different if we had failed to develop communication through speech (Wrench et al., 19944). To develop oral communication, information gap activities are suggested. Information gap activities have the scope of integrating all four skills (Venkateswaran, 1995)

Related to this skill, Aliakbari and Jamalvandi (2010) pointed out that among the four language skills, speaking seems intuitively the most important since the people who know a language are referred to as 'speakers' of that language; as if speaking includes all required knowledge for a language. According to Yakovleva and Yakovlev (2014), the speaking skill offers insights into the thinking process of students, enabling teachers to familiarize themselves with their cognitive skills through verbal expression can assist teachers in nurturing and enhancing this particular skill. Referring to Kirkgoz (2011) argued that since speaking is required in academic and professional performances as well as demands production skills, therefore, speaking with a greater degree of proficiency is of great significance, particularly for students who are to accomplish various academic tasks in English. Nofal (2012) emphasized that when students are unable to learn how to speak or lack opportunities for speaking in the classroom, their motivation to learn may dwindle, leading to a loss of interest. Conversely, if appropriate activities are taught effectively, speaking in class can become an enjoyable experience, boosting overall learner motivation and transforming the English language classroom into a lively and engaging environment. Furthermore, Weshah and Tomok (2011) noted that assessing speaking skills can be challenging, as it requires focused attention on specific aspects such as pronunciation, grammar, vocabulary comprehension, as well as overall fluency and understanding. As cited in (Keshta & Al-Faleet, 2013), Wilkins (1972) pointed out that without having grammar knowledge English learners can convey very little, but without vocabulary knowledge, they can convey nothing.

Listening Skill

Listening skill is one of the most important skills in English learning. Learners can practice listening in many different ways. Referring to (Chapelle, 1997) pointed out that extensive listening via various media was widely considered to be beneficial for improving a student's listening ability; furthermore, EFL/ESL learners need many

listening exercises before they can deal with authentic listening materials. Interestingly, referring to strategy instruction in terms of listening comprehension, as listening is important for learning a language, in recent years there has been a growing interest in what should be done to help students develop and use this skill more effectively; because not all language learners acquire the same listening proficiency level to communicate successfully (Fathi & Hamidizadeh, 2019).

Significantly, (Darancik, 2018) stated that on a normal day, we usually listen twice as much as speaking and four times as much as reading and writing, when listening, they are dependent upon the speed set by the speaker (Turgunova & Abdurahimovna, 2023). Referring to Hadian (2015) claimed that among the four aspects namely listening, speaking, reading, and writing, listening is an important capability of social interactions, and it has been found that people receive new messages more efficiently via listening than reading. Listening comprehension is a crucial part of language acquisition and instruction. It is influenced by many factors, among which metacognitive strategies are most important. Learners' understanding of mental and emotional processes in their L2 listening can also help them master the ways of improving their listening skills (Fathi & Hamidizadeh, 2019). Similarly, (Chou, 2017) argued that metacognition plays an important role in each phase of listening comprehension. Before approaching the listening task, learners make the prediction, select appropriate strategies needed for completing it, and distribute attention accordingly. Regarding dealing with language skills priority, listening is the most fundamental language skill which can be developed and it should be a clear focus of classroom instruction.

Reading Skill

Reading comprehension is very interesting for all learners as it provides much information such as education, science, agriculture, industry, business, marketing, and banking. It is said that reading comprehension is relevant to vocabulary knowledge (Perfetti & Stafura, 2014). Similarly,

Wu et al. (2019), reading comprehension heavily relies on vocabulary knowledge, making it a crucial aspect. Vocabulary has consistently been identified as a strong indicator of one's proficiency in writing, reading, comprehension, and speaking in any language (Moghadam et al., 2012). Additionally, Miralpeix (2008) highlights the

significance of vocabulary acquisition in learning any language, often exemplified by the fact that when traveling abroad, a dictionary is preferred over a grammar book. Perfetti and Stafura (2014) further argue that vocabulary plays a pivotal role in reading models, as research has revealed its impact on early reading skills and related processes such as phonological, orthographic, and morphosyntactic abilities.

Based on (Mokhtari & Niederhauser, 2012) viewed reading and comprehensive vocabulary knowledge as essential resources of variation in terms of reading understanding, in particular, as it affects higher-lever language processes namely grammatical processing, formation of schemata, and text models. Waring and Takaki (2003) pointed out that reading is one important source for acquiring vocabulary, effectiveness, and efficiency. Jiang et al. (2012) viewed that word reading efficiency refers to the ability of readers to recognize individual words accurately and rapidly. Similarly, Torgesen et al. (1997) stated that lack of efficiency in phonemic decoding and word recognition has been recognized as one of the factors impeding efficient EFL reading comprehension.

Comprehension of written text is a crucial skill for learners, as it allows them to not only understand the explicit meaning but also grasp the underlying concepts. Scholars like Enever (2014) and Grabe (1991) have emphasized the importance of reading as a valuable skill that learners must master in academic settings. Additionally, Cromley et al. (2010) have suggested that teachers should prioritize reading comprehension as it is a key predictor of student success. Interestingly, Reis et al. (2008) have pointed out that reading comprehension is a specific skill that enables learners to gain a better understanding of the world and encourages them to engage in thoughtful reflection.

Skilled reading depends on the effective operation of a wide range of cognitive processes, one of the more complex of which is fluency (Beglar et al., 2012). More importantly, Khajavi and Abbasian (2013) stated that reading comprehension possesses a vital role in the academic life of many students. The extensive reading approach has shown many benefits for learners although it often relies on learners being motivated to read outside the classroom to read large amounts (Kirchhoff, 2013). Referring to a survey investigated (Barry, 2013) showed that above 80% of the students considered

reading valuable, important, and very important to them.

Writing Skill

Writing skills are very important in terms of writing paragraphs, essays, or business letters. An intriguing observation made by Li (2014) is that English writing holds immense significance as a language skill for college students. Over time, English writing has posed a significant challenge for college students, evident in the difficulties they face due to limited vocabulary and the frequent use of Chinglish expressions in their essays. These challenges hinder their ability to express themselves clearly and effectively. An intriguing observation made by Li (2014) is that English writing holds immense significance as a language skill for college students. Over time, English writing has posed a significant challenge for college students, evident in the difficulties they face due to limited vocabulary and the frequent use of Chinglish expressions in their essays. These challenges hinder their ability to express themselves clearly and effectively. Evans et al. (2010) presented that teachers believe that correcting the grammar of student writers' work will help them improve the accuracy of subsequent writing. Typically, students learn grammatical elements in one portion of English/language arts class, experience literature in another portion, and write in still another portion (Chandler, 2003).

According to (Ju, 2010) viewed that most teachers realize that students have to study grammar to achieve high credits for their exams. Furthermore, it is useful for understanding the structure of a language and helpful for students to know how to make or combine sentences. This can help them write correctly. Referring to Mahmoud (2014) claimed that using the cooperative language learning approach through group writing discussions can enhance students' interpersonal and communication skills. It also assists them in establishing a clear purpose for their writing. Additionally, this approach ensures the proper execution of the writing process, as students are provided with ample opportunities to brainstorm, share ideas, draft, plan, organize, revise, and edit their written work. Furthermore, Hayashi (2005) highlights the significance of peer practice in writing as an effective method for improving writing skills.

A study conducted by (Okasha & Hamdi, 2014) views that by using strategic writing techniques, the writing skills and attitudes developed among experimental group

students. And he used strategic writing. The strategic writing techniques consist of 1.) Stop Strategy; 2.) Dare Strategy; 3.) Story Writing Strategy; and 4.) Star Strategy and along with "Power" Strategy which stands for 1.) P=Picking ideas; 2.) O=Organizing ideas; 3.) W=Writing; 4.) E= Evaluation and 5.) R= Re-examining and rereading. In addition, Alkodimi and Al-Ahdal (2021), writing a considered a fundamental skill that students must acquire during their tertiary education. This skill is particularly crucial for university students as it enables them to effectively communicate their research findings with researchers worldwide. Mastering research writing is an essential early skill that university students must acquire and continually cultivate throughout their educational journey.

2.3 English learning and teaching's attitude and motivation

Attitudes toward teaching English languages are frequently seen as a crucial factor in the success of language learning. Numerous studies have shown a strong association between *linguistic proficiency* and a *positive attitude* and *motivation*, which has been sparked by key work on the subject (Gardner & Lambert, 1972). The connections between these 3 facets of learning the English language, however, are beyond obvious studies. For instance, according to (Dörnyei et al., 2004), the motivation to acquire a second language is a multifaceted variable that includes several elements, including the learner's attitudes about the needed language and their cultural environment, as well as personality and identity concerns. It follows that any examination of attitudes must take into account the interaction between these three factors. The five attitude/motivation variables that Alizadeh (2016); (Dörnyei, 1998; Gardner & Lambert, 1972) identified in his socio-educational theory are integrativeness, attitudes toward the learning situation, motivation, integrative orientation, and instrumental orientation. These variables are especially relevant to our research. The degree to which a language learner may understand the focused language group is referred to as integrativeness. According to the theory, people who are more eager to belong to the community that speaks the target language will be more motivated to study it.

Pre-service teacher's Difficulty in learning and teaching English

Some of the most common difficulties that pre-service teachers face in learning English include Grammar and vocabulary. English grammar and vocabulary can be

complex and challenging to learn, especially for speakers of other languages. Pronunciation (Mohammed, 2018). Pronunciation can be a difficult skill to master, and it can be especially challenging for pre-service teachers who are not the mother tongue speakers of English. Confidence (Gilakjani & Ahmadi, 2011). Some pre-service teachers may lack confidence in their own English language proficiency (Wessels et al., 2017). This can make it difficult for them to speak up in class or to teach English to others.

Moreover, Teaching methods are also a big issue for pre-service teachers. Pre-service teachers often need to learn new teaching methods and techniques. This can be a challenge, as there are many different teaching methods available, and it can be difficult to know which methods are the most effective. On the other hand, classroom management is one more challenge for student teachers. Managing a classroom of students can be challenging because they do have not enough confidence and may not have the skills or experience necessary to do so effectively (Stoughton, 2007; Sueb, 2013).

Main and Hammond (2008) indicated that encouraging pre-service teachers to reflect on their own learning experiences is the one that teacher educators do to help them. This can help them to identify their strengths and weaknesses as learners and to develop strategies for improving their learning. Helping pre-service teachers to develop a strong belief in the importance of learning. This can be done by providing them with opportunities to learn about the latest research on learning and by helping them see the benefits of lifelong learning (Sueb, 2013). Creating a supportive learning environment in teacher education programs. This can be done by providing pre-service teachers with opportunities to collaborate with experienced teachers, and by providing them with feedback on their learning.

By promoting positive pre-service learning attitudes, we can help to ensure that future teachers are well-prepared to meet the challenges of the 21st century.

In addition, qualified language teachers have been the main focus of attitude study up to this point because they are suggested to have the versatility to lecture at primary, secondary, and tertiary levels with an equivalent degree of competence (Alizadeh, 2016; Enever, 2014). The necessity to reimagine the role of the language instructor for young learners is, however, a result of the global trend toward integrating L2 instruction from the very beginning of compulsory schooling. According to (Brumen & Fojkar, 2012);

and Enever (2014), this entailed creating a model of a generalist primary teacher who was certified to teach all (or nearly all) subjects on the curriculum as well as a foreign language.

When compared to the profile of the foreign language teacher, the subject of attitudes about teaching and learning the English language assumes a noticeably diverse form. Primary school teachers may have more or less positive views regarding learning and consequently teaching a foreign language, in contrast to expert language instructors who are typically extremely driven to study languages. Additionally, we can infer that problems with their L2 language ability will have an impact on their attitudes. Furthermore, Garton et al. (2011) made several recommendations as a result of their examination of the methods used around the world to teach English to young learners, and one of those recommendations relates to the necessity of improving instructors' English language abilities.

The authors contend that even English-trained primary school instructors frequently lack confidence in their language skills. This, however, is not necessarily connected to their actual or insufficient proficiency level, but rather to the widespread perception that teaching English to young learners requires proficiency comparable to that of a native speaker.

Factors that Influence Pre-service Teachers' Attitudes toward English Proficiency

Several factors can influence pre-service teachers' attitudes toward English proficiency. These factors include Their own experiences with English (Mokhtari & Niederhauser, 2012). Pre-service teachers who have had positive experiences with English are more likely to believe that it is important for students to be proficient in this language (Silva Bratož, 2015). For their cultural background, Pre-service teachers who come from cultures where English is not the dominant language may be more likely to believe that English proficiency is not as important (Hatipoğlu, 2015). For their professional goals, Pre-service teachers who want to teach in international schools or who want to work in the global business community are more likely to believe that English proficiency is essential (Fu & Wang, 2021). For their teacher education program, the way that English proficiency is taught in teacher education programs can also

influence pre-service teachers' attitudes toward this issue. Programs that focus on the importance of English proficiency are more likely to produce pre-service teachers who believe that this skill is essential.

These factors merit further study, particularly in light of the crucial role teachers play during a learner's formative early years of schooling. The ELLiE study, which tracked the Introduction of English language studying in primary school classrooms in seven European countries, highlighted that the teacher's attitude has a significant impact on the student's ability to learn the English language. According to the findings of ELLiE case studies conducted in seven different European nations, successful teachers are those who have a good attitude in teaching English. This is true even though successful foreign language learning can occur under various learning circumstances and be linked to the use of a variety of teaching methods (Enever, 2011).

Students' satisfaction in learning English

According to Chen et al. (2005), student satisfaction refers to the positive emotions or attitudes that students have toward their learning activities. It can be measured by the difference between their expectations and the actual outcomes they experience. A smaller difference indicates higher satisfaction, while a larger difference indicates lower satisfaction. Domer (1983) further suggests that learner satisfaction can be understood as the gap between a learner's expectations and their actual achievements. When the gap between expectations and achievements is smaller, learners tend to be more satisfied. Conversely, when the gap is larger, learners may feel dissatisfied. As cited in (Lee, 2008), Hameed and Amjad (2011) argued that positive student experiences lead to student satisfaction. Naaj et al. (2012) claimed that meeting and exceeding the students' expectations not only satisfies students but also leads them to become advocates who provide a free promotion source for the university. Reporting on satisfaction in a blended learning environment, Zhao et al. (2021) define satisfaction as the sum of student feelings and attitudes that result from aggregating all the benefits that a student hopes to receive from a blended learning environment system. Menon and Saitis (2006); (White, 1956) emphasized the crucial role of learning satisfaction in motivating English learners. They argued that in an age where English is the global language, enjoyment derived from three factors fuels interest: the physical environment

where learning takes place, active participation in activities, and the inherent appeal of the activities themselves.

3. Research Methodology

3.1. Participants

Eight pre-service teachers enrolled in their second year of a primary English teacher preparation program conveniently participated in this study. Selection considered their year of study. Their curriculum typically covered language skills, linguistics, literature, and teaching methodology. However, the program lacked dedicated courses on English as an international language, English as a lingua franca, or World English. Completion of this academic program, culminating in a ten-week teaching practicum in a primary school, was assumed to equip participants with sufficient language skills and pedagogical knowledge for primary school English instruction. Subsequently, these pre-service teachers would take a Ministry of Education, Youth, and Sport (MoEYS) administered qualifying exam and, upon passing, receive a Bachelor of Arts in Education.

This study involved a purposefully selected sample of eight fourth-year student teachers majoring in Primary Education at Phnom Penh Teacher Education College. The majority were female (87%) and between 21 and 23 years old. As the sample is not intended to represent the broader population of student teachers, we chose this specific group to explore their perspectives and attitudes toward teaching English at the primary level.

Table 1: Student Teachers of Primary Education in the Study

Name	Gender	Class	GPA	Program
Student teacher 1	M	AIV	3.0	Primary Education 12 + 4
Student teacher 2	F	AIV	3.5	Primary Education 12 + 4
Student teacher 3	F	AIV	3.5	Primary Education 12 + 4
Student teacher 4	F	AIV	4.0	Primary Education 12 + 4
Student teacher 5	F	BIV	3.5	Primary Education 12 + 4
Student teacher 6	M	BIV	3.0	Primary Education 12 + 4
Student teacher 7	F	BIV	3.5	Primary Education 12 + 4
Student teacher 8	F	BIV	4.0	Primary Education 12 + 4

Note: 12 + 4 refers to the Bachelor's Degree of Education provided by Phnom Penh Teacher Education College, which takes four years to complete

Eight student teachers of Primary Education participated in the interview, two of whom were male, as can be seen in Table 1, and the rest were female. The participants in the interview were chosen by the researchers based on their GPA scores in the final exam of semester 1. They are interviewed with the questions as shown in Table 2.

3.2 Data Collection

The main technique of data gathering for the qualitative research is a series of semi-structured interviews with eight participants. Interviews are a useful tool for examining pre-service teachers' perspectives. Important individuals have been chosen via purposeful sampling. The majority of the participants were found based on their meaningful academic participation in the English study. Purposive sampling, according to (Kelly, 2004), is a potent technique employed in qualitative investigations to obtain rich data regarding the issues under investigation. Notably, PTEC participants constitute the investigation's participants to fully comprehend the important topics through both verbal and non-verbal communication. The interviews were voice-recorded, and the second author then transcribed and translated them into English. Most interviews were conducted in the period 22 July to 6 August 2023.

3.3 Data analysis

To ensure comprehensive utilization of relevant data across interview transcripts, the research team employed a meticulous qualitative data analysis process. Thematic coding guided the analysis, with extracted data categorized under predefined themes encompassing English study difficulties (subject matter and research reading), motivation levels, primary English teaching methods, and support needs. Further sub-coding within each theme facilitated the identification of nuanced issues. Additionally, key representative quotes, anonymized through coded references, provided evidence to support the study's findings.

Following the presentation of the study's findings, a comprehensive discussion links the researcher's interpretations with established research literature discussed in the preceding literature review. This ensures the study's grounding in existing knowledge and reinforces its academic relevance. Furthermore, adherence to ethical standards was

meticulously maintained throughout the research process. All data collection procedures prioritized confidentiality, privacy, and voluntary participation. Notably, the researcher sought informed consent from each interviewee to record the interactions for in-depth analysis, in addition to taking detailed handwritten notes during the interviews. Participants were assured that their information would be safeguarded from external access and solely utilized for this research. Rigorous data collection and analysis procedures were implemented to ensure the accuracy and reliability of the findings, upholding the principles of fidelity and transparency in the use of data throughout the study.

4. Result and Discussion

4.1 Result

Research question 1: What is the main difficult thing in teaching the English language at primary school?

Through interviews, the study identified three prominent themes that emerged from the data obtained from interview question 1: inadequate training, English language proficiency, and lack of pedagogical knowledge. The findings provide valuable insights into the challenges faced by student teachers in effectively teaching English in primary school settings.

Inadequate Training

One of the major themes that emerged from the interviews was the inadequate training provided to student teachers at TECs about teaching English. Many participants expressed their concerns about the lack of practical training and opportunities to develop their teaching skills specifically for teaching English as a foreign language since all of their practicum periods were used mostly for other important subjects such as Khmer Literature and Mathematics. Student teacher 1 said that he had learned different methods of teaching the four macro skills at PTEC, but he hadn't had the opportunity to practice teaching English with those methods. They highlighted the need for more training, mentoring programs, and hands-on experiences that focus on English language pedagogy.

English Language Proficiency

The second theme that emerged from the interviews was the issue of English language proficiency among student teachers or primary education. Most of the participants expressed their struggles in mastering the language, which they believed hindered their ability to effectively teach English to primary school students. Student teacher 6 clarified that his knowledge of the subject matter was the main concern for him in teaching English. Similarly, student-teacher 7 admitted that she had not enough confidence in teaching English to primary students because of her low English proficiency, she also said that she was always afraid of making mistakes. Participants stressed the importance of strengthening their English language skills through targeted language courses and immersion programs, to enhance their confidence and competence as English language teachers.

Lack of Pedagogical Knowledge

Another significant theme that arose from the interviews was the lack of pedagogical knowledge among student teachers when it came to teaching English. Participants expressed their concerns about not having a solid understanding of appropriate teaching strategies, lesson planning, and assessment methods specifically tailored for English language instruction in primary schools. Student teacher 3 indicated that the contents of the courses they learned at PTEC were very hard for them to understand the main concepts of those strategies and methodologies in the teaching and learning process, especially related to the macro skills, and student teacher 7 also reported that she could not implement the teaching strategies into her lesson plans during the micro-teaching with her peers, and she struggled with implementing techniques to strengthen the four skills. They emphasized the need for comprehensive pedagogical training that focuses on the specific challenges and needs of teaching English to young learners.

The findings highlight the importance of addressing the issues of inadequate training, English language proficiency, and lack of pedagogical knowledge among student teachers. To improve the quality of English language instruction in primary schools, it is crucial to provide targeted training programs, language enhancement courses, and pedagogical workshops. Additionally, collaboration between teacher

training institutions, primary schools, and relevant stakeholders is essential to create a comprehensive support system for student teachers.

Research question 2: What are student teachers' perceived abilities and the essential factors that support English teaching in primary schools?

English language proficiency development

Results from the interviews revealed several essential factors that support English teaching in primary schools, according to the perspectives of student teachers. The findings highlighted the importance of English language proficiency for effective teaching. Many student teachers emphasized the need for courses and training programs that specifically focus on improving their English language skills for teaching purposes. They believed that a strong command of the language is crucial to delivering lessons effectively. Student teacher 8 emphasized a strong need to improve her English proficiency, and she thought that her improvement in English level would help her improve her teaching.

Pedagogical training

Another significant factor identified was the need for pedagogical training to teach each macro skill to primary school students. Student teachers expressed the desire for comprehensive training that equips them with the necessary teaching strategies and methodologies specifically tailored for English language instruction in primary schools. They stressed the importance of learning how to engage young learners, create interactive and communicative activities, and effectively manage the classroom environment. Most student teachers concluded that the methods learned at PTEC were not comprehensive enough to teach young learners, and they needed only those methods that could be applied at the primary education level.

The results of the interviews highlight the essential factors that support English teaching in primary schools from the perspective of student teachers. These factors include English language proficiency and pedagogical training modules. The findings emphasize the importance of addressing these factors to enhance the quality of English language instruction in primary schools and ultimately improve the learning outcomes of students.

Research question 3: What are the student teachers' attitudes towards learning English for teaching at primary school?

a) pre-service teachers' beliefs about the importance of English for teaching at primary school

Pre-service teachers are generally positive about the importance of learning English for teaching at primary school. They believe that English is a valuable skill for students to have in the 21st century and that it can help them to succeed in school and life. As Pre-service teacher 1 explained *"I think English is very important for students in the 21st century. It's the language of the world, and it's essential for communication and success."* In particular, pre-service teachers are also aware of the challenges of learning English. They cite factors such as the difficulty of the language, the lack of resources, and the pressure to perform well in English exams. For instance, Pre-service teacher 2 claimed *"Learning English is challenging, but it's also very rewarding. I'm motivated to learn English because I want to be able to help my students succeed."* Despite the challenges, pre-service teachers are motivated to learn English for teaching at primary school. They believe that the benefits of learning English outweigh the challenges, and they are committed to becoming proficient in the language. Besides, Pre-service teachers have a variety of ideas about how to improve English learning for primary school students. They suggest using more interactive and engaging teaching methods, providing more opportunities for students to practice their English, and making English learning more relevant to students' lives. Evidently, *"I think there are a lot of ways to improve English learning for primary school students. We need to use more interactive and engaging teaching methods, and we need to provide more opportunities for students to practice their English.", said* Pre-service teacher 3. Therefore, pre-service teachers are positive about the importance of learning English for teaching at primary school. They are aware of the challenges of learning English, but they are motivated to overcome these challenges to become proficient in the language. They have a variety of ideas about how to improve English learning for primary school students.

b) Student teachers' attitudes towards learning English for teaching at primary school

Pre-service teachers are generally positive about the importance of

learning English for teaching at primary school. They believe that English is a valuable skill for students to have in the 21st century and that it can help them to succeed in school and life. They also believe that learning English can help students develop 21st-century skills such as critical thinking, problem-solving, and collaboration. To show that Pre-service teacher 8 mentioned *"[…] Nowadays, students who study at university must know English quite well, […] he need it for doing assignment and research, etc. […], there is a lot of things read and watch through Google, Facebook, YouTube*…Similarly, Pre-service teacher, 6 added *"[…] all-important thing is in English, so it is very important for studies." Essentially, for communication."* Similarly, pre-service teachers are also aware of the challenges of learning English. They cite factors such as the difficulty of the language, the lack of resources, and the pressure to perform well in English exams. However, they believe that the benefits of learning English outweigh the challenges. *"Learning English is challenging, but it's also very rewarding. I'm motivated to learn English because I want to be able to help my students succeed."*, said Pre-service teacher 2. Despite the challenges, pre-service teachers are motivated to learn English for teaching at primary school. They believe that the benefits of learning English outweigh the challenges, and they are committed to becoming proficient in the language. They are also motivated by the desire to help their students succeed in school and life. For example, Pre-service teacher 5 asserted *"I study a lot in the program, if I spend time to understand more about the method, I will be able to find the ways to teach English to primary school students. We need time with plenty of teaching methods and experience to provide more opportunities for my future students to practice their English to meet the demand."* Pre-service teachers have a variety of ideas about how to improve English learning for primary school students. They suggest using more interactive and engaging teaching methods, providing more opportunities for students to practice their English, and making English learning more relevant to students' lives. They also suggest providing more support for pre-service teachers who are learning English. The pre-service teacher's concerns need to be addressed to improve English learning for primary school students. With the right support, pre-service teachers can help to make a significant difference in the English learning of primary school students.

c) *Pre-service teachers' perceived ability to teach English effectively at primary school*

Pre-service teachers generally believe that they can teach English effectively in preparation for 21st-century skills. They believe that their training in English language teaching has prepared them to teach English in a way that is engaging and relevant to students' lives. They also believe that they can use technology to support English learning and to help students develop 21st-century skills. As Pre-service teacher 7 mentioned *"I think I have a good understanding of how to teach English effectively. I'm confident that I can use my training to help my students learn English."* However, pre-service teachers also identify some areas where they need more support. These areas include *Their own English proficiency*. While pre-service teachers believe that they are proficient in English, they also recognize that they can continue to improve their language skills. *Their knowledge of 21st-century skills*. Pre-service teachers believe that they have a good understanding of 21st-century skills, but they also recognize that they need more knowledge about how to integrate these skills into their English teaching. *Their ability to use technology effectively*. Pre-service teachers believe that they can use technology to support English learning, but they also recognize that they need more training on how to use technology effectively in the classroom. In this case, Pre-service teacher 2 added *"My English is no good enough, but I'm trying with confidence that I'll be able to improve my language skills before I start teaching." Along with that Pre-service teacher 7 expressed "I think it's important to be able to integrate the 21st century skills into my English teaching."* So, Students need more support. With the right support, pre-service teachers can be well-equipped to
teach English in a way that is engaging, relevant, and prepares students for the 21st century.

4.2 Discussion

We found that pre-service teachers are generally positive about the importance of learning English for teaching at primary school. They believe that English is a valuable skill for students to have in the 21st century and that it can help them to succeed in school and life. They also believe that learning English can help students develop 21st-century skills such as critical thinking, problem-solving, and collaboration. However, the study also found that pre-service teachers have some concerns about learning English

for teaching at primary school. These concerns include the lack of qualified English teachers in primary schools, the lack of resources for English learning
in primary schools, and the pressure to perform well in English exams.

The study also found that these concerns need to be addressed to improve English learning for primary school students. With the right support, pre-service teachers can help to make a significant difference in the English learning of primary school students. The study found that pre-service teachers generally believe that they can teach English effectively in preparation for 21st-century skills. Likewise, Enever (2014) stated in his study that when student teachers are given good conditions in terms of content knowledge and effective teaching methods, they are motivated to teach. Similarly, Ahmed et al. (2018) mentioned that students' perception of the learning environment and its relation to their study year and performance well, student-teacher could afford their teaching environment. However, they also identify some areas where they need more support, such as their own English proficiency, their knowledge of 21st-century skills, and their ability to use technology effectively. In addition, with the right support, pre-service teachers can be well-equipped to teach English in a way that is engaging, and relevant, and prepares students for the 21st century. The study suggests that some of the key areas where pre-service teachers need support include: *English proficiency:* Pre-service teachers need to have a strong command of English to be effective teachers. They need to be able to speak, understand, read, and write English fluently. *Knowledge of 21st-century skills:* Pre-service teachers need to have a good understanding of what 21st-century skills are and how they can be integrated into English teaching. They need to be able to help students develop these skills in a way that is relevant to their lives. To support this finding, Chan et al. (2021b) suggested that teacher educators should give instruction clarity, feedback, autonomy support, and motivation to student teachers to make them teach self-efficacy. *Ability to use technology effectively:* Pre-service teachers need to be able to use technology effectively in the classroom. They need to be able to use technology to support English learning and to help students develop 21st-century skills. The study suggests that by providing pre-service teachers with support in these areas, they can be well-equipped to teach English in a way that is engaging, and relevant, and prepares students for the 21st century.

5. Conclusion and Recommendation

6.1 Conclusion

The research study "Pre-service Teachers' Attitudes to Learning English for Teaching at Primary School in Preparation for 21st Century Skill" with the findings and discussion above, findings of this study suggests that pre-service teachers are generally positive about the importance of learning English for teaching at primary school. They believe that English is a valuable skill for students to have in the 21st century and that it can help them to succeed in school and life. They also believe that learning English can help students develop 21st-century skills such as critical thinking, problem-solving, and collaboration. However, the study also found that pre-service teachers have some concerns about learning English for teaching at primary school. These concerns include the lack of qualified English teachers in primary schools, the lack of resources for English learning in primary schools, and the pressure to perform well in English exams. The study concludes that these concerns need to be addressed to improve English learning for primary school students. With the right support, pre-service teachers can help to make a significant difference in the English learning of primary school students.

6.2 Recommendations

Based on the findings of this study, the following recommendations are made:

- Provide pre-service teachers with support in the areas of English proficiency, knowledge of 21st-century skills, and ability to use technology effectively. This support can be provided through in-service training, mentoring, and access to resources.

- Increase the number of qualified content knowledge and teaching self-efficacy in primary schools. This can be done by implementing formative assessment and feedback more carefully and providing them with the support they need to be effective teachers.

- Provide primary schools with more resources for English learning. This includes textbooks, teaching materials, and technology.

- Reduce the pressure on pre-service teachers to perform well in English competencies. This can be done by changing the way English performance (i.e. micro-teaching, practicum…) is designed and graded.

- The research should be conducted as an experiment on the effective English teaching methodology in the Cambodian context.

By following these recommendations, we can help to ensure that pre-service teachers have the skills and support they need to teach English effectively in primary schools. This will help to improve English learning for all students and prepare them for the 21st century.

In addition to the above recommendations, the study also suggests that it would be beneficial to conduct further research on the following topics:

- The effectiveness of different methods of providing support to pre-service teachers in the areas of English proficiency, knowledge of 21st-century skills, and ability to use technology effectively.
- The impact of different policies and practices on the English learning of primary school students.
- The factors that influence the motivation of pre-service teachers to teach English effectively.

By conducting further research on these topics, we can gain a better understanding of how to improve English learning for primary school students and prepare them for the 21st century.

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Promote Student-Teachers' Reading Habits and Reading Proficiency Through Reading Literacy Methods

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Phnom Penh Teacher Education College (PTEC)

ABSTRACT

Promoting student-teachers' reading habits is a critical aspect of their academic success and personal development. Student-teachers need to be proficient readers themselves to effectively teach literacy skills to students. However, we found that year-one student-teachers do not have strong reading habits or skills, and this can impact their study results, and their ability to teach and motivate their students' learning in the future. This is where the use of reading literacy methods comes into play. These methods are designed to enhance student-teachers' literacy skills, improve their comprehension, expand their vocabulary, and build positive habits toward reading. This paper aims to understand the reading habits of student-teachers and discusses the reading literacy methods that can be utilized to promote the reading habits and reading proficiency of student-teachers. Data were collected by viewing student-teachers' reading notes on the template provided every week during the course to see their progress in reading, and by analyzing the questionnaire about self-reflection on their reading habits after finishing the course for one year. We found that reading literacy methods have positive effects on their reading habits our student-teachers love reading more by spending their time reading almost every day, especially when they apply the reading literacy techniques learned from the course in their reading as well. Most of them self-evaluated their reading proficiency to be more effective than before by achieving the reading objective at the appropriate time. More or less, we found that student-teachers have changed their perspective on reading even though few of them don't have much time for reading, they are always conscious that reading is really important for their careers and self-improvement. Ultimately, this paper argues that promoting reading habits and proficiency is a critical part of teacher education and that utilizing reading literacy methods is a powerful way to help student-teachers develop a lifelong love of reading and become better equipped to teach literacy skills to their

future students.

Keywords: *Reading literacy; reading habits; reading proficiency; student-teachers*

1. Introduction

Reading habits are the key factor in grasping another knowledge. However, building up the reading habit cannot be achieved in a day or a week, it needs time, consistent practice, and commitment. According to the PISA-D national report in 2018, only 8% of Cambodian students achieved the minimum level of proficiency in reading (MoEYS, 2018). According to the study by Sam Kunthy (2013) found that university students tend to read only the books related to the assignments that their lecturers provided or required them to read. In teacher education programs promoting reading habits in student-teachers is the most important task to do to cultivate their habits to be the role model for their future students. The baselined survey of KIZUNA (2022) on the reading proficiency of first-year student-teachers at Phnom Penh Teacher Education College (PTEC) showed that student-teachers had very poor results on reading tests. According to the observation on the student-teachers literacy, they still had very low reading ability even though they had graduated grade 12 and passed the national exam to study at PTEC for their bachelor of education. They seemed to not have independent habits in reading. They usually read when their lecturers required them to do assignments. On the other hand, what we can see is that they do not like reading, but they are distracted by their phones instead. Their reading ability was low evidenced by their poor language use in writing, spoken language, vocabulary choices, and spelling. The speed in reading was slow, while reading comprehension was still a problem, sometimes it was caused by poor general knowledge. Meanwhile, critical thinking was not adopted as a skill in them yet. Another reason that made student-teacher reading proficiency a problem was reading without strategies or methods.

Reading is the main attitude of academic life that learners and scholars adopt as a daily routine. As student-teachers, they need to spend four years to fulfill the degree before becoming teachers at primary school and secondary school, and they cannot avoid reading to complete the tasks of each lecturer. The student-teachers are a selected group of individuals who have passed the national exam of grade 12 and passed the

entrance exam of teacher selection. These student-teachers come from diverse backgrounds and bring with them a range of experiences and perspectives. However, we found that student-teachers do not have a positive habit of reading yet. Most of the time they read only the documents related to the assignments provided by their lecturers, not from their preference of reading other books that can benefit their thought or expand their knowledge beyond what they learned at the college. According to the literature, the survey, and the observation on the low reading attitude of student-teachers and as well as students in general knowledge education, Phnom Penh Teacher Education College cooperated with KIZUNA and the Ministry of Education, Youth, and Sports to develop the course syllabus of Reading Literacy to include in the teacher education program at Teacher Education Colleges in the academic year of 2021 - 2022 to promote student-teachers reading habits. The course is provided to year-one student-teachers of both primary and lower secondary programs to equip them at the start of their teacher education program, expecting that they will develop themselves as independent readers so that they can be ready for the journey as teachers.

The research aims to answer the questions below:

1. What are the reading habits of first-year student-teachers at Phnom Penh Teacher Education College?

2. How do reading literacy methods promote student-teacher reading habits and reading proficiency?

This study will indicate the reading habits and reading proficiency of first-year student-teachers before and after studying the reading literacy course for one semester. We will also learn about their perceptions of reading after one year of finishing the course.

2. Literature Review

2.1. What is Reading Literacy

Reading literacy is a new subject included in the teacher education of the formula of 12 + 4 at Phnom Penh Teacher Education College to promote student-teacher reading habits and proficiency. The purpose of this course is not teaching, but facilitating student-teachers to read by using reading methods in every week. The

primary purpose of this course is not to teach the student-teachers the knowledge of a particular subject as in regular classes, but to get them to cultivate the habit of reading.

For a person to develop a new habit, he or she needs to proactively engage in it on his or her initiative, not just because someone tells him or her to. To make people work on their initiative, they need to experience with joy and understand the significance of reading, not as knowledge, but through experience. Therefore, this course includes a variety of activities to help student-teachers enjoy reading. These activities can also be applied to other subjects besides this subject. The secondary purpose of this subject is to improve reading literacy (Kenji et al., 2021).

In 1991, the Association for the Evaluation of Educational Achievement (IEA) decided to join the terms *reading* and *literacy* together to carry a broad concept of what the ability to read is. Reading literacy includes the ability to reflect on what has been read and to use it as a tool for attaining individual and societal goals. Reading literacy is defined as the ability to understand and use written language forms required by society and/or valued by the individual. Young readers can construct meaning from a variety of texts. They read to learn, to participate in communities of readers in school and everyday life, and for enjoyment (Mullis, et al. 2004)

Reading literacy is defined as understanding, using, evaluating, reflecting on, and engaging with texts to achieve one's goals, develop one's knowledge and potential, and participate in society. But in this era how people read has changed since 2009 because of the technological development that reading involved not only printed pages, but electronic format also. This led to a proliferation in the amount of text encountered every day that students can access and navigate through different sources of text (Mo, 2019).

According to John R. Bormuth (1973), literacy can be defined as being able to read the written scripts of any language which is regarded as the most valuable skill that man can use the writing to write, record, accumulate, and store his knowledge or information. Someone literate will be able to overcome the barriers that time and space throw in the way of communication, some have been able to master and apply technical information, enlarge their perspective, and satisfy their aesthetic desires through reading literature and other documents. Meanwhile, literacy activities play an important role in

realizing character-building education to increase productivity and competitiveness. Literacy must be done as early as possible (Shara A.M., et al., 2020).

Reading literacy is the ability to decode the scripts of any languages that inscribed and implied the information, story, knowledge, philosophy, entertainment, and so on to get the meaning that readers can reflect and react to for various purposes. In education, reading literacy is a priority to start as the foundation for acquiring many other subjects and knowledge.

2.2. Research on Promoting Reading Habits

Promoting reading habits and reading proficiency is not done successfully without methods. Educators around the world use many strategies, techniques, and methodologies to help their students build reading habits and advance reading ability. As stated in the research of Palani (2012), some believed that phonics, the teaching of basic skills, was the better approach whereas others believed that the whole language, a holistic philosophy of literature-based instruction, was the effective method. At the school level, if teachers can instill and create in children's mindset the value of reading, it will be possible to keep students to continue reading on their own their whole life with confidence. To do so, there are techniques to develop reading abilities such as parental guidance and encouragement, motivation by the teacher, inculcation of desirable hobbies and interests, constant use of a dictionary, daily newspaper reading, book reading, visiting libraries, well-constructed reading material, and study improving vocabulary and language.

Reading habits and reading proficiency are always related to each other. If someone has reading habits, usually he will automatically be proficient in reading and vice versa. Even people understand so, but they are always distracted by something else and leave reading behind. For instance, the research of Sokhet SUN (2019) confirmed that reading habit has a great effect on students' academic performance. However, promoting reading habits by just the motivation from the inside is not enough. Without strategies or methods to support, students can easily give up what they determined to read. Reading methods are really important in terms of providing goals and objectives to students so that they can understand what they want from the reading.

Thomson, S., Hillman, K., and De Bortoli, L. (2013) mentioned in A Teachers' Guide to PISA Reading Literacy, that students who associated with more reading by using strategies promoted to critically learn and become effective learners who can get better results in their study than other students. The study of Fisher, D., Frey, N., & William, D. (2002) indicated that after applying the seven reading strategies, i.e., read aloud, KWL Charts, graphic organizer, vocabulary instruction, writing to learn, structured notetaking, reciprocal teaching, students had significantly improved on their score from 5.9 up to 8.2 in their work.

According to Radka Wildova (2014) in his research about attitudes to reading, through reading literacy, the interview with pupils of Czech primary schools indicated that 66% of pupils prefer reading as a school activity, 43% of pupils put reading first; and in leisure time activity, 42% of pupils put reading first again.

There are many studies about different methods to promote students' reading habits and proficiency and also the implementation of techniques, strategies, and methodologies to help students cultivate reading preferences in foreign contexts. However, we have not seen any studies about the employment of any methods in promoting student-teacher reading habits and proficiency in the context of teacher education in Cambodia yet. Therefore, this research is initiated to cultivate the reading habits of student-teachers and examine the positive effect of reading literacy methods on first-year student-teachers reading at Phnom Penh Teacher Education College.

3. Research Methodology

3.1. Research Setting and Participants

The research is designed using mixed methods to verify the clear effect of the reading literacy methods on the reading habits of first-year student-teachers through both qualitative and quantitative ways. Data were collected by using two kinds of tools such as student-teacher weekly reading notes and questionnaires.

The research collected data from two groups of 50 student-teachers in total, of which 25 students are from primary education and 25 students are from Lower secondary education. The two classes are facilitated to read with the same reading literacy methods. The data were collected over 2 years, qualitative data were collected

during the course by reviewing the 50 student-teacher reading notes after each week of reading method, and quantitative data were collected one year after the course by using a questionnaire designed in Google form, to observe whether they still keep their reading habits or not, to learn about their perspective in reading, and calculate the amount and percentage of students who have different reading preferences after a year without being facilitated to read. However, after a year of finishing the course in reading literacy, the researcher contacted those 50 student-teachers to complete the research questionnaire, and there were 38 responses received from them.

3.2. The Implementation of the Reading Literacy Methods

The process of the research implementation was conducted for 15 weeks by following the syllabus of reading literacy. In the first week, student-teachers were facilitated to read with discussion and writing reviews after reading as the pre-test. In the following weeks, student-teachers were to read with other techniques as following such as week 2 reading with discussion after the psychological safety game, week 3 was objective driven reading, week 4 is a testing effect, week 5 is thinking during reading, week 6 is summarizing, week 7 is think "Why" before and after reading, week 8 is connecting with experience, week 9 is reading for action, week 10 is critical reading, week 11 is question-driven reading, week 12 is reading for teaching, week 13 is reading for intending to teach 10-year-old children, week 14 is reading by writing composition after reading. In the 15th week, the reading with discussion and writing review was conducted again as a post-test.

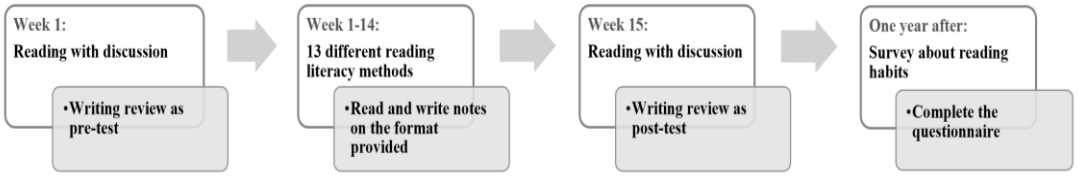


Figure 1: Process of research implementation

Each week has the basic structure of confirming the goal of the class; confirming 4 rules which consisted of do not judge, do not hesitate, enjoy, and help each other; playing game of good and news as icebreaking; giving instructions on activities before reading; activity before reading; reading stage; instruction of activity

after reading; and giving feedback.

3.3. Data Analysis

Data were analyzed in two different ways according to the data collected from the two years. Data from the student-teacher's reading notes were analyzed in the form of thematic analysis we had thematized the writing on student-teacher's notes into four main themes such as reading ability, writing and language ability, knowledge and attitude, and critical thinking skill. The data from the questionnaire were analyzed quantitatively by calculating the frequency of student-teachers answers, calculating the mean, and analyzing the percentage of their answers related to the student-teachers point of view about reading, their habits in reading, their reading habits after taking reading literacy course, kinds of books they like to read, reading literacy methods they chose to read, and the comparison of reading habits before and now.

4. Result and Discussion

4.1. Result from student-teachers Reading Notes

From reviewing 50 student-teachers' reading notes from week 1 to week 15, we found that they made progress from time to time in terms of their reading ability, writing ability, language ability, and critical thinking skills. We found significant differences between week 1 and week 15 related to reading speed, writing ability, spelling, and time management.

In the first week, student-teachers had a slow reading speed. Within 20 minutes, they finished reading just around few to five pages of the book. The writing notes in the format showed that they did not know how to take memos, instead, they just copied the whole sentences from the book down to the format. They cannot summarize the texts they read into short paragraphs, but they tend to write the key sentences and put them following to make paragraphs. Reading in a time frame was something that was not accustomed to them and they cannot manage time to read, write, and answer questions in the format properly. Even in the writing, we found so many errors in spelling that some are human errors, and some are the errors from absence of knowledge.

However, the student-teachers made significant progress in week 15 in reading speed, writing skills, orthography, and time management. They can read and write faster

compared to week 1 with more accurate writing, summarizing by using their own words concisely and precisely. In this week, their errors in spelling decreased even not a hundred percent, but they learned from the reading activities every week. They also used time effectively to do each activity.

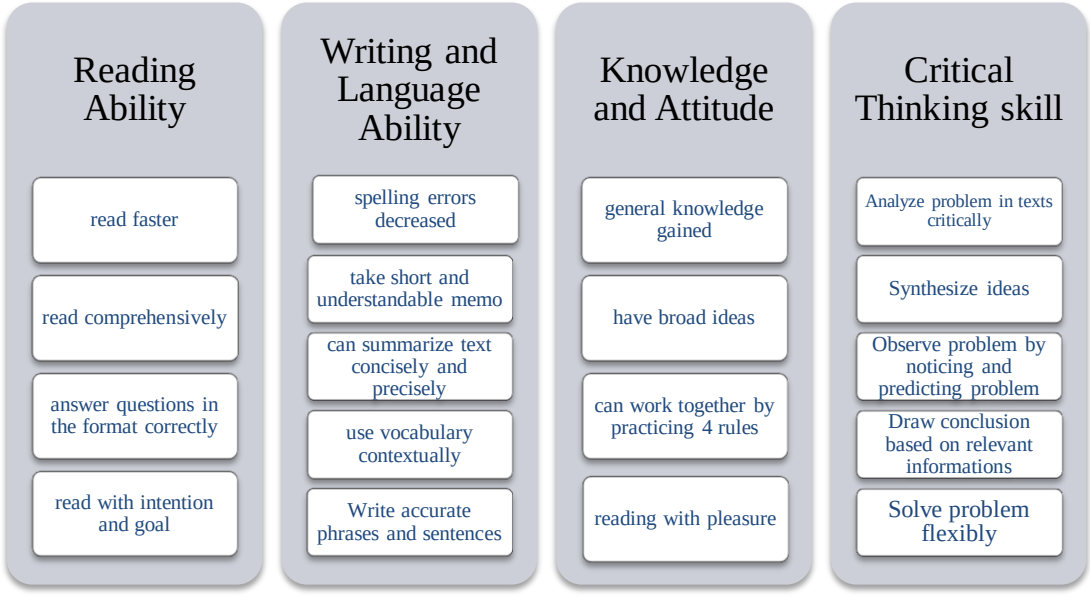


Figure 2: Result of Performance of student-teachers after taking Reading Literacy course for 15 weeks

The chart above shows the findings from the reading notes of student-teachers after being facilitated for 15 weeks with reading techniques, we found that our student-teachers made progress on their reading ability, writing skill and language use, general knowledge and attitude, and critical thinking skill.

The study indicated that by practicing reading with reading literacy methods, student-teachers can develop reading ability evidenced in the speed of reading getting faster with comprehension, and the responses to questions in the weekly format were precise and correct. Furthermore, with reading methods, they always had a clear goal and intention to read each text carefully. They did not lose in reading or their idea when they used methods or strategies to read. The reading methods helped them to set goals and what to do after reading.

From reading with reading literacy methods every week, their writing and language use have also been upgraded. Compared to the first week, at the end of the

course, student-teachers can write with more accurate spellings. This is confirmed that writing links closely with reading i.e., the more we read, the better we can write. They can remember the spelling of each word through reading as well as save more vocabulary in their heads so that they can use those words whenever they want. Meanwhile, reading also helped them to take short and meaningful memos when they read and led them to summarize contents that they have read concisely and precisely by using their own words. They can write by using vocabulary properly according to contexts with phrases and sentences in the accurate structures.

Besides elevating reading and writing skills, it also helped student-teachers to gain more general knowledge and change attitudes little by little. Books contain rich information and knowledge that readers will learn new and different knowledge depending on what they read. According to the syllabus, student-teachers were required to read the book by Dale Carnegie, entitled "How to Win Friends and Influence People" in reading practice every week, which consisted of many great chapters and texts full of educational content, self-development, and philosophy. By reading this book a whole semester, student-teachers were equipped with knowledge about people, and society, especially how to live life in the community peacefully. The reading activities with 4 rules and the content in the book had a huge influence on their attitude toward reading, studying, and people around them, and we saw they could work with other friends successfully. They started to think broadly by looking at different sides before assuming something. One satisfied outcome is that they read happily without regard the time for reading as pressure anymore. When people read with pleasure, they will learn best and adopt reading as a daily routine.

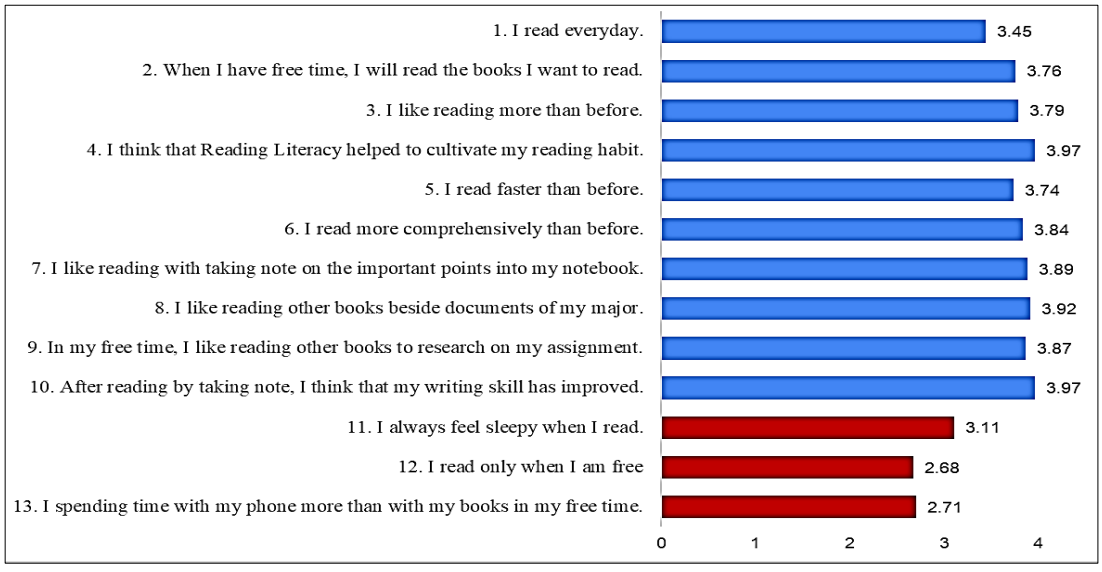
Through the reading activities every week, the reading notes showed some signs of critical thinking in our student-teachers. We found that they can analyze problems in the texts they read in different ways and write down their ideas in the format. Meanwhile, some of them also can synthesize different or similar ideas from the texts into one whole; they observe problems by noticing and predicting problems that they can practice in reading with the technique "think Why before and after reading". Almost every week, student-teachers were to conclude what they read depending on the information they collected from the texts. We found their flexibility in solving problems

with some reading techniques like reading for teaching, reading for teaching 10-year-old children, and teaching by writing composition after reading, which required student-teachers to think quickly to find the proper ways to plan activities for teaching.

4.2. Result from Questionnaire

The results from the questionnaire are from the data collected one year after finishing the Reading Literacy Course. The findings are divided into 6 parts including (1) student-teacher attitude and point of reading view, (2) self-evaluation of reading habits, (3) reading habits after one year of finishing the reading literacy course, (4) the percentage answers on reading habits by kinds of books, (5) the percentage of reading methods used by student-teachers in reading, and (6) the comparison between reading habits before and now.

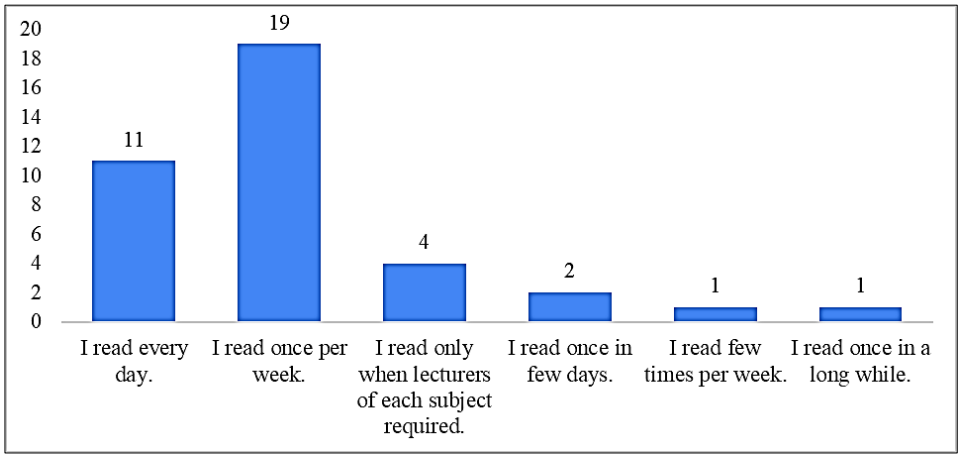
(1) Student-Teachers' Attitude and Point of View about Reading



This part is a five-likert scale questionnaire (1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = agree, 5 = Strongly agree). The blue charts had a mean score approached 4 which meant student-teachers agree that they read every day; when they have free time, they will read the books they want to; they like reading and can read comprehensively more than before. While reading, they like taking notes. They agree that they like to read other books besides their majors and also like to read for researching their assignments. They think that reading by taking notes improves their writing. The red charts are negative questions which means the score is not over 3 or lower than 3, indicating that

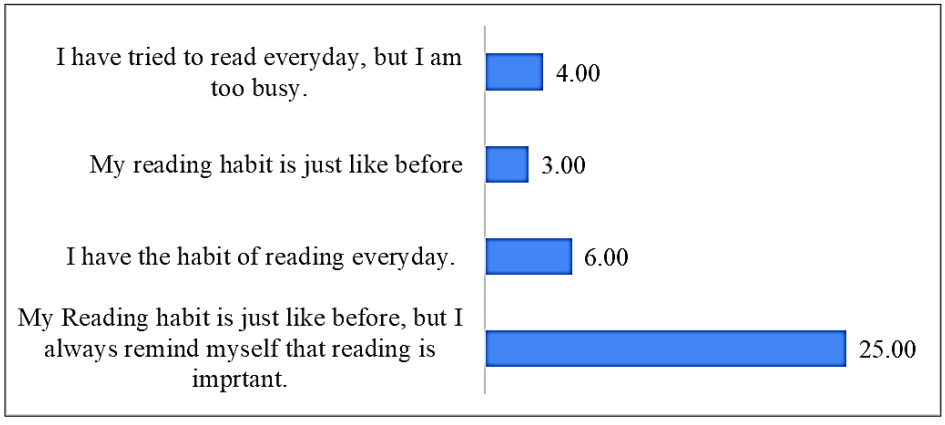
they disagree. To them, the question that they always feel sleepy when they rea, was chosen at 3 which meant that they felt simple. They disagree that they read only when they are free and disagree that they spend more time with phones in their free time.

(2) Self-evaluation of Reading Habits



The chart above is the self-evaluation of their reading habits which shows the number of students on each question. The chart showed that 11 student-teachers read every day; 19 of them read once per week; 4 of them only read when lecturers required; one of them said they read a few times per week; and only one of them read once in a long while.

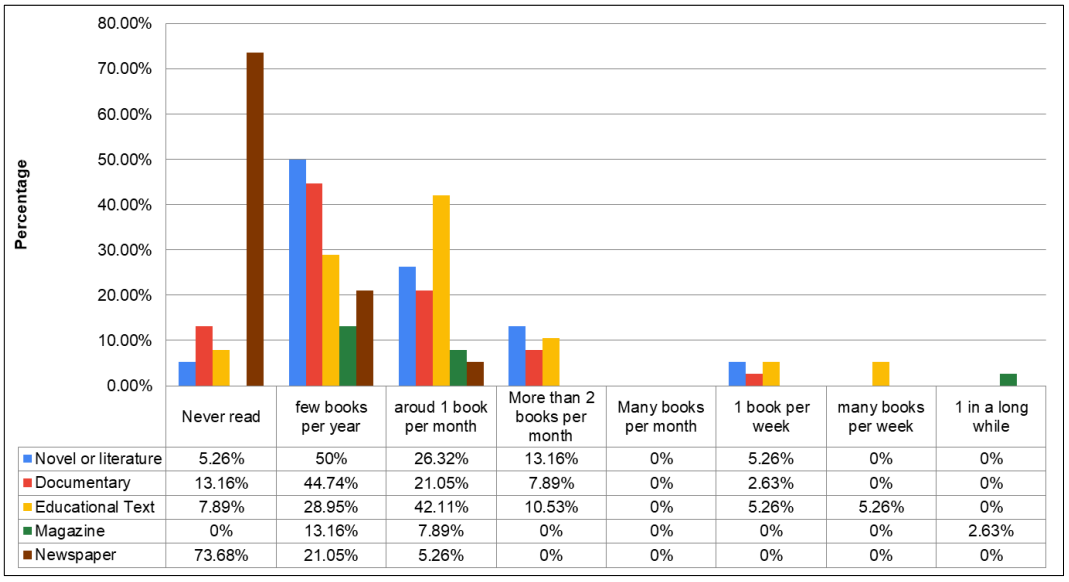
(3)Reading Habits after One Year Finishing Reading Literacy Course



The chart above indicates the reading habits after finishing the reading literacy course for one year. It showed the number of student-teachers who chose the answers to the question "After studying the reading literacy course, how do you change your reading habits?". We found that 25 student-teachers confirmed that their reading habits

are just like before, but they always remind themselves that reading is important. While 4 student-teachers said that they tried to read every day, but they were too busy, only 3 of them claimed that their reading habit is just like before. However, we found 6 student-teachers confirmed that they have the habit of reading every day.

(4)Percentage of student-teacher answers on Reading habits by Kinds of Books



	Never read	few books per year	aroud 1 book per month	More than 2 books per month	Many books per month	1 book per week	many books per week	1 in a long while
Novel or literature	5.26%	50%	26.32%	13.16%	0%	5.26%	0%	0%
Documentary	13.16%	44.74%	21.05%	7.89%	0%	2.63%	0%	0%
Educational Text	7.89%	28.95%	42.11%	10.53%	0%	5.26%	5.26%	0%
Magazine	0%	13.16%	7.89%	0%	0%	0%	0%	2.63%
Newspaper	73.68%	21.05%	5.26%	0%	0%	0%	0%	0%

The chart indicated the percentage of student-teachers' answers related to the kinds of books they read such as novels or literature, documentaries, educational texts, magazine, and newspapers, with 8 responses: (1) never read, (2) few books per year, (3) around 1 book per month, (4) More than 2 books per month, (5) many books per month, (6) one book per week, (7) many books per week, (8) one book in a long while. Interestingly, no one chose the answer "read many books per month" to all kinds of books. Even the answer "many books per week", all kinds of books were not chosen by any students, but only 5,26% were chosen for educational text.

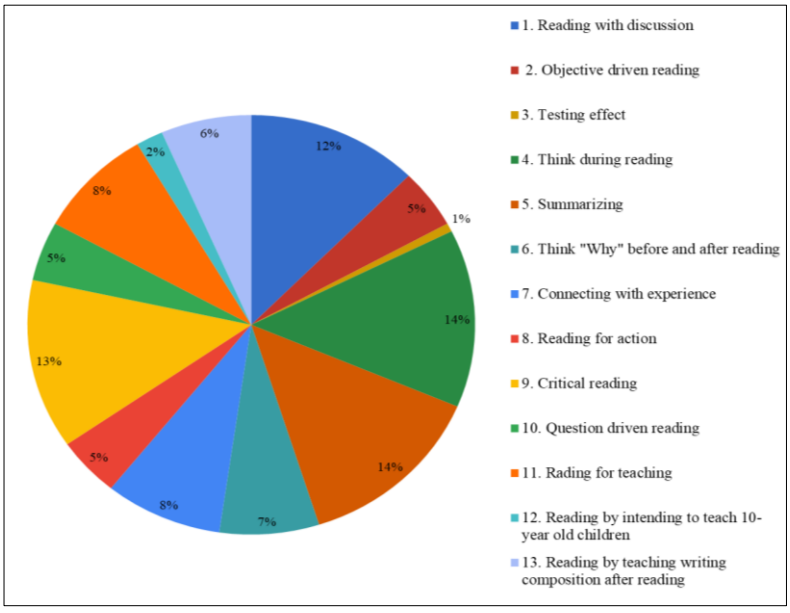
For novels or literature, 50% of student-teachers confirmed that they read few books per year, and 26.32% claimed that they read around one book per month.
For documentaries, there were 44.74% of students chose to read a few books per year, while 21.05% chose to read around one book per month.

For educational text, 42.11% of student-teachers chose to read around one book per month, while 28.95% chose to read a few books per year.

For magazines, there were few student-teachers have read this kind of document. We found only 13.16% at most claimed that they read few books per year.

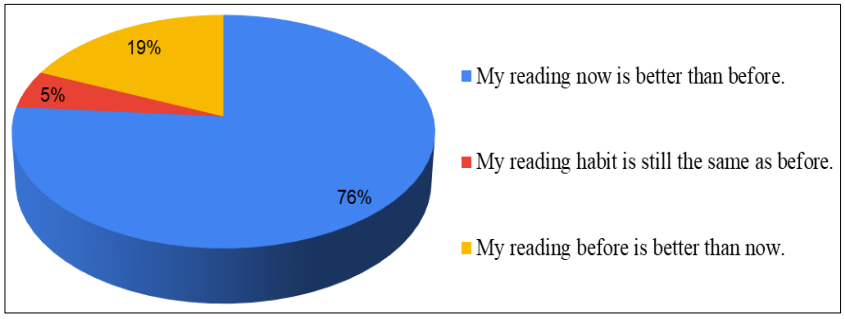
For newspapers, most of the student-teachers up to 73.68% chose 'never read'. However, we still can see 21.05% of them read newspapers and few books per year.

(5)Percentage of Reading Methods Used by Student-Teachers in Reading



The pie chart above indicates the percentage of reading methods chosen to be used in reading by student-teachers. The chart showed that the methods that they like to use are reading with discussion (12%), thinking during reading (14%), reading with summarizing (14%), and critical reading (13%). We observed that the methods that student-teachers were not interested in using in reading had a testing effect as in the chart, only 1% chose to use when they read. Similarly, the method 'Reading by intending to teach 10-year-old children' was chosen to read 2%.

(6) Reading Habits Before and Now



The pie chart above shows student-teachers' reading habits before taking the course of reading literacy and now. Positively, we can see that 76% of student-teachers stated that their reading now is better than before. However, there were 19% of them confirmed that their reading before was better than now, and 5% of them claimed that their reading habit is still the same as before. Even though not every one of them gained better reading habits, most of them thought that they had improved their habits toward reading.

In summary, the analysis of student-teacher reading notes and questionnaire clearly showed that the reading literacy methods had a positive effect on their reading habits in terms of their reading proficiency, writing skill, language use, general knowledge, positive attitude toward reading, relationship with friends and other people in the manner of living in a peaceful society, and better thinking skill. They also did a self-evaluation that their reading habits were better than before they read by using many methods from reading literacy and reading many kinds of books, and they not only read documents related to their majors, but they also read other documents for their preference too. Even a few of them still keep the same reading habits as before, but they always remind themselves that reading is really important. This is a positive sign that without obstacles, they will be attached to reading.

4.2 Discussion

According to the data analysis of student-teachers' reading notes and questionnaires, the findings found that reading habits affected student-teachers reading proficiency and vice versa. Reading with reading literacy methods has improved my reading ability, writing skills, language use, attitude toward reading, time management, and critical thinking skills. Besides these outcomes, the reading practice equipped student-teachers with general knowledge from the book contents, reading activities, and 4 rules which led student-teachers to work with their friends collaboratively without any judgment or hesitatio and read happily by helping each other. They were more flexible in solving problems.

Meanwhile, the studies of Sokhet S.U.N. (2019), Thomson, S., Hillman, K., and De Bortoli, L., (2003) and the research of Fisher, D., Frey, N., and William, S. (2002)

also indicated in their findings that reading habits had a great influence on learning outcomes that students who are integrated themselves more with reading and read with strategies can improve their critical thinking and become the successful learners with good study results. Radka Wildova (2014) also found positive findings in students' attitudes after applying reading literacy. The interview with Czeck Primary School that most students always put reading first even in school activities and in leisure time.

5. Conclusion and Recommendations

In conclusion, after reading by using reading literacy methods, first-year student-teachers had significant progress in terms of their reading habits, reading proficiency, language use, attitude toward reading, and critical thinking.

Student-teachers developed their reading ability by reading at a faster speed and with more comprehension. With reading methods, they had clear goals and intentions in reading that led them to not get lost in their ideas. Not only the progress in reading, we also found that their writing ability had been upgraded too, evidenced in their language use of vocabulary choice, spelling, and accurate structures. Through reading, they gained more general knowledge which was earned from various texts and books they read. The reading also influenced their attitude to love reading, studying, and understanding more about people around them so that they can learn to live together in a peaceful community. The most important thing is that reading trains them to think critically so that they can analyze, synthesize, observe problems in the texts they read, and draw conclusions on situations or what happened in the texts, books, and even in real life. Student-teachers understand clearly the significance of reading more than before and try to cultivate their reading habits day by day.

Besides what we concluded from the reading notes, student-teachers had done the self-evaluation on their reading habits to be better than before and always applied reading techniques they liked from the reading literacy in their reading. We found that they read many kinds of books in a year and a month. Even though there were many obstacles or work to do, they still tried to keep reading for they knew clearly about the reading benefits. The great habit of the reading literacy methods is that student-teachers mostly write down notes when they read that this activity will promote their memory,

and comprehension which leads to a precise and concise summary with better analysis and synthesis.

Therefore, reading literacy is recommended to use with all levels of education to build up the basis of reading literacy from the start which will become the foundation to acquire other subjects or for the next levels of education. Researchers who wish to research the topic should compare many steps of students' reading notes from the first week, the following weeks, and the final week. Researchers should plan the questionnaire to be more specific to collect enough data for better analysis or even use other tools to collect various information and see other sides of its effects as well.

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Using Logbook to Promote Student-Teachers' Autonomy in Conducting Research

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ABSTRACT

This action research study aims to examine the use of logbooks to promote student-teacher autonomy in conducting their research. Teacher education is a key factor in the transformation of the education quality in Cambodia. Research has become a core mission of Phnom Penh Teacher Education College (PTEC). To promote research culture and to encourage research conducted within teacher education, research is integrated into the year 3 syllabus of PTEC in 2020. All student teachers have to prepare their research proposal within semester 2 of year 3 while each PTEC year 4 student-teacher needs to conduct action research as a part of requirements for their graduation. Since conducting research is very new for them, student-teachers have encountered a major difficulty in managing their research work process. They are not independent in doing their work but they tend to rely so much on their supervisors instead. Therefore, the researcher would like to introduce a logbook to promote year 4 student-teacher autonomy in conducting their research. There were 10 student-teachers in both primary and secondary level (12+4) programs of Phnom Penh Teacher Education College (PTEC) participated in this study. They were divided into 2 groups based on their academic year: 6 of them are in the 2022 cohort while 4 of them are in the 2023 cohort. Observations and semi-structured interviews were used as tools for data collection in this study. To see whether using a logbook is effective, the researcher introduced a logbook to student-teachers at the beginning of their year 4 and before they started conducting their research. The findings clearly showed that the logbook not only promoted student-teacher autonomy in conducting research but also encouraged them to read more. Therefore, the researcher would recommend all educational research lecturers start introducing their year 3 student teachers and all supervisors to introduce logbooks to their student-teachers too.

Keywords: *Logbook, Autonomy*

1. Introduction

The Ministry of Education, Youth, and Sport of Cambodia has considered teacher education as a key factor for the improvement of education quality in Cambodia. To succeed in transforming and ensuring teacher education quality, research skills have been taken as a core mission at the newly established teacher education college, Phnom Penh Teacher Education College (PTEC), to promote research culture, integrated research and practices in the education of this fast-transforming knowledge-based society. To encourage research conducted within teacher education, research was introduced to the year 3 syllabus of 2020. All student-teachers have to prepare their research proposal within semester 2 of year 3 while research report writing and defense are one of the requirements for year 4 student-teachers graduation. Anyway, research is still very new for higher education in Cambodia, particularly teacher education. Since conducting research is very new for them, during 2 years, the researcher has identified a new challenge faced by year 4 student-teachers. They have encountered a major difficulty in managing their research work process. They are not independent in doing their work but they tend to rely so much on their supervisors instead. They do not know what they should do or plan to do to succeed in their research projects. As a result, many student-teachers kept their work until the last minute while the quality of their work was also very limited.

Therefore, the researcher aims to introduce a logbook to year 4 student-teachers.

The objective of the research study is to examine the use of a logbook to promote student-teacher autonomy in conducting their research.

The study aims to answer the following research question:

How does the logbook help promote year 4 student-teacher autonomy in conducting research?

This study will illustrate some practical insights into how the logbook promotes year 4 student-teacher autonomy in conducting research.

2. Literature Review

A student's logbook is a tool for individuals to keep a record of events taking place during their learning period. It keeps track of his or her learning process. It will also show the planning, the carrying out of plans, and the evaluation of the ongoing

learning process as well (Toogood, 2006). The survey by Dam in 1993 on 300 EFL teachers from Denmark, Sweden, and Spain who participated in a workshop on "Autonomy Implemented" from 1986 to 1993 illustrated that the use of a logbook by those teachers increased their autonomy.

Anyway, before introducing students to use a logbook, teachers should be aware of the use themselves. They should also inform students about the importance and the reason to use a logbook for their study. Moreover, they should state the rules of using a logbook from the beginning so that their students know what they should do. They should advise their students to be independent, have a sense of ownership for their logbooks as well as regard them as a useful tool for their learning. Last but not least, they should give their students space and time to do their logbooks to review, self-evaluate, and discuss with their classmates.

Furthermore, the research by Dam in 2003 also identified some important elements to point out while instructing students to use logbooks: firstly, they should note down their progress, secondly, show the reflection on the activities and theories that they have learned, then, evaluate the process as well as the results of each learning period, last but not least, set the plan of what they should do, why they should do it, what to do next and homework after each lesson too.

3. Research Methodology

3.1. Research design

The researcher employed pure qualitative data collection because she wanted to explore how a logbook would help promote Year 4 student-teacher autonomy in the central concern of this research. Observations and focus group interviews were used as the main tools for data collection.

3.2. Research setting and participants

Ten Year 4 student-teachers from both primary and secondary (12+4) programs of Phnom Penh Education College (PTEC) participated in this study. There were 4 female student-teachers among 7 primary student-teachers and 2 female students among 3 secondary student-teachers.

The participants were selected purposefully since they were the student-teachers under the researcher's supervision.

3.3. Research instruments and data collection procedure

This study was started at the beginning of the academic year 2021-2022. Six student-teachers were introduced to logbooks for the first time. The researcher showed them the details that should be included in the research logbook and she confirmed with them that it would be a part of the class contribution score. The researcher spent one-year observing student-teachers' autonomy progress after introducing the logbook.

At the same time, the researcher taught the educational research subject to Year 3 student teachers of secondary level. In semester 2, they all were required to prepare their research proposals for their year 4 research projects. The research logbook was not introduced to them. Again, the researcher kept observing closely their autonomy while they were writing their research proposals.

However, at the beginning of the new academic year 2022-2023, the researcher introduced the research logbook to four Year 4 student-teachers, 1 was from primary while 3 were from the secondary program and she previously observed them last year. Once again, she informed them that the logbook was a part of the class participation assessment.

3.4. The procedure of using a logbook

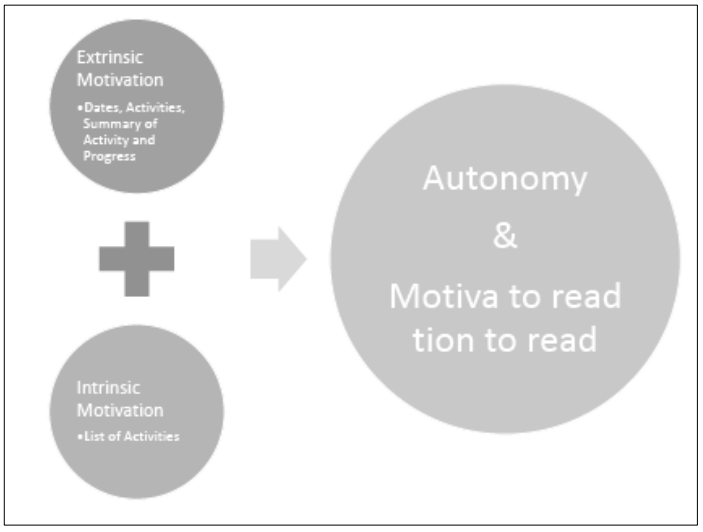
The research logbook was designed in Microsoft Excel specifically for tracking their research progress. It consisted of some important elements such as date, activity, summary of activity, and progress in sheet 1 while in sheet 2, they can note down the list of activities. Before beginning, the researcher instructed student-teachers to complete this logbook every time they worked on their research projects. They must only modify the green columns. First, they may enter the date. Next, they can select a type of activity they undertook. Then, they can add more types of activities in the sheet 'LIST OF ACTIVITIES'. Next, they should summarize what they did. The summary should not exceed 280 characters. If they use more characters, the box will turn red. Thus, the short summaries were encouraged. This logbook provides both student-teachers and supervisors insight into the student-teacher work process. It was very useful as a resource forreflective thinking.

3.5. Data analysis

To analyze the data, the researcher developed two main themes: extrinsic

motivation and intrinsic motivation, and two sub-themes: autonomy and motivation to read.

Figure 1: Outcomes of Logbook



4. Result and Discussion

4.1 Result

4.1.1 Observations

Before introducing logbook

The data from the observations during the proposal period, before introducing the logbook to student teachers, clearly showed that student-teachers were not able to track their progress as well as manage their work. They tended to be very dependent on supervisors. They did not have a clear plan of what they should do or what they were going to do. As a result, their work was so messy. They lost their confidence in working. Therefore, all of them kept the work until the last minute.

After introducing logbook

After introducing the logbook, all student-teachers have their plans to do their projects. They can track their progress as well as develop their work. Moreover, they can manage their projects and finish them within the time set
successfully.

4.1.2 Focus group interviews

The data from focus group interviews illustrated that student-teachers can manage, and track their research progress.

S4P: "When I was in Year 3, I did not have the motivation to do as I felt so complicated.

When I was first introduced logbook, I only knew it was a part of the class participation

assessment. Later on, I realized that a logbook is very useful to me. I work a week ahead."

Moreover, using a logbook also encourages student-teachers to read more literature for their research project.

S2S: "Previously, I could not remember what literature I already reviewed because I

always forgot what I had read. As a result, sometimes I read this while I read that

another time. Then, I did not know what I had read. Yet after using the logbook, I know what I have read and what I need to read. I am so motivated to read much more literature."

Furthermore, student-teachers use logbooks not only for their research works but also for other subjects too.

S1S: "I use a logbook not only for my research but also for other subjects because a logbook is very useful."

Last but not least, they have their personal space for working as well as enjoying some relaxing time after using a logbook.

S3S: "In general, I noted down what I did and what I want to do in the logbook. For those activities I am still doing, I may note them as "In progress" while for those I already finished, I wrote, "Completed". I always update my logbook every day yet I take Saturday and Sunday as my days off."

4.2 Discussion

The findings of this study are in line with those of Dam in 2003 who confirmed that the use of a logbook implemented the autonomy of 300 EFL teachers and students in three countries such as Denmark, Sweden, and Spain. Moreover, Menegale in 2020

also agreed that a logbook helped higher education students in Italy to have much improvement in learning English. They were also able to reflect, be aware of, and active participate in classroom activities.

5. Conclusion

The logbook not only promotes student-teachers' autonomy in conducting their research project but also motivates them to read and review more literature. The researcher would like to recommend all research supervisors introduce logbooks to their Year 4 student-teachers. Furthermore, all educational research lecturers should consider introducing a logbook to their Year 3 student-teachers too so that they will have an idea of it before they go to work with their projects. Last but not least, other lecturers also should take logbooks into their accounts.

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The Implementation of the Less Responsibility Technique Incorporation with the SIOP Model to Promote Pre-service Teachers' Content Knowledge and Lesson Planning Skill

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ABSTRACT

Research has shown that the less responsibility technique and the SIOP model strongly promote student learning at all educational levels. However, little is known about the less responsibility technique incorporated with the SIOP model's influence on teacher education. This study examined the impact of the less responsibility technique incorporated with the SIOP model on primary pre-service teachers' academic achievement and lesson planning skills using a pre-test/post-test quasi-experimental design. Two classes were conveniently selected from Teacher Education College in Cambodia, one class assigned as the experimental group (N = 35) and the other as the control group (N = 30). And 5 pre-service teachers from the experimental group were randomly selected for the semi-interview. For one semester, the experimental group was exposed to the less responsibility technique with the SIOP model while the control group was taught through lecture-based learning. Data were collected through achievement tests of content knowledge and lesson plan preparation. The ANCOVA results revealed that the less responsibility technique with the SIOP model was more effective for learning achievement and lesson planning, but no significant difference was found between male and female students. The perception of this implementation method was positively accepted among the randomly selected pre-service teachers. In conclusion, less responsibility techniques with the SIOP model can foster learning achievement and lesson planning skills among primary pre-service teachers in TEC.

Keywords: *less responsibility technique; SIOP model; content knowledge; lesson planning*

1. Introduction

The SIOP Model (Sheltered Instruction Observation Protocol) is a research-based instructional framework that can be used to promote the content knowledge (Fadda, 2020) and lesson planning skills of pre-service teachers (Chen & Zhang, 2019; Kareva & Echevarria, 2013). The model includes eight components that focus on providing comprehensible input, scaffolding instruction, and promoting interaction among students (Echevarria, Richards-Tutor, Changes, & Francis, 2011). One technique that can be used to implement the SIOP Model is the less responsibility technique (Angay-Crowder, Choi, Khote, & Shin, 2023). This technique involves gradually reducing the amount of scaffolding that teachers provide to students as they become more proficient in the content area (Jason David Aldridge, 2018). This can be done by gradually increasing the complexity of the tasks that students are given, providing less explicit instruction, and giving students more opportunities to work independently (Hampel, 2010). The use of the less responsibility technique in conjunction with the SIOP Model is effective in promoting the content knowledge and lesson planning skills of pre-service teachers. In a study by (Echevarria, Short, & Powers, 2008), pre-service teachers who used the less responsibility technique in their lesson planning were more likely to create lessons that were aligned with the SIOP Model and that provided comprehensible input to students. The implementation of the less responsibility technique can be a valuable tool for pre-service teachers who are looking to improve their content knowledge and lesson planning skills (Webb, Massey, Goggans, & Flajole, 2019). By gradually reducing the amount of scaffolding that they provide to students, pre-service teachers can allow themselves to learn from their students and develop their skills as teachers (Maynes, Julien-Schultz, & Dunn, 2010; Pearson, McVee, & Shanahan, 2019). In addition, the use of the less responsibility technique can also help pre-service teachers to develop their teaching style (Clark, 2014). As they become more comfortable with the content area and with the SIOP Model, they can begin to experiment with different instructional strategies (Echevarria, 2005) and find what works best for them and their future students.

The implementation of the less responsibility technique incorporated with the SIOP Model is, therefore, a promising approach to promoting the content knowledge

and lesson planning skills of pre-service teachers. By gradually reducing the amount of scaffolding that they provide to students, pre-service teachers can allow themselves to learn from their students and develop their skills as teachers.

Accordingly, we decided to examine the less responsibility technique incorporated with the SIOP Model's effect on primary pre-service teachers' content knowledge and lesson planning skills. The reasons why we focused on content and lesson planning environments were that prospective teachers are not well-prepared for teacher profession (Rutt & Mumba, 2020; Skilton-Sylvester, 2020) and that, in the search of the literature, we did not find any study analyzing the impact of the less responsibility technique (Orlich, Harder, Callahan, Trevisan, & Brown, 2012) incorporated with the SIOP Model on the two educational outcomes of primary pre-service teachers (Short et al., 2011). The present study addressed the following research questions:

(1) Is there a significant difference between the reported levels of content knowledge of primary pre-service teachers in the experimental (LRT with SIOP) and the control (lecture-based learning) groups?

(2) Is there a significant difference between the reported levels of lesson planning of primary pre-service teachers in the experimental group (EG) and the control group (CG)?

(3) What are the pre-service teacher perceptions on implementing LRT with SIOP?

2. Literature Review

2.1 Less Responsibility Technique (LRT)

The less responsibility technique, gradual release of responsibility, or "I do, we do, you do" technique was first described by Madeline Hunter in her book, "Teaching Strategies: A Guide to Effective Instruction" (1982). Hunter argued that the technique could be used to help students learn new concepts and skills clearly and systematically (Hunter, 1982).

The "I do, we do, you do" technique has been the subject of several research studies. In a study by Vaughn et al. (2013), the technique was found to be effective in promoting student learning in a variety of subject areas. The authors found that

students who were taught using the "I do, we do, you do" technique were more likely to achieve mastery of the learning objectives than students who were taught using other methods. Similarly, Lo (2019) asserted that pre-service teachers who used the less responsibility technique in their lesson planning were more likely to create lessons that were aligned with the SIOP Model and that provided comprehensible input to students.

Another study, conducted by Rutt and Mumba (2020), found that the use of the LRT technique helped to improve student engagement. The authors found that students who were taught using the technique were more likely to be actively engaged in the learning process than students who were taught using other methods. Whereas another study conducted by Fisher and Frey (2013), found that the use of the less responsibility technique helped students to develop their critical thinking skills. The authors found that students who were given more responsibility for their learning were more likely to be engaged in the learning process and to be able to think critically about the content.

The gradual release of responsibility is a teaching strategy that involves gradually reducing the amount of scaffolding that teachers provide to students as they become more proficient in the content area. This can be done by gradually increasing the complexity of the tasks that students are given, providing less explicit instruction, and giving students more opportunities to work independently (Canan, 2016). Likewise, Vogt and Echevarria (2008) argued that the less responsibility technique could be used to help students develop their learning strategies and become more independent learners.

For this reason, the research suggests that the less responsibility technique can be an effective way to promote student learning. By gradually reducing the amount of scaffolding that teachers provide, students can be allowed to develop their learning strategies and become more independent learners.

2.2 Sheltered Instruction Observation Protocol (SIOP Model)

The SIOP Model (Sheltered Instruction Observation Protocol) is a research-based instructional framework that can be used to promote academic achievement (Echevarria & Vogt, 2010; Kareva & Echevarria, 2013). The model includes eight components that focus on providing comprehensible input, scaffolding instruction, and promoting interaction among students (Echevarría, Vogt, & Short, 2017). The SIOP Model was developed by Echevarria and Short (2004) and has been the subject of numerous

research studies. In a meta-analysis of 29 studies, Short, Echevarría, and Richards-Tutor (2011) found that the SIOP Model had a positive impact on the academic achievement of ELLs. The authors found that students who were taught using the SIOP Model had significantly higher achievement scores than students who were taught using traditional methods. The SIOP Model has also been shown to be effective in promoting the development of language skills in ELLs. In a study by Calderon (2012), students who were taught using the SIOP Model made significantly greater gains in their language skills than students who were taught using traditional methods. The SIOP Model is a comprehensive and research-based instructional framework that can be used to promote the academic achievement and language development of ELLs (Kareva & Echevarria, 2013). The model is flexible and can be adapted to different grade levels and subject areas.

2.3 LRT, SIOP Model, Content Knowledge, and Lesson Planning

The less responsibility technique is a teaching strategy that involves gradually reducing the amount of scaffolding that teachers provide to students as they become more proficient in the content area. This can be done by gradually increasing the complexity of the tasks that students are given (Maynes et al., 2010), providing less explicit instruction (Ness, 2011), and giving students more opportunities to work independently (Pearson et al., 2019). The SIOP Model is a research-based instructional framework that can be used to promote the academic achievement of English language learners (ELLs) (Echevarria & Short, 2004). The model includes eight components that focus on providing comprehensible input, scaffolding instruction, and promoting interaction among students (Echevarría & Short, 2011).

The less responsibility technique can be incorporated with the SIOP Model to help pre-service teachers develop their content knowledge and lesson planning skills (Echevarria et al., 2011; Echevarria & Short, 2010; Webb et al., 2019). By gradually reducing the amount of scaffolding that they provide to ELLs, pre-service teachers can allow themselves to learn from their students and develop their skills as teachers. In a study by Skilton-Sylvester (2020), pre-service teachers who used the less responsibility technique in their lesson planning were more likely to create lessons that were aligned with the SIOP Model and that provided comprehensible input to students. The author

found that the use of the less responsibility technique helped pre-service teachers to develop their content knowledge and to become more effective teachers. Another study, conducted by Rutt and Mumba (2020), found that the use of the less responsibility technique helped students to develop their critical thinking skills because students engaged in the learning process and to be able to think critically about the content.

3. Research Methodology

3.1 Participants

TEC in Cambodia provides a four-year teacher education program that focuses on content knowledge, teaching methods, and teaching practicums (MoEYS, 2019). It is designed to prepare high-school graduates who wish to become secondary school teachers. To gain entry into this program, they need to take a national entrance examination. Once they have graduated from this program, they are posted to public schools depending on their prior selection of school. They succeed in their studies based on each course during teacher education programs (TEPs), teaching practicums, and the state examination. In this analysis, participants were 46 fourth-year pre-service teachers majoring in teaching primary education in the academic year of 2022–2023 (23.90% males and 76.10% females). They were treated as primary pre-service teachers in this study. These primary pre-service teachers were taking a language assessment for reading and writing courses in two classes at a TEC when recruited as participants. The sample selection process included (1) conveniently selecting the two primary classes from six primary classes in the TEC and (2) conveniently assigning one class as the EG (N = 23) and the other as the CG (N = 23). For interviewing, 5 pre-service teachers were selected using simple random. In this study, the 5 pre-service teachers were labeled as Student 1, student 2, student 3, student 4, and student 5. The primary pre-service teachers in the two groups had never experienced LRT incorporated with the SIOP Model before. Two male teacher educators of language assessment at a TEC volunteered to teach in this research. One teacher educator, a researcher, was taught to employ LRT incorporated with the SIOP Model with the EG while the other chose to use lecture-based learning with the CG.

3.2 Measures

We, a researcher and a teacher educator, prepared achievement tests that followed the entire content of the course. Then researcher piloted the test to another primary student teacher class. The achievement test consisted of 16-item tests with four different forms of test (multiple choice, Matching, True or false, and essay writing). We adapted scales on lesson plan rubrics from Echevarría et al. (2017). The adaptation followed the translation and back-translation method (Behling & Law, 2000). First, the original items were adapted by the researchers and then translated into Khmer by two bilingual Cambodian researchers. After that, we translated the items in Khmer back into English and compared the two translated versions to see if each item could match the initial meaning. After reaching a consensus about the equivalence of Khmer and English concepts, the Khmer version of the rubric was applied to six pre-service teachers' lesson plans to check for face validity. The protocol is composed of 30 items grouped into 3 sections: Preparation, Instruction, and Review/Evaluation. Items were further clustered under Instruction into the following subsections: Lesson Preparation, Building Background, Comprehensible Input, Strategies, Interaction, Practice/ Application, Lesson Delivery, and Review/Assessment. Individual items were scored using a Likert scale with scores ranging from 4 to 0, as shown in Figure 1 for item #4 of the Preparation section. For each item, descriptors are listed for scores of 4, 2, and 0, and space was provided for recording comments and specific examples from the observation.

Figure 1: SIOP Sample

PREPARATION

4	3	2	1	0	NA
4. supplementation material used to a high degree, making the lesson clear and meaningful (graphs, models, visual)		Some use of supplementary materials		No use of supplementary materials	

Comments:

(Source: Echevarria, 2008)

3.3 Instructional procedures

A 15-week pre-test-post-test quasi-experimental design was applied to analyze the LRT with SIOP's effect on primary pre-service teachers' content knowledge and lesson planning skills, compared to lectured-based learning. In the language assessment course, primary pre-service teachers had to complete two assignments (i.e. group assignments and individual assignments for the EG and individual assignments for the CG) and take a final exam. The attendant constituted 10%, homework, quizzes, and extra reading contained 30%, the assignment constituted 30%, and the final exam comprised 40% of the course evaluation.

Instruction in the experimental group

In the EG, the primary pre-service teachers were grouped to work together for 15 weeks. To facilitate their learning, the LRT with SIOP process of Echevarría et al. (2017) was adopted. This process had three main stages.

Stage 1 (Assigning group and academic tasks). The first stage of the training focused on assigning groups and academic tasks. The teacher educator started by specifying the learning objectives and assessing the pre-service teachers' levels of content knowledge and lesson planning skills. Then, the teacher educator placed the pre-service teachers into five heterogeneous groups of five based on their pre-test scores of their content knowledge of lesson preparation. Next, the teacher educator performed a series of activities to help the pre-service teachers work together effectively. These activities included: a) Assigning interdependent roles to the group members, b) Providing the groups with interdependent materials and tasks c) Explaining the assigned tasks, how to complete them, and success criteria, d) Teaching the groups social skills, such as communication, leadership, trust-building, and conflict management. The teacher educator's goal was to help the pre-service teachers develop the skills they need to work effectively in collaborative groups. By assigning interdependent roles, providing interdependent materials and tasks, and teaching social skills, the teacher educator helped the pre-service teachers learn how to communicate effectively, share leadership responsibilities, build trust, and resolve conflicts.

Stage 2 (Monitoring and intervening in the learning process). The second stage of the training focused on monitoring and intervening in the learning process. The

teacher educator motivated each group member to engage in discussing ideas, sharing needed materials and information, giving constructive feedback on each other's work, and teaching each other. The teacher educator also continuously checked the academic progress and behaviors of each group member and offered constructive feedback on their learning. If necessary, the teacher educator intervened to answer questions, teach required social skills, and clarify how to do the assigned tasks. In addition, when the groups finished their work in each unit, the teacher educator randomly selected one member of each group to present the group work to the class. This allowed the teacher educator to assess the group's learning and to provide feedback to the entire group. The teacher educator's goal in this stage was to help the pre-service teachers learn how to work effectively in collaborative groups and to apply the social skills they had learned. By monitoring the learning process and intervening as needed, the teacher-educator helped the pre-service teachers stay on track and learn from their mistakes.

Stage 3 (Assessing group processing and learning performance). The last stage of the training focused on assessing group processing and student learning. The teacher educator had each group present their work to the class unit by unit, and provided constructive feedback on their work and performance. This allowed the teacher educator to assess the group's learning and to provide feedback to the individual group members. Before the course ended, the teacher educator had each group present their assignments to the class and asked the group members to reflect on their learning processes. This allowed the teacher educator to assess the group's ability to reflect on their learning and to identify areas for improvement. After getting feedback, each group revised their assignment and then submitted it to their teacher educator. The teacher educator then reassessed the levels of the group's learning motivation and academic engagement. This allowed the teacher educator to track the group's progress over time and to identify areas where they needed additional support. The teacher educator's goal in this stage was to assess the effectiveness of the training program and to identify areas for improvement. By providing feedback and assessing the group's learning, the teacher educator helped the pre-service teachers learn from their mistakes and improve their skills.

Instruction in the control group

In the CG, the other teacher educator provided direct instructions unit by unit, which was called lecture-based learning in this research. Like the teacher educator in the experimental learning group, the teacher educator in this group set learning objectives, explained the given tasks and assignments and how to complete them, checked academic progress and behaviors, and provided constructive feedback. However, the primary pre-service teachers in this group were not placed to work in small heterogeneous groups throughout the semester. They were just involved with some activities such as short-time group discussions, questions and answers, and individual assignments and presentations. The teacher educator in the CG also assessed the levels of his primary pre-service teachers' learning outcomes and lesson planning skills before and after the experiment.

3.4 Data analysis

The data gathered for analysis in this research was comprised of pre-test and post-test scores of content knowledge and lesson planning of the EG and the CG. We applied analysis of covariance (ANCOVA) to compare the changes in post-test content knowledge and lesson planning, considered as dependent variables, by controlling the effects of pre-test content knowledge and lesson planning, treated as covariates. The independent variables in this study were LRT with SIOP and lecture-based learning. When controlling covariates in ANCOVA, the error variation is decreased and the statistical power of the analysis is increased (Philippas, 2014). We used partial eta squared (η^2) as the measure of effect size. According to (Cohen, 1988), the values of partial η^2 of 0.01, 0.06, and 0.14 are known as small, medium, and large effect sizes. In this study, there were no statistically significant differences between the EG and the CG in terms of male and female ($t = 0.84$, $p > 0.05$).

4. Result and Discussion

4.1 Result

4.1.1 Research question 1: Is there a significant difference between the reported levels of content knowledge of primary pre-service teachers in the experimental (LRT with SIOP) and the control (lecture-based learning) groups?

We investigated the achievement levels of the primary pre-service teachers in content knowledge and lesson planning skills. The inferential statistics for the pre-test and post-test of content knowledge and lesson planning skills for the experimental and the control groups are presented in Table 1. The ANCOVA results for the LRT with SIOP Model's effect on content knowledge and lesson planning skill are given in Tables 2 and 3, respectively.

Table 1. Descriptive statistics for pre-test and post-test scores of content knowledge and lesson planning skill

			Pre-test CK		***Post-test CK***
Variables /Group	N	M	SD	M	SD
Content Knowledge					
Experimental	23	31.22	4.07	36.43	4.64
Control	23	30.13	3.90	33.78	4.34
Lesson planning					
Experimental	23	43.61	2.06	81.30	5.30
Control	23	61.78	8.52	75.52	4.78

Table 2. ANCOVA results for the LRT with SIOP's effect on content knowledge

Source	*df*	*Mean Square*	*F*	*P*	*Partial* η^2
Corrected Model	2	366.077	66.61	0.000	0.76
Intercept	1	22.026	4.01	0.052	0.09
Pre-test Content Knowledge	1	651.262	118.51	0.000	0.73
Group	1	28.973	5.27	0.027	0.11
Error	43	5.495			

a. *R Squared = .756 (Adjusted* R *Squared = .745)*

The results in Table 2 demonstrate that there was a significant difference in the post-test content knowledge of the two groups, $F\ (1,43) = 5.27,\ p < 0.05,\ Partial\ \eta^2 = 0.11$. However, the effect size was medium. The covariate (pre-test content knowledge) also had a significant effect on the post-test content knowledge, $F\ (1,43) = 118.51,\ p < 0.05,\ Partial\ \eta^2 = 0.73$. In this case, the effect size was large. These findings indicate that

the primary pre-service teachers with LRT with SIOP experiences performed better on the content knowledge part of the achievement test than those who experienced lecture-based learning.

4.1.2 Research question 2: Is there a significant difference between the reported levels of lesson planning of primary pre-service teachers in the experimental group (EG) and the control group (CG)?

Table 3. ANCOVA results for the LRT with SIOP's effect on lesson planning skill

Source	*df*	*Mean Square*	*F*	*P*	*Partial* η^2
Corrected Model	2	254.993	10.99	0.000	0.34
Intercept	1	2463.569	106.23	0.000	0.71
Pre-test Content Knowledge	1	125.442	5.41	0.025	0.11
Group	1	407.971	17.59	0.000	0.29
Error	43	23.190			

a. *R Squared = .338 (Adjusted R Squared = .308)*

As shown in Table 3, there was a significant difference between the two groups in terms of the post-test lesson planning skill, $F\ (1,43) = 17.59,\ p < 0.05,\ Partial\ \eta^2 = 0.29$. In this case, the effect size was large. The covariate (pre-test lesson planning) also had a significant contribution to the post-test lesson planning, $F\ (1,43) = 5.41,\ p < 0.05,\ Partial\ \eta^2 = 0.11$. However, the effect size was medium. These results show that the primary pre-service teachers in the LRT with SIOP context did better on the lesson planning part of the achievement test than those in the lecture-based environment.

4.3 Students' perception of the implementation of LRT incorporated with the SIOP Model

To make sure whether this combined method was adequate for pre-service teachers, the additional interview was to seek the point of view after implementing this method.

The following are the thematic findings from the interview as following: Increased satisfaction and self-confidence:

Students reported feeling more satisfied with their learning and more confident in their knowledge and skills after using the LRT and SIOP Models. They also reported

that they were better able to think critically and solve problems. As student 2 said, "Learning in this way (thinking thoughtfully) is not difficult." In addition, student 4 added, *"I get better thinking […] because I try to think, understand questions and lessons, and learn to share ideas that improve thinking and long-term memory."* Besides, student 5 released her view that *"[…] my classmates and I want to learn with the teacher's method because the teacher let us do something and he friendly support and gave feedback to us. Especially, I like the "I do we do you do" that the teacher applied because I am clear and feel confident in doing assignments […]."* This is clearly illustrated that students contented and joyful in these arranged activities with some support from students. Especially they felt confident in managing lesson plan preparation critically.

Enhanced teamwork and communication skills

Students said that the LRT and SIOP Model helped them to develop better teamwork and communication skills. They were able to work more effectively with their classmates and share ideas more easily. For instance, student 5 claimed that *"[…] Learning like this (learning by doing research) has helped to increase each other's knowledge […] we had time to ask each other for clarifying then asked the lecturer at the end to make sure."* It is an important view that students are accustomed to working in as teamwork and good communication because it is not only for the fulfillment of the course work but also for their future role-playing the real class.

Increased understanding of lesson planning

Students said that they had a better understanding of lesson planning after using the LRT and SIOP Models. They were able to write more effective lesson plans that included assessments at different stages of the learning process. In the view of Student 1, cited *"The tasks that the teacher assigned me to do previously, such as planning, group discussions, classroom observations, etc., gave me a better understanding of how to write a good lesson plan, […] (including) various assessments in the teaching process and have the skills to share ideas as well as experiences with classmates when working in a team."* Similarly, Student 4 expressed his point of view that *"For the subject of assessment in this semester, I like and have a lot of attractive points such as[…] other student and I, […] gained a lot of knowledge and skill on the process of evaluating the experience during the observation, learning extensively related to the evaluation strategy of writing the lesson plan which integrated the four language skills and assessment into lesson plan preparation."*

So, students gained more from such a method (LRT with SIOP) to develop reliable lesson plan preparation.

Improved teaching methods

Students said that the LRT and SIOP Model helped them to improve their teaching methods. They learned how to use a variety of teaching techniques, including group discussion, brainstorming, and questioning. Moreover, students were clearer about deciding the right method for the right student learning styles. Given this fact, student 3 emphasized that *"[…] after getting the prompt of lesson plan checklist, my lesson plan preparation was more comprehensible than before, particularly, right method for future students. I understood better how to prepare and write a lesson plan and apply it to the class, I was able to incorporate the assessment method into the lesson more than before and have the confidence to compose it more than before. […]."* The LRT with SIOP reminded pre-service teachers to make sure about preparing the lesson plan, in particular, the subsistence teaching method for teaching.

4.2 Discussion

This study examined the effects of LRT incorporated with the SIOP Model and lecture-based learning on content knowledge and lesson planning skills of primary pre-service teachers. The ANCOVA results revealed that content knowledge and lesson planning skills were statistically greater in the LRT incorporated with the SIOP group.

We found that LRT incorporated with SIOP is more effective in improving content knowledge and lesson planning achievement of primary pre-service teachers. This is because, in the LRT incorporated with the SIOP process, the pre-service teachers were involved with learning, clarifying, and retaining what was being taught to their groupmates and classmates. According to (Johnson & Johnson, 2017), this learning process is more effective than competitive or individualistic learning. These findings further support the results of prior studies that have shown that pre-service teachers tend to acquire greater content knowledge in classes where LRT incorporated with SIOP is used (Fisher & Frey, 2013; Kareva & Echevarria, 2013; King, 2021; Koc, 2016). More specifically, this study is in agreement with previous studies that have been published that learning cooperatively can enhance students' content and lesson planning

achievement(Chan, Maneewan, & Koul, 2021a; Vogt & Echevarria, 2008).

We also found that LRT incorporated with SIOP exerts more influence on efficacy for lesson preparation, building background, instructional strategies, practice for classroom management, and student engagement among primary pre-service teachers. Given these findings, some explanations are offered. First, in the LRT with SIOP process, the pre-service teachers had to teach the content taught to their classmates in the class. On the other hand, the SIOP Model is a research-based instructional framework that is designed to help language learners succeed in mainstream classrooms. The model includes eight components that focus on lesson planning, delivery, and assessment. When using this model with less responsibility technique, helped pre-service teachers much with content knowledge and lesson planning as well. Because all components of the SIOP Model and the three-step process of less responsibility technique can promote student-teacher confidence in content knowledge of lesson preparation (Savage, 2014). This technique involves providing primary pre-service teachers with scaffolding or support during lessons so that they can focus on learning the content (Shi, Zaier, & Maina, 2021). This can be done by providing visual aids, simplifying language, or giving students more time to complete tasks.

The less responsibility technique can be effectively incorporated with the SIOP Model to promote pre-service teachers' content knowledge and lesson planning skills. By providing scaffolding to content knowledge and lesson plan preparation, pre-service teachers can learn how to adapt lessons to meet the needs of all learners(Skilton-Sylvester, 2020). They can also learn how to use a variety of instructional strategies to help language learners understand the content. In addition, the less responsibility technique can help pre-service teachers develop their content knowledge. By simplifying language and providing support to content knowledge, pre-service teachers are forced to think about the content in a deeper way(Jason David Aldridge, 2018). This can help them to better understand the concepts and to develop their teaching skills. A study by (McVee, Shanahan, Pearson, & Rinker, 2015) found that pre-service teachers who used the less responsibility technique in their lessons were more likely to use effective instructional strategies and to provide scaffolding to how to plan the lesson for teaching effectively. The study also found that these pre-service teachers had a better

understanding of the content and were more confident in their ability to teach language learners.

Second, the pre-service teachers could learn the course content more effectively through the process of "I do we do and you do". These successful learning experiences might have influenced their teaching self-efficacy through this protocol, in agreement with the results of prior studies. For instance, work by (Jason David Aldridge, 2018) has shown that pre-service teachers' science teaching self-efficacy is enhanced through their successful experiences in learning science content and science teaching methods. Similarly, pre-service teachers who perceive that they have acquired basic competencies (e.g., knowledge, skills, and disposition) tend to enhance their teaching self-efficacy (Chan, Maneewan, & Koul, 2021b; Fisher, 2008; Fujii, 2019).

Therefore, the less responsibility technique with SIOP is a valuable tool that can be used to promote pre-service teachers' content knowledge and lesson planning skills. By providing scaffolding to language learners, pre-service teachers can learn how to adapt lessons to meet the needs of all learners. They can also develop their own content knowledge and teaching skills. To support this method, students reported having a positive overall experience with the LRT and SIOP Models. They said that they found the methods to be effective and enjoyable. The LRT and SIOP Model are effective teaching methods that can help to improve student satisfaction, self-confidence, teamwork, communication skills, and understanding of lesson planning.

6. Conclusion and Recommendations

The current study examined the LRT with the SIOP Model's effect on content knowledge and lesson planning skills of primary pre-service teachers. However, like other studies, this study also has some limitations. First, the participants were fourth-year primary pre-service teachers in Cambodia, which might lead to a generalization issue. Therefore, replication studies should be conducted with pre-service teachers of other majors and levels from other cultural settings. Second, this study gathered only quantitative data on the LRT with the SIOP Model's influence on content knowledge and lesson planning with a few interview questions. Hence, to gain greater insight into how primary pre-service teachers develop their teaching confidence in the LRT with a

SIOP environment, future research should collect both quantitative and qualitative data with numerous data collected with another TEC. Finally, the learning outcomes in our study were only content knowledge and lesson planning. Further research should take into account other language learning outcomes competencies and other subjects or other specialties as well.

Despite the above limitations, our study showed that LRT with SIOP positively contributed to greater content knowledge and stronger lesson planning among primary pre-service teachers, when compared to direct instruction. Therefore, teacher educators should implement LRT with SIOP to improve primary pre-service teachers' content knowledge and lesson planning. However, to ensure the effectiveness of LRT with SIOP, we recommend that teacher educators should (1) assign pre-service teachers to small heterogeneous groups with positive role interdependence apply micro-teaching, and check their performance with SIOP tools.

Overall, students reported having a positive overall experience with these methods. the LRT and SIOP Model are effective teaching methods that can help to improve student satisfaction, self-confidence, teamwork, communication skills, and understanding of lesson planning.

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Implementing Self-Assessment to Improve Teaching Performances of Lecturers and Their Attitude Towards Self-Assessment: A Case Study of Lecturers at Phnom Penh Teacher Education College

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ABSTRACT

Since teaching, learning, and assessment must go abreast and are inevitable, this study comes into existence to see how impactful teachers' self-assessments and own performance are. The study aims to explore the impact of a teacher's self-assessment on teaching performances and to find out their attitude towards the teacher's self-assessment. In its qualitative research design, a semi-structured interview, which was validated by a local and an internal expert and which was tried out before the actual interview, was conducted to collect data from responsible lecturers who underwent the course in a semester in the academic year 2022 - 2023. Upon the completion of the thematic analysis, the findings showed that common methods utilized by those lecturers were the use of offline and online surveys, writing diaries and notes, mental reflection, students' feedback, and comments on teachers' teaching. The impacts of their self-assessment were a timely instructional adjustment, self-reflective practice encouragement, lifelong learners, becoming prospective researchers, and awareness of their student personalities, interests, and needs. It could be concluded that self-assessment implementation is used with different methods and should be contextualized and that its results assist teachers in fostering their teaching performances. Further research should focus on other research aspects such as students' learning outcomes and perspectives using a survey to gather information from more participants and students' self-assessment of their learning.

Keywords: *Assessment; Attitude; Self-assessment; Instructional Adjustment; Teaching Performance*

1. Introduction

1.1. Research Background and Problems

Two key players, regardless of other stakeholders in education sectors, cannot be ignored in the world of the classroom. They are teachers and learners. Learning is done by the students, whereas teachers are in charge of instruction. Is that simple to say? Teaching refers to learning guidance and facilitation, enables students to learn, and sets the conditions for students to learn (Brown, 2007). According to Brown (2007), learning can be defined as an acquisition, information or skills retention, reinforced practice, and a change of behavior. Learning itself has three main elements: contents, learning process, and end/product. As learners, they might ask themselves what they gain in a session when they learn from their teacher. This is an end, one of the main elements. The query is how teachers or students know what students have learned and achieved the learning outcomes, and what teachers can do about the results.

Instruction has four main components: objectives, contents, organization of learning experiences, and assessments (Khemani, 2015). As a matter of fact, without assessment, one cannot claim the success of teaching and learning. Many teachers plan their lessons without taking assessment into account and sometimes devalue the assessment (PTEC Lesson Plan Template, 2020). They question themselves why their students fail the course or cannot catch up with the lessons though teachers use different techniques and strategies to get students engaged in learning. Notably, students reflect on what they have learned in three ways: 1) knowing their desired goal, 2) having a clear picture of their present position, and 3) some insight into how to tighten the gap between the two (Black and William, 1998). Even though a plethora of benefits of self-assessment have become apparent, "acquisition of" instead of "participation" in learning is the general focus of higher education (Boud and Falchikov, 2006). Self-assessment, also called teachers' self-reflection, commences with the perceptions of incorporating learning and teaching (Taras, 2010). Therefore, since the utmost importance of self-assessment in instructional design, instructional modification, and learning has not been widely raised in the Cambodian context, particularly in an educational institution to develop future primary and lower secondary level teachers, the study on this gap must be addressed and explored.

1.2. Research Objectives

The purposes of this study were:

1. To explore the impact of a teacher's self-assessment on teaching performances.
2. To find out their attitude towards the teacher's self-assessment.

1.3. Research Questions

1. What are the impacts of a teacher's self-assessment on teaching performance?
2. What is the teacher's attitude towards self-assessment?

1.4. Scope and delimitation

Though the study aimed to externalize and generalize its results, it has its delimitation as follows:

1. The sample of this study is three teacher trainers at Phnom Penh Teacher Education College.

2. The self-assessment is specifically done by teachers teaching the "Assessing Learning and Performance course".

3. The variables

3.1 Independent variables: teacher's self-assessment

3.2 Dependent variable: teaching performance

1.5. Research Significance

This study yielded the following benefits:

1. understanding how different types of assessments could be employed to enhance learning or engage students in the learning process both inside and outside the classroom.

2. Constant teachers' self-assessment can contribute to better instructional adjustments and practices.

2. Literature Review

2.1 Assessment

There are numerous definitions of assessment. This research looks into the meanings suitable in the Cambodian context; meanwhile, some other definitions were also mentioned to extend the body of knowledge. Some teachers use the terms, evaluation, measurement, assessment, and test interchangeably. However, the mentioned

terms mean differently.

To start with, evaluation is the process of using information gained from assessment to judge students, teachers, or programs (Mertler, 2017). Similarly, evaluation is defined as any process/procedure used to determine whether students meet predetermined criteria (Overton, 2012) so that students can proceed to the next level or obtain a certificate or not. Moreover, measurement is a process involving assigning a numerical or narrative score for samples of particular attributes or behaviors that result in a structured situation. The test is a part of the assessment (Kizlik, 2012) and is "a formal set of questions or tasks, often administered to a group of students, that address· particular cognitive capabilities learned in a specific course or subject area" (Mertler, 2017, p. 7).

Moreover, more than just simply testing, assessment is used to understand the state or condition of learning and orientates both the students' and instructors' attention to what is important (Watson, n.d.), and McMillan (2017) defined an assessment in the classroom as the process in which a teacher collect, translate, and make use of data or any other information of students' learning to support his or her decision making, such as monitoring student progress, diagnosing their weaknesses and strengths, providing feedback to parents and students, more importantly improving his/her instructional performances and the like.

2.2.1 Self-assessment

Self-assessment can be carried out by both learners and teachers. Although students' self-assessment has been raised, the main focus of the paper is on teachers' self-assessment. To start with, self-assessment is when students get involved in making judgments about their learning outcomes and achievements (Wride, 2021). It is considered a valuable way and one of the most important skills to 1) assist students' life-long learning and 2) to develop learners' future capacity as an assessor. Generally, self-assessment refers to the critical evaluation of an individual's performance, output, beliefs, or abilities so that he/she can improve himself/herself. Self-assessment, in a teaching career, is a process in which teachers gather, note down, and analyze information or any data that happened in the lesson or at work so that they can improve their actions where necessary. As far as we know teaching is complex, teachers from

self-assessment and self-reflection have opportunities to think about what works or does not work in their teaching performance and what the reasoning is behind their deeds. Self-assessment and reflection provide teachers with an opportunity (Jarvinen-Taubert, 2023).

2.2.2 Types of Assessment

Some researchers additionally categorize types of assessment into formative and summative assessments. While other researchers group the two types of assessment, assessment for learning and assessment as learning considered as "formative assessment", and the other type of assessment, assessment of learning considered as "summative assessment". The production of feedback for students about their learning resulting from any task or activity in a program or course is called formative assessment Grades in the course are not the main focus, so the focus of formative assessment is on student learning (McMillan, 2017; Watson, n.d.). Scores or grades or levels used as judgment on student performance which are the results of students' learning activities or task completion are considered as summative assessments (McMillan, 2017; Watson, n.d.). Student performance, which is recorded or can be presented to relevant people, is the emphasis of summative assessment. The detailed types of assessments will be illustrated in the ensuing section.

Knowing the difference between assessment of learning and learning is crucial because it helps teachers realize how influential recent theories of learning and motivation and external accountability testing are (McMillan, 2017).

1. Assessment of learning (AOL)

Primarily, documenting student performance is considered a "summative assessment"; it is an assessment of learning, including chapter and unit tests, semester tests, final papers, reports, and presentations. McMillan (2017) posited that the usages of summative assessment cover monitoring and recording student capabilities, grading students' work, reporting their progress to their parents, selecting them into any particular program, conferring honors, establishing an official record of their performance for college admission, future employment, accountability, and especially recently evidence of their learning for evaluation purposes of teacher's performance.

Some characteristics of AOL are sporadic, summative, general, highly efficient, high-stake, and normative (McMillan, 2017). McMillan continued that assessment of learning ranks students, focuses on reliability, delays feedback, provides summary judgments, and is conducted at the end of instruction, such as at the end of a unit, semester, or school year (Mertler, 2017, 2003), and used to report to parents.

Similarly, according to Prof. Peter (2020), characteristics of effective AOL or summative assessment include validity and reliability (it is relevant and credible) (Mertler, 2017), practical and scalable (it is feasible to administer) (Mertler, 2017), formative and positive (it should be informative for future learning despite its eventual evaluation stage), ethical (it should be a benefit for a person or it is unethical to collect data about a person's knowledge without his/her acknowledgment, a single use (it should be for only one purpose), easily reported (it provides an outcome or a comparison to previous performance and/or external criteria/standard), and is a conclusion (this should be a norm-referenced exam for judging the quality of schooling and students' learning outcomes.

2. Assessment for learning (AFL)

Assessment for learning is part of everyday practice by teachers, students, and colleagues or peers seeking, reflecting on, and responding to information from observations, dialogues, and demonstrations in ways that foster ongoing learning (International Conference on Assessment for Learning, 2009). AFL is an instructional approach producing feedback which is then utilized to foster students' learning performance. Students become more engaged in the process of their learning; they consequently gain confidence to learn up to the expectation and set standards (Cambridge-community, 2022).

Moreover, assessment for learning is a type of formative assessment conducted during a unit of instruction and describes the needs for subsequent learning. It is also used to give feedback to students and enhance student motivation. Other characteristics of formative assessment include tasks that allow teachers to modify instruction, suggest corrective instruction, specific, In-depth testing, focus on validity,
immediate feedback, and diagnostic (McMillan, 2018).

Five main processes take place in "assessment for learning":

1. Teachers scaffold their students while asking questions so that students can find out what level they are at.

2. The teacher provides each student with comments and feedback about what they can do to improve their learning.

3. Students discern the successful criteria of work or each task that they are doing.

4. Students, taking part in peer assessment and self-assessment, become more independent learners.

5. Summative-based formative assessments such as interim exams, digital work, or portfolio submissions are also used to help students improve.

3. Assessment as learning (AaL)

Students are the key people in this type of assessment, and with their teachers' guidance and facilitation, students self-assess themselves and/or peers after each instruction.

Characteristics of AaL are to engage students in learning, foster students self-monitoring of learning, be conducted during a unit of instruction, concentrate on criteria used to evaluate student knowledge, provide immediate feedback, focus on student learning validity, and enhance student motivation (McMillan, 2018). Teachers use all data from student self-assessments to improve their teaching performances.

3.1.2 Purposes of assessment

There are different purposes for different types of assessment (NSW Education Standards Authority, n.d d.).

1. Assessment for learning (formative assessment)

This kind of assessment aims to measure the ability of the learners to do something at any particular time in the learning process, to provide information about teaching decisions and lesson planning, and to allow teachers to give immediate, descriptive comments/feedback on learning guidance. In other words, This assessment for learning is an ongoing assessment tied to learning outcomes.

2. Assessment as learning (self-assessment)

. Requiring teacher direction and support, this kind of assessment aims to engage learners with their thinking about their learning and with being aware of their

monitoring and evaluation. In other words, they self-reflect their abilities upon the completion of their learning section or course.

3. Assessment of learning (summative assessment)

This type of assessment, occurring at the end of a learning theme, aims to evaluate whether or not learners have achieved the learning outcomes and have accomplished to what level and to make decisions about learners' next placement. In other words, this assessment measures learners' ability to meet the pre-defined and/or required outcomes upon the completion of learning and practice.

4. Attitude

As defined by Allport (1935, p. 810), "Attitude is a mental or neural state of readiness, organized through. experience, exerting a directive or dynamic influence upon individuals' response to all objects and situations."

Frequent discussions and actions regarding attitudes entail 1) a teacher's pure caring and kind attitude, 2) an inclination to shared accountability in a classroom setting, 3) a genuine sensitivity to students' differentiation, 4) a motive to offer all students meaningful learning experiences, and 5) an eagerness to stimulate students' innovation and creativity (Gourneau, 2005).

3. Learning and Teaching performance

As mentioned previously, learning and teaching cannot be separated from assessment. Based on the traditional or forward design, three components must go abreast: 1) objectives, 2) learning, and 3) evaluation (OLE) (Saint, 2019). In contrast, backward design begins with objectives, is followed by assessment or evaluation, and eventually ends with instructional delivery (Saint, 2019). These three elements must be aligned at all times.

3.1 Learning, teaching performance, and assessment

Data from student self-assessment should inform educators about both student's knowledge and ability to work with others and adapt to group diversity (Ornstein and Hunkins, 2018, 2013). Students need to be accountable for their assessments such as self-and peer assessments, which reflect their achievement, to ultimately enhance longer-term learning potential (Coyle, Hood, & Marsh, 2010). Such data from student learning enables teachers to realize their students' dispositions,

knowledge, understanding, and skills gained in the course and contributes to the positive transformation and improvement of their well-informed instruction/teaching performance.

3.2 Teaching performance and assessment

Teaching performance is defined as observable and measurable outcomes in the learning and teaching environment, which include teachers' actions, behaviors, and attitudes and which lead to the attainment of learning goals for their students (Australian Institute for Teaching and School Leadership, 2023).

Teaching practice, synonymous with teaching performance, refers to any form of work-integrated acquisition that can be described as an application of theory in practice before pre-service teachers or in-service teachers penetrate the relevant industry (Kiggundu & Nayimuli, 2009).

Assessment and teaching cannot be separated because teachers in each classroom are accountable for various aspects of continual decision-making daily. It is essential that this decision-making process can be effectively carried out only after teachers gain reliable and valid data from various assessment methods. Crucially, "teachers be cognizant of the interrelationships between assessments and the various aspects of teaching" (McMillan, 2017, p. 14).

The congruence of three essential components, learning objectives, assessment, and teaching performances/learning experiences organized by teachers, can yield teaching effectiveness. Upon the setting of learning objectives, teaching performance comes after to support the predetermined objectives through result-based orientation, and assessment provides students with the opportunity to demonstrate their knowledge, understanding, and skills set in the learning objectives and provides teachers with the offering of targeted feedback and guidance to better further student learning (Carnegie Mellon University, 2023).

Figure 1: Three major components of instruction

In a nutshell, the entire instructional process is then closely examined, with the discussion focusing on the three main aspects of the instructional process, namely planning for instruction, delivering instruction, and assessing instruction.

Additionally, Guskey (2002) in the theory of teacher change says that professional

growth can be the result of self-assessment because it provides an opportunity or a mechanism for the influence of teaching performance or practice.

4. Classroom assessment components

Four essential components that contribute to effective classroom assessment are purpose, measurement, interpretation, and use (McMillan, 2017). To start with, having a purpose in mind for the assessment helps teachers to specify what the assessment should be like, how it is scored, and how its scores will be utilized. Second, after being aware of the assessment purposes already, teachers consider how to gather information about student learning and their teaching; the process of this gathering can be different: formal and informal or qualitative and quantitative. Third, upon the gathering of student learning data, it is time teachers find ways to interpret the results and assign criteria or performance standards for their student learning outcomes. Fourth, the use of data gained from the interpreting stage is the ultimate phase where teachers judge or evaluate their students and decide whether the purposes set above are aligned.

5. Principles/Characteristics of assessment

Seven features of optimal assessment have been suggested by Dennie Palmer Wolf and Dean F. Reardon (1966, pp. 52 - 83), the authors of "Access to Excellence through New Forms of Student Assessment," as an alternative assessment to a traditional assessment as follows:

5. 1 Assessment should foster student learning progress toward proficiency in the course.

5.2 It should let teachers realize the consequences of instructional effects.

5.3 It ought to help to clarify student learning processes and their products in learning.

5.4 It ought to allow students to engage with their self-assessment; it is that they are active participants in judging their learning accomplishments.

5.5 It should be a fundamental focus of group activity.

5.6 It should cover meaningful tasks that tie into overall learning and the curriculum's knowledge goals.

5.7 It should be comprehensive (range of understanding contents, detailed

knowledge, and skills).

The principles of learning measurement and evaluation (Lawthong, 2018; Saint, Trans., 2021) are as follows:

1. The consistency in learning goals, objectives, and standards.
2. A variety of informative evidence from different measurement methods.
3. Students' participation in measurement and evaluation.
4. Reliability and/or Objectivity.
5. Transparency and/or verifiability.
6. Fairness/impartiality.

3. Research Methodology

This is a qualitative research conducted in a semester course at Phnom Penh Teacher Education College (PTEC), one of the first established teacher training institutions in Cambodia financially and technically supported by both educational local and foreign partners.

3.1. Population and sample

All lecturers at PTEC could be the interviewees in this study. However, specific lecturers were selected. Three lecturers were purposely selected. The following criteria were used to select these key informants:

1. They had many years of experience in teaching.
2. They were a lecturer who was trained in learning and designing class tests and standard tests.
3. They assessed themselves after teaching.
4. They were graders who marked students' exam sheets in the subject learning and assessment in the state exam of student teachers under the supervision of the Ministry of Education, Youth, and Sport.

3.2. Research instruments

A semi-structured interview was used to collect data. Three main factors make semi-structured interviews an effective method: 1). qualitative and open-ended data collection, 2). an exploration of a particular topic regarding participants' thoughts, feelings, and beliefs, and 3). deeply delving into personal and sensitive matters

(DeJonckheere & Vaughn, 2019). Likewise, in qualitative research data gained from the semi-structured interview is more rigorous than other types of interview since the researchers could acquire exhaustive and thorough information from key informants while considering the emphasis of the study (Mashuri & Sarib, 2022). Moreover, researchers could be flexible and adaptable to hold their track as compared to an unstructured interview, where its direction is not fully considered (ibid.).

Six questions, some of which were 1) what self-assessment was, 2) what methods the key informants used to self-assess, and the like, were employed to gather information (see detailed questions in appendix A). The interview lasted approximately fifteen minutes.

3.3. Data collection and analysis

To collect qualitative data, the researchers did the following things:

3.3.1. Data collection procedures

1. Participants were informed about the purposes of the study.

2. Their consent was sought before the data records were stored.

3. Interview questions were developed based on an exhaustive synthesis of the literature review.

4. Questions, after the development, were validated and verified by experts for credibility.

5. The interviews were recorded for transcription.

6. A verbatim transcription was not used since the focus of the study was the intended meaning/themes gained from the key informants.

7. Transcription of raw data was sent, checked, and verified by the key participants for its accuracy.

8. The researchers grouped the similar data, coded them as themes based on keywords, and then categorized themes.

9. Data were analyzed based on percentage and frequency.

3.3.2. Data analysis

Upon the completion of data collection, data were analyzed using thematic content analysis. This method is used because of its simplicity and flexibility, yet rigor, and is used to identify and analyze diverse patterns of themes in learning and teaching

(Clarke and Braun, 2013).

4. Result and Discussion

4.1. Results

Objective 1: To explore how a teacher's self-assessment impacts teaching performance.

To respond to this objective, the researchers asked a few questions (see below) in the interview to see how clearly and much the key informants conceptualize the self-assessment and its impacts.

1. How do they define "self-assessment"?

Most of them answered that it is an evaluation of their teaching practices to check their strengths and weaknesses and eventually promote their teaching methods and other areas of teaching. For example, one key participant expressed that, "Self-assessment is a reflective process where they evaluate their teaching practices and professional needs…… for the improvement in teaching methods …. classroom management, and other aspects of their professional practice." # 3

3. What methods do they use in "self-assessment"?

The participants used different methods to self-assess, which can be classified into internal and external assessments.

Internally, the key informants self-assessed using teaching journals, diaries, and mental reflection. One participant, for instance, stated that "I, on top of using a record, reflected my teaching mentally. It is that I didn't write anything down, yet I reflected on my previous teaching, and made my next teaching better." #2

Externally, all of them let their students assess them anonymously through surveys or writing. The participants said "I gather the feedback from students, using a survey form or allowing them to write about my teaching on the paper without their names." #3

Two interviewees reviewed the work of their students so that they could check how much students caught up with their teaching and their teaching effectiveness. One of them particularly said, "... I used the review of my student work such as tests, assignments, and projects." #2

Interestingly, one of the key informants mentioned the power of observation. She said, "I regularly observe my students while teaching because my students' facial expressions can check whether or not my students pay attention to my teaching or how much they can understand their lesson." #1

Upon asking a few of the oriented questions, the researchers asked an essential query number 3, "How does a teacher's self-assessment change your teaching performance?"

According to the interview, the researchers found that self-assessment led to 1) a timely instructional adjustment/adaptation like better teaching strategies and approaches, improvement of testing, and content review, 2) fostering of professional development, 3) the encouragement of reflective practice, 4) research and lifelong learning. For instance, one of the key informants expressed that,

"After doing my self-assessment, I can strengthen my teaching, knowledge, and understanding of the subject matter." #2

Another participant continued that, "...consistent self-assessment, I have become a lifelong learner myself, constantly evolving and adapting my practices to better serve my students and improve their educational experience." #3

The finding also indicates that doing self-assessment helps the key participant better know and understand her students. She said, "I try to remember my students' names, learning individualized attitudes/personalities, and interests." #1

Objective 2: To find out their attitude towards the teacher's self-assessment. The findings show that all the key informants did their self-assessment regularly: daily and weekly. When they did their self-assessment, they felt positive and mentioned several benefits. From the results, the key informants would continue doing self-assessments because they could identify their strengths and weaknesses, quality teaching, avoid repeating the same mistakes, timely instructional adaptation/adjustment, teaching effectiveness, and the like. One of the key informants said "Regularly, doing self-assessment is an integral part of my teaching. …. It cultivates a growth mindset, encouraging me to embrace challenges, persist in the face of setbacks, and see efforts as a pathway to mastery." #3

4.2 Discussion

Objective 1: To explore how a teacher's self-assessment impacts teaching performance. Teaching performance and professional growth: As indicated in the data gained and presented in the findings, teachers who self-assessed improved their teaching and enhanced their professional growth. Similarly, Guskey (2002) in the theory of teacher change denotes that teachers' self-assessment can provide them with opportunities for career growth and better teaching performance, and teachers, using peer observation guidelines, class observation instruments, student feedback, self-evaluation, viewing a videotape of their teaching, and consultation with peers/colleagues, professionally grow and instruct their students better and more effectively (University of Michigan, n. d.).

Knowledge of students: Recognition of students can be the result of feedback and comments provided by students to their teacher(s). Students with their teachers' facilitation assess themselves and their teachers after their teachers finish their instruction in each session and can inform about their current knowledge/performance and positions. According to Black and William (1998), McMillan (2017), and MoEYS (2016), professional teachers know their students' personalities, learning styles, needs, and interests. Furthermore, as mentioned in Carnegie Mellon University (2023), effective teaching involves gaining pertinent information and knowledge about students. Thus, using a teacher's self-assessment helps teachers know their students better. Self-assessment/reflection practice: As mentioned in the findings, the teacher's self-assessment encourages teachers' reflective practice. Similarly, the Australian Institute for Teaching and School Leadership (2023) mentioned that teaching effectiveness is the result of progressive refinement of self-developed courses, self-reflection, and feedback from both colleagues and students.

Research and lifelong learning: using self-assessment helps teachers continuously learn about their profession, knowledge, and skills. LeMahieu and Reilly (2004) describe that there are need for subsequent learning, which yields from the teacher's self-assessment, and continue that corrective instructions can be learned from teachers' own mistakes.

Objective 2: To find out their attitude towards the teacher's self-assessment. Teachers' positive attitude toward self-assessment in teaching performance: The participants felt good when they could learn about themselves, doing their assessment on teaching. By the same token, frequent discussions and actions regarding attitudes entail 1) a teacher's pure caring and kind attitude, 2) an inclination to shared accountability in a classroom setting, 3) a genuine sensitivity to students' differentiation, 4) a motive to offer all students meaningful learning experiences, and 5) an eagerness to stimulate students' innovation and creativity (Gourneau, 2005).

5. Conclusion and Recommendations

5.1 Conclusion

This research began with an interest in teacher's self-assessment and why this typical assessment could not be separated from daily instruction. This qualitative research has its purpose to answer two questions: 1) What are the impacts of a teacher's self-assessment on teaching performance? and 2) What is the teacher's attitude towards self-assessment?

The data collection was done with the verified and validated semi-structured interview questions from two experts, and teacher trainers were purposively chosen. Its results showed that teachers used diverse methods to self-assess their teaching.

Some of those self-assessments were a mental reflection, the record in the journals, the use of questionnaires in the survey both online and offline, and the student's assessment of their teacher's teaching.

5.2 Recommendations

Realizing the benefits of teachers' self-assessment from the data interpretation, the researchers would like to provide the following recommendations:

- Recommendation 1: To timely adjust teaching performances to better their teaching, teachers should use self-assessment methods that are appropriate for them, for example, mental self-assessment, diary, or student survey.

- Recommendation 2: Teachers should bear in mind that assessments from students on their teaching performances could be a not positive one; however, they should accept the feedback.

- Recommendation 3: To get more rigid data, future research should be done with both qualitative and quantitative methods, which can be a semi-structured interview and survey of a questionnaire with more teachers.

- Recommendation 4: For further research, researchers can focus on the students' self-assessment so that both teachers and students can collaborate to enhance student learning.

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Enhancing Reading Comprehension through Cooperative Learning: A Study with Student Teachers at Phnom Penh Teacher Education College (PTEC) in the Context of English Instruction for Primary Education

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ABSTRACT

Our research focused on examining how the utilization of Cooperative Learning (CL) affects the reading comprehension abilities of student teachers. We selected fifty student teachers studying Primary Education and divided them into two groups: a control group and an experimental group. The control group received lecture-based instruction, while the experimental group was taught using the Cooperative Learning technique known as Student Team-Achievement Divisions (STAD). To assess the impact, we conducted pretests and posttests for both groups and analyzed the data using a sample t-test. The results indicated that CL was more effective in enhancing the reading comprehension skills of student teachers compared to the outcomes observed in the control group. Therefore, we highly recommend that educators incorporate cooperative learning strategies like CL into their English as a Foreign Language (EFL) reading comprehension courses within teacher education training contexts.

Keywords: *Cooperative learning; STAD; Reading Comprehension, Student Teachers, Primary Education*

1. Introduction

The Ministry of Education, Youth, and Sport in Cambodia recognized the impact of globalization and international competition. In response, they decided to include English in the Grade 4 curriculum in 2014. However, the ministry has not yet achieved its objectives of ensuring that teachers have the necessary resources and proficiency to effectively teach English. As a result, many primary school teachers in Cambodia face challenges when it comes to teaching English in primary education. The lack of sufficient language knowledge has led to a shortage of English instruction in these schools, resulting in students either not learning English at all or only reaching a

minimum level of proficiency.

Another significant aspect of education reform in Cambodia is teacher education. To address the demand for trained teachers, the Ministry established Phnom Penh Teacher Education College (PTEC) in 2017. As part of their training program, primary education teachers at PTEC are required to take courses that focus on both language acquisition and teaching methods for English subjects. During their time at PTEC, student teachers are expected to engage in reading materials written in English. This reading practice is crucial for their development as it equips them with knowledge about teaching approaches tailored specifically for students in primary education. However, challenges related to reading comprehension are not unique to Cambodia, as traditional methods are still being used by many teachers worldwide.

According to Jin and Cortazzi (2002), the conventional method of teaching reading can lack inspiration, as it often involves teachers giving lectures and students simply memorizing information. This approach frequently leads to disengagement and a dislike for reading among students. To address this issue, scholars such as Gömleksi˙z (2007) and Ning (2011) propose a student-centered and communicative approach to teaching reading. Cooperative learning, which involves student interaction and communication, has been proven to encourage language use and enhance reading skills (Gömleksi˙z, 2007; Ning, 2011; Tsai, 2004).

Cooperative learning offers specific advantages for aspiring teachers, as it not only improves their learning outcomes but also boosts their confidence (Hornby, 2009; Kopparla and Goldsby, 2019). When compared to group presentations, cooperative learning is considered an effective approach to learning (Supanc, Völlinger, and Brunstein, 2017). Other studies (Gladwin IV & Stepp-Greany, 2008; Zoghi et al., 2010) have also shown that cooperative learning produces better results than lecture-style teaching in English reading instruction. However, the implementation of cooperative learning in reading instruction within teacher education remains relatively unexplored in Cambodia.

For this study, we aimed to examine how incorporating Student Team-Achievement Divisions (STAD) in learning affects the reading comprehension skills of student teachers at PTEC. Our main research question was: Does implementing STAD

in learning enhance the reading comprehension abilities of student teachers in primary education when compared to the traditional lecture-style teaching method?

2. Literature Review

2.1 Cooperative Learning

Cooperative learning is a teaching method in which students collaborate in small groups to enhance their learning and achieve common goals, as stated by Johnson et al. (1998). It is widely used and has been shown to have positive effects on various outcomes (Johnson & Johnson, 2002). This approach plays a crucial role in teaching different language skills, such as university English reading comprehension (Law, 2011; Meng, 2010), oral English (Gao, 2011; Pattanpichet, 2011), English writing (Roddy Jr, 2009), and EFL courses (Suh, 2009; Tuan, 2010). Numerous studies on the effectiveness of cooperative learning have found that this method promotes better performance, more satisfying interpersonal interactions, and higher self-esteem compared to competitive or individualistic efforts (Gömleksi˙ z, 2007; Johnson et al., 1998).

In a cooperative learning classroom environment, several factors should be present, including positive interdependence, individual accountability, face-to-face engagement, social/interpersonal skills, group processing, and equal opportunity for achievement (Johnson et al., 1991). Teachers' roles need to evolve from being knowledge transmitters to being thought mediators (Calderon, 1990). As thought mediators, teachers should provide coaching, modeling, and facilitation. To be effective facilitators, teachers must intervene to help students solve problems, assess interpersonal relationships, and monitor the acquisition of language skills. This allows them to adjust their approach to enhance student learning (Chen, 1998). Creating a secure, non-threatening, and learner-centered environment is essential for every student to actively participate in their group (Ning, 2011).

According to Fosnot and Perry (2005), English reading materials can be acquired through social interaction, as students undergo a process of re-definition and reconceptualization to internalize their learning. When students interact and use language to construct meaning socially, their reading skills improve (Zoghi et al., 2010). Cooperative learning is particularly effective when applied to enhance language learning,

foster a vibrant and supportive English learning environment, facilitate language acquisition, and make language learning more meaningful.

2.2 Student Team Achievement Divisions (STAD)

The main focus of this study is on STAD, which has been implemented in subjects like math, language arts, social studies, and science. According to Slavin (1987), STAD has consistently proven to be one of the cooperative learning methods for improving student achievement across different subject areas. In STAD small groups of 4 to 5 individuals with mixed abilities work together to teach each other the course content and prepare for tests. This technique promotes collaboration among students and holds them accountable, for their individual and team learning. It also emphasizes setting team goals based on the progress of each group member.

When applying STAD in the classroom, Ghaith and Yaghi (1998) outline four stages; instruction, group study activities, individual quizzes, and team recognition. Initially, learners listen to the teacher's explanation of the material followed by working in mixed-ability groups to complete activities or worksheets. They then take quizzes before acknowledging their teams' achievements.

According to studies, there are conflicting findings, on the effectiveness of STAD as a method for improving reading comprehension. While some reports suggest that students who were taught using STAD experienced enhancements in their reading comprehension abilities (Adams, 1995) other studies indicate that there was no positive impact, on the development of reading comprehension skills with the use of STAD (Bejarano, 1987; Miritz, 1989; Rapp, 1991).

2.3 Cooperative Learning in Teacher Education

Student teachers who are enrolled in teacher training programs can also benefit from cooperative learning environments. Previous research has demonstrated that these learning environments significantly enhance the factual knowledge of pre-service teachers (Hornby, 2009), improve their overall learning experience, and boost their confidence in various subjects (Kopla & Goldsby, 2019). It is worth noting that when compared to presentation-based learning environments, those that incorporate cooperative learning tend to have a greater impact on pre-service teachers' conceptual understanding and competence (Supanc et al., 2017).

Research suggests that collaborative learning can enhance student outcomes in the field of teaching. While content knowledge and teaching self-efficacy are indicators of effective teaching (Chan et al., 2021; Ch & Kong, 2), there is limited understanding regarding the influence of collaborative learning on pre-service teachers' reading skills. Additionally, there is a lack of research on how achievement divisions can be utilized to assess how collaborative learning facilitates the acquisition of knowledge. To address this gap, our study aimed to evaluate the impact of learning utilizing the Student Teams-Achievement Divisions technique on pre-service teachers' reading comprehension. This is particularly important as current teacher education programs often do not adequately prepare teachers for English language instruction (Kourieos & Diakou, 2019).

3. Research Methodology

In this study, the researchers employed action research, and this section presents information on the research design, treatments, and instruments used in this study.

3.1 Research Design

For 15 weeks in the semester, students explored nine topics centered around teaching methodologies in schools, including principles and techniques for teaching English. To assess the effectiveness of these methods, a quasi-experimental posttest comparison group design was employed.

The study involved a sample of 50 student teachers specializing in Primary Education. The researcher acted as the instructor for the group comprising 25 participants (N = 25), while another lecturer oversaw the control group, which also consisted of 25 participants (N = 25). In the experimental group, students were taught using the STAD (X_1) approach, whereas the control group received traditional lecture-based training (X_2). The only difference between the two groups was their method of instruction; they had access to the same learning materials, followed a similar schedule, took similar tests, and were taught by the same instructor. To gather data, worksheets from each chapter were utilized as both pretests and posttests.

Table 1: Experiment design for the study.

Groups	Instructional Methods	Pretest	Treatments	Posttest
Experimental group	STAD Cooperative learning instruction	O_1	X_1	O_2
Control group	Traditional lecture instruction	O_1	X_2	O_2

Note: The experiment group was instructed using the "Student Team-Achievement Division (STAD) Cooperative Learning instruction," while the control group received traditional lecture instruction. Pretests consisted of worksheets related to the topic in week 1, and the posttests were reading comprehension worksheets based on selected topics.

3.2 Treatment

The student teachers in the experimental group began receiving instruction in the second week under the guidance of an experienced English teacher. During the first week, both the experimental and control groups attended a traditional lecture as a reference point for the pretest. All classes took place in the student teachers' classrooms in the language department and lasted for two hours for both groups. The study spanned 15 weeks and covered nine topics from the fourth-year course syllabus of Primary Education. To complete weekly worksheets provided by the lecturers at Phnom Penh Teacher Education College, the student teachers were required to read the assigned materials.

On the other hand, the comparison group received lecture instruction, which is also known as teacher-centered instruction. In this approach, the teacher delivered instruction to the class by discussing the material paragraph by paragraph, focusing on syntax and meaning. Before each class, students were asked to preview the texts. The teacher engaged with students through questions and guided discussions throughout each class session. At the end of each class, each student was given a worksheet to be completed within 25 to 30 minutes.

3.3. Data Analyses

We used SPSS 26 software to analyze the collected data during the data analysis process. We thoroughly examined the post-test results to assess the impact of cooperative learning lessons on the outcomes. Additionally, we conducted a sample t-test to determine if the observed changes were statistically significant.

4. Result and Discussion

4.1 Result

The research findings align with the following research question: " Does implementing STAD in learning enhance the reading comprehension abilities of student teachers in primary education when compared to the traditional lecture-style teaching method?

Table 2 presents the results of an independent sample t-test comparing the average scores on standardized worksheets for both groups during the pretest. The analysis revealed no significant difference in the average scores of English reading comprehension between the experimental group (n = 25) and the control group (n = 25). The experimental group had an average score of 67.52 (standard deviation = 8.32), while the control group had an average score of 64.84 (standard deviation = 7.27), t(48) = 1.21, p = .231 > .05. These results indicate that both groups had similar reading comprehension scores based on their worksheet performance before the experiment.

Table 2: Independent sample t-test on the pretest of the experimental and control groups.

	Experimental group $n = 25$		Control group $n = 25$				
	M	SD	M	SD	*t*	df	*p*
Pretest	67.52	8.32	64.84	7.27	1.21	48	.231*

*Significant at p < .05 (Sig. 2 tailed)

After implementing the STAD treatment, we conducted a sample t-test to examine if there were any significant differences between the two groups. Interestingly, we observed variations in reading comprehension abilities, indicating that student teachers who received instruction using STAD, which involved learning, individual assessments, and team recognition, performed better. On the other hand, the control group had lower scores on the post-test. Table 3 presents the means and standard deviations of both groups, along with the results of the sample t-test conducted after the treatment. Specifically, the STAD group (n = 25) achieved a score of 71.52 (SD = 7.41), while the control group (n = 25) had a score

of 66.88 (SD = 6.84). The findings from this t-test indicated a significant difference between the two groups (t(48) = 2.29, p = .026 < .05).

Furthermore, we also utilized a paired sample t-test to evaluate improvements within each group. The results revealed that STAD instruction in the experimental group was more effective than lecture-based instruction in improving English reading comprehension among student teachers. It is worth mentioning that the paired sample t-test results showed an improvement in both groups. Please refer to Table 4 for detailed information.

Table 3: Independent sample t-test on the posttest of the experimental and control groups.

	Experimental group *n* = 25		Control group *n* = 25				
	M	SD	M	SD	*t*	df	*p*
Posttest	71.52	7.41	66.88	6.84	2.29	48	.026*

*Significant at p < .05 (Sig. 2 tailed)

Table 4: *Paired sample t-test on the pretest and posttest of the experimental and control groups.*

Groups	Test	*n*	Mean	SD	*t*	*p*
Experimental	Pretest	25	67.52	8.32	-10.10	.000*
	Posttest	25	71.52	7.41		
Control	Pretest	25	64.84	7.27	-5.23	.000*
	Posttest	25	66.88	6.84		

*Significant at p < .05 (Sig. 2 tailed)

4.2 Discussion

The findings of this study suggest that the STAD technique is more effective than the traditional lecture-based method in improving the reading comprehension skills of student teachers. These results are consistent with previous studies conducted by Gömleksi˙ z (2007), Ning (2011), and Tsai (2004), which also found positive effects of Cooperative Learning (CL) on students' reading comprehension performance.

In group settings, students benefit from the support of their teammates and peers. There is a belief that the success of the team depends on and values the contributions of each individual. When a specific solution or answer is needed, group partners can assist. If a student gives a response, knowledgeable peers in the group can explain why that response is considered incorrect. This type of explanation encourages interaction within the group, leading to a deeper understanding of the material through processes such as explanation, elaboration, and mental engagement.

Cooperative learning enables students to adapt and convey information in a way that is easier for others to understand, particularly when collaborating with peers who have different abilities. This cognitive connection is often facilitated by the relationships among students. On the other hand, when it comes to teaching methods, there is a more formal interaction between the teacher and students. Establishing a relationship and overcoming psychological barriers requires more effort because there is a perceived greater distance between the two parties.

These findings support the idea in information processing theory that working memory has limitations. Individuals are unable to constantly process all the input they receive. Instead, they can only focus on a limited amount of input for attention and processing (Celce-Murcia, 2001, p. 271). Peer learning serves as a mechanism to compensate for the information deficit caused by attention and working memory constraints. In Cooperative Learning (CL) groups, members collaborate to decipher and organize words in a passage based on task requirements and their cognitive abilities. Therefore, it is reasonable to assume that students engaged in STAD, who have a good understanding of a task, can effectively explain it to their peers using their language.

The results of this study suggest that students who were involved in the Student Team Achievement Divisions (STAD) method performed better than those in the traditional instruction group based on their scores (refer to Table 3). This finding is consistent with previous research that has observed higher performance among students who use cooperative learning methods compared to their peers (Armstrong & Palmer, 1998; Shachar & Sharan, 1994).

However, based on our observations, we noticed that occasional conflicts among group members had an impact on the effectiveness of the group. Therefore, it is advisable to make adjustments to the composition of the group when needed. Additionally, since this study focuses on analysis, the small sample size used may not fully capture students' perspectives on cooperative learning. It would be beneficial for future research to supplement this with additional information, such as interviews, to gain a better understanding of how students perceive cooperative learning.

One challenge faced in instruction is incorporating approaches like Student Team-Achievement Divisions (STAD) or other cooperative learning methods into an English as a Foreign Language (EFL) reading comprehension course. This requires planning and effort from both teachers and students. Despite the challenges involved, these approaches offer advantages that contribute to positive learning experiences and improve English reading comprehension. According to teachers' feedback, it undeniably serves as a valuable teaching tool for EFL reading courses. Therefore, we strongly recommend that teachers regularly incorporate cooperative learning into their EFL reading lessons.

5. Conclusion and Recommendations

The results from tests assessing reading comprehension revealed that student teachers who received instruction through Student Team Achievement Divisions (STAD) outperformed their counterparts who solely underwent traditional lecture-based instruction. The application of cooperative learning instruction was found to be significantly more beneficial in enhancing the group's reading comprehension when compared to the traditional lecture training provided to the control group. Our study's findings are consistent with existing research on the effectiveness of cooperative learning in improving reading comprehension (Gömleksi˙ z, 2007; Ning, 2011; Tsai, 2004).

In educational contexts where English is taught as a second language (ESL) or foreign language (EFL), terms like "group work," "pair work," and "peer work" are commonly utilized and hold a significant role in communicative language education textbooks. At our institution, PTEC, teacher education emphasizes training student

teachers to creatively incorporate collaboration into their teaching methodologies. However, our study underscores that the mere act of placing students into groups does not guarantee successful outcomes. The establishment of collaborative learning (CL) requires more than just grouping students; it necessitates the incorporation of key elements that enable students to feel valued within their teams and the class as a whole.

Teaching can present a considerable challenge, particularly for educators tasked with managing classes that are both large and diverse. The need to address the individual needs of each student adds a layer of complexity to the teaching process.

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ការបញ្ចូលបច្ចេកទេសសញ្ញាគណិតវិទ្យាដែលមានទ្រង់ទ្រាយស្រដៀងទៅនឹងតម្លៃពីជគណិតនៃចម្ងាយកំណុំរបស់កញ្ចក់ស្វែរទៅក្នុងវិធីសាស្ត្របង្រៀន ដើម្បីការបង្កើនសមត្ថភាពដោះស្រាយចំណោទបញ្ហា

Integrating Algebraic Value of Spherical Mirror Focal Length-like-mirror Symbol Technique into Teaching to Enhance Problem Solving Competence

សន សុឃៀម សៀង ប៊ុនធឿន ស្រ៊ុន សៀងហួរ ម៉ុល ពិសី ណៃ ឌីណា ជាម អង់ និងសៀង សុខារី

ដេប៉ាតឺម៉ង់វិទ្យាសាស្ត្រ មហាវិទ្យាល័យអប់រំវិទ្យាសាស្ត្រ វិទ្យាស្ថានគរុកោសល្យរាជធានីភ្នំពេញ

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សង្ខិត្តន័យ

ការសិក្សាស្រាវជ្រាវនេះមានគោលបំណងប្រៀបធៀបប្រសិទ្ធភាពនៃការដាក់បញ្ចូលបច្ចេកទេសសញ្ញាគណិតវិទ្យាដែលមានទ្រង់ទ្រាយស្រដៀងទៅនឹងតម្លៃពីជគណិតនៃចម្ងាយកំណុំរបស់កញ្ចក់ស្វែរទៅក្នុងវិធីសាស្ត្របង្រៀន ដើម្បីបង្កើនសមត្ថភាពដោះស្រាយបញ្ហា។ ក្រុមគ្រួតពិនិត្យ និងក្រុមពិសោធន៍កំណត់ក្នុងការស្រាវជ្រាវ ដែលមានក្រុមគរុនិស្សិត២៤នាក់។ ក្រុមគ្រួតពិនិត្យបង្រៀនដោយប្រើវិធីសាស្ត្របង្រៀនតាមបែបប្រពៃណី ចំណែកក្រុមពិសោធន៍បង្រៀនដោយប្រើវិធីសាស្ត្របង្រៀនតាមបែបប្រពៃណីផ្សំគ្នាជាមួយបច្ចេកទេសសញ្ញាគណិតវិទ្យា ដែលមានទ្រង់ទ្រាយស្រដៀងទៅនឹងតម្លៃពីជគណិតនៃចម្ងាយកំណុំរបស់កញ្ចក់ស្វែរ។ ការស្រាវជ្រាវនេះជាការសិក្សាតាមបែបបរិមាណវិស័យដែលទិន្នន័យបានប្រមូលដោយប្រើបុរេតេស្ត និងតេស្តបញ្ចប់។ ទិន្នន័យដែលប្រមូលបានត្រូវបានវិភាគដោយប្រើតេស្តស្ថិតិធីតេស្ត (t-test)។ លទ្ធផលតេស្តបញ្ចប់ដែលអ្នកសិក្សាស្រាវជ្រាវទទួលបានគឺតម្លៃពិន្ទុមធ្យមរបស់ក្រុមគ្រួតពិនិត្យគឺ ៣០.៥០ ទល់នឹងតម្លៃពិន្ទុមធ្យម ៣៣.៧៥ របស់ក្រុមពិសោធន៍។ តាមរយៈពិន្ទុមធ្យមនេះ ក្រុមពិសោធន៍ទទួលបានពិន្ទុមធ្យមខ្ពស់ជាងក្រុមគ្រួតពិនិត្យបន្តិចបន្តួច ដែលបង្ហាញថាមានភាពមិនមានភាពខុសគ្នាដោយp=0.104 > 0.05។ កំណើនពិន្ទុមធ្យមរបស់ក្រុមពិសោធន៍បានកើនឡើងពី ២៣.៩២ ទៅដល់ ៣៣.៧៥ ចំណែកឯក្រុមគ្រួតពិនិត្យវិញកំណើនបានកើនពី ៣០.១៧ ដល់ ៣០.៥០ ប៉ុណ្ណោះ។ សរុបសេចក្តីមកអាចសន្និដ្ឋានបានថា វិធីសាស្ត្របង្រៀនតាមបែបប្រពៃណីដែលបានដាក់បញ្ចូលបច្ចេកទេសរូបតំណាងសញ្ញាតម្លៃពីជគណិតនៃចម្ងាយកំណុំរបស់កញ្ចក់ស្វែរមានប្រសិទ្ធភាពខ្ពស់ជាង វិធីសាស្ត្របង្រៀនបែបប្រពៃណីតែឯង ព្រោះការបង្រៀនដោយអនុវត្តវិធីសាស្ត្រត្រូវការការហ្វឹកហ្វឺនជាប្រចាំ។

ពាក្យគន្លឹះ៖ *វិធីបង្រៀន តម្លៃពីជគណិត និងបច្ចេកទេសសញ្ញាគណិតវិទ្យា*

១. សេចក្តីផ្តើម

ដើម្បីជានាបានន្លូវចង្វាក់ផលិតកម្មបញ្ញាវន្ត ប្រភពធនធានមនុស្សដែលមានសមត្ថភាពខ្ពស់ និងសីលធម៌ល្អសម្រាប់សង្គម និងពិភពលោក ក្រសួងអប់រំត្រូវយកចិត្តទុកដាក់លើកត្តាជាច្រើនដូចជា ការពង្រឹងគុណភាពអប់រំ វិទ្យាសាស្ត្រ និងបច្ចេកវិទ្យា ដើម្បីឈានដល់ទីតាំងមួយ គុណភាពមួយ ឬស្តង់ដារមួយដែលសង្គម តំបន់ និងពិភពលោកទទួលស្គាល់ ក្រសួងអប់រំត្រូវតែផ្តោតអាទិភាពលើកត្តាសំខាន់ៗមួយចំនួន (១)ការយកចិត្តទុកដាក់លើគ្រូបង្រៀន (២)ការពង្រីកវិសាលភាពសាលារៀនគ្រប់កម្រិត (៣)ការពង្រឹងអធិការកិច្ចគ្រប់ជ្រុងជ្រោយលើការគ្រប់គ្រងសាលារៀន (៤)ការជំរុញការអប់រំបច្ចេកទេសនៅមធ្យមសិក្សាទុតិយភូម (៥)ការអប់រំបំណិនឱ្យស្របតាមទីផ្សារការងារ (៦)ការអភិវឌ្ឍកម្មវិធីសិក្សានិងសៀវភៅសិក្សាគោលគ្រប់ជ្រុងជ្រោយ និង(៧)ការត្រៀមប្រកួតកីឡាស៊ីហ្គេមឆ្នាំ ២០២៣។ និងដំណាក់កាលបន្ទាប់២០១៩-២០២៣ និងឆ្ពោះទៅឆ្នាំ២០៣០ ក្រសួងអប់រំ យុវជន និងកីឡាបានប្តេជ្ញាសម្រេចឱ្យបានគោលដៅអភិវឌ្ឍន៍ប្រកបដោយចីរភាព២០៣០ស្តីពីការអប់រំដោយឈរលើគោលការណ៍ គុណភាព សមធម៌ បរិយាន្ត ការសិក្សាពេញមួយជីវិតសម្រាប់ទាំងអស់គ្នា។ ម្យ៉ាងទៀត ក្រសួងបានបន្តកាត់បន្ថយគម្លាតជំនាញដោយសហការជាមួយអ្នកពាក់ព័ន្ធក្នុងការបង្កើនការផ្គត់ផ្គង់ជំនាញ ដែលមានតម្រូវការខ្ពស់ក្នុងវិស័យអាទិភាពមួយចំនួនដោយដាក់ចេញនូវការអប់រំបែបឌីជីថលដើម្បីឆ្លើយតបទៅនឹងគោលនយោបាយ និងទិសដៅនៃសេដ្ឋកិច្ចឌីជីថលកម្ពុជា (MoEYS, 2019)។ បន្ថែមលើនេះ គោលនយោបាយស្តីពីសាសារៀនជំនាន់ថ្មី (MoEYS, 2016) និងគោលនយោបាយស្តីពី ការអប់រំវិទ្យាសាស្ត្រ បច្ចេកវិទ្យា វិស្វកម្ម និងគណិតវិទ្យា គោលនយោបាយដើម្បីឆ្លើយតបទៅនឹងតម្រូវការទីផ្សារការងារនៅយុគសម័យឌីជីថល ឬឧស្សាហកម្ម ៤.0 ត្រូវបានបង្កើតឡើង (MoEYS, 2021)។ សរុបសេចក្តីមក ក្រសួងអប់រំត្រូវបន្តការលើកកម្ពស់ការបណ្តុះបណ្តាលគ្រូបង្រៀនឱ្យមានប្រសិទ្ធភាពតាមស្តង់ដាររវិជ្ជាជីវៈដែលបានកំណត់ដើម្បីឱ្យធនធានមនុស្សនៅកម្ពុជាមានចីរភាពសមត្ថភាពចំណេះដឹង ជំនាញ សីលធម៌ ឬអាចថាជាពលរដ្ឋសកលដើម្បីដឹកនាំសង្គមកម្ពុជាឱ្យមានកេរ្តិ៍ឈ្មោះល្បីល្បាញនៅលើឆាកអន្តរជាតិ។

ដើម្បីសម្រេចបានន្លូវទ្ធផលសិក្សារបស់សិស្សឱ្យកាន់តែល្អប្រសើរឡើង ពីមួយឆ្នាំទៅមួយឆ្នាំ បន្ទប់សិក្សារបស់សិស្សត្រូវតែបំពាក់ដោយសម្ភារៈទំនើបៗសមស្របសម្រាប់ការបង្រៀន និងរៀនដែលយើងអាចហៅថាបន្ទប់រៀនវៃឆ្លាត។ លើសពីនេះទៅទៀត គ្រូបង្រៀនត្រូវតែប្តូរតួនាទីពីអ្នកបង្រៀនទៅជាអ្នកសម្របសម្រួលដល់ដំណើរការសិក្សារបស់សិស្សឱ្យមានសកម្មភាព និងមានអន្តរកម្មរវាងគ្រូនិងសិស្ស ឬសិស្សនិងសិស្សដែលនៅក្នុងថ្នាក់ជាមួយគ្នា ក្នុងគោលបំណងឱ្យសិស្សអាចក្រេបជញ្ជក់ចំណេះដឹង បំណិននិងគំនិតច្នៃប្រឌិតដោយខ្លួនគេផ្ទាល់ដែលបានកំណត់ក្នុងផែនការយុទ្ធសាស្ត្រវិស័យអប់រំឆ្នាំ

២០១៩ (MoEYS, 2019)។ វិធីសាស្ត្របង្រៀនបែបនេះត្រូវបានគេស្រាវជ្រាវឃើញថាជាវិធីសាស្ត្រដែលមានប្រសិទ្ធភាពខ្ពស់ បើប្រៀបធៀបទៅនឹងវិធីសាស្ត្រផ្សេងទៀត។

បើទោះបីជាក្រសួងអប់រំ យុវជន និងកីឡា ព្យាយាមធ្វើកំណែទម្រង់វិស័យអប់រំ ជាពិសេសបញ្ចូលនូវវិធីសាស្ត្របង្រៀនថ្មីៗយ៉ាងណាក៏ដោយ បញ្ហាប្រឈមនៅតែកើតមាន។ យើងបានដឹងហើយថាវិធីសាស្ត្រមួយៗមិនអាចប្រើត្រឹមត្រូវសមស្របសម្រាប់បង្រៀនគ្រប់មុខវិជ្ជាទាំងអស់បាននោះទេ ហេតុនេះគ្រូត្រូវតែមានចំណេះដឹង បំណិននិងគំនិតច្នៃប្រឌិតក្នុងការជ្រើសរើសវិធីសាស្ត្របង្រៀន ឬសកម្មភាពបង្រៀនណាដែលសមស្របទៅនឹងទំហំថ្នាក់ របៀបរៀនរបស់សិស្សនិងស្ថានភាពមេរៀននីមួយៗអោយបានច្បាស់។ ជាការពិតណាស់ ការជ្រើសរើសវិធីសាស្ត្របង្រៀនមួយដែលសមស្របទៅនឹងស្ថានភាពជាក់ស្តែងរបស់ថ្នាក់រៀនមួយមិនមែនជារឿងងាយស្រួលនោះទេ ហេតុនេះគ្រូម្នាក់ៗត្រូវស្វែងរកវិធីសាស្ត្រដែលសមស្របនោះតាមរយៈការអង្កេត ស្រាវជ្រាវដោយផ្ទិតផ្ទង់បំផុតតាមលក្ខណៈវិទ្យាសាស្ត្រ។ អ្នកស្រាវជ្រាវបានសង្កេតឃើញថាការជ្រើសរើសវិធីសាស្ត្របង្រៀន ឬសកម្មភាពបង្រៀនសមស្របនៅក្នុងថ្នាក់រៀននីមួយៗក្នុងប្រទេសកម្ពុជានៅមានកម្រិតនៅឡើយ បញ្ហានេះឆ្លុះបញ្ចាំងតាមរយៈលទ្ធផលតេស្តមួយគឺកម្មវិធីអន្តរជាតិស្តីពីវាយតម្លៃលទ្ធផលសិក្សារបស់សិស្សសម្រាប់ប្រទេសកំពុងអភិវឌ្ឍ (PIZA-D) ដែលប្រទេសកម្ពុជាបានចូលរួមក្នុងការធ្វើតេស្តសមត្ថភាពលើមុខវិជ្ជាចំនួនបីគឺ អំណាន គណិតវិជ្ជា និងវិទ្យាសាស្ត្រ ជាលទ្ធផលកម្រិតពិន្ទុដែលសិស្សកម្ពុជានៅអាយុ១៥បានទទួលបានគឺកម្រិតទាបជាងគេបំផុតក្នុងចំណោមបណ្តាប្រទេសដែលចូលរួម ហើយក៏ទាបជាងកម្រិតអប្បបរមានៃស្តង់ដាផងដែរ។ តាមរយៈលទ្ធផលគិតជាភាគរយនៃចំនួនសិស្សដែលមានអាយុ១៥ឆ្នាំរបស់កម្ពុជាដែលបានធ្វើតេស្ត(PISA-D) លើមុខវិជ្ជាទាំងបី មានតែសិស្ស១0ភាគរយនៃសិស្សកម្ពុជាសរុបដែលបានចូលរួមធ្វើតេស្តទេដែលបានដាប់កម្រិតទី២ (Minimum proficiency level) ផ្នែកគណិតវិទ្យា ហើយមានតែ៨ភាគរយ (8%) ដាប់មុខវិជ្ជាអំណាន ដោយឡែកមុខវិជ្ជាដែលបានលទ្ធផលទាបជាងគេគឺមុខវិជ្ជាវិទ្យាសាស្ត្រដែលមានចំនួនតែ ៥% ប៉ុណ្ណោះ (MoEYS, 2018)។ តាមរយៈលទ្ធផលនេះ ចំនួនសិស្សដែលមានចំណេះដឹងទាបជាងគេលើផ្នែកវិទ្យាសាស្ត្រដែលជាផ្នែកយ៉ាងសំខាន់មួយដែលជាប់ទាក់ទងទៅនឹងបច្ចេកវិទ្យា ធម្មជាតិ និងវិជ្ជាជីវៈជាច្រើនក្នុងទីផ្សារការងារក្នុងសាកលលោក។ ម្យ៉ាងទៀត លទ្ធផលនេះបង្ហាញថា សិស្សមានអាយុក្រោម១៥ឆ្នាំមានចំណេះដឹងផ្នែកវិទ្យាសាស្ត្រមិនទាន់គ្រប់គ្រាន់នៅឡើយគឺទាបជាងកម្រិតទាបបំផុតដែលកំណត់ដោយស្តង់ដាតេស្ត។ ដោយសារសិស្សកម្ពុជាបច្ចុប្បន្នមានទំនោរមិនចង់សិក្សាផ្នែកវិទ្យាសាស្ត្រនោះទេ ដែលមុខវិជ្ជាផ្នែកវិទ្យាសាស្ត្រមិនត្រូវសិស្សភាគច្រើនចាប់អារម្មណ៍សិក្សានោះទេ។

មុខវិជ្ជារូបវិទ្យាជាផ្នែកមួយនៃវិទ្យាសាស្ត្រ ហើយជាមុខវិជ្ជាមួយដែលពិបាកស្វែងយល់ដោយសារវាជាវិទ្យាសាស្ត្រមានលក្ខណៈអរូបីច្រើន (Erinosho, 2013)។ ជាក់ស្តែងមេរៀនមួយក្នុងផ្នែករូបវិទ្យាគឺមេរៀនកញ្ចក់ស្ងែរ ដែលជាមេរៀនមួយដែលពិបាកយល់ហើយសិស្សងាយភាន់ច្រឡំលើខ្លឹមសារ និងដំណោះស្រាយលំហាត់។ សិស្សអាចចងចាំខ្លឹមសារមេរៀន ប៉ុន្តែងាយភាន់ច្រឡំក្នុងការគូសកាំពន្លឺ និងដោះស្រាយលំហាត់មិនបានល្អពេញលេញនៅឡើយ ទោះបីកម្រិតទាបក៏ដោយ (Gittes et all., 1997)។ មានការសិក្សាស្រាវជ្រាវជាច្រើនបានលើកឡើងថា សិស្សមានការលំបាកយល់លើខ្លឹមសារមេរៀនអុបទិចធរណីមាត្រ (Aregehagn, et al.,(2023)។ មានភស្តុតាងជាច្រើនបានបង្ហាញថា វិធីសាស្ត្របង្រៀនតាមបែបប្រពៃណីមិនសូវមានប្រសិទ្ធភាពក្នុងការបង្រៀនខ្លឹមសាររូបវិទ្យាទេ ដែលរួមមានពន្លឺជាដើម (García-Martínez et all., (2015)។ ការសិក្សាស្រាវជ្រាវមួយរៀបចំដោយ Kencana, et all. (2021) បានបញ្ជាក់ថាមេរៀនអុបទិចជាជាមេរៀនដែលមានលក្ខណៈអរូបី ហេតុនេះអ្នកសិក្សាត្រូវតែមានការគិតស៊ីជម្រៅទើបអាចយល់ពីខ្លឹមសារបាន។ ការសិក្សារបស់ Resita and Ertikanto (2018)បានរកឃើញថា សិស្សប្រហែល៨0ភាគរយនៃវិទ្យាល័យចំនួន៣នៃខេត្តឡាំពូង (Lampung) ប្រទេសឥណ្ឌូនេស៊ី បានអះអាងថាមុខវិជ្ជារូបវិទ្យាជាមុខវិជ្ជាមួយពិបាកយល់។

ដោយមើលឃើញបញ្ហាសិស្សភាគច្រើនមិនសូវចាប់អារម្មណ៍សិក្សាផ្នែកវិទ្យាសាស្ត្រ ដោយសារកត្តារួមផ្សំជាច្រើនដែលក្នុងនោះ វិធីសាស្ត្របង្រៀនក៏ជាផ្នែកមួយចូលរួមក្នុងបញ្ហានេះដែរ (Kaltakci-Gurel et all., 2016)។ ការស្វែងរកវិធីសាស្ត្របង្រៀនដែលសមស្របសម្រាប់ខ្លឹមសារមេរៀនវិទ្យាសាស្ត្រជារឿងដែលចាំបាច់បំផុត។ ហើយវិធីសាស្ត្រឬសកម្មភាពនោះមានលក្ខណៈសម្បត្តិសមស្រប ដែលអាចជួយសម្រួលខ្លឹមសារមេរៀនដែលពិបាកសម្រាប់សិស្សបែរមកក្លាយជាងាយស្រួលសម្រាប់ពួកគេ។ ម្យ៉ាងវិញទៀតសកម្មភាពឬបច្ចេកទេសបង្រៀនត្រូវប្រែក្លាយលក្ខណៈអរូបីទៅជាលក្ខណៈរូបី ដោយប្រើការប្រៀបធៀបឬរូបតំណាងបាតុភូតដើម្បីបង្កើនការយល់ដឹងរបស់សិស្សលើមេរៀន ដែលពិបាកស្មុគ្រស្មាញសម្រាប់សិស្ស។ ធ្វើបែបនេះទើបអាចទាក់ទាញចំណាប់អារម្មណ៍សិស្សឱ្យងាកមកសិក្សាផ្នែកវិទ្យាសាស្ត្របាន ជាពិសេសមុខវិជ្ជារូបវិទ្យាឱ្យកាន់តែផុសផុលឡើងវិញបាន។ មេរៀនកញ្ចក់ស្ងែរជាមេរៀនមួយ ដែលពិបាកយល់ហើយសិស្សងាយភាន់ច្រឡំលើខ្លឹមសារ និងដំណោះស្រាយលំហាត់ថែមទៀតផង។ ដើម្បីស្វែងរកបច្ចេកទេស ឬវិធីសាស្ត្របង្រៀនដែលសមស្របសម្រាប់ខ្លឹមសារមេរៀននេះ អ្នកស្រាវជ្រាវសាកល្បងវិធីសាស្ត្រដោយមានគោលបំណងប្រៀបធៀបពីប្រសិទ្ធភាពនៃការដាក់បញ្ចូលបច្ចេកទេសសញ្ញាគណិតវិទ្យា (សញ្ញាធំ និងសញ្ញាតូច) ដែលមានទ្រង់ទ្រាយស្រដៀងគ្នាទៅនឹងតម្លៃពីជគណិតនៃចម្ងាយកំណុំរបស់កញ្ចក់ស្ងែរផេត និងកញ្ចក់ស្ងែរប៉ោងទៅក្នុងវិធីសាស្ត្របង្រៀនតាមបែបប្រពៃណី និងវិធីសាស្ត្របង្រៀនតាមបែបប្រពៃណីតែឯងលើសមត្ថភាពដោះស្រាយ

លំហាត់របស់គរុនិស្សិតឆ្នាំទី២ នៃវិទ្យាស្ថានគរុកោសល្យរាជធានីភ្នំពេញ។

គោលបំណងស្រាវជ្រាវនេះគឺសិក្សាស្រាវជ្រាវបានលើកជាសំណួរឡើងថា៖ រវាងការដាក់បញ្ចូលបច្ចេកទេសសញ្ញាគណិតវិទ្យា (សញ្ញាធំ និងសញ្ញាតូច) ដែលមានទ្រង់ទ្រាយស្រដៀងទៅនឹងតម្លៃពីជគណិតនៃចម្ងាយកំណុំរបស់កញ្ចក់ស្ងើរផេតនិងកញ្ចក់ស្ងើរប៉ោងទៅក្នុងវិធីសាស្ត្របង្រៀនតាមបែបប្រពៃណី និងវិធីសាស្ត្របង្រៀនតាមបែបប្រពៃណីតែឯង តើវិធីមួយណាអាចបង្កើនសមត្ថភាពដោះស្រាយបញ្ហាដែលទាក់ទងនឹងមេរៀនកញ្ចក់ស្ងើរបានល្អជាងគេ?

២. វិធីសាស្ត្រស្រាវជ្រាវ

ស្រាវជ្រាវនេះគឺជាការសិក្សាស្រាវជ្រាវតាមបែបបរិមាណវិស័យ (Quantitative Research) ដោយប្រើប្រាស់តេស្តង្ងាយតម្លៃស្តង់ដារគឺបុរេតេស្ត(Pre-Test)និងតេស្តចុងកាល (Post-Test) ដែលរៀបចំឡើងតាមស្តង់ដាររតេស្តដោយគោរពតាមនិយាមស្តង់ដាតេស្តរបស់ក្រសួងអប់រំ យុវជន និងកីឡា។ ទិន្នន័យត្រូវបានប្រមូលតាមប្រព័ន្ធឌីជីថលហ្គូហ្គលហ្វ៊ឹម(google form)។ កម្រិតសំណួរបានរៀបចំយ៉ាងលម្អិតនិងយកចិត្តដាក់បំផុតដោយរៀបចំពីកម្រិតងំបូងដែលជាកម្រិតចងចាំរហូតដល់កម្រិតវិភាគដោយគោរពតាមកម្រិតប្លឹម។។ ការវិភាគទិន្នន័យដែលទទួលបានក្រោយពីការប្រមូលរួចគឺប្រព្រឹត្តទៅដោយប្រើប្រាស់កម្មវិធី Microsoft Excel (HAD17)។ ទិន្នន័យដែលទទួលបានត្រូវបញ្ចូលទៅក្នុង Excel (HAD17) និងវិភាគទិន្នន័យបែបបរិមាណវិស័យដោយស្ថិតិបែបពណ៌នា (Descriptive statistics analysis) គម្លាតស្តង់ដា និងការវិភាគស្ថិតិបែបសន្និដ្ឋាន(Inferential Statistics) ដើម្បីកំណត់តម្លៃភី(P-value) ដោយប្រើកម្មវិធីវិភាគទិន្នន័យធីតេស្ត(t-test)។ ការសិក្សាស្រាវជ្រាវបានសម្រេចជ្រើសរើសសំណាកដោយចេតនា ដោយកំណត់គរុនិស្សិតឯកទេសរូបវិទ្យាជាក្រុមត្រួតពិនិត្យ បំណែកឯកគរុនិស្សិតឯកទេសគីមីជាក្រុមពិសោធន៍។

តារាងទី១៖ តារាងសំណាកដែលបានកំណត់

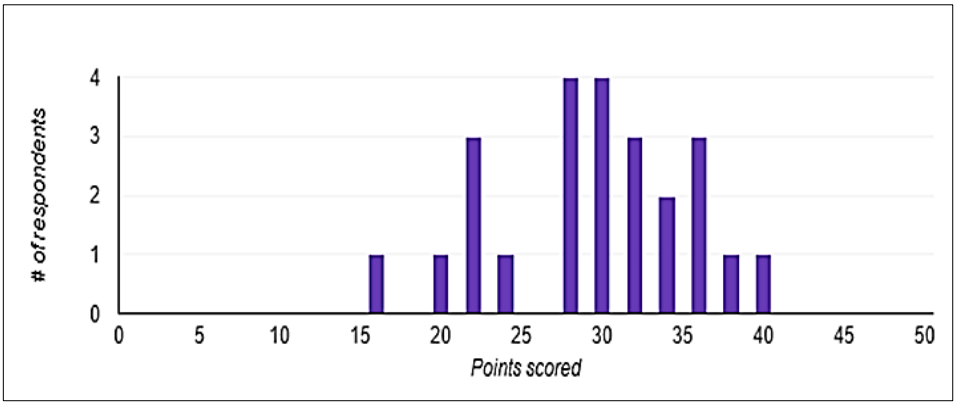
ក្រុម	វិធីសាស្ត្របង្រៀន	បំនួនសំណាក (នាក់)	បំនួនគរុនិស្សិតស្រី (នាក់)
ក្រុមត្រួតពិនិត្យ	វិធីប្រពៃណី	២៤	១៧
ក្រុមពិសោធន៍	វិធីប្រពៃណីមានដាក់បញ្ចូលបច្ចេកទេសរូបតំណាង	២៤	២0

ដើម្បីទទួលបានទិន្នន័យ ដែលជាលទ្ធផលសម្រាប់ការស្រាវជ្រាវ អ្នកស្រាវជ្រាវបានអនុវត្តការប្រមូលដោយចុះផ្ទាល់ទៅក្នុងថ្នាក់ទាំងពីរក្រុម៖

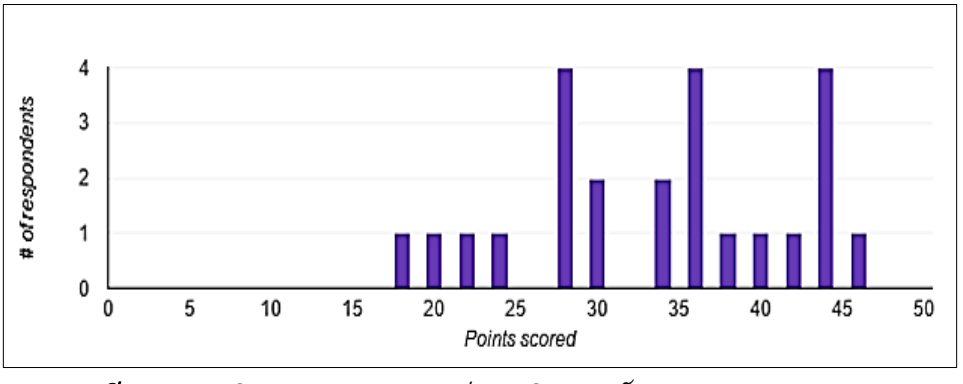
- ដំណើរការអនុវត្តបុរេតេស្ត (Pre-Test)៖ ត្រូវបានអនុវត្តមុនពេលចាប់ផ្តើមជំហានទី១នៃកិច្ចតែងការបង្រៀនម៉ោងទី១ ក្នុងរយៈពេល៣០នាទី។ គរុនិស្សិតនីមួយៗតម្រូវឱ្យអង្គុយឆ្ងាយពីគ្នាក្នុងពេលធ្វើតេស្តដើម្បីចៀសវាងបញ្ហាអសកម្មមួយចំនួនដែលអាចប៉ះពាល់ដល់ដំណើរការប្រមូលទិន្នន័យ។ បន្ទាប់មកអ្នកស្រាវជ្រាវបានបង្រៀនដោយផ្ទាល់ដោយគោរពតាមពេលវេលាកំណត់ក្នុងកិច្ចតែងការបង្រៀនដែលប្រើប្រាស់វិធីសាស្ត្របង្រៀនដែលបានជ្រើសរើស។
- ដំណើរការតេស្តបុងកាលឬតេស្តបញ្ចប់ (Post-Test)៖ ក្រោយពីសិស្សបានរៀនចប់លើខ្លឹមសារមេរៀនកញ្ចក់ស្ងើរួច ការធ្វើតេស្តនឹងត្រូវប្រព្រឹត្តទៅនៅបុងម៉ោងទី២នៃកិច្ចតែងការ ដោយអ្នកស្រាវជ្រាវបានបញ្ជូនតំណភ្ជាប់ចូលទៅកាន់ក្រុមតេលេក្រាមរបស់ក្រុមនីមួយៗ។

៣. លទ្ធផលស្រាវជ្រាវនិងការពិភាក្សា

តាមរយៈការធ្វើបុរេតេស្ត និងតេស្តបញ្ចប់តាមក្រុមនីមួយៗ អ្នកស្រាវជ្រាវទទួលបានលទ្ធផលតាមក្រុមនីមួយៗតាមរយៈរបាយពិន្ទុរបស់ក្រុមនីមួយៗដូចបង្ហាញក្នុងក្រាបខាងក្រោម។

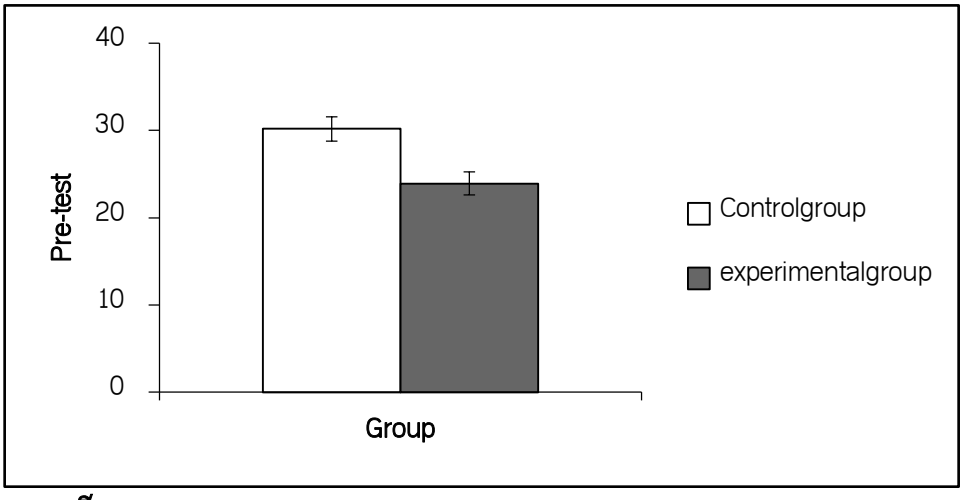


***រូបភាពទី១៖** របាយពិន្ទុតេស្តបុងកាលរបស់ក្រុមត្រួតពិនិត្យ*



***រូបភាពទី២** ៖ របាយពិន្ទុតេស្តបុងកាលរបស់ក្រុមពិសោធន៍*

តាមរយៈការប្រៀបធៀបពិន្ទុមធ្យមបុរេតេស្តរវាងក្រុមពិសោធន៍ និងក្រុមត្រួតពិនិត្យ បានបង្ហាញថា ពិន្ទុមធ្យមរវាងក្រុមទាំងពីរមានតម្លៃខុសគ្នាគួរឱ្យកត់សំគាល់ ដែលពិន្ទុមធ្យមរបស់ក្រុមត្រួតពិនិត្យធំជាងពិន្ទុមធ្យមរបស់ក្រុមពិសោធន៍ដូចបង្ហាញក្នុងក្រាបខាងក្រោម។ តម្លៃពិន្ទុមធ្យមរបស់ក្រុមត្រួតពិនិត្យគឺ៣០.១៧ ទល់នឹងតម្លៃពិន្ទុមធ្យម ២៣.៩២ របស់ក្រុមពិសោធន៍។ ដោយសារតម្លៃវ៉ារ្យ៉ង់នៃពិន្ទុរបស់ក្រុមទាំងពីរខុសគ្នាបន្តិចបន្តួច ($p = 0.688 > 0.05$) អ្នកស្រាវជ្រាវអាចកំណត់តម្លៃភីសម្រាប់ពិន្ទុមធ្យមស្មើនឹង0.00២ ($p = 0.002 < 0.05$) ដែលបញ្ជាក់ថាតម្លៃមធ្យមនេះមានគម្លាតខុសគ្នាយ៉ាងធំគួរឱ្យកត់សំគាល់។



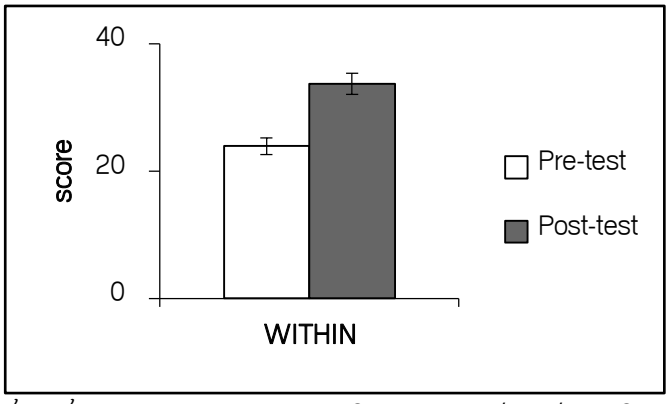
***រូបភាពទី៣៖** លទ្ធផលបុរេតេស្ត*

ផ្អែកលើលទ្ធផលនៃគម្លាតស្តង់ដារវាងក្រុមទាំងពីរ ពិន្ទុដែលទទួលបានមានតម្លៃប្រហាក់ប្រហែលគ្នា ដូចបានបង្ហាញក្នុងតារាងខាងក្រោម ដែលគម្លាតស្តង់ដារបស់ក្រុមត្រួតពិនិត្យគឺ ៦.៩០ ទល់នឹងគម្លាតស្តង់ដា ៦.៤៤ របស់ក្រុមពិសោធន៍។

តារាងទី២៖ *គម្លាតស្តង់ដាររបស់ក្រុមត្រួតពិនិត្យ និងក្រុមពិសោធន៍*

Level	Mean	SD
Control group	30.167	6.901
Experimental group	23.917	6.447

លទ្ធផលនៃការប្រៀបធៀបរវាងបុរេតេស្តនិងតេស្តបញ្ចប់បានបង្ហាញថា តម្លៃពិន្ទុមធ្យមខុសគ្នាគួរឱ្យកត់សំគាល់ ($p = 0.00011 < 0.05$) ដែលតម្លៃពិន្ទុមធ្យមបំពោះបុរេតេស្តគឺ ២៣.៩២ ទល់នឹងតម្លៃពិន្ទុមធ្យម ៣៣.៧៥ បំពោះតេស្តបញ្ចប់ដូចបង្ហាញក្នុងក្រាបខាងក្រោម។



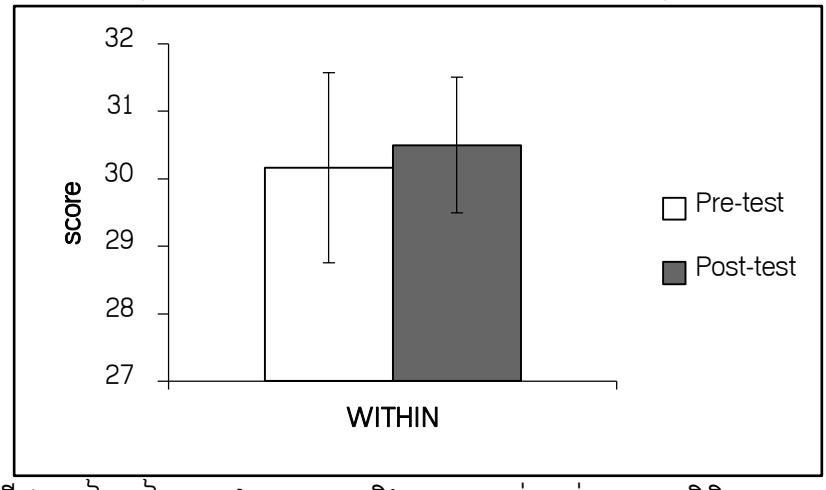
រូបភាពទី៤ *៖ប្រៀបធៀបលទ្ធផលរវាងបុរេតេស្ត និងតេស្តបញ្ចប់របស់ក្រុមពិសោធន៍*

លើសពីនេះទៅទៀត បើផ្អែកលើលទ្ធផលនៃតម្លៃគម្លាតស្តង់ដារវាងបុរេតេស្ត និងតេស្តបញ្ចប់ក៏បានបង្ហាញលទ្ធផលតម្លៃខុសគ្នាដែរ ដែលគម្លាតស្តង់ដានៃបុរេតេស្តគឺ ៦.៤៥ ទល់នឹងគម្លាតស្តង់ដា ៨.២ នៅតេស្តបញ្ចប់ដូចបង្ហាញក្នុងតារាងខាងក្រោម។

តារាងទី៣ ៖ *គម្លាតស្តង់ដារនៃ Pre-test &Post-test*

Level	Mean	SD
Pre-test	23.917	6.447
Post-test	33.750	8.200

ចំណែកឯលទ្ធផលនៃក្រុមត្រួតពិនិត្យវិញបានបង្ហាញថា លទ្ធផលបុរេតេស្ត និងតេស្តបញ្ចប់បានបង្ហាញពីតម្លៃពិន្ទុមធ្យមស្ទើរតែមិនខុសគ្នា ($p = 0.868 > 0.05$) ដែលតម្លៃពិន្ទុមធ្យមសម្រាប់បុរេតេស្តគឺ ៣០.១៧ ទល់នឹងតម្លៃពិន្ទុមធ្យម ៣០.៥០ សម្រាប់តេស្តបញ្ចប់ដូចបង្ហាញក្នុងក្រាបខាងក្រោម។



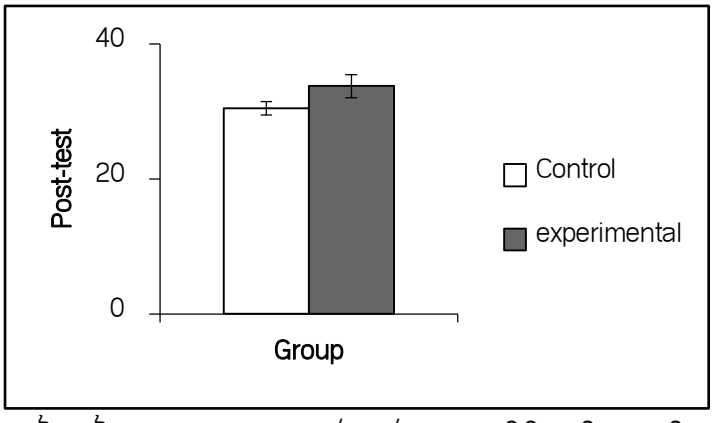
រូបភាពទី៥ ៖ប្រៀបធៀបលទ្ធផលបុរេតេស្តនិងតេស្តបញ្ចប់របស់ក្រុមត្រួតពិនិត្យ

ដោយឡែក បំពោះតម្លៃគម្លាតស្តង់ដារវាងបុរេតេស្ត និងតេស្តបញ្ចប់ក៍មានតម្លៃខុសគ្នាគួរឱ្យកត់សំគាល់ ដែលគម្លាតស្តង់ដានៅបុរេតេស្តប្រហែល ៦.៩០ ទល់នឹងគម្លាតស្តង់ដា ៤.៩១ នៅតេស្តបញ្ចប់ ដូចបង្ហាញក្នុងតារាងខាងក្រោម។

តារាងទី៤ ៖គម្លាតស្តង់ដារនៃ Pre-test &Post-test

Level	Mean	SD
Pre-test	30.167	6.901
Post-test	30.500	4.908

ប៉ុន្តែពិន្ទុមធ្យមរវាងក្រុមទាំងពីរ មានតម្លៃខុសគ្នាបន្តិចបន្តួចប៉ុណ្ណោះ ដែលពិន្ទុមធ្យមរបស់ក្រុមពិសោធន៍ ធំជាងពិន្ទុមធ្យមរបស់ក្រុមត្រួតពិនិត្យដូចបង្ហាញក្នុងក្រាបខាងក្រោម ដែលតម្លៃពិន្ទុមធ្យមរបស់ក្រុមត្រួតពិនិត្យគឺ ៣០.៥០ ទល់នឹងតម្លៃពិន្ទុមធ្យម ៣៣.៧៥ របស់ក្រុមពិសោធន៍។ ដោយសារតម្លៃវ៉ារ្យ៉ង់នៃពិន្ទុរបស់ក្រុមទាំងពីរខុសគ្នាខ្លាំង ($p' = 0.008 < 0.05$) អ្នកស្រាវជ្រាវអាចកំណត់តម្លៃកីសម្រាប់ពិន្ទុមធ្យមស្មើនឹង 0.១0៤ ($p = 0.104 > 0.05$) ដែលបញ្ជាក់ថាតម្លៃមធ្យមនេះមានគម្លាតពីគ្នាបន្តិចបន្តួចបណ្ណោះ។



***រូបភាពទី៦ ៖**ប្រៀបធៀបលទ្ធផលតេស្តបញ្ចប់របស់ក្រុមត្រួតពិនិត្យ និងក្រុមពិសោធន៍*

តាមរយៈលទ្ធផលបុរេតេស្តដែលទទួលបានខាងលើ តម្លៃពិន្ទុមធ្យមរបស់ក្រុមត្រួតពិនិត្យគឺ ៣០.១៧ ទល់នឹងតម្លៃពិន្ទុមធ្យម ២៣.៩២ របស់ក្រុមពិសោធន៍។ យោងតាមលទ្ធផលនេះ វាបានបង្ហាញយ៉ាងច្បាស់ថា បំណោះដឹងមានស្រាប់លើមេរៀនកញ្ចក់ស្ងៃរបស់ក្រុមត្រួតពិនិត្យ គឺខ្ពស់ជាងបំណោះដឹងមានស្រាប់របស់ក្រុមពិសោធន៍ ($p = 0.002 < 0.05$)។ ចំណែកឯលទ្ធផលតេស្តបញ្ចប់ដែលអ្នកសិក្សាស្រាវជ្រាវទទួលបាន គឺតម្លៃពិន្ទុមធ្យមរបស់ក្រុមត្រួតពិនិត្យគឺ ៣០.៥០ ទល់នឹងតម្លៃពិន្ទុមធ្យម ៣៣.៧៥ របស់ក្រុមពិសោធន៍។ បើសិនជាពិនិត្យទៅលើពិន្ទុមធ្យមនេះក្រុមពិសោធន៍ទទួលបាន

ពិន្ទុមធ្យមខ្ពស់ជាងក្រុមត្រួតពិនិត្យបន្តិចបន្តួច ($p = 0.104 > 0.05$)។ ហេតុនេះ យើងនឹងមិនមានអំណះអំណាងគ្រប់គ្រាន់ក្នុងការបដិសេធសម្មតិកម្មសូន្យ ឬយើងអាចទទួលយកសម្មតិកម្មសូន្យ។ ប៉ុន្តែបើសិនជាពិនិត្យមើលទៅលើគម្លាតពិន្ទុមធ្យមរវាងបុរេតេស្ត និងតេស្តបញ្ចប់របស់ក្រុមទាំងពីរ នោះយើងពិនិត្យឃើញថាកំណើនពិន្ទុមធ្យមរបស់ក្រុមពិសោធន៍ធំជាងក្រុមត្រួតពិនិត្យ។ កំណើនពិន្ទុមធ្យមរបស់ក្រុមពិសោធន៍បានកើនឡើងពី២៣.៩២ ទៅដល់ ៣៣.៧៥ ចំណែកឯក្រុមត្រួតពិនិត្យវិញកំណើនបានកើនពី ៣០.១៧ ដល់ ៣០.៥០ប៉ុណ្ណោះ។ តាមរយៈកំណើនពិន្ទុរវាងក្រុមទាំងពីរនេះអ្នកស្រាវជ្រាវអាចសន្និដ្ឋានថា ក្រុមពិសោធន៍ដែលប្រើបច្ចេកទេសរូបតំណាងសញ្ញាតម្លៃពីជគណិតនៃចម្ងាយកំណុំរបស់កញ្ចក់ស្ទ្រៃបញ្ចូលក្នុងវិធីសាស្ត្របង្រៀនបែបប្រពៃណីមានប្រសិទ្ធភាពខ្ពស់ជាងវិធីសាស្ត្របង្រៀនបែបប្រពៃណីបន្តិចក្នុងការបង្កើនសមត្ថភាពដោះស្រាយចំណោទបញ្ហាលើមេរៀនកញ្ចក់ស្ទ្រៃ។ លទ្ធផលនេះគឺស្របទៅនឹងការរកឃើញក្នុងការស្រាវជ្រាវមួយដែលរៀបចំដោយ(Vazquez, & Chiang., 2014) ដែលបានអះអាងថាវិធីបង្រៀនដែលប្រើរូបភាពតំណាងមានប្រសិទ្ធភាពក្នុងការបង្កើនការចងចាំ និងលទ្ធផលសិក្សារបស់សិស្ស។ ហើយក៏ស្របទៅនឹងការរកឃើញរបស់ការសិក្សាមួយផ្សេងទៀតដែលរៀបចំដោយ Badarudin (2014) ការបង្រៀនដោយការប្រៀបធៀបដែលប្រើរូបភាពគឺមានប្រសិទ្ធភាពលើលទ្ធផលសិក្សារបស់សិស្ស។

៥. សេចក្តីសន្និដ្ឋាន

ឆ្លងតាមការពិភាក្សាលើលទ្ធផលស្រាវជ្រាវខាងលើ ក្រុមពិសោធន៍ដែលប្រើបច្ចេកទេសរូបតំណាងសញ្ញាតម្លៃពីជគណិតនៃចម្ងាយកំណុំរបស់កញ្ចក់ស្ទ្រៃបញ្ចូលក្នុងវិធីសាស្ត្របង្រៀនបែបប្រពៃណី មានប្រសិទ្ធភាពខ្ពស់ជាងវិធីសាស្ត្របង្រៀនបែបប្រពៃណីបន្តិច ក្នុងការបង្កើនសមត្ថភាពដោះស្រាយចំណោទបញ្ហាលើមេរៀនកញ្ចក់ស្ទ្រៃ។ ទោះបីជាលទ្ធផលដែលអ្នកស្រាវជ្រាវរកឃើញថាក្រុមពិសោធន៍ខ្ពស់ជាងបន្តិចលើក្រុមត្រួតពិនិត្យយ៉ាងណាក៏ដោយ អ្នកស្រាវជ្រាវអាចទាញសេចក្តីសន្និដ្ឋានដោយមិនទើសទាល់ថា វិធីសាស្ត្របង្រៀនតាមបែបប្រពៃណី ដែលបានដាក់បញ្ចូលបច្ចេកទេសរូបតំណាងសញ្ញាតម្លៃពីជគណិតនៃចម្ងាយកំណុំរបស់កញ្ចក់ស្ទ្រៃមានប្រសិទ្ធភាពខ្ពស់ជាងវិធីសាស្ត្របង្រៀនបែបប្រពៃណីតែឯង ក្នុងការបង្កើនសមត្ថភាពដោះស្រាយចំណោទបញ្ហាដែលទាក់ទងនឹងមេរៀនកញ្ចក់ស្ទ្រៃ។ ម្យ៉ាងវិញទៀត វិធីណាក៏ដោយឱ្យតែអាចបង្កើនចំណេះដឹងរបស់សិស្ស និស្សិត ឬគរុនិស្សិតបានប្រសើរជាងគេទោះបីបន្តិចបន្តួចក្តី លោកគ្រូ អ្នកគ្រូទាំងអស់គួរតែប្រើប្រាស់ឬអនុវត្តវិធីនោះ។ សរុបសេចក្តីមក វិធីសាស្ត្របង្រៀនតាមបែបប្រពៃណីដែលបានដាក់បញ្ចូលបច្ចេកទេសរូបតំណាងសញ្ញាតម្លៃពីជគណិត នៃចម្ងាយកំណុំរបស់កញ្ចក់ស្ទ្រៃមានប្រសិទ្ធភាពខ្ពស់ជាងវិធីសាស្ត្របង្រៀនបែបប្រពៃណីតែឯង។

៥.១ អនុសាសន៍

ក្រោយពីបានធ្វើការសិក្សាស្រាវជ្រាវលើប្រធានបទនេះ អ្នកស្រាវជ្រាវបានជួបប្រទះនូវបញ្ហាប្រឈមមួយចំនួនដូចជា៖

១. ដោយសារកិច្ចការស្រាវជ្រាវនេះផ្តោតតែលើពិន្ទុមធ្យមរបស់ក្រុមពិសោធន៍ និងក្រុមត្រួតពិនិត្យ ហេតុនេះមិនទាន់ដឹងច្បាស់ថាតើចំណេះដឹងលើផ្នែកណានៃមេរៀនកញ្ចក់ស្ងែរ ដែលគរុនិស្សិតនៅតែមានការភាន់ច្រឡំ។ ដូច្នេះអ្នកស្រាវជ្រាវក្រោយៗ អាចធ្វើការងារនេះបន្តទៀតដោយកំណត់ថាតើខ្លឹមសារមេរៀនត្រង់ចំណុចណាដែលគរុនិស្សិតមានការភាន់ច្រឡំ (គិតជាភាគរយ) កម្រិតទាប កម្រិតមធ្យម ឬកម្រិតខ្ពស់។

២. អ្នកស្រាវជ្រាវមិនបានផ្តោតលើការពេញចិត្តរបស់គរុនិស្សិតលើវិធីសាស្ត្របង្រៀន បើសិនជាអាចការសិក្សាស្រាវជ្រាវក្រោយៗ ទៀតអាចធ្វើការស្ទង់មតិលើការពេញចិត្តរបស់គរុនិស្សិតក្នុងការអនុវត្តវិធីសាស្ត្របង្រៀនរបស់គ្រូ។

៣. មានចំនុចសំខាន់មួយផ្សេងទៀត ដោយសារការសិក្សានេះជាករណីសិក្សាក្នុងសាលាចំនួនមួយ ប្រាកដណាស់ទិន្នន័យដែលទទួលបានមិនទាន់ឆ្លើយតបទៅនឹងស្ថានភាពជាក់ស្តែង និងគ្រប់សាលាផ្សេងទៀតនៅឡើយទេ។ ដូចនេះ អ្នកសិក្សាស្រាវបន្តគួរតែស្រាវជ្រាវនៅសាលាផ្សេងទៀតឱ្យបានប្រើនដើម្បីប្រាកដថាវិធីសាស្ត្របង្រៀននេះមានប្រសិទ្ធភាពពិតតាមលក្ខណៈវិទ្យាសាស្ត្រស្រាវជ្រាវ។

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