

# The Development of Collaborative Learning Activities in Science Subject for Grade 12 Students in Thailand

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**ABSTRACT:** The research objectives were (1) to develop a set of Collaborative Learning Activities in the Science Subject for Grade 12 students in Thailand, (2) to compare the post-test and pretest mean score of students' science learning achievement after and before participation the set of Collaborative Learning Activities in the Science Subject for Grade 12 students in Thailand, and (3) to compare the score of scientific literacy and the criterion of 75 percentage after participation the set of Collaborative Learning Activities in the Science Subject for Grade 12 students in Thailand. The sample for this research were the 27 Grade 12 students of the bilingual program Academic Year 2023-2024 in Sarasas Witaed Minburi School. The research instruments were (1) Lesson Plans with the Collaborative Learning Activities validated by the three experts at the good level (Mean=4.29 and SD=0.02), (2) Science Learning Achievement pretest and posttest validated by the three experts with IOC value between 0.67 – 1.00 and the reliability value by Cronbach's alpha was 0.82, the difficulty value between 0.25-0.75 and the discrimination value between 0.25-0.87 and (3) Scientific Literacy Self-Assessment Test validated by the three experts at the good level (Mean=3.73, SD=0.37) and the reliability value by Cronbach's alpha was 0.81. The findings of this research were as follows: (1) The set of Collaborative Learning Activities in the Science Subject for Grade 12 students in Thailand were composed of 7 Contents on Climate in 7 periods. It was validated by the three experts at the good level (4.29). (2) The average score of students' science learning achievement after participation the set of Collaborative Learning Activities in a Science Subject was higher significantly than that one before participation at the level of 0.05. (3) The students had the average score of scientific literacy after participation the set of Collaborative Learning Activities in a Science Subject higher significantly than the criterion of 75 percentage at the level of 0.05.

**Keywords** - collaborative learning activities, Grade 12 Science Subject, Science Achievement, Scientific Literacy.

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## 1. INTRODUCTION

Science is defined as applied knowledge. It is a subject that has an impact on our everyday activities. It is also defined as a tool that is important to both individuals and to the nation to survive and to meet the global economic requirements. This implies that science subjects continue to be of the most important subjects, as the world is currently at a stage where its wealth and economic development is highly dependent to the science workforce. Ngema, M.H [1].

It is important that 'science education is needed for citizenship'. It would be designed to develop the curiosity of young people about the natural world around them, and help them acquire a broad appreciation of the

important ideas and explanatory frameworks of science and how scientific enquiry works. The processes and ideas of science are of great importance to everybody in three ways. The first is in their personal lives, for example so that they can validly identify the components of a healthy life-style. The second is in their civic lives, so that they take an informed part in social decisions, for example on future options for electricity supply. The third is in their economic lives, where they need to be able to respond positively to changes in the science-related aspects of their employment. Kaptan and Timurlenk, 2012 [2].

Current science curricular reform efforts throughout the world have re-focused on the necessity of teaching students to make informed and balanced decisions about how science impacts their lives and to use scientific knowledge to solve problems. This type of learning is best accomplished using more student-centered active-learning strategies (e.g. peer instruction/ discussion; problem- and case-based learning; peer teaching; team-based learning, and inquiry-based learning). Brickman et al. [3].

Darko and Wang [4] found that University of Cape Coast B. Ed Management students show a favorable attitude toward collaborative learning. Collaborative learning, according to the study, provides a more learner-centered environment, improves students' academic skills, develops strong working relationships among students, and increases class participation. Group activities assist students acquire intrinsic motivation, extrinsic motivation, and management skills, among other things.

Collaborative learning is a form of active learning. Students collaborate with a group of fellow students and work together towards a common goal. It allows students to exchange thoughts and develop an understanding of the concepts they are learning in class. When collaboratively learning, students review what they have learned and clarify any misconceptions amongst each other—even if they do not know it.

Scientific literacy is the ability to live in a satisfying manner in harmony with the cultural environment. Hurd (1998) defines scientific literacy as 'a talent that enables people to think logically in the event of possible personal, political, or economic problems in their lives'. According to 'National Science Education Standards,' scientific literacy includes understanding scientific concepts and supporting cultural and economic production and the decision-making process. Genç [5].

The term "scientific literacy" has become a dominant educational slogan and a major goal for science education in many countries over the past two decades. Millar [6]. Based on the definition of PISA 2006 (OECD, 2009a) [7], scientific literacy is defined as "the capacity to use scientific knowledge, to identify questions and draw conclusions based on the facts in order to understand the universe. ". Based on this definition, scientific literacy has four domains, namely scientific knowledge, scientific process, scientific context, and attitude towards science. On the other hand, Bybee [8] suggests a comprehensive theoretical scale and was better suited for the assessment of student's scientific literacy. This assessment classifies the ability of scientific Literacy in some taxonomy, which include scientific illiteracy, nominal scientific literacy, functional scientific literacy, conceptual scientific literacy, and multidimensional scientific literacy. Ni'mah [9].

The researcher is a science teacher who teaches Grade 12 students in the Bilingual Program in the private school in Bangkok. The researcher would like to introduce the collaborative learning approach where the students would be grouped and paired throughout the lessons. After introducing the lessons, the students would have time to talk to each other to explain the lesson to their classmates/ group mates who are not comfortable with the English language.

## 2. STATEMENT OF OBJECTIVES

- 2.1 To Develop a set of Collaborative Learning Activities in the Science Subject for Grade 12 students in Thailand;
- 2.2 To compare the post-test and pretest mean score of students' science learning achievement after and

before participation the set of Collaborative Learning Activities in the Science Subject for Grade 12 students in Thailand;

- 2.3 To compare the score of scientific literacy and the criterion of 75 percentage after participation the set of Collaborative Learning Activities in the Science Subject for Grade 12 students in Thailand.

### 3. HYPOTHESIS

H1: The average score of students' science learning achievement after participation the set of Collaborative Learning Activities in a Science Subject is greater than that one before participation.

H2: The average score of students' scientific literacy is higher than the criterion of 75 percentage

### 4. RESEARCH METHODOLOGY

#### 4.1 Research design

The researcher will use a pre-experimental design in the form of - a group Pretest and Post-test design using a quantitative approach.

Y1	X	Y2
Pretest	Treatment	Post-test
Science Learning Achievement	Using Set of Collaborative Learning Activities	Science Learning Achievement

Fig.1

#### 4.1 Respondents

4.1.1 **Population:** The population for this research will be 20-30 students per batch of the enrolled Grade 12 students of the bilingual program in Sarasas Witaed Minburi School.

4.1.2 **Sample:** The sample for this research will be the 2 sections 27 students of the current enrolled Grade 12 students of the bilingual program Academic Year 2023-2024 in Sarasas Witaed Minburi School.

#### 4.2 Research Instruments

There were 2 research instruments as follows;

##### 4.2.1 Instructional Instruments

The instructional instruments that will be used by the researcher are the lesson plans with the set of collaborative learning activities, the Fishbowl Method, the Think-Pair-Share Method, and the Jigsaw Method.

##### 4.2.2 Data Collection instrument

There were 2 data collection instruments for this research. Science Learning Achievement Pretest and Post-test and Scientific literacy Self-assessment Test.

##### 4.2.3 Data Gathering Procedure

The data was collected by using pretest and post-test. A pretest was given to the students at the beginning of the research. Then, the post-test was given to the students at the end of the research.

##### 4.2.4 Data analysis

4.2.4.1 The t-test dependence was used to test the difference between the pretest and post-test of the study by using the SPSS program.

4.2.4.2 The t-test for One sample was used to test the difference between the Scientific Literacy and the criteria of 70% Student by using the SPSS program.

### 5. RESEARCH FINDINGS

TABLE 1: Components of a set of Collaborative Learning Activities in the Science Subject for Grade 12 students

inThailand.

Week	Lesson plan No.	Contents	Period (55 minutes)
1	1	Effects of Climate Change	1
2	2	Climate and Seasons	1
3	3	Weather and Climates	1
4	4	Weather Forecasting	1
5	5	Weather Tools and Instrument I	1
6	6	Weather Tools and Instruments II	1
7	7	Meteorologic Information Utilization	1
		<b>Total</b>	<b>7</b>

**Regarding TABLE 1:** The set of Collaborative Learning Activities in the Science Subject for Grade 12 students in Thailand was composed of 7 Contents on Climate in 7 periods. The topic contents composed of (1) Effects of Climate Change, (2) Climate and Seasons, (3) Weather and Climates, (4) Weather Forecasting, (5) Weather Tools and Instrument I, (6) Weather Tools and Instruments II, and (7) Meteorologic Information Utilization.

**TABLE 2:** Effective level of the set of Collaborative Learning Activities in the Science Subject for Grade 12 students in Thailand by the three experts' opinions (n=3)

Lesson plan No.	The 1 <sup>st</sup> Expert	The 2 <sup>nd</sup> Expert	The 3 <sup>rd</sup> Expert	Average	S.D.	Level
Lesson plan 1	4.42	4.42	4.42	<b>4.42</b>	<b>0.00</b>	Good
Lesson plan 2	4.28	4.28	4.00	<b>4.19</b>	<b>0.16</b>	Good
Lesson plan 3	4.42	4.42	4.42	<b>4.42</b>	<b>0.00</b>	Good
Lesson plan 4	3.85	3.57	3.85	<b>3.76</b>	<b>0.16</b>	Good
Lesson plan 5	4.71	4.57	4.42	<b>4.57</b>	<b>0.15</b>	Very good
Lesson plan 6	4.42	4.57	4.71	<b>4.57</b>	<b>0.15</b>	Very good
Lesson plan 7	3.85	4.42	4.14	<b>4.14</b>	<b>0.29</b>	Good
<b>Average</b>	<b>4.28</b>	<b>4.32</b>	<b>4.28</b>	<b>4.29</b>	<b>0.13</b>	<b>Good</b>

**Regarding TABLE 2:** The mean average of the effectiveness of the set of Collaborative Learning Activities in the Science Subject for Grade 12 students in Thailand evaluated by the three experts was at the good level (Mean =4.29, SD =0.13).

When considering each lesson plan, it was found that Lesson 5 and Lesson plan 6 were at the very good level (Mean=4.57, SD=0.15). Other Lesson plans were at the good level. The lesson plan that received the least effective evaluation was Lesson plan 4 but it was still at the good level (Mean=3.76, SD=0.16).

**TABLE 3:** Comparison the Post-test and Pretest score of students' science learning achievement after and before participation the set of Collaborative Learning Activities in the Science Subject for Grade 12 students in Thailand. (n=27)

Assessment	n	Mean	S.D.	df	t	Sig.
<b>Full score (30)</b>						
Pre-test	27	10.56	4.48	26		
					19.19*	.000
Post-test	27	18.04	4.38	26		

p<0.05

**Regarding TABLE 3:** After analyzed by using t-test, it was found that the Post-test and Pretest score of students' science learning achievement after and before participation the set of Collaborative Learning Activities in the Science Subject for Grade 12 students in Thailand were different (t value = 19.19, sig. = .000). When considering mean of Post-test and Pretest score of students' science learning achievement, it was found that Post-test score was significantly higher than Pretest score of students' science learning achievement at the level of .05.

**TABLE 4:** Comparison the Post-test and Pretest score of students' scientific literacy after and before participation the set of Collaborative Learning Activities in the Science Subject for Grade 12 students in Thailand. (n=27)

Assessment	n	Mean	S.D.	df	t	Sig.
<b>Full score (40)</b>						
Pre-test	27	15.30	4.46			
				26	21.20*	.000
Post-test	27	29.96	3.16			

p<0.05

**Regarding TABLE 4:** After analyzed by using t-test, it was found that the Post-test and Pretest score of students' scientific literacy after and before participation the set of Collaborative Learning Activities in the Science Subject for Grade 12 students in Thailand were different (t value = 21.20, sig. = .000). When considering mean of Post-test and Pretest score of students' scientific literacy, it was found that Post-test score was significantly higher than Pretest score of students' scientific literacy at the level of .05.

**TABLE 5:** Comparison the Post-test score of students' scientific literacy and the criteria of 75 percentage (scores=30) after participation the set of Collaborative Learning Activities in the Science Subject for Grade 12 students in Thailand (n=27)

Assessment	n	Mean	S.D.	df	t	Sig.
<b>Full score (40)</b>						
Post-test	27	29.96	3.16			
				26	49.33*	.000
Criteria 75%	27	30.00	0.00			

p<0.05

**Regarding TABLE 5:** After analyzed by using t-test, it was found that the Post-test score of students' scientific literacy after participation the set of Collaborative Learning Activities in the Science Subject for Grade 12 students in Thailand were different (t value = 49.33, sig. = .000). When considering mean of Post-test and Criteria of 75% of score of students' scientific literacy, it was found that Post-test score was significantly higher than the Criteria of 75% of score of students' scientific literacy at the level of .05.

## 5 DISCUSSION

According to the results, the researcher proposed the discussion as follows:

**5.1** The set of Collaborative Learning Activities in the Science Subject for Grade 12 students in Thailand were validated by the three experts at the good level (4.29) because the researcher designed the set of Collaborative Learning Activities or Lesson plans in the Science Subject for Grade 12 students based on the Science Subject contents students had previously worked on in their textbooks and applied Tuckman's Team Development Model for classroom teaching, Macpherson [10]. The lessons were designed following the school lesson plan form which contains seven stages of class development: Warm-up, Forming, Storming, Norming, Performing, Adjourning, and Wrap-up. West Chester University [11] stated that Tuckman's model explains that as the team develops maturity and ability, relationships establish, and leadership style changes to more

collaborative or shared leadership. Tuckman's Team Development Model was the most used framework for a team's stages of development. His descriptions of Forming, Storming, Norming and Performing provide a useful framework for looking at every team. The four stages are a helpful framework for recognizing a team's behavioral patterns; they are most useful as a basis for team conversation, rather than boxing the team into a "diagnosis." And just as human development is not always linear, team development is not always a linear process. Having a way to identify and understand causes for changes in the team behaviors can help the team maximize its process and its productivity. Due to the research applied the model of Tuckman's Team Development Model, so the set of Collaborative Learning Activities in the Science Subject for Grade 12 students in Thailand were validated by the three experts at the good level. The result of this study was in line with Jones [12] found that the Tuckman Model can be implemented in a class setting with the stages except the last stage, adjourning, that might not be applicable in a negotiation role-play setting when conducted in class. However, it is highly relevant to corporate level and its implication can add a significant value when implemented. The implication that was found from the use of this model is that it is a great aid in monitoring student progress, skills, behavior, emotions, flexibility, adaptability and adjustability to different circumstances, different interaction with different cultures, and different case scenarios. It is, on a micro level, a tool to observe student's behavior, problem solving skills, critical thinking skills, management skills, and leadership attributes. Additionally, Guttenberg [13] found that the results for teams that progressed through Tuckman's group development model included a) completion of more projects, b) more projects completed on-time, c) reduced length of time to complete the projects, and d) significantly more total cost savings and avoidance due to the projects. The findings from this study are consistent with past studies that showed group behavior dynamics have considerable influence on the success of teams.

**5.2** The average score of students' science learning achievement after participation the set of Collaborative Learning Activities in a Science Subject was higher significantly than that one before participation at the level of 0.05 because this study used Collaborative Learning to improve the science learning achievement. Awen [14] stated that Collaborative Learning is an active, constructive process rather than the process of knowledge acquisition. It is a transformational process in which new ideas, experiences, and personal judgments are integrated into one's new knowledge. In a collaborative learning environment, students are typically required to work together in small groups to complete a task or solve a problem. This type of learning has been shown to promote higher-order thinking skills, such as analysis and synthesis, and to encourage students to take more responsibility for their learning. Additionally, collaborative learning can help students learn new information more effectively. Studies have shown that students who participate in collaborative learning activities retain more information than those who learn independently. When the researcher applied Collaborative Learning in this study, the post-test of students' science learning achievement after participation the set of Collaborative Learning Activities in a Science Subject was higher significantly than that one before participation at the level of 0.05. The result of this study was in line with Parveen et al. [15] found that collaborative learning strategies have a significant effect on student science achievement. The results of the study were likely to help teachers, administrators, and policy makers in improving the quality of teaching and learning of science at the elementary level. Latifa [16] found that using a collaborative learning strategy improved the students' reading comprehension at agribusiness students at UMPAR. The results of the study also revealed that a collaborative learning strategy improves the students' ability in teaching Reading Comprehension. Additionally, Adeoye and Igbinedion [17] found that there was a significance difference between the mean academic achievement scores of students exposed to collaborative teaching and those exposed to lecture method in Junior Secondary School since it leads to exchange of ideas and better understanding among students.

**5.3** The students had the average score of scientific literacy after participation the set of Collaborative Learning Activities in a Science Subject higher significantly than the criterion of 75 percentage at the level of 0.05 because the researcher applied Collaborative Learning to develop students' scientific literacy. Scientific Literacy means the capacity to use scientific knowledge, to identify questions and to draw evidence-based

conclusions to understand and help make decisions about the natural world and the changes made to it through human activity. (OECD, 2019) Sutrisna and Anhar [18] stated that the scientific literacy abilities of the students consisted of three scientific competencies according to PISA, namely competence to explain phenomena scientifically; evaluating data and designing scientific investigations; and interpret data and scientific evidence. Febryana et al [19] stated that students learning outcomes will be better and more meaningful if students have good scientific literacy in science learning. Anggraeni et al. [20] concluded that scientific literacy is a skill that students must possess. Scientific literacy and collaboration skills are needed to face the demands of 21st-century learning with the rapid development of technology and knowledge. The result of this study was in line with Dewi et al. [21] found that textbook based on collaborative learning model is effectively used to train students' scientific literacy skills and can be tested widely.

## 6 CONCLUSION

### 6.1 Advantage

Based on the results of this study, we can conclude that students can effectively work in collaboration and that they enjoyed working towards a similar goal. It is obviously necessary to teach students how to collaborate with each other to avoid misbehavior; they need to understand the rules and patterns of collaboration to effectively work together. Therefore, as part of lesson planning, it would be important to include a session where children are explained, in simple words, the principles of collaboration and how this non-traditional way of learning is beneficial to them. Teachers, as well, need to participate in educational courses where they learn about the theory and practices of collaborative learning in second language teaching.

Based on the results of this study, the set of collaborative learning approach have positive impact on the grade 12 students' scientific learning achievement and scientific literacy scores as reflected on the pretest and post-test. It highlighted the fact that engaging in collaborative learning activities improves the learning process, activity participation and learning retention to the students.

### 6.2 Recommendation

#### 6.2.1 Recommendation for schools and educators:

**6.2.1.1** A set of collaborative learning activities is highly recommended to be blended in the way of teaching of the educators to the students. It provides a positive learning experience to the students and educators alike.

**6.2.1.2** Provide training and workshop to enhance the teaching techniques of educators that incorporate collaborative learning activities. It would help the educators and administrators to facilitate which activities would best suit the school's style of teaching and the student's needs.

**6.2.1.3** Continuous development and feedback. It will help provide a successful transition and adaptation of new trend in terms of teaching style and collaborative learning activities as set to be implemented by the educators in each class. Feedback would also be important to know the scale if the set of collaborative learning activities are effective or needs to be changed to cater the learning achievement of the students.

#### 6.2.2 Recommendation for future research:

**6.2.2.1** The future researches in the same field would include a comparative study between the given set of collaborative learning activities and the new trends in the collaborative learning field.

**6.2.2.2** A different set of collaborative learning activities to be used in other class setting to know the effectivity of the collaborative learning activities. Collaborative learning is a continuous process of improvement for everyone involve and the set of collaborative learning activities used in this research is limited due to the given situation. It would be recommended to have a follow up on the said topic to explore other collaborative learning activities.

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