# EFFECTS OF USING 5E LEARNING CYCLE COOPERATE WITH SONGS ON SCIENCE LEARNING ACHIEVEMENT AND POSITIVE LEARNING ATMOSPHERE OF LOWER SECONDARY SCHOOL STUDENTS, BANGKOK METROPOLITAN

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**Abstract:** This study was a quasi-experimental research. The aims of this study were to evaluate the science learning achievement and positive learning atmosphere of a group of students that studied with a 5E learning cycle cooperate with songs; in comparison with the control group that learned from a traditional lecture method. The student groups were two classes of MathayomSuksa 1 (grade-7) students of Debsirin School, Bangkok, in the academic year 2015. The students taught with a 5E learning cycle cooperate with songs had a mean science learning achievement score that was significantly higher than the control group taught by the traditional lecture method and above the criterion score (70%). In addition, the positive learning atmosphere of the classroom that was taught by the 5E learning cycle cooperate with songs was rated "good", as opposed to the rating of the classroom that learned through the traditional lecture method.

**Keywords:** 5E Learning Cycle, Science Songs, Science Learning Achievement, Positive Learning Atmosphere.

## Introduction

The purpose of science education is to enable students to develop and expand their scientific knowledge that they need in their present-day social life. This can be achieved by encouraging them to make use of the knowledge in developing technologies, be aware of the knowledge value, and be responsible to society by making an appropriate use of such knowledge in a global context. Science education also contributes to a higher level of economic competitiveness and can aid in critical and analytical thinking. Determining whether one has scientific knowledge is based on the three criteria of the ability to (i) identify scientific points, (ii) give an explanation of a phenomenon from a scientific perspective, and (iii) employ scientific evidence (OECD, 2013). Knowledge in science and technology is increasingly

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necessary in modern society and it plays an essential part in everyday life. Therefore, science education is a key component to prepare human resources for the country's developments (IPST, 2011).

Thailand became a member of the International Association for the Evaluation of Learning achievement (IEA) in 1968, and its learning achievement in mathematics and science were evaluated by the IPST, which also acted as Thailand's National Research Center. The "Trend in International Mathematics and Science Study (TIMSS) 2011" ranked Thailand 25$^{th}$ out of 45 participating countries and 14 states in science education with a score of 451 points based on the McKinsey criteria and 424-462 points based on the TIMSS criteria. Thus, the quality of Thai education was low. This compares poorly with the evaluation in 2007 when the score stood 20 points higher at 471 (fair quality). Moreover, the evaluation scores in both 2007 and 2011 were lower than the international standard, which has been defined at 500 (IPST, 2012).

The annual national tests on science subjects at lower secondary school level in Thailand from 2010 to 2014 had average scores of 29.17, 32.19, 35.37, 37.95 and 38.62, respectively, all of which are under the required level of 50. In addition, the average science O-NET scores of Thai schools under the Secondary Educational Service Area Office 1 from 2011 to 2013 stood at 44.13, 46.64 and 44.37, respectively. These scores showed a tendency of 2.27-point decrease and sat 0.24 points under the nationwide average, and clearly reflect the poor and unsatisfactory level of achievement of science education in Thailand. The learning achievement, an indicator of the quality of education, however, depends on several factors and is also related to the level of intelligence (NIETS, 2015).

Apart from the learning achievement, education experts have also studied related factors and teaching methods to increase their effectiveness. In addition to the teaching method, the learning atmosphere was found to play a crucial role in the learning process as well. The learning atmosphere is an influential factor that can encourage and motivate students to study. It increases the student-instructor interactions, the classroom becomes livelier and students become more eager and attentive, enabling them to take greater part in activities, conduct self-study, and exchange their opinions in a more active fashion. Similarly, the classroom atmosphere plays a vital part in running a smooth and lively class as it helps to increase the interaction between the instructor and students (Dechakhup, 2012). A positive learning atmosphere is characterized by friendliness, intimacy, participation, freedom to study, stimulation and motivation, in-class challenges, mutual respect, and order.

The atmosphere of science classes of lower secondary students under the Secondary Educational Service Area 1 Office in Bangkok (Thailand) was evaluated from a survey of 50 students using a questionnaire in January 2015. The predetermined teaching method was child-centered, which allows students to run learning activities and draw conclusions by themselves. However, it was found that in most classes, instructors still taught their students through a traditional lecture method due to the fact that there were a lot of lessons that must be finished within a limited period of time. This lecture method, from the students' perspective, was boring and put stress on them, impeding them from enjoying the class. They would

like their science classes to have an atmosphere that encourages a learning process, where learning activities are interesting, fun and exciting with sufficient materials. They would like amicable instructors who allow them to create leaning activities by themselves as well.

Running a science class where students learn by reasoning, conducting an experiment, interpreting, and arguing with scientific evidences enables them to think logically and have a scientific mind (National Research Council, 2005).

The 5E learning cycle is a model that is focused on investigative process based on constructivism, where students generate new knowledge based on their existing knowledge. They investigate a topic and find answers on their own until they obtain an understanding of what they are investigating, thus achieving the body of knowledge on their own. The 5E learning cycle was originally developed by Bybee and experts in the biological science curriculum study (BSCS) in 1992. The full cycle consists of the five steps: (i) engagement, (ii) exploration, (iii) explanation, (iv) elaboration and (v) evaluation (BSCS, 2006). It is believed that the use of this model results in a greater learning achievement. This is in accordance with the study of Davis (1979) that compared the level of students' learning achievement and attitude towards two science classes: one taught with a 5E learning cycle and the other with a traditional lecture method. The 5E learning cycle group had a higher level of learning achievement than the control group taught by the traditional lecture method. Moreover, students who were taught with both a 5E learning cycle and argument mapping showed a higher level of learning achievement than those who were taught with a traditional method (Singhasena, 2009).

What should be taken into consideration when a lesson is taught to students at primary and lower secondary levels is the fact that children at these ages are interested in 'fun activities', such as games and music, that allow them to have fun while learning (deAndres, 2002). Such fun activities help improve the classroom atmosphere, encourage interaction between the instructor and students, and so make it easier for students to learn (Moon, 2005). Incorporating music into the teaching process is a technique that motivates students in their learning and allows them to obtain long-term knowledge (Murphy, 1990). In addition, music helps improve the students' listening, speaking, reading and writing skills and, therefore, it is used in various teaching methods, especially those that focus on improving communicative skills (Kathleen, 1999). Similarly, Li & Branel (2009) found that the use of music as a teaching material not only made it easier for students to remember vocabulary and phrases, but it also improved their attitude towards learning science. Likewise, Bonnet et al. (2001) suggested that music and vocabulary work well together as teaching materials.

Songs that can be used in science classes may be existing ones or ones that the instructor newly writes to serve the lesson's objectives (Lake, 2002). The instructor may also make use of dancing as well. The use of songs promotes understanding and relieves the students' stress. Lake's proposal is not unlike that proposed by Prensky (2001) that songs can be implemented in science lessons. They promote students' learning and are used as lesson starters because their content can promote student's learning of the language of science.

Incorporating songs with science-learning activities as a teaching strategy is an effective and easy tool to transmit knowledge and to attract the students' attention. Rhythm affects attitude and mood and promotes enthusiasm. As songs are heard daily in modern students' lives, they can help students understand the language of science and visualize it. There are examples that the use of scientific words and important content in choruses helps the students relate separate ideas and understand more (Murphy, 1990).

Accordingly, with the background, conditions and problems of teaching science in Thailand, it was of interest to study the effects of using a 5E learning cycle cooperate with science songs on the science learning achievement and positive learning atmosphere of lower secondary school students in the Bangkok Metropolitan.

**Research Objectives**

There were two related objectives in this research:

(i) To evaluate the science learning achievement of a student group that was taught with a 5E learning cycle cooperate with science songs in comparison with the control group that was taught by a traditional lecture method.

(ii) To evaluate the positive learning atmosphere of the classroom that were taught with a5E learning cycle cooperate with science songs in comparison with the control group that were taught by a traditional lecture method.

**Literature Review**

The literature related to the effects of using a 5E learning cycle with science songs on the science learning achievement and positive learning atmosphere of lower secondary school students is reviewed with regard to the following topics.

*1. Science learning achievement*

According to Caroll (quoted by Laohaphaiboon, 1994), learning achievement in science is the degree to which each student understands the taught lesson. Similarly, Dechakhup and Yindisuk (2005) defined learning achievement as "the size of success achieved through the teaching process." According to Heller et al. (2012), learning achievement in science is the overall outcome students achieve through taught lessons, which is measured in the three dimensions of knowledge, comprehension and application. The measurement can be conducted using a test that consists of the selected- and constructed-responses, and so the science knowledge of students can be tested using multiple choice questions.

*2. Positive learning atmosphere*

Lawrenz (1976) described a positive learning atmosphere as 'an environment which is characterized by the three major components of (i) the instructor's behavior, (ii) interaction between the instructor and students and (iii) interaction among students that leads to better learning environment. Dechakhup et al. (2012) defined 'positive learning atmosphere' as a learning environment in which the interaction between the instructor and students and the interaction among students themselves facilitate the

teaching process and make the whole class become more active, and is an environment where class cooperation is found.

*3. The 5E learning cycle*

The 5E learning cycle is an instructional model that focuses on investigative process based on constructivism, where students generate new knowledge based on their existing knowledge. The 5E learning cycle was originally developed by Bybee and experts in the biological science curriculum study (BSCS) in 1992. The full cycle consists of five steps: (E1) engagement, (E2) exploration, (E3) explanation, (E4) elaboration and (E5) evaluation (BSCS, 2006). In the first step (Engagement) the student's interest is captured and the lesson is introduced. Then in the second step (Exploration) the students come up with their hypotheses on a given question or topic, design the testing process, and collect the data. In the third step (Explanation) the students analyze the data they have collected, draw conclusions and present them to the whole class, with the instructor's assistance. At the fourth step (Elaboration) the students use the conclusion they have reached to explain an existing phenomenon or a new one. Finally, in the fifth step (Evaluation), the instructor measures the students' understanding and knowledge in terms of the degree (depth) and accuracy. However, this step should in fact take place throughout the cycle.

*4. Science songs*

According to Crowther (2006), a science song is a song rich in science content and related to the lesson plan, and so it can be used in engaging students in science learning. Similarly, Governor (2011) and Governor et al. (2013) defined a science song as a song in which the original lyrics are replaced by content-rich lyrics specifically designed to teach or explain science lessons, with its melody remaining unchanged.

**Methodology**

This research was a quasi-experimental research with a posttest-only control group design of two groups of students. The first group was taught five lesson plans of science with the 5E learning cycle cooperate with science songs, while the second (control) group was taught the same five lesson plans with a traditional lecture-based method.

*Population and sample group*

The sample groups in this research were grade 7 (lower secondary school) students in the first semester of the academic year 2015 at Debsirin School, Bangkok (Thailand), within the Secondary Educational Service Area 1 Office, Bangkok (Thailand), and under the Office of the Basic Education Commission, Ministry of Education.

*Research tools*

The research tools were comprised of:

1. Tools used for collecting data:

1.1. Science learning achievement evaluation form

1.2. Positive learning atmosphere observation form
2. Tools used for the science learning plans:
2.1. Plans of the 5E learning cycle cooperate with songs
2.2. Plans of the traditional instruction

*Data Collection*
The researcher conducted the teaching according to the five predetermined lesson plans and data were collected in both the experimental and control groups. The data were collected as follows:

1.Preparing students and collecting data before the experiment
Preparation of the students in both the experimental and control groups was conducted by introduction of the lesson and explaining the objective of the learning and scoring criteria. For the experimental group, the researcher also explained to the students about science learning through the 5E learning cycle and the use of science songs with respect to the (i) method and steps of learning through the 5E learning cycle and songs and (ii) the students' role during the in-class activities.

2. Data collection during the experiment
The researcher taught the experimental and control groups for the same amount of time (12 classes, 50 minutes each). During each class, data were collected by videotaping the class and noting the learning atmosphere observation on three occasions (in learning plan 1, 2and 5).

3. Actions after the experiment
At the end of the study period of five lesson plans had been completed in both groups, and the data on the learning achievement were collected using a science learning achievement test. The number of questions asked in the test was adjusted in accordance with the lessons learned, and were the same between the two groups. Students were given 40 minutes to do the test.

*Data presentation and analysis*
Data are presented in two parts, based on the data collection tool used, as follows.

1. Analysis of data derived from the science learning achievement
Learning achievement of the students in the experimental and control groups were summarized as the mean and standard deviation (S.D.) of the science learning achievement evaluation form. Then, the difference in the average scores were tested for significance using a one-way ANCOVA, with the covariance being the respective student's science grades when they were at grade 6, in order to eliminate the influence of any pre-existing knowledge of these students.

2. Analysis of data derived from the positive learning atmosphere observation
From the videotaped classes, the researcher analyzed the behaviors that indicated a positive learning atmosphere of the experimental and control groups, in terms of the (i) motivation of attention, (ii) freedom, (iii) mutual acceptance, (iv) challenging

atmosphere, (v) warm and friendly atmosphere, and (vi) disciplinary control. The significance of any differences in average scores of the positive learning atmosphere between the experimental and control groups was tested for using the Friedman Test, accepting significance at the $p < 0.05$ level.

**Results**

The findings can be summarized as follows:

1. After completion of the five lesson plans the experimental group (5E learning cycle cooperate with songs) had a higher average science learning achievement score than the defined criterion score of 70% and it was also significantly higher than the control group.

2. The positive learning atmosphere of the classroom taught by the 5E learning cycle cooperate with songs was rated "*good*", which was greater than that of the classroom taught by the traditional lecture method.

**Discussion**

Applying the 5E learning cycle cooperate with songs had a positive effect on both the science learning achievement and the positive learning atmosphere of grade 7 students at a lower secondary school in Bangkok, Thailand. Accordingly, the discussion is divided into two parts. The first part deals with the achievement of science learning while the second part is focused on the positive learning atmosphere.

*1. Learning Achievement in Science*

The result showed that students that learned through the 5E learning cycle with songs had a significantly higher science learning achievement score than the defined 70% criteria or the control group that was taught science using a traditional lecture method. This may result from the following two reasons.

Firstly, in the engagement stage (E1 stage), instructors gave an introduction to the lesson using songs to draw the students' attention and encourage their perception to the lesson that would be taught. The songs normally contained one main idea or principle, used repetition technique with short lyrics and eased the pace and tone to enhance the students' recognition. Instructors could give some questions in order to link to the next teaching stage as well.

Secondly, in the explanation stage (E3 stage), the instructors supervised the students in collecting information explored in the classroom, and then supervised them in analyzing, discussing, drawing and presenting their conclusions. Students were encouraged to discuss, shape and correct the content they had learned. After extracting the data, students came up with a conclusion, and then transformed the conclusion to the song under the instructor's supervision and support. Thus, the 5E learning cycle cooperate with songs had a positive effect on the students' achievement. This is in agreement with previous reports, where the 5E learning cycle with songs improved the students' learning in a physics classroom (Soomro et al., 2010), while students taught by the 5E learning cycle with argument mapping received a significantly better learning compared to the control group (Singhasena, 2009).

*2. Positive Learning Atmosphere*

The learning atmosphere in the classroom taught by the 5E learning cycle with songs was rated "*good*", based on viewing the class video records, and was better than that of the classroom that learned through the traditional lecture method. This may result from the fact that singing songs in the class contributed to a better learning atmosphere.

According to Dechakhup (1987), a positive learning atmosphere is necessary for in-class activities because it made such activities vivid and created relationship and co-operation in the classroom, where both the instructor and students were involved in creating a positive environment for learning. Moreover, Governor (2011) concluded that combining songs with activities in the classroom helped to improve the learning atmosphere. The songs could be used as an attention attracting tool, where the tone and rhythm of the songs had an effect on the mood and feeling of the students, making them excited and amused, or laugh. The positive learning atmosphere led to enthusiastic learning and enhanced the students' understanding of the scientific vocabulary because the key words in the lyrics were linked to illustrations. As a consequence, students improved their understanding in the lessons with the knowledge they learned from the songs. Not only was the positive learning atmosphere important for creating activities in the classroom, but it was also related to the level of the students' achievement.

O'Relly (1975) studied the relationship between the social and personal characteristics of students, focused on the learning achievements of 1,700 grade 9 and 10 students from 48 classrooms. Of the variables studied (Intelligence Quotient, academic achievement and learning atmosphere), the learning atmosphere accounted for 67% of the variance in the academic achievement. Thus, it was concluded that the classroom atmosphere was one of the most important factors that enhanced academic achievement and this social factor was more important than the personal characteristics of the students.

When songs were incorporated into the learning activities it led to a higher positive learning atmosphere. The important factors included the smoothness in teaching, students' participation, amusement, student-teacher interactions and a warm atmosphere in the classroom. Consequently, students in the classroom who learned within a positive learning atmosphere with songs showed higher academic performances.

**Suggestions**

*1. Application of the results*

In using songs to create learning activities and a positive learning atmosphere, the personal character and teaching style of the instructor should be taken into account. This is because whether the use of the 5E learning cycle with songs will succeed or not largely depends on the instructor's character and teaching style.

*2. Future study*

The success in using the 5E learning cycle with songs also largely depends on the selected songs as students of different ages are interested in different song types or

genres. If the songs used in the classroom are known and liked by the students, it is likely that they will lead to improved academic performances of the students. Therefore, future studies should also evaluate the students' learning retention.

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