US-China Education Review A, ISSN 2161-623X
January 2013, Vol. 3, No. 1, 10-18

# SoSTI Course: An Elective Science Course for Thai Upper Secondary School Non-science Students*

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This study is aimed to develop the interdisciplinary SoSTI (science of sound in traditional Thai musical instruments) course for Thai non-science upper secondary school students to study the students' attitudes toward science before and after studying from the course. The SoSTI course development is based on the interdisciplinary concept model and constructivist theory. The research study is divided into five phases: (1) pre-developing the course, (2) developing the course, (3) conducting the pilot study, (4) implementing and evaluating, and (5) analyzing data and writing the conclusion, respectively. The SoSTI course is an elective course corresponding to the Basic Education Core Curriculum B.E. 2551 (A.D. 2008). This course was conducted with 35 12th-grade non-science students in the second semester of the 2010 academic year at a school in Bangkok, Thailand, for a whole semester. The research instruments were students' attitude toward science questionnaire, and students' opinions toward the SoSTI course questionnaire. The results of this study presented that, after completing the SoSTI course, the students' attitudes toward science comparing before and after studying the SoSTI course were not significantly different at the .05 level. However, they have positive opinions toward the course.

*Keywords:* elective science course, non-science students, students' attitude toward science

## Introduction

The development of science curriculum is one of the most interesting fields in science education research. This is because science reflects the growth of every country and related to the daily life of every person. However, the progression of science always comes with the development of technology. Many of the developments have been affected the people to overlook something important which are the root of their own context, such as culture, art, and local wisdom. Keeping pace with the world of science and technology brings

*Acknowledgements: This work was financially supported by the Institute for Promotion of Teaching Science and Technology (IPST), Bangkok, Thailand. The authors would like to thank to the Thailand Center of Excellence in Physics (CHE), Science Education Center, and Srinakharinwirot University (SWU), Thailand, for all supports during the completion of this paper.

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more benefit to the nation like a tree spreading its branches to grow. Culture is comparable with the plant root and stalk to support those brunches. In Thailand, IPST (Institute for the Promotion of Teaching Science and Technology) has been continually developing Thai science curriculum since 1970 (IPST, 2002, p. 1). Later, under the theme "A science for all", science subject becomes more essential to all students (Klainin & Soydhurum, 2004). The National Science Curriculum Standards, the basic education curriculum 2001, states the characteristics of curriculum and teaching/learning in science. Firstly, science curriculum should have the connection among content, concepts, and cultural context. Moreover, the flexibility and diversity of the curriculum are also concerned. Secondly, science curriculum should support learners' thinking skills and learning abilities. For a particular community, integrating science with society, culture, and tradition is indispensable (The Ministry of Education, 2008). The learners' surrounding communities can support students to understand science in their own context and see the relation between science and the world situations (AAAS (American Association for the Advancement of Science), 1998, p. 126).

Thailand is a country that has its own unique cultural history. One thing that reflects the uniqueness of Thai arts and culture is traditional Thai music. Traditional Thai music has influenced the Thai people and presented the simplicity of the society. Traditional Thai music and musical instruments are assumed to be a valuable cultural heritage of Thailand from the past to present (Indhawong, 2003). Additionally, Thailand cultivates the youth of the nation to learn traditional Thai music and instruments since they were young (The Ministry of Education, 2008). This is guaranteed the familiarity and basic knowledge of the Thai youth towards Thai music. Thus, if we can design the science course integrating with students' familiar things like musical instruments, it will promote students' liking and interesting in science (Pruekpramool, C., Phonphok, N., White, O. L. & Musikul, K., 2011).

Moreover, it is arguable that music and science are intimately related. The science of sound and music shares some relationship in understanding sound and can present the basic ideas for investigating musical instruments scientifically (Vijayalakshmi, K., 2007). In addition, Eger, J. (2007), a musician, stated that physics and music are an interdisciplinary complement of each other (Tanrattanakula, J., 2007, p. 410). Browne (2007) additionally affirmed that the science of sound can easily understand with musical instruments. Musical instruments can provide many comprehensible examples in the topic of sound (Knight, 2004). For that reason, the researcher believes that using traditional Thai musical instruments will help students who are afraid of science to like science.

According to various students' learning styles, specifically considering to the upper secondary school non-science students, the core science curriculum cannot promote students' liking and interesting in science. Whether the non-science students like or dislike science, they are still required to enroll courses in science. This requirement certainly makes almost non-science students earn low GPA (grade point average) in science (Pruekpramool et al., 2011).

Consequently, the researcher was inspired to design a science course dealing with music, in order to make this course suitable for non-science upper secondary school students. In addition, the course corresponded to the basic core curriculum B.E. 2551 of Thailand (A.D. 2008). Besides, this course was an interdisciplinary work following the interdisciplinary concept model proposed by Jacobs (1989) which blended the science content from physics, chemistry and biology (sound and material concepts), music content (Traditional Thai musical instruments), mathematics (equations of sound wave), and human culture.

## Research Objectives

The objectives of this study are to develop the science of sound interdisciplinary course for non-science upper secondary school students by applying traditional Thai musical instruments and using integrated teaching approach and to compare students' attitude toward science before and after studying from the course.

### Participants

The participants of this study were 35 non-science students who were studying in Mathayomsuksa 6 (Grade 12) of a school in Bangkok, Thailand, in the second semester of 2010 academic year.

### Variables

Independent variable is: using the SoSTI (science of sound in traditional Thai musical instruments) course via integrated teaching approach.

Dependent variable is: students' attitudes toward science and students' opinion toward course.

## Methodology

The course development process is divided into five main phases by using the R & D (research and development) as the research design in this study.

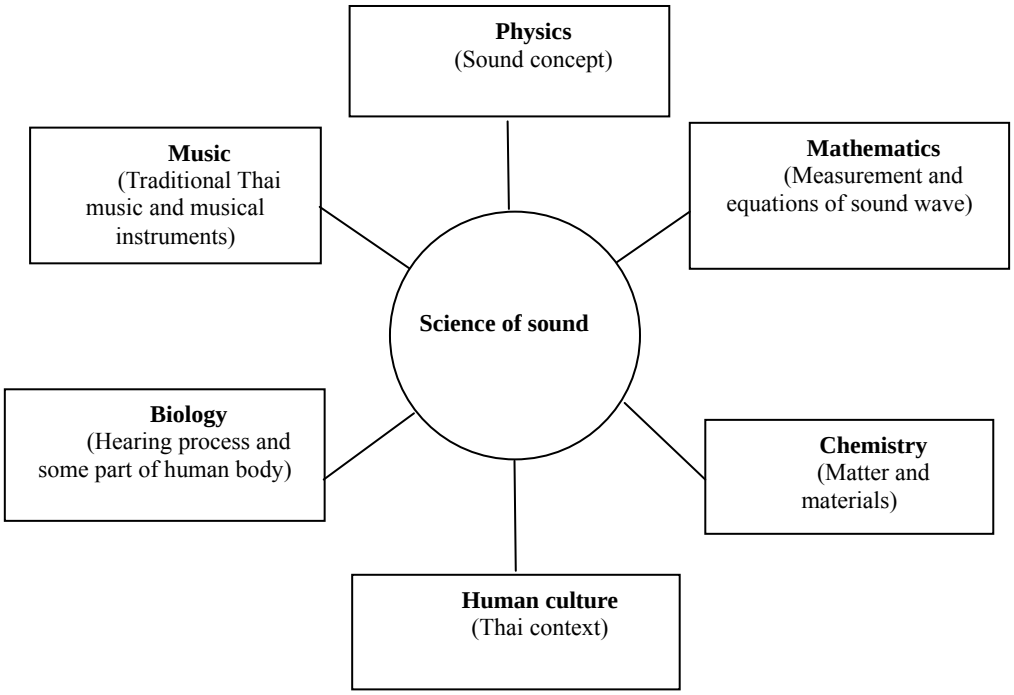


*Figure 1*. Interdisciplinary concept model of SoSTI course.

### Phase 1: Pre-developing the Course

The aim of this phase was to investigate the fundamental data and information about the science of sound, music, traditional Thai musical instruments, and the relationships among them. It was also designed to explore how non-science upper secondary school students think about science and traditional Thai musical instruments. This phase was divided into three steps:

(1) Step 1: Studying documents and related literatures;

(2) Step 2: Interviewing the guru of traditional Thai musical instruments;

(3) Step 3: Conducting a survey with non-science upper secondary school students about their opinions toward science and traditional Thai musical instruments.

**Phase 2: Developing the Course**

The researcher designed and developed a draft of the course, which is primarily composed of three important parts:

(1) Part 1: Developing course, outlining and creating the whole course structure by using seven steps of Taba's curriculum development (Taba, 1962, pp. 9-14) and the interdisciplinary concept model developed by Jacob (1989) to identify the organizing theme and content of the curriculum as shown in Figure 1.

The course content of the SoSTI course consists of:

(A) Introduction of the science of sound;

(B) Introduction of traditional Thai musical instruments (see Figure 2): (a) Stringed instruments: Saw-û-, Saw-dûa-ng, and Jàkhây-; (b) Wind instruments: Khlùi, Pì-nâw-k, and Pì-cháwa-; and (c) Percussion instruments: Gràp sây-pha-, Ránâ-t ày-k, Tà pho-n, Kháw-ng wong yài, and Chìng;


*Figure 2.* Traditional Thai musical instruments.

(C) The system of sound in traditional Thai musical instruments;

(D) The science of sound in traditional Thai stringed instruments;

(E) The science of sound in traditional Thai wind instruments;

(F) The science of sound in traditional Thai percussion instruments;

(G) Making traditional Thai musical instruments.

The researcher selected various instructional strategies or teaching approaches based on constructivist theory concerning appropriateness for non-science upper secondary school students.

(2) Part 2: Developing instructional materials which are the teacher's handbook and student's handbook for use in the course. Teacher's handbook and student's handbook followed the content of the course. The researcher created the lesson plans in teacher's handbook based on 5-E learning cycle;

(3) Part 3: Preparing research instruments:

(A) Student's attitude toward science questionnaire adapted from a SAI (scientific attitude inventory) II (Richard & Foy, 1997);

(BA) Students' opinion towards course questionnaire was created by the researcher.

**Phase 3: Conducting Pilot Study**

The pilot study of the SoSTI course was used with one classroom which composed of 55 non-science upper secondary school students selected by purposive sampling. These students were studying in Matthayomsuksa 5 (Grade 11) in the first semester of 2010 academic year.

**Phase 4: Implementation**

In the implementation phase, the researcher, as a teacher, conducted the SoSTI course to 35 students in the sample group which are non-science upper secondary school students selected by purposive sampling. These students were studying in Matthayomsuksa 6 (Grade 12) in the second semester of 2010 academic year at a school in Bangkok, Thailand.

**Phase 5: Analyzing Data and Conclusion**

Students' attitudes toward science and students' opinions toward the SoSTI course before and after completing the course was analyzed.

## Results

**Students' Attitudes Toward Science**

The researcher assessed students' attitudes toward science before and after completing the SoSTI course by using scientific attitude test adapted from SAI II (Richard & Foy, 1997) under the authorization. The researcher analyzed statistically by paired samples *t*-test and the results are revealed in Table 1.

Table 1

*Paired Sample T-test for Pretest and Posttest for Students' Attitudes Toward Science*

| Paired analysis | Paired differences | | | | | *t* | *df* | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std. deviation | Std. error mean | 95% Confidence interval of the difference | | | | |
| | | | | Lower | Upper | | | |
| Sum pretest and posttest students' scientific attitudes toward science | -0.09514 | 0.39559 | 0.06687 | -0.23103 | 0.04075 | -1.423 | 34 | 0.164 |

From Table 1, the *t*-value indicated that *t* equals absolute value of -1.423 at $\alpha = 0.05$ and degree of freedom of 34. The *t*-test scores presented that the mean scores are not significantly different at the 0.05 level. Therefore, the students' attitudes toward science are not explicitly change after they learned from the SoSTI course.

Table 2

*GPA of the Participants*

| GPA | Frequency | Percent (%) |
|---|---|---|
| 2.00–2.50 | 9 | 25.7 |
| 2.51–3.00 | 14 | 40.0 |
| 3.01–3.50 | 12 | 12.0 |
| 3.51–4.00 | - | 0.0 |
| Total | 35 | 100.0 |

Table 3

*Students' Opinions Toward the SoSTI Course*

| Item statements | *N* | Mean | Std. deviation | Data interpretation |
|---|---|---|---|---|
| Content | | | | |
| 1. Content is suitable for the level of students | 35 | 3.89 | 0.796 | Agree |
| 2. Content can be integrated to real life | 35 | 3.83 | 0.785 | Agree |
| 3. Content can promote students' awareness of the important of science | 35 | 3.77 | 0.910 | Agree |
| 4. Content can promote students' awareness in traditional Thai music and musical instruments | 35 | 4.29 | 0.750 | Agree |
| 5. The difficulty level of the content | 35 | 3.23 | 0.598 | Neutral |
| 6. The overall satisfaction to the content of the course | 35 | 4.06 | 0.802 | Satisfy |
| Learning Process | | | | |
| 1. Learning process is suitable for the level of students | 35 | 3.86 | 0.810 | Agree |
| 2. The activity can activate the learning of students | 35 | 3.80 | 0.833 | Agree |
| 3. The learning process can connect the theory into practices and actions | 35 | 3.66 | 0.639 | Agree |
| 4. The instructional materials and equipments are appropriate | 35 | 3.91 | 0.818 | Agree |
| 5. The classroom atmosphere is suitable for learning process | 35 | 3.66 | 0.838 | Agree |
| 6. The difficulty level of activities | 35 | 3.23 | 0.808 | Neutral |
| 7. The overall satisfaction to the learning process | 35 | 3.97 | 0.747 | Satisfy |
| Teacher's characteristic | | | | |
| 1. Teacher knew the content very well | 35 | 4.31 | 0.758 | Agree |
| 2. Teacher behaviors and manners in class are suitable | 35 | 4.34 | 0.639 | Agree |
| 3. Teacher dressed appropriately | 35 | 4.34 | 0.725 | Agree |
| 4. Teacher language used is suitable | 35 | 4.23 | 0.731 | Agree |
| 5. Teacher paid good attention and always cared for students | 35 | 4.23 | 0.808 | Agree |
| 6. Teacher always comes to the class on time | 35 | 4.57 | 0.655 | Strongly agree |
| 7. The overall satisfaction to the teacher | 35 | 4.43 | 0.655 | Satisfy |

**Student's Opinions Toward the SoSTI Course**

The students' opinions toward SoSTI course after studying was measured by using students' opinions toward SoSTI course questionnaire created by the researcher. The questionnaire was divided into two parts: the general information part and the students' opinions toward the SoSTI course after studying this course. The results can be seen in the following.

(1) Part 1: General information: The participants composed of 35 students (14 males and 21 females). They were studying a non-science major program in Matthayomsuksa 6 (Grade 12) in the second semester of the 2010 academic year from Rattanakosin Sompoch Bangkhen School, Bangkok, Thailand. Students' GPA can be seen in Table 2.

From Table 2, there are nine students (25.7%) have GPA between 2.00 and 2.50, 14 students (40.0%) have GPA between 2.51 and 3.00, 12 students (12.0%) have GPA between 3.01 and 3.50, and no one has GPA higher than 3.51;

(2) Part 2: Student's opinions toward the SoSTI course: This part was divided into three aspects, content, learning process, and teacher's characteristics, respectively. The researcher used the criterion scores to interpret the data. The results can be seen in the Table 3.

From Table 3, the results revealed that students have positive opinions toward the SoSTI course. Students were satisfied with the SoSTI course in all three aspects, content, learning process, and teacher's characteristics, respectively. The students thought that the contents and activities in the SoSTI course are understandable and not too difficult. Moreover, they enjoyed studying the course.

## Discussion

After completing the SoSTI course, students' attitudes toward science is not certainly changed. However, the students' attitude toward science is change in some items. Attitude is a part of human thinking, feeling, and doing in either positive or negative ways (Butler, 1999; Grote, 2005). For science area, attitudes toward science play an important role in success in science (George, 2000; Junck, 2002; Osborne, 2003; Prokop, Tuncer, & Chudá, 2007; Foley & McPhee, 2008). Attitudes toward science have relationship with students' achievements (Kan & Akbaş, 2006; Malaysia & Tan Yao Sua, 2007). In the same tone, Papanastasiou and Zembylas (2002) claimed that positive attitudes can promote higher achievement in science while low achievement in science came from students' negative attitudes toward science. However, students who have high achievement in science do not infer that they have positive attitudes toward science. For science education area, Osborne (2003) stated that attitudes toward science are one of the interesting issues to study. In order to evaluate students' attitudes toward science, there are few factors that influence students' attitudes toward science, gender, classroom or teacher factors, instructional strategies, and students' beliefs and perceptions about science (Osborne, 2003). Conversely, there are some research studies revealed that gender has no effect on students' attitudes toward science (Prokop et al., 2007; Glynn, Taasoobshirazi, & Brickman, 2007). It is arguable that if we need high achievement in science, we have to promote positive attitude toward science to the students. Foley and McPhee (2008) revealed that hands-on activities and various kinds of learning experiences can positively promote students' attitude toward science. In the same way, Adesoji (2008) stated that problem-solving method can also promote positive attitudes

toward science to the students.

According to the development of the science of sound in traditional Thai musical instruments interdisciplinary course for non-science upper secondary school students by using integrated teaching approach, this research was developed under the constructivist theory. The various instructional strategies and activities in the SoSTI course can help be students interested in science. The SoSTI course was created specifically for non-science upper secondary school students and they may or may not like science. However, non-science students learned many science courses, the difficulties in science still affect to the students (Cook & Mulvihill, 2008). From the questionnaire statistic results, there are some changes presented that the students' attitudes toward science have changed after they learned from the SoSTI course. Moreover, non-science students realized that learning through real life situations or materials will help them understand science better corresponding to the research study of Glynn et al. (2007), which revealed that the real world situation or familiar things will increase motivate students in learning science.

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