SoSTI Course: The Development of Science Course for Thai Upper Secondary School Non-science Students

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Abstract

The purposes of this study were to develop the Science of Sound in Traditional Thai Musical Instruments course (SoSTI course), an interdisciplinary one, for Thai non-science upper secondary school students and to study the students' attitudes toward science before and after stydying from the course. The SoSTI course development was based on interdisciplinary concept model proposed by Jacobs (1989) and constructivist

theory. The research study was divided into five phases, pre-developing the course, developing the course, conducting pilot study, implementation and evaluation and analyzing data and 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 to thirty five non-science students in 12th grade in second semester of 2010 academic year at Rattanakosinsompoch Bangkhen School, Bangkok, Thailand, for a whole semester. The research instruments were students' attitude toward science questionnaire, and students' opinions toward the SoSTI course questionnaire.

The findings of this study indicated that, after complete the SoSTI course, the students' attitudes toward science before and after completing the SoSTI course are not significantly different at the .05 level. However, students' attitudes toward science are significantly different at the .05 level by using item analysis. Besides, they have positive opinion toward the course.

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 often 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 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, the Institute for the Promotion of Teaching Science and Technology (IPST) has been continually developing Thai science curriculum since 1970. (IPST, 2002: 1). Later, under the theme 'A science for all', science subject become 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. Lastly, 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 to see the relation between science and the world situations (AAAS, 1998: 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 toward 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 (Chaninan, et al, 2011)

Moreover, it is arguable that music and science are intimately related. The science of sound and music share some relationship in understanding sound and can present the basic ideas for investigating musical instruments scientifically (Karri, 2007). In addition, Eger (2005), a musician, stated that physics and music are an interdisciplinary complement of each other (Tanrattanakula, 2007: 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 to help students who are afraid of science to like science.

According to various students' learning styles, specifically consider 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 grade point average (GPA) in science (Chaninan, 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 at Rattanakosinsompoch Bangkhen School, Bangkok, Thailand in the second semester of 2010 academic year.

Variables

Independent variable

Using the science of sound in traditional Thai musical instruments course (SoSTI course) via integrated teaching approach

Dependent variable

Students' attitude toward science and students' opinion toward course

Methodology

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

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 also was 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:

Part 1: Developing course outline and creating the whole course structure by using 7 steps of Taba's curriculum development (1962: 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.

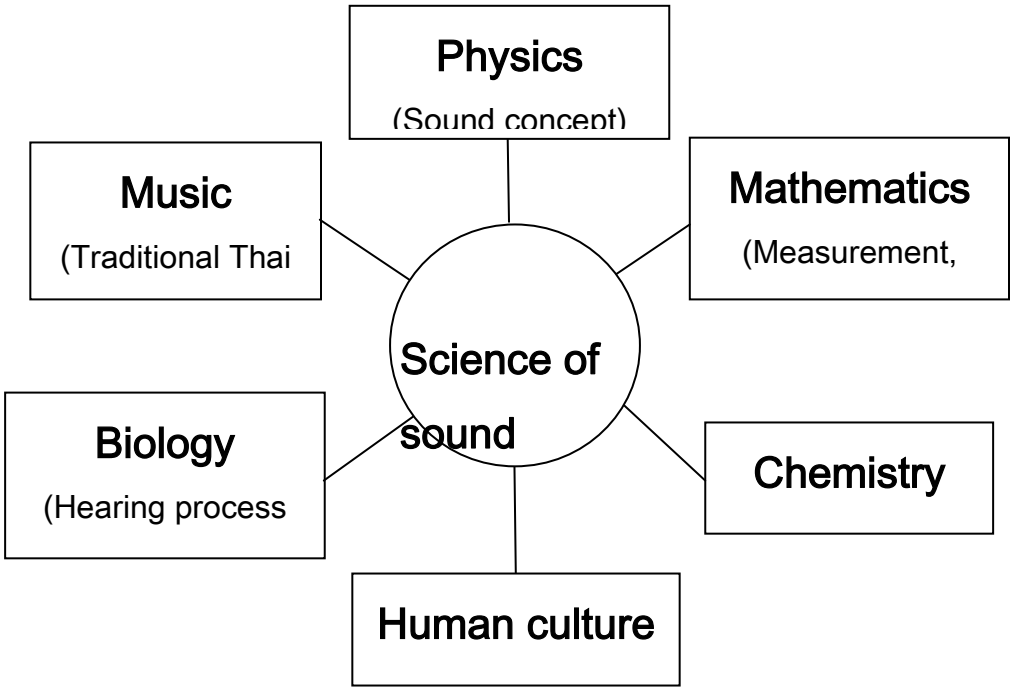

Figure 1 Interdisciplinary Concept Model of the science of sound in traditional Thai musical instruments course

The course content of the SoSTI course consists of;

1) Introduction of the science of sound
2) Introduction of traditional Thai musical instruments
   - Stringed instruments: Saw-û-, Saw-dûa-ng and Jàkhây-
   - Wind instruments: Khlùi, Pì-nâw-k and Pì-cháwa-
   - Percussion instruments: Gràp sây-pha-, Ránâ-t ày-k, Tà pho-n, Kháw-ng wong yài and Chìng

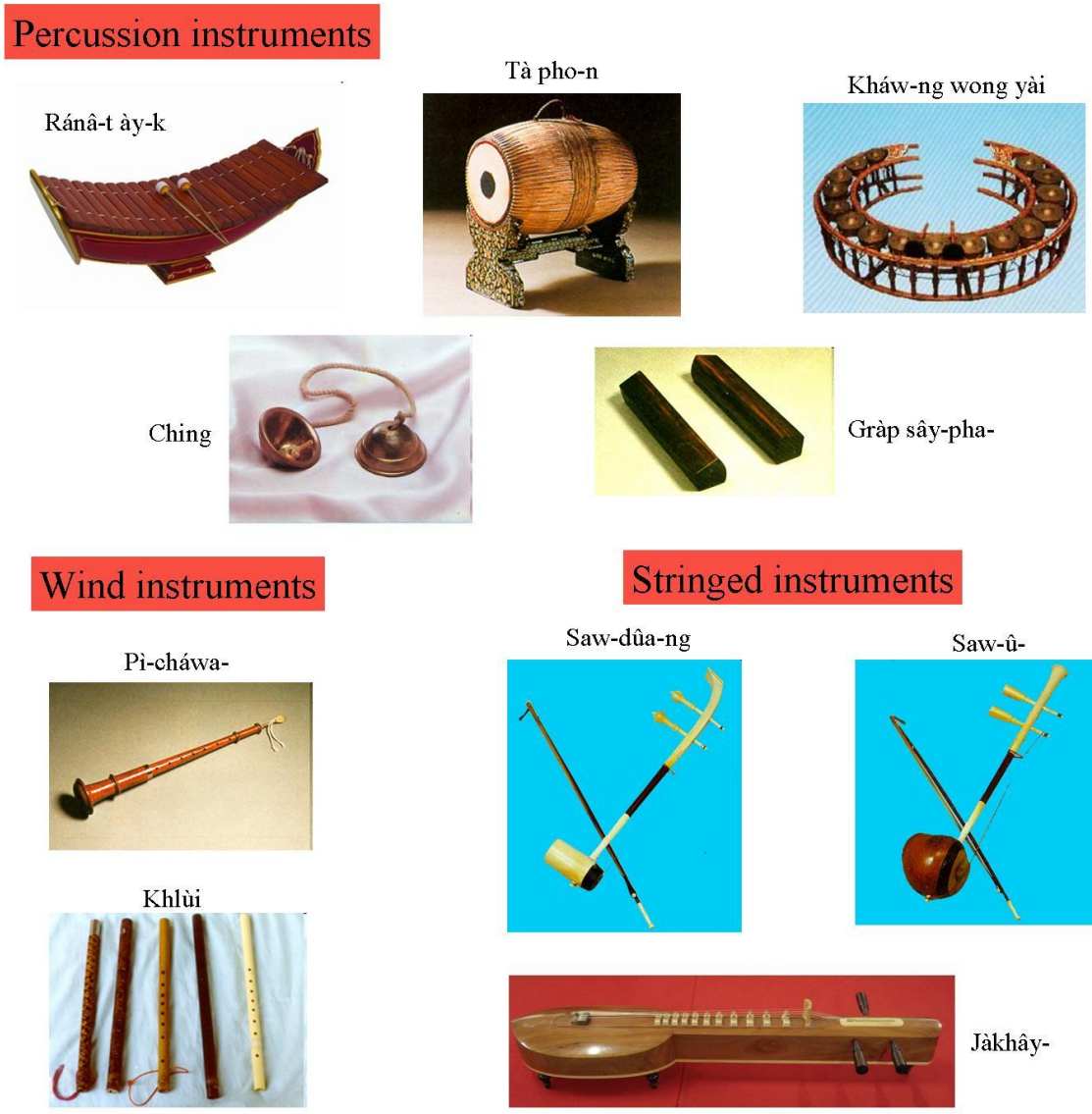

Figure 2 Traditional Thai musical instruments

3) The system of sound in traditional Thai musical instruments

4) The science of sound in traditional Thai stringed instruments

5) The science of sound in traditional Thai wind instruments

6) The science of sound in traditional Thai percussion instruments

7) 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.

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,

Part 3: Preparing research instruments

1. A Scientific Attitude Inventory (SAI II) to measure the student's attitude toward science adapted from Richard & Foy (1997).
2. Students' opinion toward 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 Rattanakosinsompoch Bangkhen School, Bangkok, Thailand.

Phase 5: Analyzing data and conclusion

Student's attitude toward science and students' opinions toward the SoSTI course before and after completing the course was analyzed by using SPSS program for window.

Results

Students' attitude toward science

The researcher assessed students' attitude toward science before and after completing the SoSTI course by using scientific attitude test adapted from Scientific Attitude Inventory (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' attitude 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 attitude toward science	-.09514	.39559	.06687	-.23103	.04075	-1.423	34	.164

From Table 1, the t-value indicated that t equals absolute value of - 1.423 at α=.05 and degree of freedom of 34.The t-test scores presented that the mean scores are not significantly different at the .05 level. Therefore, the students' attitude toward science is not explicitly change after they learned from the SoSTI course.

Furthermore, the researcher analyzed students' attitude toward science in each item of the test which composed of 40 items (N= 40) and the results can be seen in Table 2.

Table 2 The item analysis paired sample t-test for pretest and posttest for students' attitude 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			
Item analysis for pre and post-test scores	-.09600	.19235	.03041	-.15752	-.03448	-3.157	39	.003

From Table 2, the t-value indicated that t equals absolute value of - 3.157 at α=.05 and degree of freedom of 39. The t-value from indicated that students' attitude toward science before and after completing the SoSTI course are significantly different at the .05 level. The result of item analysis of the test revealed that the students' attitude toward science had increased but were not explicitly changed. Therefore, the students' attitude toward science is change after they learned in the SoSTI course.

Student's opinions toward the SoSTI course

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

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' Grade Point Average (GPA) can be seen in Table 3.

Table 32 Grade Point Average (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

From Table 3, there are 9 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.

Part 2: Student's opinions toward the SoSTI course

Part two of students' opinion toward the SoSTi course 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 4.

Table 4 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	.796	Agree
2. Content can be integrated to real life	35	3.83	.785	Agree
3. Content can promote	35	3.77	.910	Agree

Item statements	N	Mean	Std. Deviation	Data interpretation
students' awareness of the important of science				
4. Content can promote students' awareness in traditional Thai music and musical instruments	35	4.29	.750	Agree
5. The difficulty level of the content	35	3.23	.598	Neutral
6. The overall satisfaction to the content of the course	35	4.06	.802	Satisfy
Learning Process				
1. Learning process is suitable for the level of students	35	3.86	.810	Agree
2. The activity can activate the learning of students	35	3.80	.833	Agree
3. The learning process can connect the theory into practicing and actions	35	3.66	.639	Agree
4. The instructional materials and equipments are appropriate	35	3.91	.818	Agree
5. The classroom atmosphere is suitable for learning	35	3.66	.838	Agree

Item statements	N	Mean	Std. Deviation	Data interpretation
process				
6. The difficulty level of activities	35	3.23	.808	Neutral
7. The overall satisfaction to the learning process	35	3.97	.747	Satisfy
Teacher's characteristic				
1. Teacher knew the content very well	35	4.31	.758	Agree
2. Teacher behaviors and manners in class are suitable	35	4.34	.639	Agree
3. Teacher dressed appropriately	35	4.34	.725	Agree
4. Teacher language used is suitable	35	4.23	.731	Agree
5. Teacher pay good attention and always care for students	35	4.23	.808	Agree
6. Teacher always comes to the class on time	35	4.57	.655	Strongly Agree
7. The overall satisfaction to the teacher	35	4.43	.655	Satisfy

From Table 4, 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' attitude toward science is not certainly changed. However, the mean scores of students' attitude toward science are significantly different at the .05 level by using item analysis. Therefore, it is arguable that the students' attitudes toward science have changed after they learned from the SoSTI course.

Attitude is a part of human thinking, feeling, and doing in either positive or negative ways (Butler, B.M., 1999; Grote, 2005). For science area, attitude toward science has an important role in success in science (George, 2000; Junck, 2002; Osborne, 2003; Prokop, Tuncer and 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 & Zembylas (2002) claims 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 attitude toward science is one of the interesting issues to study. In order to evaluate students' attitudes toward science, there are few factors that influence students' attitude towards 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, Tuncer and Chudá, 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 & 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 students interest 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 and 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, Taasoobshirazi, and Brickman (2007) which revealed that the real world situation or familiar things will increase motivate students in learning science.

Acknowledgement

This work was financially supported by the Institute for Promotion of Teaching Science and Technology (IPST), Bangkok, Thailand. I 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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