

Teaching Physics in English: A Continuing Professional Development for Non-Native English-Speaking Teachers in Thailand

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Abstract

The purposes of this study were to develop a Continuing Professional Development (CPD) using English integrated science approach training curriculum and to promote physics teacher's efficacy to be expert teachers and be able to teach Physics in English. The quality of the curriculum was at a high level corresponding to the congruence scores of the overall curriculum and curriculum content which equaled 0.85 and 0.93, respectively. Besides, the appropriateness scores of the curriculum content, instructional materials and curriculum format equaled 0.89, 1.00 and 0.53, respectively. The participants were 22 Non-Native English-Speaking Teachers (NNESTs) who taught physics in the schools that attended the projects of "World-class standard school" and "English for Integrated Studies (EIS)" administered by the Ministry of Education, Thailand. Considering the participant's opinions from semi-structured interview and satisfaction assessment form, the results found that the participants' satisfaction was at a high level. From the follow up after training with 7 physics teachers, the results revealed that there were some concerns from teachers in several aspects based on their efficacy which were communication skills, choosing and using appropriate instructional materials, developing the physics lesson plan in English, dealing with classroom problems, and lifelong learning to improve their English skills and teaching. According to students' opinions, students that were taught by these trained teachers were satisfied with learning physics in English because this way of learning can promote their communication skills. However, before they start learning Physics in English, improving their language ability was the most important that they required.

Keywords: Continuing Professional Development, English integrated science approach, Non-Native English-Speaking Teachers

1. Introduction

Under the influence of the international countries towards science education in Thailand, in order to keep up with the dynamic change in education, Thailand needs to prepare the education personnel to be ready in every aspect. Besides, according to the incorporation of the Association of Southeast Asian Nations (ASEAN) Economic Community in 2015, Thailand is one of the countries becoming a part of this community. Therefore, developing and promoting Thai citizens to the international level is one of the main purposes of the country. The urgent need for Thailand in the process of preparation should be started in the education area. Education is the foundation of development in all areas and has an important role to promote the other areas in order to become a strong country (Boonyakiat, 2010). According to the educational reform focusing on human development in Thailand, the reform clearly corresponds to the National Scheme of Education of B.E. 2545-2559 (2002-2016) and the Eleventh National Economic and Social Development Plan (2012-2016) which frame the main idea of development emphasizing on "people-centered progress" related to the Philosophy of Sufficiency Economy, society, economy, environment and politics (Office of the National Education Commission, 2002, p. 8; Office of the National Economic and Social Development Board, 2011, p. viii). Preparing a country to compete in national and international levels, human resource development is the first essential key factor especially to enhance the quality of education of the country and to improve learners' competencies and the 21st century skills. Thus, the Office of the Basic Education Commission (OBEC) of Thailand has improved the curriculum and learning activities emphasis on teaching to be more productive and universal. Moreover, not only improving curriculum and learning activities, OBEC has also focused on thinking skills and English communication skills of Thai people to fulfill labor demand and workforce needs (The Upper Secondary Education Bureau, 2012). Regarding

the abovementioned, the Ministry of Education of Thailand has encouraged Thai learners to improve foreign language skills specifically in English by launching World-Class Standard School project.

The World-Class Standard School project is an urgent measure starting with 500 pilot schools in primary and secondary school levels since 2010 academic year. These schools have to develop their own school-based curriculum and stipulate the learning process in order to assist learners achieving the goals of the Basic Education Core Curriculum B.E. 2551 (A.D. 2008). In addition, the integration of additional learning areas conducting to the universal level and the identification of articulated goals of learning are the key factors to explicitly develop learners' skills. The purposes of the World-Class Standard School project are; 1) to develop learners' potential for becoming the quality global citizens, 2) to increase the quality of teaching and learning comparing to the international standard, and 3) to improve the quality of school management system (The Upper Secondary Education Bureau, 2011, p. 9). In this respect, the World-Class Standard School project creators have expected that the schools in this project will be able to proceed teaching and learning in English especially in science, mathematics and technology subjects. Not only the World-Class Standard School project but there is another project called "English for Integrated Studies" or EIS. As an EIS school, teaching science, mathematics and computer subjects in English is the first priority. The EIS project was started in 2004 at Sunthon Phu Pittaya school, Rayong province, Thailand. Teachers who attended this project are Non-Native English-Speaking Teachers (NNESTs) in Thailand which English is not the primary language. The results of the project revealed that this way of teaching can be used successfully considering the increasing of Ordinary National Education Test (ONET) scores of the students in Thailand. Moreover, students progressively have skills to develop the concrete concepts. These make this project has been widely accepted and has many schools participated in (Ngamsom, 2008).

Teacher is the main factor to achieve the purpose of teaching and learning. For Thailand, English is not the official language. For Thai Teachers, they should have the ability to communicate fluently in both Thai and English languages to reach the goal of the country. Besides, teachers should be able to develop and select the instructional materials correctly and properly. Therefore, by necessity, the development of teachers' abilities in communicating and transferring knowledge in English proficiently should be the prime aspect to promote for Thai teachers in Thailand (The Upper Secondary Education Bureau, 2010, p. 24). However, from a survey asking for opinions of teachers who participated in World - Class Standard School project and EIS school project using Self-SWOT analysis questionnaire and interview protocol, the results indicated that most teachers were not able to communicate in English in class. Teachers, less than 2 percent, were able to communicate in English in the classroom throughout the period. In addition, most teachers were not able to develop or select the appropriate instructional materials for content knowledge and learning. The main limitations were language barrier and teachers lack confidence to communicate in English both in speaking and writing. Furthermore, teachers did not know the proper techniques of teaching and learning dealing with Thai students who also had difficulty in communicating in English as well (Dahsah, Phonphok, Panyain, & Coll, 2012).

As mentioned above, teachers must be able to communicate in English fluently. However, the most important thing is that teachers need to correctly communicate the content knowledge particularly in science concepts. Science is the basis of life. The Office of the National Education Commission of Thailand (2002, p. 17) stated that science and technology are the foundation for all Thai citizens to be educated. Moreover, we need to promote and encourage those who already have knowledge and talent in science and technology with the full potential in order to have the ability to compete with other countries in the future. Physics is a branch of science and is the foundation of scientific knowledge in other fields. Besides, Physics can be applied to daily life situations of learners and leads to better conceptual understanding and the complicated concepts (Matthews, 1997; Sadler & Tai, 2001; The Institute for the Promotion of Teaching Science and Technology, 2010, p. 88). Thus, teaching and learning in English should start from Physics concepts and Physics teachers which are the important factors to further understanding in other fields of science.

The learning theory used in this study comes from Malcolm S. Knowles's theory of Andragogy or adult learning theory. Knowles (1980, pp. 44-45) proposed the characteristics of adult learners into four assumptions.

".....1) their self-concept moves from one of being a dependent personality toward being a self-directed human being; 2) they accumulate a growing reservoir of experience that becomes an increasingly rich resource for learning; 3) their readiness to learn becomes oriented increasingly to the developmental tasks of their social roles; and 4) their time perspective changes from one of postponed application of knowledge to immediacy of application, and accordingly, their orientation toward learning shifts from one of subject-centeredness to one of performance-centeredness" (Knowles, 1980, pp. 44-45).

Consequently, learning management for adult learners must be suitably prepared, for examples, teaching and learning models, location and time, etc. Additionally, the abilities to learn of adult learners typically require a step-by-step approach and depend on individual potential. The key elements that make individuals able to learn are learners, stimulus and response combining with learning processes that are related to the brain process. This learning process is composed of eight phases which are; 1) Motivation Phase, 2) Apprehending Phase, 3) Acquisition Phase, 4) Retention Phase, 5) Recall Phase, 6) Generalization Phase, 7) Performance Phase and 8) Feedback Phase (Gagne, 1996, pp. 138-150 cited by Kerdpermpul, 2010). Similarly, learning theory and process are required to correspond with the three domains of learning which are cognitive, affective and psychomotor domains as well (Bloom, 1981, pp. 40-43 cited by Kerdpermpul, 2010). The Continuing Professional Development (CPD) is a good way to develop teachers' scientific knowledge and Pedagogy Content Knowledge or PCK (Fraser, 2010, pp. 92-96; Yuen, 2012, p. 387). Additionally, CPD not only improves teachers' teaching capability but CPD also encourages teachers to share their knowledge in their communities and organizations as well. Moreover, CPD for teachers importantly needs to be consisted with the contexts and exactly meets the needs of teachers and also the country's policy (Yuen, 2012, p. 387).

Researchers realize the importance of the policies of the country to enhance learning in order to reach a universal standard. However, the development of teachers' efficacy to be able to teach effectively is an important and urgent factor and needs to be developed properly and systematically. The process of development also requires corresponding learning theory and learning process. Then, as aforementioned, the Continuing Professional Development (CPD) using English integrated science approach training curriculum was generated. The purposes of this study were to develop expert teachers to be able to teach physics using English as a medium of teaching and to study physics teachers' views toward the program and teaching physics in English as well. Moreover, this study will be useful for applying to other scientific disciplines in the further study.

2. Research Objectives

The purposes of this study were as follows;

- (1) To develop Continuing Professional Development (CPD) using English integrated science approach training curriculum.
- (2) To develop expert teachers to be able to teach physics using English as a medium of teaching.
- (3) To study Physics teachers' satisfactions toward the training curriculum.
- (4) To study students' opinions and satisfactions toward teachers who teach them physics in English.

3. Participants

The participants in this research were 22 Non-Native English-Speaking Teachers (NNESTs) who presently teach the concepts of physics and their schools had participated in the World-Class Standard School project and EIS school project in Thailand. The participants were interested in the training curriculum and voluntarily applied for training in this program by themselves.

4. Research Variables

Independent variable is implementing of the CPD using English integrated science approach training curriculum for physics teachers in Thailand.

Dependent variables are as follows;

- (1) Physics teachers' efficacies in transferring knowledge in English and selecting proper instructional materials.
- (2) Physics teachers' satisfactions toward the training curriculum.
- (3) Students' opinions and satisfactions toward teachers who teach them physics in English.

5. Research Methodology

The training curriculum was developed based on the theory of Andragogy proposed by Malcolm S. Knowles (1980, pp. 44-45) and learning process proposed by Robert M. Gagne (1996, pp. 138-150 cited by Kerdpermpoon, B., 2010). The development of training curriculum is divided into two major phases using Research and Development (R&D) as a research design. The summary of research methodology is revealed in Figure 1.

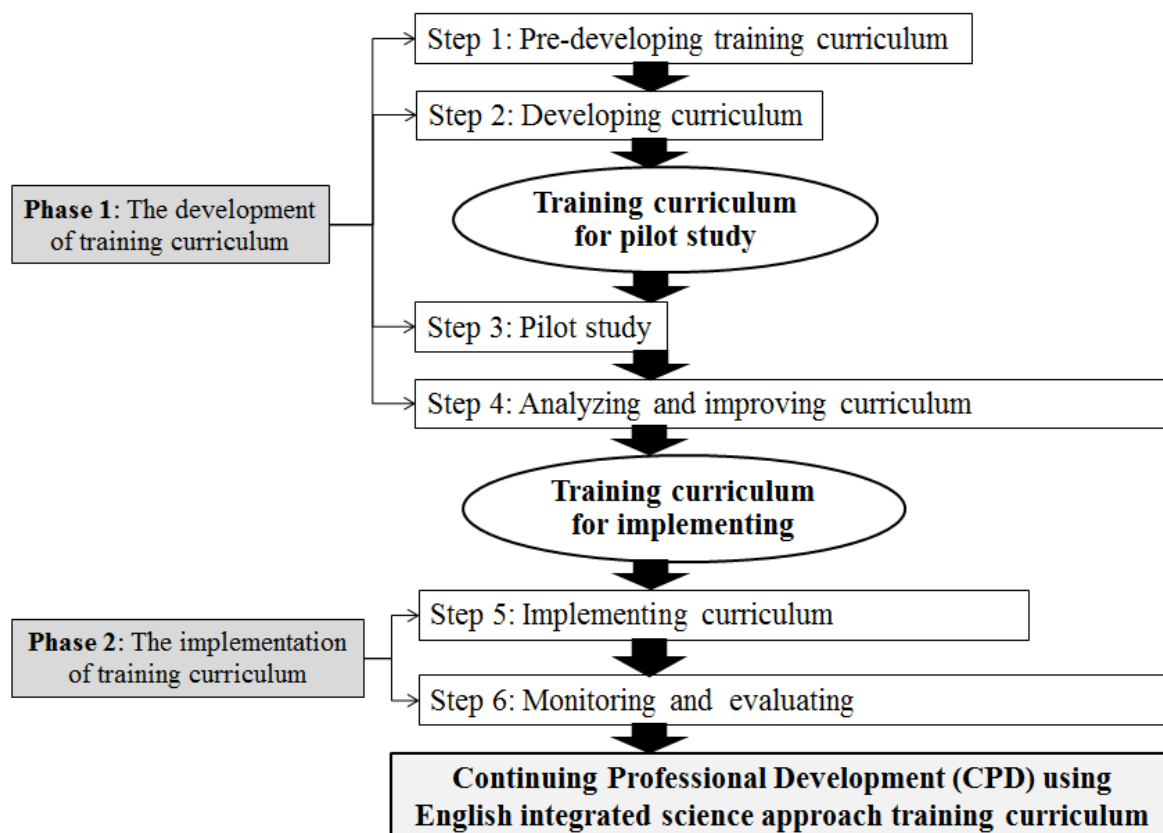


Figure 1. The summary of research methodology

Phase 1: The development of training curriculum

Step 1: Pre-developing training curriculum

The preparation of training curriculum development using a CPD program English integrated science approach for physics teachers aimed to study related literatures including basic information such as curriculum development management, physics teaching and learning, learning theory and process, teaching for non-native English speaking teachers etc. to be the rudimentary information for this research study.

Step 2: Developing curriculum

5.1 Researchers Design and Develop Structure of Training Curriculum, Curriculum Outlines, and Research Instruments

The development of structure of training curriculum was created based on Taba's curriculum development (Taba, 1962, pp. 9-14) as follows;

- (1) Diagnosis of needs: Researchers analyzed the data from Step 1 and summarized the needs of training curriculum development.
- (2) Formulating of objectives: Researchers identified objectives of training curriculum by considering the correspondence between the needs of training curriculum and policies of the country.
- (3) Selecting of content: Researchers identified the content used in training curriculum by literally considering the correspondence among the needs of training curriculum, policies of the country, and the true competency of participants.
- (4) Organizing of content: Researchers identified the content used in training curriculum and plan for the order of the content and time spending for each topic in the content.
- (5) Selecting of learning experiences: Researchers designed learning experience and learning activities used in the curriculum to suit with the participants.

(6) Organizing of learning experiences: Researchers used several learning strategies by emphasizing on the participants' learning styles. The participants had to construct their own knowledge through hands-on activities.

(7) Determining of what to evaluate: Researchers created the evaluation form to evaluate content validity and internal congruency of training curriculum by considering the Index of Congruence (IOC) from three experts.

5.2 Researchers Make a Handbook of Training Curriculum Following the Identified Course Structure and Content. Evaluate the Quality of the Training Curriculum by Three Experts Focusing on Content Validity, Internal Congruency and Appropriateness of Training Curriculum

Scope of the content

The training curriculum using a CPD program English integrated science approach for physics teachers in Thailand has created and designed to be a four-day workshop. The content in this curriculum consisted of;

- Guideline for teaching physics in English
- Writing the lesson plans
- Teaching physics in English demonstration 1
- Teaching physics in English demonstration 2
- Microteaching and reflections

5.3 Researchers Develop Research Instruments Which Are Semi-Structured Interview and Physics Teachers' Satisfactions toward the Training Curriculum Questionnaire. The Criterion of the Questionnaire is Divided into Five Levels Using Likert Scale

Step 3: Pilot study

Researchers revised the training curriculum from the feedbacks of three experts on content validity, internal congruency and appropriateness of training curriculum. The training curriculum for a pilot study was used by training 20 physics teachers in secondary school level in Kalasin province, Thailand. This training was a four-day workshop and operated by 8 staffs.

Step 4: Analyzing and improving the curriculum

After a pilot study, data obtained from semi-structured interviews, Physics teachers' satisfactions toward the training curriculum questionnaire and also the recommendations of the experts after the pilot study were analyzed quantitatively and qualitatively. The results of the training curriculum from pilot study were used to reflect the problems occurred during the workshop and to improve the training curriculum before the implementation.

Phase 2: The implementation of training curriculum

Step 5: Implementing curriculum

Researchers implemented the training curriculum developed from Phase 1 to 22 non-native English-speaking teachers who currently teach the concepts of physics. Teachers from across the country were interested in the workshop and applied for training in this four-day workshop by themselves. After completing the workshop, the participants had to work in pair in order to design learning activities and prepared the lesson plans written in English together by pairing with a teacher at the same or a nearby school. Each pair cooperatively designed learning activities and wrote the lesson plans together. Then, the first teacher conducted the lesson plan to the classroom. The second teacher observed the first teacher when he/she was teaching. After teaching completely, these two teachers reflected and shared their comments and feedback to improve activities and lesson plans together. Afterward, the second teacher conducted the improved lesson plan to the classroom and the first teacher was the one who observed the classroom. Two teachers reflected and shared their comments and feedback again through the process of lesson study which was composed of 3 steps, 1) preparation, 2) actual class and 3) class review sessions (Baba, 2007, pp. 1-2). Each pair of teachers must be performed at least two lesson plans that were taught in English in second semester of 2012 academic year.

Step 6: Monitoring and evaluating

Monitoring and evaluating of the training curriculum were conducted to monitor and evaluate both during the workshop and after the workshop.

- (1) Monitoring and evaluating of the training curriculum during the workshop

This step was to evaluate the participants' satisfactions toward the training curriculum using questionnaire created by researchers from Phase 1.

(2) The follow-up evaluation

The follow-up evaluation was carried out monitoring and evaluating of 7 participants who volunteered themselves for the follow-up process. The researchers observed their class in schools focusing on three aspects as follows;

1) Observation of teaching and learning in the classroom

Two researchers had observed teachers' classes. Each person performed teaching in 1-2 periods. Researchers evaluated Physics teachers' efficacies in transferring knowledge in English, the accuracy of the content and language, teaching confidence, and also students' behaviors and participations in the classroom.

2) Evaluations of lesson plans and worksheets

Researchers had evaluated all teaching documents, for examples, lesson plans, worksheet etc. developed by two teachers who work in pair. Researchers also checked the accuracy of the content and language, and also the appropriateness of teaching and learning strategies as well.

3) Conducting semi-structured interviews

Semi-structured interviews were conducted to teachers and students in order to ask for the overall of the preparation of teaching, feelings or opinions toward teaching Physics in English, the benefits and problems when using this way of teaching and learning, respectively using Focus group method.

6. Results

The result of this study will be presented as 2 phases; the development of training curriculum and the implementation of training curriculum as follows.

Phase 1: The development of training curriculum

The Quality of a Continuing Professional Development (CPD)

The quality of the training curriculum mainly considered from the internal congruence from three experts. The interview data from the pilot study was a secondary data. The quality was considered in 3 dimensions; the congruence of the curriculum, the congruence of the curriculum contents, and the appropriateness of the overall curriculum.

The results revealed that the congruence score of the overall curriculum equaled 0.85 as shown in Table 1.

Table 1. The congruence score of curriculum from three experts

Items	No. of the experts (N=3)			The Congruence Score
	Congruence	Not sure	Not congruence	
1. The current problems, the importance and the principle of the curriculum are consistent.	3	-	-	1.00
2. The current problems, the importance and the objectives of the curriculum are consistent.	2	1	-	0.66
3. The principle and the objectives of the curriculum are consistent.	2	1	-	0.66
4. The objective and learning experiences of the curriculum are consistent.	2	1	-	0.66
5. The curriculum is consistent with the context and the needs of the country.	3	-	-	1.00
6. The curriculum is integrated among English, Physics, and the appropriate learning experiences.	3	-	-	1.00
7. The curriculum is practical.	3	-	-	1.00
The overall congruence score				0.85

The curriculum content composed of; 1) Guideline for teaching physics in English, 2) Writing the lesson plans, 3) Teaching Physics in English demonstration 1, 4) Teaching physics in English demonstration 2, and 5) Microteaching and reflections. The congruence score of curriculum content equaled 0.93 which was a very high level as shown in Table 2.

Table 2. The congruence score of curriculum content from three experts

Content	No. of the expert (N=3)			The congruence score
	Congruence	Not sure	Not congruence	
1) Guideline for teaching physics in English	3	-	-	1.00
2) Writing the lesson plans	3	-	-	1.00
3) Teaching Physics in English demonstration 1	3	-	-	1.00
4) Teaching physics in English demonstration 2	3	-	-	1.00
5) Microteaching and reflections.	2	1	-	0.66
The overall congruence score				0.93

Considering the appropriateness of overall curriculum by three experts, the results found that the appropriateness score of the curriculum content equaled 0.89. The appropriateness score of the instructional materials and learning documents equaled 1.00. And the appropriateness score of the curriculum format and template equaled 0.53. The appropriateness of overall curriculum was a very high level as shown in Table 3-5.

Table 3. The congruence score of the appropriateness of content from three experts

Items	No. of the expert (N=3)			The congruence score
	Congruence	Not sure	Not congruence	
1. The content is accurate.	3	-	-	1.00
2. The sequence of the content is appropriate.	1	2	-	0.33
3. Pictures, graphs, tables are clear, accurate, and understandable.	3	-	-	1.00
4. Specific vocabulary is appropriate with participants.	3	-	-	1.00
5. The content quantity is appropriate.	3	-	-	1.00
6. The content is useful and practical.	3	-	-	1.00
The overall congruence score				0.89

Table 4. The congruence score of the appropriateness of learning materials from three experts

Contents	No. of the expert (N=3)			The congruence score
	Congruence	Not sure	Not congruence	
1. Learning materials and learning experiences are consistent.	3	-	-	1.00
2. Worksheets, activity sheets are appropriate with learning experiences and content.	3	-	-	1.00
3. Content is consistent with the time and participants.	3	-	-	1.00
The overall congruence score				1.00

Table 5. The congruence score of the appropriateness of the curriculum format and template from three experts

Contents	No. of the expert (N=3)			The congruence score
	Congruence	Not sure	Not congruence	
1. The font size is appropriate.	3	-	-	1.00
2. The size of curriculum book is appropriate.	3	-	-	1.00
3. The table of content is clear and easy to find the content.	1	1	1	0.00
4. The curriculum book is interesting	1	2	-	0.33
5. Pictures are appropriate.	1	2	-	0.33
The overall congruence score				0.53

The participants' satisfaction of a Continuing Professional Development (CPD) from Pilot study.

According to the pilot study of the curriculum, considering the participants' opinions from semi-structured interview and satisfaction assessment form, the results found that the participants needed more time for writing lesson plan and designing learning activity. In addition, the curriculum documentation was unattractive and lack of the clarity on the part of page and content. All results were the fundamental information needed to improve the development of a CPD training curriculum for Physics teachers by using English integrated science approach for the further study as can be seen in Table 6.

Table 6. The participants' satisfaction of a CPD training curriculum from Pilot study

Items	levels of satisfaction					Average (Percentages)
	5	4	3	2	1	
1. The site of workshop is appropriate.	68.2	27.3	4.5	-	-	4.64 (92.8)
2. The duration of workshop is appropriate.	36.4	59.1	4.5	-	-	4.32 (86.0)
3. The workshop is comfortable.	81.8	18.2	-	-	-	4.82 (96.4)
4. Lunch and coffee break are appropriate.	81.8	18.2	-	-	-	4.82 (96.4)
5. Learning materials and audio visual equipment are appropriate.	72.7	27.3	-	-	-	4.73 (94.6)
6. The workshop content and objective are consistent.	68.2	31.8	-	-	-	4.68 (93.6)
7. The trainers have a strong content.	90.9	9.1	-	-	-	4.91 (98.2)
8. The uses of techniques and communication are appropriate.	59.1	40.9	-	-	-	4.59 (91.8)
9. The trainers answer question clearly.	81.8	18.2	-	-	-	4.82 (96.4)
10. The workshop materials are useful.	72.7	22.7	4.5	-	-	4.68 (93.6)
11. The participants can write a lesson plan in English and design the activity.	27.3	40.9	31.8	-	-	3.95 (79.0)
12. The participants can apply and can be the expert teacher.	40.9	54.5	4.5	-	-	4.36 (87.2)
13. Overall of the workshop is appropriate.	77.3	22.7	-	-	-	4.77 (95.4)
Average.						4.62(92.4)

Phase 2: The implementation of training curriculum

In this phase, Physics teachers' efficacies and satisfactions with a CPD program and students' satisfaction will be focused.

Physics teacher's efficacies

After the workshop with seven physics teachers, the evaluation of lesson plan, classroom observation, and the interview data were considered to describe teachers' efficacies. The researchers found that physics teacher's efficacies divided into communication skills, choosing and using appropriate instructional materials, developing physics lesson plan in English, dealing with classroom problems, and lifelong learning for improve their English skills and teaching. The details are below.

-Communication skills

Most of Physics teachers were able to communicate with students with a classroom language in English. However, for academic language, the difficulty had been explicitly shown while they were performing their teaching. During the class, teachers regularly read from the book or PowerPoint presentation that they created. As one of the teachers said *“the slide of the presentation clearly helped me for using the academic language in English in Physics classroom.”*

-Choosing and using appropriate instructional materials

Most of the teachers were able to choose and use the appropriate materials and technology corresponding to specific physics contents. As one of the teachers mentioned that *“the simulation can make the students understand better and it is interesting”*. Another teacher said that *“the learning material such as video is really helpful and be able to help the students understand better”*.

-Developing physics lesson plans in English

Physics teachers were able to develop physics lesson plans in English with all components of the lesson plan including worksheets and activity sheets as well. However, during the process of developing, the teachers had a difficult time writing the lesson plans in English. The main reason was because of the language barrier.

-Dealing with classroom problems

Physics teachers were able to deal with classroom problems very well especially when the students were facing a hard time understanding what teachers speak. The teachers then repeated. In addition, if the students still did not understand, teachers used Thai language in order to assure that students understand clearly. As one teacher said *“during the class, teachers need to observe students’ faces at the same time to confirm that students are at the same point and understanding in the correct way. If they do not understand, teachers need to speak again or using Thai language to clarify their understanding”*.

-Lifelong learning for improving their English skills and teaching.

From the interview, we found that Physics teachers had more confidence to teach Physics in English because they practiced while they were in the training program. As one of the teachers responded that *“I have learned a lot from the workshop especially writing lesson plans in English make me had more confident to teach Physics in English”*.

Physics teachers’ satisfactions of a CPD training program

From the participants’ satisfaction with the training program, the researcher discovered that most of the participants (96.2%) were satisfied considering the overall program (4.81 out of 5.00). Most of the participants (93.8%, 93.8% and 92.6%, respectively) were satisfied with the trainers’ ability in transferring knowledge (4.69 out of 5.00), the usefulness of training activities (4.69 out of 5.00 and thought that training activities were interesting (about 4.63 out of 5.00). Most of the participants thought that the level of understanding about teaching Physics in English before attending the training was in the low level (about 2.69 out of 5.00). After attending the training program, most of the participants (83.8%) thought that the level of understanding about teaching Physics in English had increased (4.19 out of 5.00). The results can be seen in Table 7.

Table 7. The participants’ satisfaction of a CPD training program from implementation

Items	The levels of satisfactions					Average (Percentages)
	5	4	3	2	1	
1.Trainers’ ability in transferring knowledge.	68.8	31.2	-	-	-	4.69 (93.8)
2. The activities are useful.	68.8	31.2	-	-	-	4.69 (93.8)
3. The activities are interesting.	62.5	37.5	-	-	-	4.63 (92.6)
4. The level of understanding about teaching Physics in English before attending the training program.	18.7	-	31.3	31.3	18.7	2.69 (53.8)
5. The level of understanding about teaching Physics in English after attending the training program.	50.0	25.0	18.7	16.3	-	4.19 (83.8)
6. The overall satisfaction.	81.2	18.8	-	-	-	4.81 (96.2)

Students’ opinions and satisfactions toward learning physics in English

Semi-structured interviews were conducted for students using focus group method asking students’ opinions and feelings toward learning Physics in English. The data can be summarized in 3 points of view as follows;

-Students were satisfied with learning physics in English because this way of teaching was able to promote their communication skills especially in English. Moreover, it helped students learn more new vocabulary in English. As one student said *“learning physics in English could make me have more interest in learning and convince me to know more about new words”*.

-Students were satisfied with learning physics in English, however, improving their language ability was still the most important because they thought that their English skills were weak. As one student’s opinion stated that *“before we start learning something in English and English is not our official language, I think that we need to start from the basic by having strong English background first for both teachers and students. If not, we will have more troubles in understanding the concepts”*.

-Students were satisfied with learning physics in English. The essential reason of students came from Physics textbook and learning materials. These materials helped students to have greater understanding. As one student said *“the book is in English. This will help us have deeper understanding and more universal comparing to study in Thai”*. Corresponding to another student, *“the learning materials are mostly from the internet such as video clips. Teacher will tell us to study from it and it is really helpful for learning”*.

7. Conclusion and Discussion

To step into the Association of Southeast Asian Nations (ASEAN) Economic Community in 2015, the Ministry of Education of Thailand has a policy to prepare the students to be a part of ASEAN Economic Community (AEC) and one of the most important policies is to promote and support teaching and learning in English. Currently, there are over 500 schools in primary and secondary school levels have joined the World-Class Standard School project and started providing teaching and learning in English (The Upper Secondary Education Bureau, 2010). Teaching and learning science in English is a challenge for not only the counties in the ASEAN community (Selamat, Esa, Saad, & Atim, 2011) but this is also a challenge for all non-English speaking countries as well (Hudson, 2009; Ferreira, 2011; Mokiwa & Msila, 2013). Moreover, for English-speaking country such as Canada, the literature revealed that there are problems in teaching science in the classroom for English as a Second Language or ESL students as well. Although, teachers can speak English fluently, it is found that ESL students have a problem to understand the language. Besides, they come to the class with their prior knowledge and different contexts depending on their home countries. These may cause students the problems about integrating new knowledge to their prior knowledge and have affected directly to attitudes towards science of the students (Buck, 2000; Shaffer, 2007, pp. 3-7).

The purposes of the study were to promote physics teacher’s efficacy to be expert teachers and be able to teach Physics in English using a CPD English integrated science approach training curriculum. The development process was divided into 2 phases; 1) the development of training curriculum and 2) the implementation of training curriculum including the follow up. The results from phase 1 revealed that the quality of the curriculum considered from the internal congruence from three experts were consistent in all aspects. However, the curriculum documentation is unattractive and lack of the clarity on the part of page and content. The results from phase 2 indicated that the participants’ satisfactions of a CPD program toward overall aspects of the training program, trainers’ ability in transferring knowledge and the usefulness of activities were in the high level. Moreover, the participants gained more knowledge about teaching Physics in English after training which consisted with the study of Ngamsom, S. (2006). From the follow up after the workshop with 7 physics teachers, their responses show that physics teachers can use the classroom language with students in English. However, for academic language, teachers still read from the books and the presentations. Likewise, from survey research considering English communication skills of Thai teachers and students, the results revealed that skills of both teachers and students are not quite well (Dahsah, Phonphok, Panyain, & Coll, 2012). As well, research in Malaysia, found that teachers could not fluently explain science content in English but could explain very well in National language (Hudson, 2009, p. 168; Selamat, Esa, Saad, & Atim, 2011, p. 8). There are some teachers obviously fluent in English, however, students do not understand while using English as a medium of teaching and learning (Hudson, 2009, p. 168). Contradiction also happened in South Africa, students not only communicate in English but they also communicate in the classroom with their official languages which composed of 11 languages (Ferreira, 2011, p. 102). Moreover, a survey research additionally revealed that Thai science teachers had no confidence to teach in English specifically in discussion session in the classroom. In addition, writing lesson plans including worksheet, activity sheet, and other instructional materials in English obviously have affected teachers’ efficacies of their teaching (Dahsah, Phonphok, Panyain, & Coll, 2012).

Although, lacking English skills is one of the obvious problems of Physics teachers, the research results showed that physics teachers were able to choose and use appropriate instructional materials with a specific content in

English and help the students understand Physics content better. This result corresponded to the Upper Secondary Education Bureau (2012) which stated that the appropriate and various kinds of instructional materials can help students understand deeply in science concepts. Moreover, Physics teachers can develop physics lesson plan in English with all components of the lesson plan including worksheets and activity sheets after teachers joined and trained in the CPD training program. Besides, Physics teachers can deal with classroom problems very well especially when the students did not understand what teachers speak, the teachers will speak again in English or in Thai language. This technique is called code switching for communication in the classroom (Ferreira, 2011, p. 103) and helps for some scientific concepts which are abstract and difficult to explain to the students who are not proficient with the language (Ferreira, 2011, p. 108). The code switching technique is also used to confirm that the student has really learned those concepts (Mokiwa & Msila, 2013, p. 55). However, learning this way is an opportunity for students to develop their English skills (Shaffer, 2007, p. 15). From the literature review, some research has shown that teaching science in English helps students to improve their English skills and gains better grades and scores in English subject (Selamat, Esa, Saad, & Atim, 2011, p. 7; Nor, Aziz, & Jusoff, 2011, p. 38). Corresponding to students' opinions toward learning Physics in English from semi-structured interviews through focus group method, students, who have studied Physics subject in English from teachers in this CPD training program, revealed that this way of teaching can promote their communication skills especially in English and can improve their language ability. The essential reason of the progress of students' English ability comes from Physics textbook and learning materials. These materials will help students have greater understanding. However, some research has indicated that textbooks which were not written in the students' mother tongue language. Students may not understand all concepts and miss some parts of the concepts (Ferreira, 2011, p. 108). In the meantime, cultural and context backgrounds of the students will also affect to their learning. Teachers need to guide students while using textbooks in order to suit with students from different backgrounds (Hudson, 2009, p. 168; Ferreira, 2011, p. 109).

For the development of English skills of teachers and students when English is a medium of teaching and learning, for teachers, reading from various sources such as articles, magazines, newspaper etc. will allow teachers gradually improve grammar, vocabulary and correct pronunciation. More importantly, teachers need to force themselves to speak English or to create an English community in schools or via communication channels (Hudson, 2009, p. 169). For general and shy students, in order to improve their English skills in classroom, working together as a group is a very effective way of learning because it allows students to learn and practice the language from each other (Shaffer, 2007, pp. 9-10; Ferreira, 2011, p. 108).

The most essential result of this research study came from Physics teacher's responses about confident in teaching Physics in English. They have more confident to teach Physics in English because they practice a lot while they are in the workshop. Therefore, if the teachers are trained continuously to increase their skills in teaching Physics or other subjects in English, they will have more confident to teach, to apply and can ultimately be expert teachers. Moreover, the national policy of professional development for teachers should be emphasized teaching Physics in English and should be more practicable for the teachers. Professional development and decision makers can benefit from the research about teachers' efficacies and difficulties in teaching Physics in English.

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