Physics Education in Thailand

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Introduction

In Thailand, physics is known as a very difficult subject for students. Perhaps this is the same as for students in many other countries around the world. An understanding of physics concepts can help us reveal the truth of nature, and a knowledge in Physics can be applied to create new inventions, innovations and new discoveries. These include, not only applications in science, but also in engineering, medical and other technologies. However, these facts do not interest most students, especially those in high-school. It seems that the main reason that students are interested in Physics is because the subject is one of the topics required in the university entrance examination. For students at undergraduate levels who have to take introductory physics courses, many of them study by memorization instead of by understanding. This way of learning affects their understanding in their own subject fields in higher years. Those who are involved in physics teaching have become aware of these problems and have begun to do research into physics teaching in order to discover better instruction methods appropriate for different learners' characters or levels. The new research areas in Thailand are teaching and learning and innovation in physics education. It is hoped that research results will help enhance the development of physics teaching since education reform has become a very important current issue of the country.

Physics Curriculum in Thailand

In 1972, the Institute for the Promotion of Teaching Science and Technology (IPST) in Thailand was established in order to develop a national science and mathematics curriculum at the secondary school level. Since then, the curriculum and knowledge contents of each branch in science have gradually improved. In 1999, the ministry's new curriculum structure for basic education was reformed as follows.

Level of school education

The school curriculum is assigned into four levels, corresponding to the student level of education:

Level 1: Primary school of grades 1 – 3
Level 2: Primary school of grades 4 – 6
Level 3: Secondary school of grades 1 – 3
Level 4: Secondary school of grades 4 – 6 (High-school level)

Knowledge content

The contents include a body of knowledge, learning skills and learning process as well as the learner's virtue and ethics. The contents are separated into eight groups: Thai language, mathematics, science, social studies, religion and culture, hygiene and physical education, art, occupation and technology, and foreign languages.

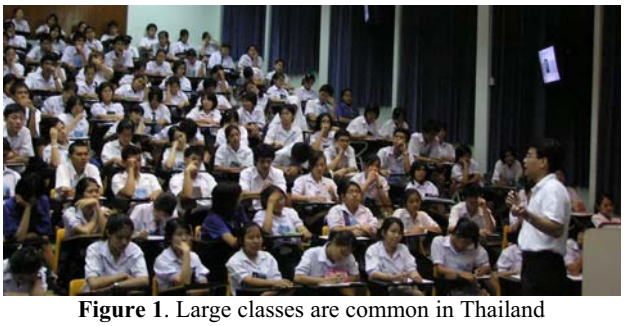

Figure 1. Large classes are common in Thailand

Contents in science

The body of knowledge in the group of science is further divided into eight contents areas, comprising:

1. Living things and living process;
2. Life and environment;
3. Matter and its property;
4. Force and Motion;
5. Energy;
6. Earth changing process;
7. Astronomy and space; and
8. Nature of science and technology.

It can be seen that physics is involved in contents areas 3, 4 and 5. Knowledge standards have been set up for these contents areas. Here are some examples of the standard contents for Force and Motion.

Standard 4.1: Understand the nature of electromagnetic force, gravitational force and nuclear force. It is expected that students will have an inquiry process, can communicate what they have learned to other people and be able to apply their knowledge correctly and with virtue.

Standard 4.2: Understand various kinds of motion of objects in nature. It is expected that students will have an inquiry process and scientific mind and can transfer and apply their knowledge to the community.

Although improvement of curricula and knowledge contents has been hoped for, the results are yet still not satisfactory. This can be seen from the upper secondary school students' performance in the university entrance examination. The average scores of science subjects were all relatively low. Moreover, compared with the average scores of biology (30.8%), chemistry (26.2%), and mathematics (25.8%), the physics average score was the lowest (24.7%) (reported by the Commission on Higher Education, 2005). When these students enter the university, research results show that their background

knowledge obtained from school studies does not include understanding of basic physics concepts (Emarat et al., 2002 and Narjaikaew et al., 2006).

Physics Education Research and the Formation of a Research Group in Thailand

In the past, most of the education research in Thailand was conducted within faculties of education at universities, many of which were initially teacher-training institutes. For decades, many universities, such as Srinakharinwirot University, Mahasarakham University, Thaksin University, Naresuan University and Burapha University, have offered not only BSc and PhD programmes in physics but also BEd. and MEd. programmes in physics education. These universities specialize in the teaching of physics, developing curricula and making measurements and analysis. Science education research conducted within a Faculty of Science, however, has only begun in the past five years at, for example, Kasetsart University, Chulalongkorn University, and Mahidol University.

In April 2000, one of the authors (C. Soankwan) was a visiting fellow at UniServe Science and the School of Physics, The University of Sydney, under the Thailand Australia Science and Engineering Assistance Project (TASEAP). He worked with UniServe Science on teaching and learning issues, including the development of interactive lecture demonstrations and investigating the use of new teaching resources. Since then there have been several continuing programmes, one of which was the workshop on *Web-Based Teaching and Learning in Science* in November 2000. This workshop was a set up in collaboration between TASEAP and Faculty of Science, Mahidol University, Thailand.

These activities have strengthened interest in physics education research among the authors and other academic staff at the Physics Department at Mahidol University. With help and fruitful suggestions from Prof. Ian Johnston and Prof. Mary Peat (Directors, UniServe Science), we then decided to set up a group for physics education research called the Physics Education Network of Thailand (PENThai). In 2003, Mahidol University established the Institute for Innovation and Development of Learning Process. This institute offers Master of Science and Doctor of Philosophy programmes in Science and Technology Education. In its first year, the PENThai group had five graduate students under supervision in those programmes, focusing their thesis research on physics education. Since then, the group has accepted graduate students every academic year which has increased the number of personnel, activities, and research topics in the field of physics education.

In September 2004, the Faculty of Science and the Institute for Innovation and Development of Learning Process jointly organized workshops for professional development courses at Mahidol University. The PENThai group has then begun to report research findings both nationally and internationally (see the references). In 2006, graduate students at the group have the opportunity to advance their research study abroad for one year. Two of them went to work with the Sydney University Physics Education Research group (SUPER) at the University of Sydney, Australia. Others went to Swinburne University in Australia, the University of Waikato in New Zealand and the University of Minnesota in USA. These students have published the research in collaboration with their advisors at those institutes (Narjaikaew et al., 2006, Tanahoung et al., 2007 and Wuttiprom et al., 2007).

The major objectives of the PENThai group are:

- to develop graduates and personnel who have expertise in physics education, or science education in which physics is involved, and can transfer knowledge to others;
- to continue to generate research on physics education or science education in which physics is involved;
- to organize national and international workshops, meetings or conferences where ideas can be exchanged between physics educators;
- to provide physics teachers and personnel with alternative instruction methods, curricula, and assessment methodologies that are suitable for teaching physics as well as to enhance their understanding in the subject; and
- to promote teaching process and activities that are based on active learning to physics teachers, lecturers, and students at all levels.

To pursue these objectives, during the past four years the group has set up several learning activities and workshops and promoted them to students at various schools as well as to physics teachers. The followings show some effective activities we have provided.

Activity-based learning in school

We have been doing special science classes at secondary school level every two weeks for three academic years. They teach activity-based learning, emphasizing scientific method and skills. Each session is about two hours long, and is inquiry based. Examples are: making contour maps; constructing pinhole cameras using students' ideas without any recipe; finger print pattern classification and analysis; etc.

Figure 2. Students measuring the distances of blood spatters, an example of activity-based learning in school

We also do science activities with local high school students to show them the whole process of scientific method. Starting from letting students observe the environment, they can setup comparative open-ended questions by which small groups of children can perform a simple experiment and collect, analyze data, and present their data in the same day. We found that this gives students a better idea of what scientific method is all about. We also do this with the staff of the science museum so they can use this with their activities at the museum.

Figure 3. A local science activity: students learn all scientific processes in one-day activity

Science teacher training with inquiry

Twice a year, we have a chance to setup workshops for teachers, on such subjects as how to teach reflection, how to teach inquiry, etc.

Figure 4. Science teacher training with inquiry: teachers learn how to teach science by practicing the inquiry process through hands-on activities

Outreach programme within Thailand

Once a year, we travel to the countryside to setup a one-day science activity at secondary schools. The activities consist of a science show, a science quiz show, etc. We try to give students simple scientific explanation for most of the show that we do. We do this to promote science to students who have limited opportunity to visit science museums or other science events. It also give us the chance to show teachers alternative ways to teach some topics in science.

Figure 5. The outreach programme in the north-eastern part of Thailand to promote the science teaching and learning

The Future

Besides continuing to generate research and develop physics education, the PENThai group also has the target of building and expanding a network between institutes in Thailand. It is hoped that there will be more research generated in other universities and academic institutes around the country. The group will also try to initiate more collaboration between physics education groups of other countries. There are plans to invite specialists as visiting professors to help enhance the potential in conducting physics education research in Thailand.

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