

# Elevation of Optics and Photonics Education in Thailand

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## ABSTRACT

We initiate a pilot project of photonics education outreach to Thai society in order to heighten public awareness and to inspire new generations of science and technology in photonics. Our target groups are students, teachers and public people. In our first state, we focus on students and teachers especially in the rural area. Learning-by-playing and critical-thinking-by-doing approaches are selected to nurture and reinforce students. For secondary and high school students, we provide a two-hour seminar on applications of photonics in daily life in order to motivate them to do science or engineering projects related to photonics. Specifically, our technical workshop with hands-on experiments provides a practical way for teachers to inspire their students about optics and photonics. Based on our phase I work with 1044 students from 21 primary schools, we find that 90% of them have fun and gain new asset in photonics. With our approach for secondary and high school levels, there are three projects accepted for the first round in the 2009 Young Scientist Competition. In addition, 90% of 85 teachers from 59 schools recognize and understand more about optics and photonics. In our further work, we will focus on the involvement of public people in order to create a new momentum that fulfills our mission.

## KEYWORDS

Photonics outreach, Optics outreach programs, Photonics public awareness, Learning-by-playing, Inquiry-Based Process, Critical thinking, Shining-Spectrum-to-Society.

## 1. INTRODUCTION

With the growth of science and technology (S&T) in the 21<sup>st</sup> century, Optics and Photonics (OP) has been a key player in today and future applications ranging from flat panel displays, green IT, and silicon photonics. However, OP was previously viewed as an orphan discipline because it worked behind the scene in order to make electronic systems operate effectively. This issue also leads people not to realize how OP

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impacts our everyday life and do not have motivation to learn more about it. If we consider the science core theme<sup>1</sup> in our educational system, OP is not even emphasized and therefore our industrial sector and community lack qualified engineers and researchers who can solve specific technical issues in the production line as well as who can come up with innovative ideas and products. Hence, dissemination of OP to our community is needed.

In 2008, we established a project called “Shining Spectrum to Society<sup>2</sup> (SSS) in which we aimed to promote public awareness especially new generations to understand more about OP and its applications in everyday life through the combination of a hands-on teaching approach and media engineering. We also encouraged students in high schools to utilize their knowledge, learn new things, and practice their skill in order to do their science or engineering projects related to OP. Since then, several activities have been in active and some are on the way. In this paper, we summarize our Phase I achievements in motivating students and sharing skill and processes with teachers.

## 2. TARGETS AND STRATEGIES

### 2.1 Target Groups

OP Education in Thailand has been concerned by a few small groups of people who teach<sup>3</sup> or work<sup>4-7</sup> in OP. Therefore, it has gradually grown until the shortage of human resources qualified in this field occurs in the current industrial situation and probably for the future. To alleviate this problem at its first cause, we need to setup a proper strategy and determine the target groups in order to elevate OP education in Thailand to another level. Our target groups are students, teachers, and general publics as shown in Figure 1. The first two groups directly relate to how OP education can be accomplished while the last group plays a significant role in influencing OP in the Thai community.

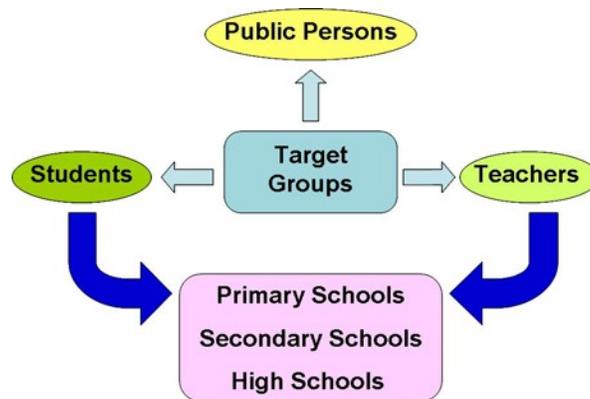


Figure 1. Our target groups in elevating OP education in Thailand.

- **Students**

For Thailand, OP definition and knowledge as well as its applications have been imperative in mind only for undergraduate and graduate students who have made contributions and have gained some experiences when they are in some universities. In the contrary, primary and secondary school students have been disregarded as the minor groups for OP learning even though they are really our new generations for our country’s development in the foreseeable future. Hence, we need to start nurturing and reinforcing them in the awareness of OP. For high schools students, we have to open their minds as well as to prepare their practical point of view and needed skill for learning basic and advanced OP issues.

- **Teachers**

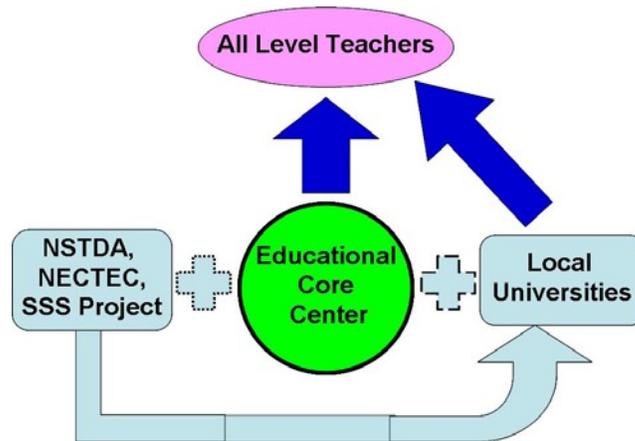


Figure 2. Our expected incorporation among teachers, local universities, and us.

Teachers are the master model of the students apart from their families. However, most science teachers in the primary and secondary schools lack proper skill and processes in teaching science. They sometimes teach science via memorizing instead of trying to engage and encourage students to learn science via scientific thinking and critical thinking processes. In addition, lack of interesting demonstrations or educational kits for teaching and hands-on learning is a key factor in making science more interesting in the class. With these issues in mind, teachers trained in OP and low-cost educational kits are needed. Figure 2 shows our scheme that networks our research institute with local universities and educational core centers in order to strengthen teachers in all levels about OP.

- **Public Persons**

Apart from teachers and students, if public people understand more about OP and its impact in everyday activity, they will play a really significant role in creating a momentum that retro-reflects to leverage OP education in Thailand to the desired level.

## 2.2 Strategies

- For elementary and primary school students: we exploit our learning-by-playing approach. We also utilize our photonics kit in the process of building the critical thinking about daily OP.
- For secondary and high school levels: we give students in these two levels a two-hour seminar on applications of photonics in daily life in order to motivate them to do science or engineering projects related to photonics. Soft and hard media are also included during the seminar<sup>8</sup>.
- For teacher: we develop an easy-to-use photonics kit using simple tools for demonstrations. We incorporate closely with the local universities to provide one day of seminar and workshop for sharing knowledge in OP and exchange ideas especially our approach for effectively teaching OP via our educational kit.

- For general publics: we join several groups from NECTEC and NSTDA to demonstrate our photonics kit in several occasions. These include two festivals held during the National Science Day and the National Children’s Day.

### 3. PRIMARY ACHIEVEMENTS AND BARRIERS

In our first state, we visit 21 primary schools in every part of Thailand. Most schools involved in our activity not only their OP education stay behind others but also their budget in leveraging the quality of their education system is low. A total number of students participated in our activity is 1044 covering 1020 in the grade four to six and 24 in the secondary level. For the high school level, we give our two-hour seminar to 1078 students from 11 schools in every part of Thailand (see Figure 3).



Figure 3. Our activities with high school students

In addition, we have networked with three local Rajabhat universities in Phuket, ChaingRai, and Surindra provinces to give a workshop and a seminar to 129 teachers as shown in Figure 4.



(a)



(b)

Figure 4. Our (a) workshop and (b) seminar for teachers.

### 3.1 Primary successes

More than 90% of primary and secondary students have fun playing with our educational kit (see Figure 5) and understand more about OP in daily life. One year after our visit, we receive the information from one school in Payao province that 50% of participated students are planning to study in a science and mathematics program. They are specifically interested in the OP program for their future study in the undergraduate level. For high school students, there are three projects accepted for the first round in the 2009 Young Scientist Competition. Note that these three projects are from the school where the project is assigned as one of the core courses.



Figure 5. Our activities with primary school students.

For teachers, 90% of 85 teachers from 59 schools recognize and understand more about optics and photonics. Most teachers appreciate our workshop and they are interested in our developed photonics kit. Note that only 85 of 129 teachers sent us their feedbacks.

### 3.2 Barriers

Based on our activities delivered to students, teachers, and general publics, they now realize and understand more about the impact of OP for our country's sustainability and competency. However, there is a barrier that delays steps to improve S&T education system in Thailand. Especially, we find that policy makers in the education are not seriously taking into consideration the OP. To alleviate this problem, we steer to general publics and local media. If they realize the importance of S&T, in particular to OP, they will help us to promote OP to our society. With this approach in mind, we join two national social festivals such as the National Children's Day and the National Science Day to demonstrate OP (see Figure 6). A correspondent from *Manager Newspaper*, one of the local newspapers, comes to interview us about our activities and goals.



Figure 6. Our activities shown during the National Children's Day at Royal Thai Government.

## 4. CONCLUSIONS

Our Phase I work can effectively inspire a group of primary students from 21 schools. We find that 90% of them have fun and gain new knowledge in OP. With our approach for secondary and high school levels, there are three projects accepted for the first round in the 2009 Young Scientist Competition. In addition, 90% of 85 teachers from 59 schools recognize and understand more about optics and photonics. Our further work will focus on getting the involvement from the public people in order to create a new momentum that fulfills our mission.

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