

Development of a Professional Development Model (PDM) for Improving Science and Mathematics Teaching in Thailand

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Background

The Institute for the Promotion of Teaching Science and Technology (IPST) is responsible for conducting research and development on science, mathematics, and technology for the basic education curriculum as well as for teachers' professional development. Since 2001, Thailand has reformed the basic education curriculum and established the National Institute for Educational Testing Service (NIETS) and the Office for National Education Standards and Quality Assessment (NESQA) with a view to improving Thailand's basic education quality. It goes without saying that teachers play a very important role in this endeavor. Therefore effective professional development of the teachers must be an important part of the reform.

IPST with her university networks and the Office of the Basic Education Commission (OBEC) have provided in-service training to science, mathematics, and technology teachers nationwide by means of face-to-face training, long-distance training via television, and self-learning packages. It is regrettable that a number of the trained teachers do not apply the knowledge gained from the training to their classroom teaching. Moreover, they still have some difficulty in organizing their classroom environment and teaching the school curriculum.

The 2005 annual report of the Office for National Education Standards and Quality Assessment indicates that 65% of schools were below standard regarding students' learning, school management, and quality of teaching.

Thailand's participation in the evaluation of students' scholastic performance under the Program for International Student Assessment (PISA) in 2003 and 2006 also revealed that Thai students' performance in mathematics, scientific, and language literacy in 2003 and 2006 were below the international mean scores.

With regard to the practice of the Wisconsin Professional Development Model (WPDM) and the lesson learned from the IN-STEP Model, IPST decided to launch a policy research on Professional Development Model (PDM) in 2006 to enhance science and mathematics education in Thailand.

Purpose

The research aims at:

1. developing a professional development model based on partnership, collaboration and networking among stakeholders;
2. improving the quality of teaching and learning science and mathematics in primary and lower secondary schools;
3. implementing the model through other professional development projects.

Methodology

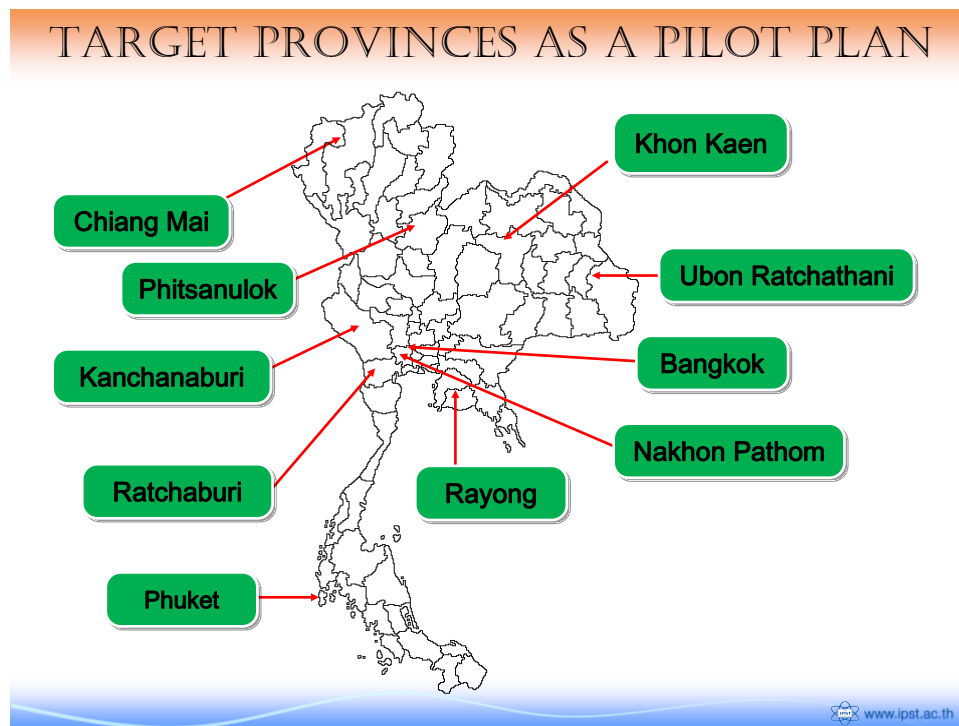
1. Design a professional development model.
2. Follow-up and improve the model.

3. Evaluate the model.
4. Implement the model through other projects.

Development of the model

The Professional Development Model was first designed in 2006 by the Curriculum Design Team (CDT) comprising IPST staff, science educators from universities, and curriculum developers from the Office of the Basic Education Commission (OBEC). The CDT analyzed results of the needs assessment of science and mathematics teachers in primary and secondary schools in order to be able to design suitable in-service training program. The training curriculum and the curriculum materials were then developed to align with the national standards with a focus on inquiry-based teaching and learning activities. The curriculum materials were designed in the form of the lesson plans for each grade level and delivered by means of workshops for three consecutive years (40 hours per year) at the training centers in universities throughout the country.

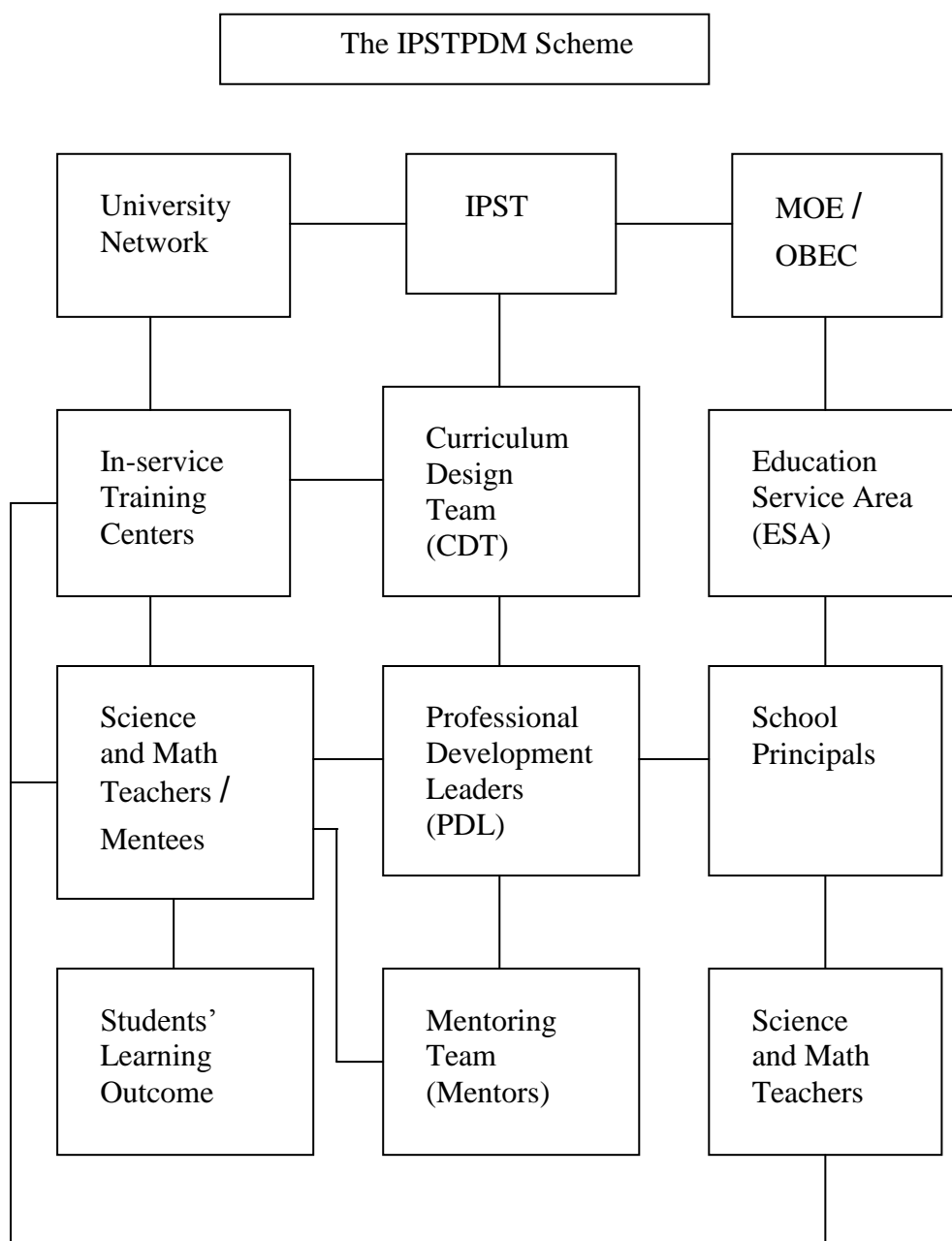
The professional development curricula were piloted in ten provinces with 8,500 science and mathematics teachers in 1,700 primary and lower secondary schools.



The follow-up research was conducted after the second year of training by a team from Kasetsart University. Results of the research showed that the teachers were not able to apply most of what they had learned at the training workshops. They could neither engage students in learning nor use questioning techniques and teaching strategies to improve students' learning. The classroom teaching was still teacher-centered.

Consequently, the PDM was modified to incorporate the use of Professional Development Leaders (PDL) and Mentoring Team in order to mentor the teachers

(mentees). The revised model involving school principals can be described by the following chart:



The PDLs are scientists, science educators from universities, IPST staff, and outstanding teachers. The 45 PDLs in the model were responsible for designing mentoring curriculum, training the mentors and the school principals and conducting follow-up program. Selection of the 145 mentors from schools participating in the project was based on certain academic and professional status (master teachers). There were 725 mentees who volunteered to participate in the model. A mentor coached five mentees by visiting them at their schools twice a semester for two consecutive years. In addition, they provided tele-coaching via mobile phone and the internet. The selected mentors and school principals were required to complete the following training curricula:

For science mentors:

- Pedagogical Content Knowledge (PCK)
- Nature of science and technology
- Inquiry-based approach
- Teaching strategies
- Thinking skills / Problem solving
- Student's misconception in science
- Questioning techniques

For mathematics mentors:

- Pedagogical Content Knowledge (PCK)
- Mathematical process skills
- Mathematical problem solving strategies
- Correction of student's misconception in mathematics

For both science and mathematics mentors:

- Building trust with the mentees and being a friendly coach
- Classroom observation and providing feedback
- Facilitating meetings with the mentees
- Using learning resources in the local areas
- How to conduct effective classroom action research

For school principals:

- Example of teaching and learning science and mathematics
- How a school principal can take part in the professional development of their teachers.

The PDLs conducted a follow-up program by visiting schools and meeting with the mentors and the school principals. They also promoted the creation of learning community and teacher networks. Conferences for sharing teaching/learning activities and learning resources among the teacher networks were also organized by IPST yearly.

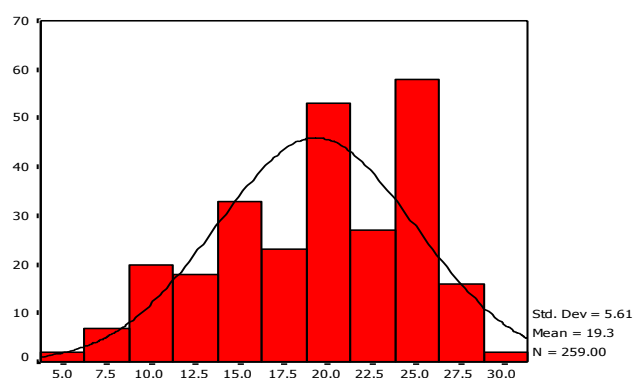
Effectiveness of the PDM

The model was evaluated by an external evaluation team in 2010 and the results may be summarized as follows:

1. The CDT and PDLs collaborated to improve science and mathematics education.
2. Having been trained, the mentors were confident to coach the mentees with the assistance of the PDLs. They also completed quite a few effective classroom research.
3. The school principals paid more attention to academic affair.
4. The learning community and teacher networks worked well and are sustainable.
5. The mentors played a very important role in enhancing teaching and learning.
6. The mentees have considerably improved teaching and learning.
7. The students' achievement mean scores were above 50% in both science and mathematics and the score distribution seem to skew toward positive side.

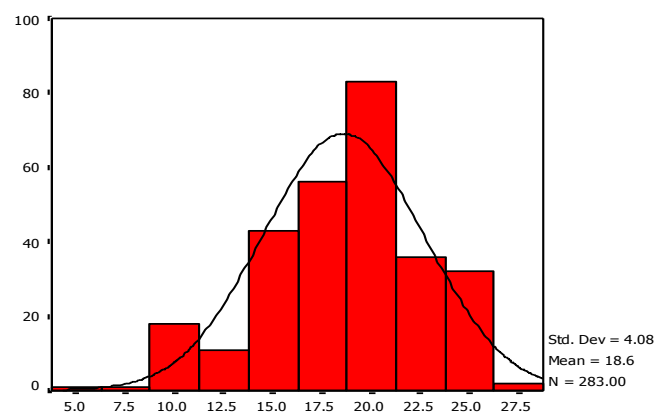
The achievement test results are as shown below.

Science Achievement Test: Grade 3



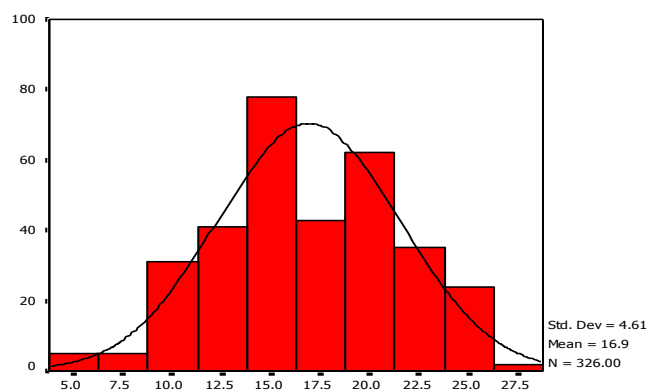
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Science Achievement Test: Grade 6



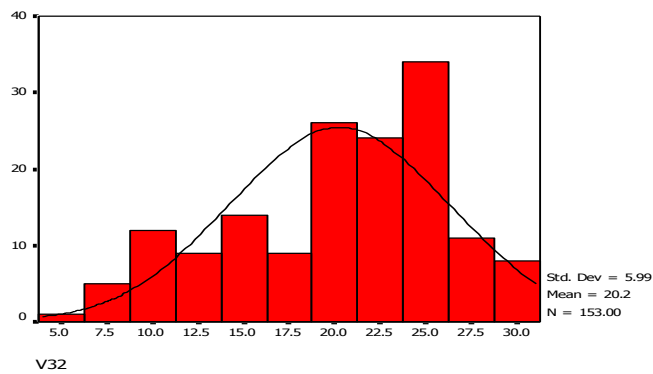
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Science Achievement Test: Grade 9

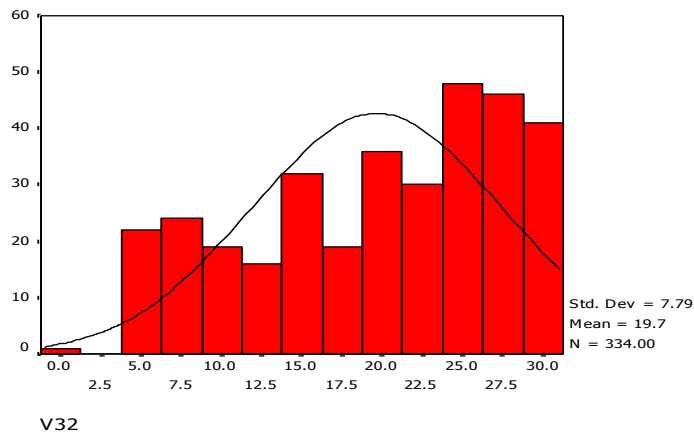


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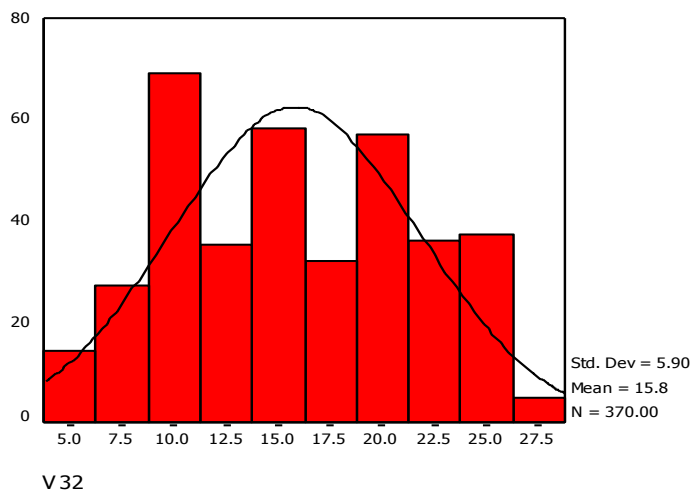
Math Achievement Test: Grade 3



Math Achievement Test: Grade 6



Math Achievement Test: Grade 9



The PDM has been implemented in the Improving Teaching Science and Mathematics in the Southern Border Provinces of Thailand (launched in 2008) to support a policy on the Special Development Area of Thailand covering 5 provinces, namely Yala, Pattani, Narathiwat, Songkhla, and Satun. The Project aims at training

primary and lower secondary school teachers in the target area so as to improve teaching and learning of science and mathematics. The education supervisors from the Education Service Areas were invited to the training workshops so that they might be able to assist in mentoring the teachers.

The teacher training curricula, which require 40 hours of training per year, are specially designed to comply with the national standards taking into account factors of cultural sensitivity such as religion, ways of life, and beliefs and values of the local people. Moreover, they emphasize relevancy to real life and curriculum integration. The learning activities therein focus on hands-on / mind-on experiences as well as project work. A variety of teaching strategies as well as the use of all available education resources are offered to the teachers who are trained along side the education supervisors who will perform the function of mentors. The mentoring program makes use of tele-coaching via mobile phone and the internet.

Local community-university networks collaboration in the southern border provinces is crucial to the success of the project. Indigenous knowledge such as rubber planting and processing, coastal farming, and food preservation has been transferred to school education. University staff now offers outreach program to enhance students' learning and opportunity for further study.

The 2010 follow-up shows positive outcomes regarding teachers' performance, students' achievement and attitude toward science, mathematics and technology. The project has been going on well and a Center for Science and Mathematics Education in the areas is under consideration for establishment in collaboration with the universities in order to conduct research and development in curriculum and training as well as to support schools and community.

The PDM has also been implemented in other IPST projects such as the Leader for Change in Teaching and Learning Science and Mathematics Project (2010-2015), the UPGRADE Project(2011-2018) and the ETV Project which has just begun this year(2011). These projects share the Curriculum Design Team, the Professional Development Leaders, the mentors and the PDM training curricula.

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