The Development and Exploration of Preservice Physics Teachers' Pedagogical Content Knowledge: From a Methods Course to Teaching Practice

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ABSTRACT

This study was conducted to describe four preservice physics teachers' development of pedagogical content knowledge (PCK) from the PCK-based Physics Methods Course to teaching practice. A multi-method evaluation was used to collect data: pre- and post-lesson preparation; a semistructured group interview about cases; an observation of teaching and semistructured interview with preservice teachers after teaching; a semistructured interview of cooperating teachers and university supervisors; and collection of related documents. The constant comparative method was employed to analyze data. The results revealed that the PCK-based Physics Methods Course potentially helped the participants to develop increased depth and breadth of understanding of each component of PCK, and to progressively develop more complete topic-specific PCK in the topic of "force and motion" by adding increasingly more complex relationships among components of PCK. The periods of PCK modeling and micro-teaching were regarded as essential parts of the course. During teaching practice however, the participants faced difficulties in transferring their topic-specific PCK developed in the course into real practice. The school context and culture had a strong potential to affect their development and implementation of PCK—the two most important factors were the supervision of the cooperating teachers and the characteristics of the students. Holistically, the process of PCK development was seen as an individual process, which depends on each participant's knowledge and experiences concerning components of PCK developed prior to and during the course, and in teaching practice.

Key words: preservice physics teacher, pedagogical content knowledge, methods course, teaching practice

INTRODUCTION

In Thailand, teachers are widely accepted as 'the heart of learning reform' because they are the most significant and indispensable components in the teaching and learning processes which occur in the classroom (Office of Rajabhat Institute Council, 2002). To acquire competent teachers, teacher

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preparation programs are significantly involved and their importance is enshrined in various Thai governmental laws, e.g., Section 52 of the National Education Act (1999), the National Education, Religion, and Culture Plan (2002-2006), and Chapter 3 of the Ninth National Economic and Social Development Plan (2002).

The general aim of teacher preparation is to prepare preservice teachers to comprehend content and how to present it in ways that are personally meaningful and potentially accessible to all students (Tuan and Kaou, 1997). This corresponds with what Shulman (1987) conceptualized as 'pedagogical content knowledge' (PCK)—"the blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organized, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction." However, the separation between content and pedagogy, and an over-emphasis on teacher-centered instruction cause a lack or limitation of PCK in preservice teachers. This may be regarded as the weakest point of teacher preparation programs and a primary constraint of the quality of teaching and learning because a prospective teacher who lacks PCK may face difficulty in transforming his or her content knowledge into pedagogical units to facilitate student understanding (Bell *et al.*, 1998; Veal, 1998).

The literature strongly suggests the subject-specific methods course as a potential place for developing PCK in preservice teachers because it can inspire and provide them with the opportunities to integrate their content and pedagogical knowledge, to practice teaching, and to reflect upon knowledge and experiences (Lederman and Gess-Newsome, 1999).

To understand the current state of teaching and learning in methods courses in Thailand, the researchers conducted a preliminary study of the Methods of Teaching Science and Technology for Elementary Level Course in the first semester of the 2002 academic year at one public university in Bangkok. The participants were two methods course instructors and 30 preservice science teachers (11 males, 19 females). The data collection methods included classroom observation, an open-ended questionnaire for preservice science teachers and an interview with the course instructors. The main findings revealed that the course instructors seldom provided the preservice teachers with knowledge pertaining to the teaching of specific science concepts to specific types of students—there was a lack of linkage between content and pedagogy taught in the course. Accordingly, this raises the need to revise the methods course to be an opportunity for developing PCK in preservice teachers.

Although PCK appears to be an important attribute needed for all preservice teachers, little is known about how various aspects of PCK are activated, integrated, and transformed in real practice (van Driel *et al.*, 1998). Particularly, in Thailand, there is no research which studies how preservice physics teachers develop PCK from the PCK-based Physics Methods Course and use it in actual teaching practice. Hence, this research aims to study: (a) how, and to what extent, the preservice physics teachers develop PCK from participating in the PCK-based Physics Methods Course; and (b) how, and to what extent, they develop and implement their PCK during teaching practice.

THEORETICAL FRAMEWORK

Based upon Shulman (1987) and Magnusson *et al.* (1999), PCK is conceptualized as "the ability of the preservice physics teacher to transform physics content knowledge he or she possesses into forms that are understandable to students with variations in understanding, abilities, and characteristics by using appropriate representations, instructional strategies, and assessment." To reflect this concept, preservice physics teachers' PCK consists of five major components: (i) orientations toward teaching physics; (ii) knowledge of science curriculum with respect to physics; (iii) knowledge of students' learning in physics; (iv) knowledge of instructional strategies for teaching physics; and (v) knowledge of assessment in physics. The relationships between these components are depicted in Figure 1.

Figure 1 illustrates that all components of PCK are interrelated; effective teaching needs the integration of all components and its appropriate application for the right students in the right circumstances. Therefore, preservice teachers should simultaneously acquire and develop all components, and integrate them into their PCK (Cochran *et al.*, 1993). Remarkably, even though PCK has the nature of an integrative construct, enhancing each component can enhance PCK as a whole (Fernandez-Balboa and Stiehl, 1995).

The development of PCK was identified as a multifaceted, complex, non-linear process that is gradually and progressively developed over time through the process of planning, teaching, and reflecting on particular subject matter (Bell *et al.*, 1998). In addition, the process of PCK development is seen as an individualized process—each teacher has his or her own unique process of content transformation (Chen and Ennis, 1995; Tuan and Kaou, 1997). This implies that teachers, who possess different degrees of content and pedagogical knowledge, and teach in different contexts, may develop different types of PCK to various degrees (Veal, 1998; Magnusson *et al.*, 1999).

From the literature, there are several factors influencing preservice teachers' development of PCK, e.g., content and pedagogical knowledge, teaching experience, reflective ability, school context and culture, and internal constructs.

PCK refers to teachers' ability to transform their content knowledge into understandable forms for students, thus, thorough and coherent understanding of the subject matter is seen as a prerequisite of PCK development (Magnusson *et al.*, 1999). However,

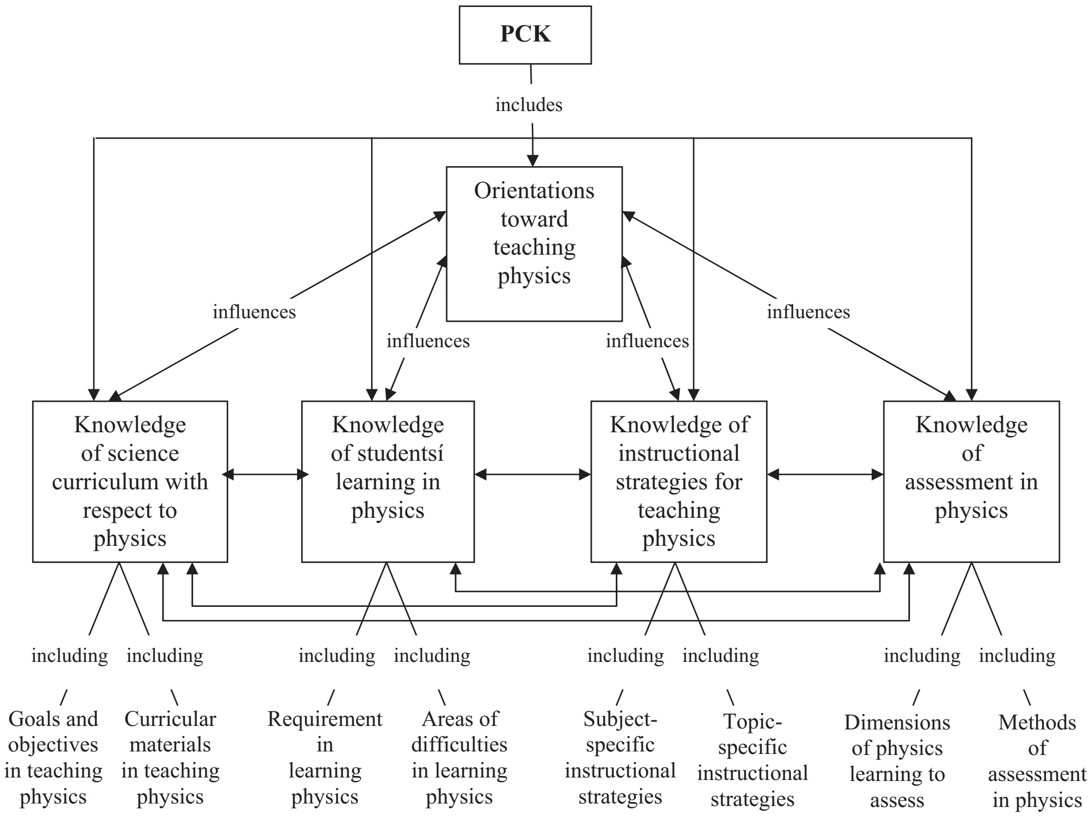

Figure 1 Knowledge components of PCK for teaching physics (Adapted from Magnusson *et al.*, 1999: 99).

having only robust content knowledge is insufficient for developing PCK (Cochran *et al.*, 1993) because teaching for student understanding requires teachers' deep pedagogical knowledge to ensure that core ideas of a specific topic can be effectively presented to a variety of students (Marks, 1990; van Driel *et al.*, 1998). Noticeably, although both content and pedagogical knowledge are important for developing PCK, possessing only single knowledge domain in isolation cannot efficiently influence teachers' PCK development.

PCK affects teaching and, in turn, is influenced by experience in teaching (Loucks-Horsley and Mutsumoto, 1999). That is, teachers develop PCK over time through reflections upon classroom experiences (Fernandez-Balboa and Stiehl, 1995). Therefore, teachers' reflective ability appears to be an important factor influencing their PCK development. The school context and culture also have the potential to affect teachers' development of PCK (Cochran *et al.*, 1993). In addition, teachers' PCK development can be influenced by their internal constructs including their attitudes (Amade-Escot, 2000), perceptions (Tuan and Kaou, 1997), and beliefs (Veal, 1998) concerning content, learners and learning, and teachers and teaching.

METHODOLOGY

This study was divided into two phases:

Phase I: Preservice physics teachers' development of PCK in the PCK-based Physics Methods Course

In this phase, the interpretive study (Neuman, 2003) was employed as the research model. The participants were four third-year preservice physics teachers enrolled in the 16-week, PCK-based Physics Methods course, which was conducted in the second semester of the 2004 academic year at one Rajabhat University in Bangkok. Their pseudonyms were Julie, Mark, Cathy, and Sam.

Julie, a 22-year-old preservice teacher, came from Buri Rum Province. At the primary level, she was regarded as a high-achieving student. Julie decided to further her studies in physics education because she liked the way her physics teacher taught, loved physics, and expected to become a good and beloved physics teacher. In the third year of the study, she got a cumulative GPA at 3.48. Mark, a 22-year-old preservice teacher, was born into and lives with a large, agricultural family in the rural area of Chaiyaphum Province. In Mark's view, the physics methods course was perceived as a boring subject like Psychology. Consequently, he was looking forward to interesting learning activities that would occur in the course. His cumulative GPA at the third year of the study was 2.44. Cathy, a 23-year-old preservice teacher, came from Nakhonratchasima Province. She aimed to be a teacher teaching in her hometown, however, she did not intend to be a physics teacher. In the third year of the study, she got a cumulative GPA of 2.49. Sam, a 21-year-old preservice teacher, came from Chonburi Province. At the lower secondary level, he was regarded as a high-achieving student. Sam expressed his leadership by participating in numerous school activities, and in the third year of the study, he was elected to be president of the Faculty of Education Student Club and got a cumulative GPA of 2.45.

There are eight principles which serve as guidelines to underpin the PCK-based Physics Methods course: (i) using constructivism as an epistemological basis for teaching and learning; (ii) preparing lesson plans; (iii) discussing cases; (iv) deriving experiences from teaching and observing other teachers' teaching; (v) using the course instructor as a role model for PCK teaching; (vi) performing micro-teaching; (vii) reflecting upon acquired knowledge and experiences; and (viii) using formative and authentic assessment. The four main sections of the course are: preparation for PCK development, classroom observation and written cases discussion, PCK modeling of force and motion, and micro-teaching. The details of learning activities in the course are briefly illustrated in Table 1.

To capture a highly complex construct such

Table 1 Learning activities of the PCK-based Physics Method Course.

Period	Week	Activity
Preparation for PCK development	1st	• Introduction of the PCK-based Physics Methods Course • Review knowledge of the curriculum • Participants discuss the National Education Act (1999), Basic Education Curriculum (2001), and National Science Curriculum Standards (2002) • Assign preparation of the force and motion lesson
	2nd	• Review knowledge of teaching strategies • Participants discuss constructivist and transmission modes of teaching and learning • Participants discuss constructivist teaching strategies
	3rd	• Review knowledge of assessment • Participants discuss formative and authentic assessment
Classroom observation and written cases discussion	4th	• Participants observe physics being taught and will interview physics teachers • Participants present analyses of the classroom observation and the interview followed by a discussion
	5th	• Participants discuss the 'Force and Inertia' written case
	6th	• Participants discuss the 'Reaction Force' written case
PCK modeling of force and motion	7th	• PCK modeling of force and net force followed by discussion
	8th	• PCK modeling of Newton's first law followed by discussion
	9th	• PCK modeling of Newton's second law followed by discussion
	10th	• PCK modeling of Newton's third law followed by discussion
	11th	• PCK modeling of change of momentum and net force followed by discussion
Micro-teaching	12th	• First participant perform micro-teaching followed by discussion
	13th	• Second participant perform micro-teaching followed by discussion
	14th	• Third participant perform micro-teaching followed by discussion
	15th	• Fourth participant perform micro-teaching followed by discussion
Summary	16th	• Participants reflect upon overall acquired knowledge and experiences

as PCK, the multi-method evaluation (Baxter and Lederman, 1999) was employed by combining these data collection methods: (i) pre- and post-lesson preparation; (ii) a semi structured interview about written cases; (iii) observation of, and a semi structured interview after, micro-teaching; and (iv) collection of related documents, i.e., journals, worksheets, portfolios, etc.

Phase 2: Preservice physics teachers' development and implementation of PCK during teaching practice

The multi site case study (Sturman, 1997) was employed as the research model in this phase. The participants were Julie, Mark, Cathy, and Sam, who had completed the PCK-based Physics Methods Course and subsequently performed teaching practice in secondary schools in the first semester of the 2005 academic year. During teaching practice, each participant was supervised by one cooperating teacher and each pair was supervised by one university supervisor. The context of the teaching practice is shown in Table 2. Pseudonyms were used to represent names of the schools, the cooperating teachers, and the university supervisors.

Table 2 Context of teaching practice.

Name	School	University supervisor	Cooperating teacher
Julie	School A	University supervisor A	Cooperating teacher A
Mark			Cooperating teacher B
Sam	School B	University supervisor B	Cooperating teacher C
Cathy			Cooperating teacher D

Cooperating Teacher A had 27 years of teaching experience in School A. He graduated with a Master of Education Degree (Physics Education) in 1988. He realized that training a preservice physics teacher to be an effective physics teacher was a hard and time-consuming job, but felt that it gave enormous long-term advantages to society. Cooperating Teacher B graduated with a Bachelor degree in Teaching Science and had 21 years of experience teaching physics and science. He had no experience training a preservice physics teacher, but had trained four preservice science teachers. Cooperating Teacher C graduated with a Bachelor of Education Degree (Teaching Biology) and had 20 years of experience teaching science at the lower secondary level. She had no experience training a preservice physics teacher, but had supervised three preservice science teachers. Cooperating Teacher D graduated with a Master of Physics Education Degree and had 34 years of experience teaching physics. He had trained three preservice physics teachers. In addition, although all cooperating teachers had long-term experience in teaching, they had never been trained in any school or university workshops, or programs, on how to be effective cooperating teachers.

University Supervisor A supervised Julie and Mark's teaching practice at School A. He was a novice university supervisor because he had just changed his career from a Vocational Institute to a Rajabhat University. He had completed a Master of Science Degree in Technical Education (Electrical Engineering). University Supervisor B supervised Cathy and Sam's teaching practice at School B. Similar to University Supervisor A, he was a novice university supervisor because it was his first time training preservice physics teachers. He completed his Master of Education Degree in Educational Technology.

According to the multi-method evaluation, these methods were used to collect data: (i) classroom observation of and semistructured interview with preservice teachers after teaching; (ii) semistructured interview with cooperating teacher and university supervisor; and (iii) collection of related documents, e.g., lesson plans, worksheets, assignments, tests and journals. The data from both phases was simultaneously analyzed using the process of data collection and the constant comparative method (Glaser and Strauss, 1967).

RESULTS AND DISCUSSION

The results of this study were presented and discussed according to the two research questions previously mentioned.

Preservice physics teachers' development of PCK during and after participation in the PCK-based Physics Methods Course

Period of preparation for PCK development

The surveys conducted at the beginning of the PCK-based Physics Methods Course revealed that the participants came to the course with a varied mixture of existing knowledge and experiences concerning teaching and learning. Although the participants had completed various courses on curriculum, teaching, learning, and assessment, all of them knew little about curriculum, teaching, learning, and assessment, and had little experience in teaching. In the period of preparation for PCK development, they developed more understanding about curriculum, constructivist teaching and learning, and formative assessment, and proposed a variety of ways to apply those understandings to their future teaching. At the beginning of this period, all of them expressed negative attitudes toward the constructivist learning activities conducted because those activities demanded more thinking skills and required them to accomplish many assignments that differed from learning by lecture, with which they were familiar. However, when they understood more about the constructivist view of teaching and learning, and had direct experience as a learner in the constructivist learning environment, they gradually developed more positive attitudes toward constructivist activities. Thus, more understanding about, and being exposed to, the constructivist learning activities, potentially encourages preservice teachers to be more prepared to understand and practice constructivist methodologies (Brooks and Brooks, 1999).

Period of classroom observation and written cases discussion

This period provided the participants with the opportunity to analyze strengths and weaknesses of observed physics teaching and learning, and to think critically and analytically about teaching, learning dilemmas, and solutions to the dilemas situated in the written cases. This plays a critical role in expanding and deepening the participants' pedagogical thinking and reasoning which serves as a basis for them to further develop PCK (Shulman, 1987). However, from the 'Reaction Force' case discussion, none of them noticed the student alternative conception, i.e., no reaction acting on an 'at rest' object, which was similar to their own alternative conception. This matched the findings of Halim and Meerah's (2002) study: "Being unaware of the pupils' misconceptions actually reveals the trainees' own misconceptions of the concepts."

Period of PCK modeling of force and motion

During this period, the participants derived direct experiences as learners participating in the constructivist learning activities aimed to enhance their understanding of force and motion, and derived teaching experience from observing examples of physics teaching modeled by the course instructor. The constructivist activities conducted during this period potentially enhanced the participants' understanding and reasoning about force and motion, and promoted their positive attitudes toward constructivist teaching and learning, and prompted complex thinking about physics teaching and learning. Importantly, it encouraged the participants to become aware that effective physics teaching requires the integration of several components of PCK. For example, Julie related knowledge of instructional strategies to knowledge of students' learning, teaching materials, and content.

"Learning activities should be suitable with the content intended to be taught, e.g., games, experiments, and demonstrations. The teacher should select learning activities to suit students. Learning activities selected should raise students' participation and encourage students to learn the lesson. "(8th week worksheet on PCK modeling of Newton's first law) However, the human-centered viewpoint and impetus concepts are regarded as stumbling blocks to the learning of force and motion (Buaraphan *et al.*, 2005).

Period of micro-teaching

In this period, the participants were required to perform micro-teaching of their selected physics topics to their classmates, and to discuss the teaching and the learning that had occurred. The major strength of the participants' micro-teaching was emphasizing and conducting hands-on, group, and constructivist learning activities. This shows that learning in a constructivist environment of the period of PCK modeling can encourage them to employ constructivist activities in teaching and become aware that the teacher's role is not to transmit knowledge, but to facilitate student learning (Duit and Treagust, 1995). In addition, all of the participants realized the importance of relating various knowledge components of PCK to teaching. For example, Mark related knowledge of instructional strategies to knowledge of content: "A teacher must understand the strengths of each learning activity. Activities conducted by individual teachers may be different, but they should be suitable to the content." During the periods of PCK modeling and micro-teaching, direct experience as a learner and a teacher together with reflections about knowledge and experience derived from those roles potentially encouraged the participants to develop and implement their topic-specific PCK of force and motion (Cochran *et al.*, 1993). However, the participants' major weakness was the lack of content knowledge, which is one important component of PCK. This potentially impeded the participants' implementation of topic-specific PCK of force and motion, i.e., they could not answer some of students' questions and, oftentimes, did not notice students' alternative conceptions (Halim and Meerah, 2002).

Summary

From participating in the PCK-based Physics Methods Course, the participants not only developed more depth and breadth of understanding of each component of PCK, but they were also made aware that effective physics teaching requires the ability to combine the various components of PCK. Throughout the course, the participants gradually developed more complete topic-specific PCK of force and motion by increasing the complexity of relationships among various components of PCK. Thus, giving the preservice teachers multiple opportunities to teach, observe, and reflect on their own teaching and others' teaching of specific topics is essential for them to develop and implement PCK. The participants' development and use of relationships among components of PCK are different depending on their knowledge, experience, and personal frames of mind (Amade-Escot, 2000). Therefore, the preservice teacher development of PCK is seen as individual; each preservice teacher has a unique pathway of PCK development (Chen and Ennis, 1995; Tuan and Kaou, 1997). Among the learning activities conducted in the PCK-based Physics Methods Course, the periods of PCK modeling of force and motion and micro-teaching were regarded as very essential parts of the course which helped the participants to develop and implement their topic-specific PCK of force and motion.

Preservice physics teachers' development and implementation of PCK during teaching practice;

PCK is influenced by school context and culture

The findings during teaching practice revealed that school context and culture have the potential to affect the participants' development and implementation of PCK (Cochran *et al.*, 1993; Tuan and Kaou, 1997; Amade-Escot, 2000). The two most important factors were the supervision of cooperating teachers and characteristics of students. Both factors strongly impacted on the participants' decision-making about orientations toward teaching, teaching strategies, teaching materials, and assessment.

University supervisor's role—the missing part

None of the participants regarded the university supervisors as an important factor in influencing their success in the teaching practice. The reason was that their university supervisors rarely observed their classrooms or supervised their teaching. It shows that the university supervisors did not understand their roles, though the roles and experience of the university supervisors is very important in influencing the development of PCK in preservice teachers (Appleton, 2003).

Testing out personal philosophies of teaching and learning

Throughout the teaching practice, the participants had multiple opportunities to try out and observe the effects of their philosophies of teaching and learning. They sometimes employed some learning activities conducted in the PCK-based Physics Methods Course for teaching specific topics related to force and motion. Importantly, however, they faced some difficulty in transferring PCK of force and motion, developed in the methods course, to teaching other topics during the teaching practice. Regarding this, quality supervisions and strong support from cooperating teachers and university supervisors were needed to help them transform what they learned in the university into classroom practice.

Content knowledge appears as prerequisite for PCK development

The participants' PCK is strongly influenced by content knowledge (Marks, 1990). For example, when Julie was required to teach unfamiliar topics which she had a poor understanding of, and also had negative attitudes toward, she lacked confidence in teaching them, and therefore emphasized "recite-recall-remember content for teaching" to cope with such a dilemma. Supported by the literature, teaching experience combined with familiarity with a specific topic can positively contribute to a teacher's PCK (van Driel *et al.*, 1998).

Teaching experience influenced knowledge of student learning

Experience derived from student-teacher interactions in specific classrooms has the potential to develop preservice teachers' PCK, in particular knowledge of students' learning difficulties and learning styles (van Driel *et al.*, 1998). For example, in the context of School A, Julie and Mark found that most of students faced difficulties in learning abstract concepts that do not link with everyday experiences (Magnusson *et al.*, 1999). In the context of School B, Cathy and Sam, who were assigned to teach non-science students, stated that students' cognitive and affective characteristics and their lack of motivation and concentration in learning strongly affected the quality of teaching (Penso, 2002).

Personal constructs—a salient factor

Personal constructs, e.g., motivation to be a physics teacher, and attitudes and perceptions toward physics teaching and learning, can be regarded as a salient factors influencing PCK development (Chen and Ennis, 1995). For example, Julie, Mark, and Cathy mentioned that during teaching practice they faced various situations that discouraged them from pursuing a teaching career, so they had to keep motivating themselves to be physics teachers. Up to this point, students' more positive attitudes toward teaching and learning, and better understanding of science, were the main sources which reinforced their motivation to teach.

Reflective ability: The reflective ability also appeared to be an important factor affecting the participants' development of PCK because PCK is developed over time through reflections upon classroom experiences (Fernandez-Balboa and Stiehl, 1995). For example, in the context of School B, Cathy and Sam had few opportunities to reflect upon their teaching experiences in the supervisory meetings with their cooperating teachers. This was in contrast to their experience in School A, consequently both of them developed their PCK very slowly in School B.

Summary

Authentic experiences that were derived from teaching practice not only helped the participants develop understanding of each component of PCK, but also encouraged them to integrate various components of PCK. However, the relationships among these components contained individual differences depending on the participants' degree of understanding of each component and the derived experience concerning teaching and learning. All participants tended to develop a more complete topic-specific PCK of the topics taught by adding increasingly more complex relationships among the components of PCK. Throughout the teaching practice, the preservice teachers' PCK is progressively developed over time (Lowery, 2002). The development of PCK mainly originated from the participants' multiple opportunities to teach specific topics to specific students within specific learning contexts, and to reflect on what they had learned from those experiences (Cochran *et al.*, 1993). The findings of this study support two arguments from the literature: the novice or preservice teachers normally have little PCK; and the process of PCK development is a time-consuming process (van Driel *et al.*, 1998).

RECOMMENDATIONS

The following are recommendations which emerged from this study.

First, the methods course should be considered as an important opportunity and a potential place for preservice teachers to develop and implement their PCK by integrating content knowledge learned from the Faculty of Science and knowledge of curriculum, instructional strategies, student learning, and assessment learned from the Faculty of Education.

Second, the learning activities conducted during the PCK-based methods course should be carefully and systematically planned. All components of the course should aim to help preservice teachers develop each component of PCK, integrate all components into PCK, and practice teaching based on constructivist theory.

Third, teaching experience should be considered as a major factor for developing PCK. Thus, preservice teachers should be given multiple opportunities to teach, observe, and reflect on their own teaching and others' teaching. PCK modeling of specific topics and micro-teaching are crucial parts of the methods course. However, during the period of micro-teaching, preservice teachers should be given the opportunity to practice teaching with students in a secondary school instead of their classmates because authentic experience with students in a real context can effectively enhance their knowledge of students' learning.

Fourth, learning activities conducted in the methods course should be able to widen and deepen preservice teachers' content knowledge, especially knowledge of students' alternative conceptions, which is one important component of PCK.

Fifth, there should be workshops, seminars, conferences, or other interventions that effectively enhance cooperating teachers and university supervisors' capabilities to help preservice teachers to develop and implement their PCK during teaching practice.

Sixth, teaching practice should be considered by teacher preparation programs and schools as an important, required opportunity for all preservice teachers to try out their personal philosophies of teaching and learning, and to develop and implement their PCK. Also, a closer connection between teacher preparation programs, i.e., university supervisors, and schools, i.e., cooperating teachers, should be properly set up in order to help preservice teachers transform theory into practice.

Finally, teacher preparation programs and schools should pay more attention to the roles and duties of cooperating teachers and university supervisors. They are responsible for developing the quality of the teaching practice, and should be rewarded and promoted by the teacher preparation programs and schools in several ways including certificates, rewards, promotions, research grants, lighter teaching workloads, and so forth.

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