US-China Education Review B 6 (2011) 829-839
Earlier title: US-China Education Review, ISSN 1548-6613

The Current Situation of Field Experience in a Five-Year Science Teacher Education Program in Thailand *

Chatree Faikhamta, Ekgapoom Jantarakantee, Vantipa Roadrangka
Kasetsart University, Bangkok, Thailand

This research explored the current situation in managing the field experience of a five-year science teacher education program in one university in Thailand. A number of methods were used to assess field experience situation: (1) a questionnaire on the perceptions of pre-service science teachers of field experience management; (2) participant observation at seminars; (3) interviews; and (4) analysis of supervisory comments on student teachers' teaching performance. The findings indicated that the pre-service science teachers had a high level of satisfaction with the amount of practice and with their own teaching characteristics. However, during their student teaching, they could not define clear and expected learning outcomes in lesson planning. They did not probe students' prior knowledge, rarely asked questions, could not manage a classroom and held misconceptions of science concepts. Despite of the struggles, pre-service did improve their ability to develop: lesson planning techniques; teaching strategies; student learning processes; classroom management skills; and the incorporation of instructional material.

Keywords: field experience, pre-service science teacher, cooperating teacher, supervisor, teacher education

Introduction

Field experience is a key component of many teacher preparation programs. According to recent education reforms in many countries, several universities have been re-examining, refining and implementing teacher education programs that are aligned with curricular, pedagogical and organizational reforms. These teacher education institutions have an increased focus on the development of field experience courses (Russell, 2005). Since field experience is considered as a bridge between the academic coursework and the realities of classroom teaching, pre-service teachers can learn how to teach a particular content topic to specific students in a specific context (Beeth & Adadan, 2006; Kagan, 1992). Form a social-constructivist perspective, the field experience can offer pre-service teachers opportunities to construct or reconstruct their own knowledge and beliefs through the support and guidance from knowledgeable persons (Watson, 2006), work collaboratively with other people, such as cooperating teachers, supervisors, parents, other pre-service teachers and others (Bell & Gilbert, 1994; Watson, 2006) and reflect on their own and other's ideas (Abell & Bryan, 1997). Pre-service teachers also have the opportunity to work with students which serves as a preparatory activity before they assume the full responsibilities of an in-service teacher. In a real-school atmosphere, pre-service teachers can

* The research upon which this article is based was funded by TRF (Thailand Research Fund), Project-MRG5180335 (2008-2009).
Chatree Faikhamta, Ph.D., Department of Education, Faculty of Education, Kasetsart University.
Ekgapoom Jantarakantee, Ph.D., Department of Education, Faculty of Education, Kasetsart University.
Vantipa Roadrangka, Ph.D., professor, Faculty of Education, Kasetsart University.

negotiate classroom management, school policies, organization, lesson planning and their own positions within the social structure of the school.

Like other countries, teacher education in Thailand currently is undergoing a period of learning reform. The primary goal of the Thai educational reforms is to help teachers become more aware of ways to improve student learning and how to modify teaching to meet the new learning standards. Since Thai science teachers are more familiar with the traditional national curriculum, many of them struggled to develop and implement a school-based science curriculum. Fry (2002) argued that some teachers do not understand that activity-based learning is only one of many methods that can be used to promote active and student-centered learning. A main reason for this problem is that the curriculum and teaching provided in the teacher education institutions is not attuned to the actual practice and learning process reforms in schools (Amornvivat, 2002).

Adding a full-year of field experience is the highlight of the new five-year teacher education program in Thailand. Prior to 2004, teacher education programs ran four years. The five-year program is considered as a new opportunity to improve the quality of Thai teachers and consequently develop student learning. The program aims to develop the pedagogical content knowledge (Shulman, 1987) of pre-service teachers and apply this kind of knowledge in real situations (The Institute of Promotion of Science & Technology Teaching, 2002). Pre-service teachers are also expected to implement constructivist-based teaching strategies, as suggested by the National Education Act (Office of the National Education Commission, 1999). The new five-year program requires pre-service teachers to study coursework for four years. They have one early field experience in four years and a year long field experience in five years. The extended period of field experience from one semester in the four-year teacher education program to two semesters, or one academic year in the five-year teacher education program is expected to help pre-service teachers gain a better understanding of the teachers' role, the curriculum, classroom action research and students' growth and learning over the course of an entire year.

While research on the role of the field experience in teacher preparation has increased in recent years, still, it has been limited to studies which examined how the field experience course in the five-year teacher education program had been implemented and whether this program had been successful or not. One way to learn how to improve the teacher preparation program is to study how pre-service teachers are educated. So, a challenging aspect of this study was to begin filling the gap in the literature of science teacher preparation in Thailand through a focus on investigating the implementation of the field experience, perceptions of pre-service science teachers on their field experience courses and the students' learning and struggles during the student teaching field experiences. Hopefully, this in-depth information will be used to provide further refinement to the science teacher education program in accordance with national learning reforms.

RQ (Research Questions)

The RQ are as follows:

(1) How was the field experience implemented in the science teacher education program in one university?

(2) What are the perceptions of pre-service science teachers regarding the quantity of their own practice load and the desired characteristics of teachers that have been promoted?

(3) What do the fifth year pre-service science teachers learn and what do they struggle with during the field experience?

Theoretical Framework

The research presented in this work was set within social constructivist views of teaching and learning. Constructivism provides a useful theoretical framework in science teacher education for the understanding and development of the learning of science pre-service science teachers. It is regarded as a driving force for science educators to move their attention from teachers' teaching behaviors to teachers' knowledge and how they learn, think and construct their knowledge (Shulman, 1987). A significant implication of constructivist-based views of learning (Tobin, Tippins, & Gallard, 1994) for science teacher education is the notion of a pre-service science teacher as a "learner". A pre-service science teacher is a person who actively constructs their views of teaching and learning science and brings the science teacher education program prior knowledge and beliefs (Bell & Gilbert, 1994). From a social-constructivist perspective, within a particular social context, pre-service teachers construct or reconstruct their own knowledge and beliefs through the support and guidance from knowledgeable persons (Watson, 2006), collaboratively working with other people (Bell & Gilbert, 1994) and reflecting on their own and other's ideas (Abell & Bryan, 1997; Capobianco, 2007). As a result, in most science teacher education programs, pre-service teachers have been challenged to learn about teaching science from field experiences (Northfield, 1998), rather than learning about teaching and learning theories solely from their university-based classes. Field experiences activities are regarded as "social laboratories" which provide a variety of activities for pre-service teachers to establish their own knowledge in a specific context.

Collaboration and interaction with other people can help pre-service teachers to construct their own knowledge for teaching. Lowery (2002) suggested that pre-service teachers need to collaborate with children, cooperating teachers, supervisors, university instructors, parents, other pre-service teachers and others. These people can support pre-service teachers to develop confidence in their teaching. A supportive atmosphere helps pre-service teachers to reflect on comfortably and observe the strengths and weaknesses of their own teaching (Bell & Gilbert, 1994).

Pre-service teachers who collaborate with in-service teachers or facilitators can construct their own meaning of how to teach. Zuckerman (1999) found that listening to and discussion with in-service teachers or facilitators helped pre-service teachers. Discussion with in-service teachers motivates pre-service teachers to identify the relevant details so that they can apply their practical knowledge in other situations. In-service teachers act as cooperating teachers who can strongly influence beginning teachers in terms of what and how they teach.

In a collaborative atmosphere of field experience, pre-service teachers have opportunities to become aware of their current knowledge and beliefs and engage in experiences which reconstruct their views (Loucks-Horsley & Matsumoto, 1999). Because knowledge and beliefs about science teaching and learning can be made explicit through reflection, pre-service teachers should be provided with opportunities to reflect on their own prior knowledge and beliefs. "Reflection is thinking and feeling: asking such questions as 'What am I doing?' and 'Why am I doing it'; selecting procedures; and making decisions about what to do next" (Baird & White, 1996, p. 191). Abell and Bryan (1997) argued that through reflection, pre-service teachers can clarify and confront their ideas, beliefs and values about teaching and learning science. They will be aware of and in control of what they are doing and then possibly change their personal beliefs. The reflection can occur by means of dialogues and conversations with peers and colleagues, cooperating teachers, supervisors, university instructors, parents, other pre-service teachers and researchers (Abell & Bryan, 1997; Collier, 1999).

Manouchehri (2002) reported that peer discourse, peer observations and peer feedback during field-based experience had the potential to facilitate pre-service teacher development. Peer discussion can help the pre-service teachers to confront each other's thinking, force one another to defend their personal ideas, and then extend their own ideas to a theoretical level.

Research Methodology

Research Design

This was a mixed-method research design study conducted in a five-year science teacher education program in a university in Bangkok, Thailand. In this program, field experiences were divided into two main parts: the first part consisted of three courses in observation and participation; and the second part consisted of two courses in student teaching. Thus, the design of and the questions posed in the research focused on the two main parts. In the first part, the researcher sought to find out: (1) the structure and implementation of participation and observation courses; (2) the perceptions of the pre-service science teachers regarding the quantity of their own practice and the characteristics of teachers; and (3) their satisfaction towards the management of participation and observation courses. The second part was designed to investigate the learning process and struggles experienced by pre-service science teachers as a result of teaching during their two courses of student teaching field experience. This was a two-year study collecting both quantitative and qualitative data. Multiple data sources were used and triangulated to enhance validity.

Data Collection and Analysis

The first part. RQ 1 and 2 were investigated. Various data were collected to answer RQ 1 "How is the field experience implemented for the preparation of science teachers in this program?". The researchers made observations during the field experience courses and interviewed field experience coordinators. They reviewed curriculum documents, field experience course manuals, pre-service teachers' handbooks and course syllabi. For analysis, all data were combined in order to enhance validity (Patton, 2002). The analysis of the collected data started with curriculum documents, field experience course manuals and codes were developed. These codes were compared with data from field notes of observations, the transcripts of coordinator's interviews and course syllabi.

Questionnaires were used to determine RQ 2, "What are the perceptions of pre-service science teachers regarding the quantity of their own practice and the desired characteristics of teachers that take place in field experience courses?". Since there were three field experience courses involving observation and participation (Field Ex1, Field Ex2 and Field Ex3), questionnaires were developed specifically for each. Each questionnaire encompassed four sections. The first three sections were: (1) personal data of pre-service science teachers; (2) their perceptions regarding the quantity of their own practice; and (3) their perceptions regarding the characteristics of teachers. Students chose one of five levels of agreement on a Likert-style rating scale ranging from "Strongly agree" to "Strongly disagree" to answer the questions. For the fourth section, students responded to open-ended questions at the end of the questionnaire. The questions asked pre-service teachers to give their opinions about the implementation of the field experience. The questionnaires had been developed by the researcher/authors of this article and then validated by three panels of experts. The validity and reliability were enhanced by pilot testing with pre-service teachers who were not the subjects in this study. The chronbach alpha coefficient of reliability of the questionnaires for Field Ex1, Field Ex2 and Field Ex3 was 0.96, 0.87 and

0.91, respectively. To collect the data, the questionnaires were administered to pre-service science teachers enrolled in field experience courses as:

(1) Second year pre-service science teachers, who had enrolled in Field Ex1 for the first semester of the academic year of 2007, were asked to complete a questionnaire. A completed questionnaire was returned by 39 of the 40 pre-service science teachers surveyed;

(2) Third year pre-service science teachers, who had enrolled in Field Ex2 for the first semester of the academic year of 2007, were asked to complete a questionnaire. A response rate of 100% (23 pre-service science teachers) was obtained from the survey;

(3) Third year pre-service science teachers, who had enrolled in Field Ex3 for the first semester of the academic year of 2007, were asked to complete a questionnaire. A completed questionnaire was returned by 22 of the 23 pre-service science teachers surveyed.

After each set of questionnaires on each course had been collected, semi-structured interviews were conducted to elicit additional information, as well as validate responses to questionnaire items. Five pre-service science teachers were interviewed to explore their personal perceptions of the effectiveness of the field experience courses, implementations of the courses, their learning and problems. Interviews averaged 40 minutes and were audio taped and transcribed for analysis. A computer program was used to analyze the questionnaires based on the statistics of frequency, mean and standard deviation. The additional transcripts of the interviews were analyzed inductively using content analysis.

The second part. RQ 3 "What do the fifth year pre-service science teachers learn and struggle with during a year-long field experience?" was investigated using 33 five-year pre-service science teachers enrolled in two field experience courses for student teachers in the first and second semester during 2008. Multi-method evaluations were used throughout the research process to understand the struggles encountered by the pre-service science teachers and what they had learnt about teaching science. The methods included: (1) reviewing the students' written reflections in their logbooks; (2) observation of seminar sessions; and (3) focus group interviews, with logbooks being the main source of data. The logbook design encouraged the pre-service teachers to reflect on and discuss their knowledge, learning and problems relative to the field experience.

Data from written reflections in logbooks, field notes and interview transcripts were combined in order to enhance validity (Patton, 2002). The first step in the analysis began with a particular incident from the written reflections of the pre-service science teachers in their logbooks, including reference to transcripts of the seminar discussion. Indicators were identified for the categories of "struggles" and "learning" and coded. Sub-categories, such as learning about teaching strategies and probing techniques, were identified and coded. These codes were compared for consistency and differences. The consistencies between codes revealed tentative categories. In the second step, incidents were compared to the initial versions of the categories. New incidents were assessed to determine if they exhibited the category properties. In the last step, categories and their properties were reduced, refined and then finally linked together to formulate themes to interpret the data.

Research Findings

First Part

The implementation of field experience. Field experience in the five-year teacher education program is composed of a series of courses that consists of two main components: observation and participation courses and student teaching courses. The observation and participation courses are a series of one-credit field

experiences designed to tie learning in teacher education courses to real classrooms, schools and communities. These courses include Field Ex1 (observation and participation in schools), Field Ex2 (observation and participation in the classroom) and Field Ex3 (observation and participation in teaching). The administration of the participation and observation courses was undertaken cooperatively between the Faculty of Education and the University Laboratory School. However, overall guidance was the responsibility of the University Laboratory School. Management was under the overall control of the vice principal, then the field experience coordinator and finally the school teachers. The field experience coordinator met with the school teachers who assumed roles of mentor teachers and lecturers. Course syllabi and worksheets were available to all participants in the field experience (pre-service teachers, mentor teachers and lecturers). Pre-service teachers were required to participate in the course for 15 weeks. In the first period of course orientation, the course syllabus was distributed to the pre-service teachers. The field experience coordinator introduced lecturers and mentor teachers to pre-service teachers and explained assignments and the field experience schedules to the pre-service teachers. In two to 15 weeks, pre-service teachers were divided into groups, with each group consisting of three to four pre-service teachers, who were assigned periods of block practice. At the end of the course, the pre-service science teachers met in the seminar room to discuss their learning progress, problems and comments for the course.

The main objectives of Field Ex1 were to provide the second year pre-service teachers with opportunities to learn about and practice school administration, school management, academic affairs, community relations, student affairs and guidance. After the course orientation in the first week, the school administration team lectured the pre-service teachers on the school management and administration processes. Then, in three to 15 weeks, the pre-service teachers were assigned to observe and practice jobs in 11 school departments, such as the assessment and evaluation department and the school library, under the guidance of mentor teachers in each department.

The purpose of Field Ex2 was to provide the third year pre-service teachers with opportunities to examine student activities, student sport activities and aspects of the teachers' tasks. Pre-service teachers were expected to learn about classroom management, solving some student problems, and the teachers' role and tasks. They were assigned to learn these by observing homeroom teachers at both the primary and secondary levels.

The objective of Field Ex3 was to provide the fourth year pre-service teachers with opportunities to understand and practice the application of organizing learning activities, students' behaviors, classroom management and the development of learning through the classroom action research process. Pre-service teachers were assigned to develop their skills regarding these jobs in five stages: (1) curriculum management and administration; (2) student learning; (3) extra-curricular activities; (4) classroom action research; and (5) teaching science in the primary level and secondary level. During field experience, they spent two hours each week for five weeks observing and teaching students at each level.

After completing three observation and participation courses (Field Ex1, Field Ex2 and Field Ex3), the pre-service teachers progressed to student teaching field experience (Field Ex4 and Field Ex5) in their fifth year. Student teaching focused on: planning instruction; teaching lessons; managing the classroom; developing instructional media; assessing student progress; conducting extracurricular activities; and classroom action research. Overall guidance was the responsibility of the centre for field experience. The courses had a management hierarchy of the deputy dean of academic affairs, the head of the centre, school principals, school cooperating teachers and university supervisors. Duties and responsibilities for the field experience courses

were provided to local primary and secondary schools. Arrangements for student teaching placements were made by the centre for field experience, specifically by the head of the centre. Cooperating teachers and supervisors provided front line advice, support and feedback to the student teachers. In addition, cooperating teachers were expected to assist student teachers in developing classroom management skills, gaining familiarity with teaching resources, lesson planning and reflective practice. They were tasked with providing guidance and modeling professional behavior through the development of supportive relationships. University supervisors acted as a bridge between the school and university and between student teachers and cooperating teachers. A handbook was available for all participants involved in the field experience (cooperating teachers, student teachers, supervisors and school staff). Supervision was standardized with a handbook and reporting form.

In the first and second weeks, pre-service teachers observed the teaching methods of the cooperating teachers. Observation and discussion with cooperating teachers were intended to allow pre-service teachers to become familiar with the classroom and school activities. Pre-service teachers were assigned periods of block teaching practice and then conducted their teaching, planned units and lessons, becoming an integral part of the day-to-day events and extra-curricular activities of the school. Pre-service science teachers spent an entire year (two semesters of 18 weeks each) in a local elementary or secondary school. In the first semester, the pre-service teachers were expected to teach science eight to 12 hours per week and conduct science extracurricular activities. Then, in the second semester, they were required to teach science for eight to 12 hours per week and do classroom action research. The student teaching, science extracurricular activities and classroom action research were supervised by university supervisors and school cooperating teachers at least four times a semester.

The perceptions of pre-service science teachers regarding the quantity of their own practice and the desired characteristics of teachers. This part presents the findings obtained from the questionnaire administered to pre-service teachers to determine their perceptions regarding the quantity of their own practice and the characteristics of teachers and their satisfaction toward the management of observation and participation field experience courses. Pre-service science teachers considered that they had high levels of practice in assigned jobs during all three field experience courses. Specifically, in Field Ex1, they considered that they had a high level of practicing and learning about school management and structures, library jobs, guidance service, research in special needs education, public relations, welfare and production of instructional materials. In Field Ex2, the pre-service science teachers reported a high level of practice in classroom management, producing worksheets, taking care of students, taking care of classroom cleanliness, making a presentation board and learning reinforcement. In Field Ex3, the pre-service science teachers considered how they had a high level of practice at observing teaching by the school teachers and the classroom environment, planning science lessons, planning unit plans, developing instructional materials, designing assignments, classroom management skills and at practicing teaching in a real classroom. However, they perceived that they had only a medium level of practice at developing tests and learning assessment and evaluation strategies, while the level of practice for conducting extracurricular activities was at a low level.

In all three courses, the perceptions of pre-service science teachers regarding the characteristics of teachers were at a high level. Pre-service teachers consistently perceived that observation and participation experiences enhanced their training to become good teachers. Learning encompassed: (1) how to control their emotions about individual student differences; (2) how to behave towards other teachers and students about working with

other people; and (3) the importance of being on time, dressing well and the codes and ethics of the teaching profession. However, the analysis of the interviews and open-ended questions indicated that pre-service science teachers wanted to have more practice in observation and participation. They argued that mostly the mentor teachers lectured or just observed them instead of giving them opportunities to practice and do their jobs. Additionally, pre-service science teachers had problems in making appointments because they had to study for their coursework in both the faculty of education and the faculty of science; they did not have sufficient time to participate and observe teaching by their mentor teacher or to do their jobs. They also commented that the University Laboratory School, as a field placement, did not reflect the real situation. They thought that observing and participating activities in a regular public school might help them learn more about teachers' jobs and teaching and learning in a real life situation.

Second Part

Struggles with teaching science. Through written reflections in their logbooks, pre-service science teachers were asked to reflect on their problems and struggles and on comments both from cooperating teachers and supervisors about their teaching. Several themes, coded as "struggle", across the reflective statements of all pre-service science teachers emerged. Pre-service science teachers reported that during their field experience, they faced many obstacles in teaching materials. In particular, at the beginning of their field experience, several pre-service science teachers were concerned about designing and organizing activities when they planned their lessons. It was quite difficult for them to think of how to write expected learning outcomes and how to begin and sequence learning activities. Some reflected that learning outcomes they were intended to achieve were too general and did not show what science concepts or skills the students were expected to obtain.

In teaching practice, many pre-service science teachers were challenged by the complexity of teaching and student learning. Generally, they felt that rarely, they probed student prior knowledge at the beginning of the lesson. Even though some asked questions at the introductory stage of the lesson, those questions did not relate to the science concepts they were going to teach. When they asked student questions, they accepted or rejected student answers and then went on to another concept, rather than asking students to give more details. They thought that asking further questions took time, so they seldom paid attention to students' answers and concepts. Additionally, some pre-service science teachers reflected that they struggled to ask students content-specific questions. They asked questions of the students, but most of the questions were quite difficult for students to answer.

Classroom management was another problematic issue for the pre-service science teachers. They found it difficult to think of techniques to cope with disruptive behavior by students, especially with a diverse group of students in a classroom. They reported that students did not pay attention to their learning activities, especially those whose academic ability was below average and sat at the back of the classroom. These students could not answer or seldom responded to their questions, so that only other students with higher academic performance understood what was being taught. The pre-service science teachers discussed the fact that the number of students in each class had affected their classroom management. Since each classroom had 40 to 60 students, it was difficult to assign students into a group of four members.

Another concern was the limitation of their conceptual understanding of science. Some pre-service science teachers considered that science concepts were too complex and difficult for them to teach. They felt that they held misconceptions about many science concepts. This concern inhibited them to choose key concepts and

design learning activities. They noted that when planning the lesson, they put many science concepts in one topic, so they could not provide an appropriate sequence for the science concepts they were going to teach.

Finally, pre-service science teachers' struggled with time management. Throughout their teaching practice, pre-service science teachers reported that there were many extra school activities that affected their teaching timetable and so they could not teach as they had planned. Mostly, they coped with this by omitting some science concepts and changing the hands-on experiment activities to lectures. With the limitations of time, they explained science concepts by writing on the backboard, instead of preparing hands-on activities for students.

Learning about teaching and learning science. In this section, the teachers' learning about teaching and learning science during field experience is addressed. Despite of the struggles they experienced, the pre-service science teachers also commented on "learning", which included more understanding of lesson planning, teaching techniques, student learning, classroom management and using learning materials. Many pre-service science teachers reported that they had learned how to write a good lesson plan. As they mentioned in logbooks, the correct form of lesson plans should include learning outcomes, concepts, teaching and learning processes, learning materials and evaluation. In particular, some indicated that the learning objectives or learning outcomes in the lesson plans should cover cognitive, science process skills, scientific attitude and attitudes towards science.

Another learning theme expressed by a substantial number of pre-service science teachers was teaching techniques. The pre-service science teachers came to realize the importance of conducting hands-on activities, probing students' prior knowledge, asking questions and concluding the lesson. In some cases, they were confronted with new ideas and knowledge. For instance, when they provided students with opportunities to conduct hands-on activities, their students became more interested and participated in learning science. Consequently, the pre-service science teachers claimed that hands-on activity was important to science teaching and learning. Pre-service science teachers' learning was supported by cooperating teachers and university supervisors. For example, they noted that they had learned how to introduce the lesson from specific feedback and advice from their cooperating teachers and university supervisors.

Even though pre-service science teachers had struggled with the lesson introduction at the beginning of their field experience, they improved and developed their teaching as suggested by cooperating teachers and university supervisors. Pre-service science teachers thought that probing student prior knowledge should be conducted at the beginning of the lesson rather than asking students what topics they were going to learn. They also found that time spent on waiting for an answer was very important. When they gave students time to think, they could understand more about students' ideas and conceptions from the students' replies.

Pre-service science teachers counted understanding their student learning characteristics as a part of their knowledge gained from their student teaching experiences. They commented that being a teacher in a real classroom helped them to know the characteristics and abilities of their students. Understanding individual characteristics led them think about how to design responsive teaching and learning activities.

Classroom management was another important specific learning aspect. Pre-service teachers reflected that using cooperative learning and group work techniques helped them control their classroom more easily. Some reported that at the beginning of teaching, they had problems with classroom management. Even though they asked students to work in groups, their students did not want to work with their peers. As time passed, the students became familiar with working cooperatively and understanding their roles. The final learning theme was learning materials. Pre-service science teachers reflected that providing learning materials could encourage

students' learning and attention. They became aware that effective learning materials should help students understand an abstract science concept. Thus, the pre-service teachers thought that concrete learning materials, such as a picture or an in-house apparatus needed to be prepared prior to teaching and its use in learning activities.

Conclusions, Discussions and Recommendations

This research study reflects current understanding of the field experience component in a teacher preparation program in Thailand. The research focused on investigating the implementation of field experience, perceptions of pre-service science teachers on their field experience courses and their learning and struggles in student teaching. The research studied field experience that consisted of three courses in observation and participation and two courses in student teaching. Field experience courses were a series of experiences in which the pre-service science teachers learned about and practiced school administration, a teacher's roles and content-specific teaching, respectively. Even though pre-service teachers perceived that observation and participation in field experiences helped them to be well mannered, they thought they rarely had opportunities to practice a teacher's jobs, only observing them. This may cause pre-service teachers to be unable to link their learning from academic coursework with the realities of classroom teaching (Beeth & Adadan, 2006). Specifically, the three courses in observation and participation mostly focused on general jobs and general pedagogy, rather than offering pre-service science teachers opportunities to learn content-specific teaching practices (Shulman, 1987; Watsons, 2006). Consequently, they could face many difficulties in their teaching practice in real situations. They may not be able to transfer their learning from observation and participation in field experiences into their student teaching practices. Furthermore, when pre-service teachers progressed to student teaching in a real classroom, they struggled to develop their own PCK (pedagogical content knowledge) (Black, 2004; Shulman, 1987). They could not set clear and expected learning outcomes in lesson planning. They did not probe students' prior knowledge, rarely asked questions and could not manage a classroom. They also had misconceptions about many science concepts. However, pre-service teachers did learn some lesson planning techniques and teaching strategies, as well as about student-learning processes, classroom management and how to incorporate instructional material (Abell & Bryan, 1997).

The findings of this study confirm the notion that direct experience in teaching is a key element in a teacher education program (Sadler, 2006). Field experience has a significant role in assisting the pre-service teachers gain expertise and confidence in their content-specific teaching. As pre-service teachers learned from their cooperating teachers, supervisors and even their students, they were able to improve and develop their teaching. Cooperating teachers and university supervisors should share their collaborative ideas on the learning and problems encountered by pre-service teachers and provide the pre-service teachers with comments by focusing on content-specific teaching (Abell & Bryan, 1997). Importantly, the cooperating teachers, university supervisors or other stakeholders may be able to use the findings of this study to guide their supervision.

Future research could investigate how to prepare students to develop their ability to do further classroom action research. The research could explore how classroom action research impacts on the teaching practice of pre-service science teachers. Conducting classroom action research could be an effective tool to help pre-service science teachers reflect on their teaching practice and encourage their understanding of teaching and learning in both theory and action. This type of future research could provide data about effective practices and guide the preparation of high quality science teachers.

References

Abell, S. K., & Bryan, L. S (1997). Reconceptualizing the elementary science methods course using a reflection orientation. *Journal of Science Teacher Education, 8*(3), 153-166.

Amornvivat, S. (2002). *Learning process reform of the pilot schools: The selected models*. Bangkok: Office of the National Education Commission.

Baird, J., & White, R. (1996). Metacognitive strategies in the classroom. In D. Treagust, R. Duit, & B. Fraser (Eds.), *Improving teaching and learning in science and mathematics*. New York: Teachers College Press.

Beeth, M. E., & Adadan, E. (2006). The influences of university-based coursework on field experience. *Journal of Science Teacher Education, 17*(2), 103-120.

Bell, B., & Gilbert, J. (1994). Teacher development as professional, personal and social development. *Teaching and Teacher Education, 10*(5), 483-497.

Black, K. (2004). Science in the trenches: An exploration of four pre-service teachers' first attempts at teaching science in the classroom. *International Journal of Science and Mathematics Education, 2*(1), 25-44.

Capobianco, B. M. (2007). A self-study of the role of technology in promoting reflection and inquiry-based science teaching. *Journal of Science Teacher Education, 18*(2), 271-295.

Collier, S. T. (1999). Characteristics of reflective thought during the student teaching experience. *Journal of Teacher Education, 50*(3), 173-181.

Fry, G. W. (2002). *Synthesis report: From crisis to opportunity, the challenges of educational reform in Thailand*. Bangkok: Office of the National Education Commission.

Graham, B. (2006). Conditions for successful field experiences: Perceptions of cooperating teachers. *Teaching and Teacher Education, 22*(8), 1118-1129.

Kagan, D. (1992). Professional growth among preservice and beginning teachers. *Review of Educational Research, 62*(2), 129-169.

Loucks-Horsley, S., & Matsumoto, C. (1999). Research on professional development for teachers of mathematics and science: The state of the scene. *School Science and Mathematics, 99*(5), 258-271.

Lowery, N. V. (2002). Construction of teacher knowledge in context: Preparing elementary teachers to teach mathematics and science. *School Science and Mathematics, 102*(2), 68-83.

Manouchehri, A. (2002). Developing teaching knowledge through peer discourse. *Teaching and Teacher Education, 18*(6), 715-737.

Northfield, J. (1998). Teacher educators and the practice of science teacher education. In B. J. Fraser, & K. G.Tobin (Eds.), *International handbook of science education.* The Netherlands: Kluwer Academic Publisher.

Office of the National Education Commission. (1999). *National Education Act B.E. 2542(1999)*. Bangkok, Thailand: Office of the National Education Commission.

Patton, M. Q. (2002). *Qualitative research and evaluation methods*. California: Sage.

Russell, T. (2005). Using practicum in pre-service teacher education program: Strengths and weaknesses of alternative assumptions about the experiences of learning to teach. In G. F. Hoban (Ed.), *The missing links in teacher education design.* The Netherlands: Springer.

Sadler, T. D. (2006). "I wound not last three weeks": Pre-service science teachers reflect on their student-teaching experiences. *Journal of Science Teacher Education, 17*(3), 217-241.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*(1), 1-22.

The Institute of Promotion of Science and Technology Teaching. (2002). *Thai science teachers standards*. Bangkok: The Institute of Promotion of Science and Technology Teaching.

Tobin, K., Tippins, D. J., & Gallard, A. J. (1994). Research on instructional strategies for teaching science. In D. L. Gabel (Ed.), *Handbook of research on science teaching and learning.* New York: Macmillan.

Watson, S. B. (2006). Novice science teachers: Expectations and experiences. *Journal of Science Teacher Education, 17*(3), 279-290.

Zuckerman, J. T. (1999). Student science teachers constructing practical knowledge from in-service science supervisions' stories. *Journal of Science Teacher Education, 10*(3), 235-245.