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Are Pre-Service Teachers Ready for their Field Experiences

Phadungphatthanakoon Songpon[1], Dahsah Chanyah[2]

Abstract

Pedagogical Content Knowledge (PCK) is an essential knowledge for pre-service teachers during the field experiences because it highly impacts on their classroom practices. Thus, this study aimed to explore the chemistry pre-service teachers' PCK in chemical instruction course whether they were ready to their practicum and field work experiences in schools. The participants of this study were nine pre-service teachers, who were randomly selected from the 4th year pre-service chemistry teachers (N=25) of a university situated in Bangkok. The data were qualitatively collected and triangulated through observations, interviews, and documental analysis of lesson plans from their Microteaching. The results indicated that 1) the pre-service teachers focused on guided inquiry orientation and activity-driven orientation. 2) only two of them understood knowledge of science curriculum correctly, other two misunderstood, while the others did not have the knowledge 3) the participants neither focused on exploring students' prior knowledge nor considered which content was challenge for their students. 4) all participants used guided inquiry as a teaching strategy, but still had some misunderstanding. 5) the participants used only worksheet to evaluate their students' science learning ability; a variety of methods used for assessing students' learning should be included. In conclusion, the results showed that the pre-service teachers had limited knowledge in science curriculum, students' science understanding, instructional strategies, and science assessment that are the main components of PCK. The pre-service teachers, hence, not only need to improve pre-service science teachers curriculum, but also need to scaffold techniques during their practicum.

1. Introduction

The pedagogical content knowledge (PCK) is teachers' content knowledge allowing them to teach particular contents effectively [1]. PCK was originally conceptualized by Shulman (1987), defined PCK as " 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 learning, and presented for instruction" (p.8) [2]. Shulman defined that PCK consists of two components: 1) knowledge about learners including prior knowledge, alternative conceptions, learning difficulties; and 2) knowledge of teaching in particular topics that is suitable for students having diverse abilities and backgrounds. Based on Shulman's definition, many research studies identified PCK components and added two more components which are 1) conceptions of the purposed of teaching, and 2) knowledge of curriculum [3]. In science education, PCK was categorized into five components by Magnusson, Krajcik, and Borko [4] by adding the knowledge about assessment as another component, and revised the concepts of "purposes of teaching" to "orientation toward science teaching".

1) Orientations toward science teaching refers to teachers' knowledge and belief in teaching science specific with each grade levels. Magnusson et al. identified nine science teaching orientations by characteristics of instruction that follows from orientations toward science teaching including: (1) process, (2) academic rigor, (3) didactic, (4) conceptual change, (5) activity-driven, (6) discovery, (7) project-based science, (8) inquiry, and (9) guided inquiry.

2) Knowledge of Science Curriculum refers to teachers' knowledge of learning goals and instructional materials. It is important to help teachers create science activities in classroom that cover the student's understanding due to the purpose of science curriculum.

3) Knowledge of Students' Understanding of Science refers to teachers' knowledge about students' ability, prior knowledge, and common misconception in scientific concepts.

4) Knowledge of Science Instructional Strategies refers to teachers' knowledge of how to teach relevant knowledge about subject-specific and topic-specific strategies.

5) Knowledge of Assessment in Science refers to teachers' knowledge about what and how to assess student's learning ability related to teaching goals.

[1] The Science Education Center, Faculty of Science, Srinakharinwirot University, Thailand
[2] The Science Education Center, Faculty of Science, Srinakharinwirot University, Thailand

PCK is crucial for pre-service teachers since it significantly impacts on their instructions. This knowledge helps them to create appropriate instructions to learners who have diverse interests and learning abilities [5] corresponding to Tobin and Fraser's investigation [6]. The knowledge also demonstrated that the science teachers who have a strong PCK often achieve in science teaching. As a consequence, this study aimed to explore the chemistry pre-service teachers' PCK in chemical instruction course to study if they were ready to their practicum and field work experiences in schools.

Research Objectives

This research aimed to explore the chemistry pre-service teachers' PCK in chemical instruction course to study whether they were ready to their practicum and field work experiences in schools.

Research Methodology

Qualitative research was used in this study in order to investigate the chemistry pre-service teachers' PCK in chemical instruction course to study whether they were ready to their practicum and field work experiences in schools. Multiple case studies were used as research methodology to explore pre-service teachers' PCK, enhancing transferability [7].

Research participants

The participants in this study were nine pre-service teachers who were randomly selected from the 4th year pre-service chemistry teachers (N=25) of a university situated in Bangkok. All pre-service chemistry teachers were studying in a Bachelor of Education (B.Ed.) degree.

Data Collection

The researcher collected and used data from multiple sources including classroom observation, individual interview, and lesson plan from participants' Microteaching. Field notes were used to record Microteaching observation. All pre-service teachers were interviewed at the end of the Microteaching for 15-30 minutes and recorded on audiotape, then transcribed verbatim. Documentary data on teaching and assessing (lesson plans, instructional material) was collected in order to enhance trustworthiness of the other data.

Data Analysis

The researcher attempted to conclude the understanding patterns of the pre-service teachers' PCK by using multiple sources of data to enhance transferability. The qualitative data were analyzed through inductive process: categorical aggregation, and a search for correspondences and patterns. Multiple case studies were conducted through this study so data analysis; within-case analysis and cross-case analysis were used [8]. Also, the understandings of each pre-service teacher's PCK by data interpreted from multiple sources were analyzed under the PCK framework of Magnusson et al. (1999).

Findings

The findings from triangulated data of multiple sources were shown in each component of PCK, as follows.

1) Orientation towards Science Teaching

All chemistry pre-service teachers have guided inquiry and activity-driven orientation toward science teaching. All of them used 5E inquiry cycle to create their instructions. In addition, the experiments were used as activities to motivate their students' learning. These findings allow the researcher to conclude that the pre-service teachers focused on guided inquiry orientation and activity-driven orientation.

2) Knowledge of Science Curriculum of Thailand. Other two chemistry pre-service teachers, who misunderstood the knowledge, said that they started analyzing content for instruction, then created activity and compared to the standard stated in the Core Curriculum in order to set the learning objectives. The other five said that they did not understand how to write learning objectives; they imitated the learning objectives from a teacher's manual.

3) Knowledge of students' Science Understanding

The participants neither focused on exploring students' prior knowledge nor considered which content that was challenge for their students, it indicated unawareness of students' prior knowledge, difficulties and alternative conception. To illustrate, they began the lesson by asking the students to give examples or think about topic in the lesson; however, there were no further specific probing questions to help students clarify their ideas, and involved them to the lesson. Besides, they did not research about students' alternative conceptions or difficulties related to particular concepts.

4) Knowledge of Science Instruction Strategies

All nine chemistry pre-service teachers used 5E instructional model, but the lesson plan analysis and classroom observation had shown that they had misconception in all steps of 5E inquiry cycle. In explanation step, they only explained the science concepts but did not ask students or use evidence in exploration step to construct scientific explanation. For the elaboration step, they described the extended contents to students but never mentioned how to apply the concepts from the exploration and explanation steps. The findings here could be concluded that all participants tried to use guided inquiry as their teaching strategy, but had some misunderstanding about guided inquiry.

5) Knowledge Science Assessment

All nine chemistry pre-service teachers mainly used only a worksheet to evaluate their students' science learning ability. Some of them assessed students' learning outcomes by observing students discussion, participation in answering questions, and learning behavior. Indeed, the purposes of the observation were not obvious and the evaluation of students' outcomes related to learning objectives was not mentioned**Curriculum**

Only two of the pre-service teachers understood knowledge of science curriculum correctly, other two misunderstood, while the others did not have the knowledge. The two chemistry pre-service teachers, who understood the knowledge, claimed that they created the learning objectives by analyzing standard and learning indicators stated in The Basic Education Core

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2. Conclusions

The study indicated that the chemistry pre-service teachers focused on guided inquiry orientation and activity-driven orientation, but had some misunderstanding about guided inquiry. Only two of them understood knowledge of science curriculum correctly, other two misunderstood, while the others did not have the knowledge. In addition, they did not focus on exploring students' prior knowledge, and did not consider which content that was difficult for their students. They only used worksheet to evaluate their student's science learning while there was supposed to be a variety of methods using in students' science learning assessments. This finding pointed out that the pre-service teachers are not quite ready for practicum, since they lack of an understanding and hold some misconception of PCK. Thus, it is essential to encourage pre-service teachers curriculum to develop pre-service teacher's PCK, not only in the method course, but also during their practicums.

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