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11. IN-SERVICE MATHEMATICS TEACHERS' PROFESSIONAL LEARNING IN TEACHING RESEARCH GROUP

A Case Study from China

CHINESE TRG AND ITS PRACTICAL ORIENTATION

Although Chinese mathematics teachers do not exhibit the quantity of formal higher education that their Western or Japanese counterparts do, some studies have suggested that Chinese mathematics teachers have more profound understanding of fundamental mathematics, have better PCK of mathematics, and use that knowledge more coherently during instruction (An et al., 2004; Li & Huang, 2008; Ma, 1999). Despite a lack of formal training, one possible reason for the strength of Chinese mathematics teachers' practice may be their involvement in various teaching research activities conducted by their school-based teaching research network. In TRG activities, Chinese teacher usually discuss how to improve classroom instruction. The emergence of knowledge is quite similar to PCK, which was explained by Shulman (1987). That is, when a teacher copes with a special topic, he/she will organize, adjust and present subject matter knowledge to do task design by considering a special group of students' interest and capacity. Though some studies have been done on what the PCK is (Leinhardt, 1989; Wineburg, 1991; Lampert, 1990; Ball, 1993; Grossman, 1995; et al), even Carter (1990) and Gudmundsdottir (1991) compared the different understandings on PCK in different studies. PCK is looked at as a kind of practical knowledge which is situated in a special topic of a subject. Unique PCK makes a subject teacher to be a teacher without requiring him/her to be a subject expert or an education expert. It is "different from content knowledge and knowledge of general pedagogy; rather it is consisting of representations of subject matter, student conceptions, and understanding of specific learning difficulties" (Appleton, 2003).

Chinese educators have engaged in Teaching Research Group (TRG) activities for several decades since TRG was set up in each school by administrative power (MOE, 1952, 1957). TRG activities are similar to a form of lesson study, but less well-known than Japanese lesson study (Stigler & Hiebert, 1999). Like the West, Chinese schools are organized by age into primary, junior high, and senior high schools. All grade levels study the same three core subjects: the Chinese and English languages and mathematics. Unlike the West, Chinese students form class cohorts

that stay together in the same classroom throughout the day, visited by their various teachers. Because most of the Chinese teachers who teach Chinese, English, or mathematics only teach one subject two or three times a day, these core-subject teachers are easily organized into subject-specific TRGs. City-level and province-level teaching research officers (TRO) are responsible for guiding the subject-specific teaching and research activities in their domain. This multi-tiered teaching research system is a network where province-level TROs oversee city-level TROs, which oversee school-level TRGs (Yang, 2009b). The TRG is the basic unit in this network; its main responsibility is conducting research on teaching to solve the practical problems facing teachers.

A TRG provides the learning opportunities for the front line teachers. Usually there are experienced teachers and green hands in a TRG. Although they have diverse understanding about mathematics learning and teaching, and experienced teachers are generally superior to the green hands in terms of practice knowledge, every teacher has an equal right to decide how to organize his/her own classes. That means the opinions in TRG activities are not compulsory for the implementer of a lesson, no matter whether he/she is a novice or an experienced teacher. Each one does not need to follow others' opinions or imitate what experienced teachers do, but should rely on his/her own knowledge and judgment. So, our hypothesis in the paper is that, once a teacher changed his/her behaviors in a lesson or showed his/her different understanding in post-lesson TRG activities, there will be a significant signal that he/she has acquired or understood something where learning or knowledge exists.

Over the last 60 years, Chinese teachers have developed a very focused framework to think about lesson preparation, observation, and post-lesson reflection called *Three Points*. These three points are: (1) the lesson's key point, (2) the lesson's difficult point, and (3) the lesson's critical point (Yang, 2009b). Sometimes the Three Points are not explicitly written into the lesson plan, but help to frame TRG discussion during the lesson's construction, influencing the subsequent post-lesson discussion. Current Western educational scholars often refer to Shulman's (1986, 1987) PCK to describe the peculiarities that a subject-specific teacher must master to effectively instruct students about a particular content topic. It is the knowledge that teachers need to transform their own content understanding into instruction that helps students understand. Educational scholars have struggled to describe, define, and study pedagogical content knowledge. In effect, the Chinese teachers are using a practical way to think about various sub-domains of PCK with the Three Points during their lesson-improving process. In the paper, we will show a case of TRG activities to explore how this kind of frame was used and what the teachers have learned.

METHOD

We chose the case study method to investigate how teachers' participation in TRG activities help them to acquire practical knowledge or PCK during the process of improving classroom instruction. The case study allows in-depth analysis of teacher