Chapter 18
Exploring the Development of Pre–Service Teachers' ICT–TPACK using a Cognitive Stimulation Tool

Syh-Jong Jang
Asia University, Taiwan

Meng-Fang Tsai
Kaohsiung Medical University, Taiwan

ABSTRACT

Self-regulated learning (SRL) skills and Technological Pedagogical and Content Knowledge (TPACK) are important issues in current educational studies. Most of SRL studies have highlighted the relationship between self-regulation and academic performances. However, few existing research on the aspect of SRL is seldom applied to the research on TPACK of pre-service teachers. The purpose of this paper was to examine pre-service teachers' development of TPACK with appropriate Information and Communication Technologies (ICT) using cognitive stimulation tool (CST). Pre-service teachers self-rated their ICT-TPACK at two time points, and the statistical analysis indicated significant difference. The analysis of qualitative data showed that pre-service teachers used cognitive regulation strategies to develop their understanding and application skills on ICT-TPACK and were able to use reflective practices to demonstrate their understanding of TPACK at the end of the semester. The research implications of this study and TPACK instrument development are provided along with suggestions.

INTRODUCTION

In 2001, the meeting of educational reform held by the Ministry of Education in Taiwan stated the importance of employing innovative curriculum and information and communication technology

(ICT) tools into pedagogy to increase teachers' teaching effectiveness. Therefore, school teachers have been encouraged to adopt ICT tools and develop their literacy of technology, content, and pedagogy for their professional development and teaching effectiveness by using technological de-

vices. Researchers have suggested Technological Pedagogical and Content Knowledge (TPACK) to be an essential concept that can unite pedagogical content knowledge (PCK) and technology integration into teaching to improve teachers' instructional effectiveness (Holmes, 2009; Jang & Chen, 2010; Niess, 2005).

Many studies have shown that self-regulated learning (SRL) skills are beneficial to individuals' learning. Most of them also have highlighted the relationship between self-regulation and academic performances (Kuo, Walker, Schroder, & Belland, 2014; McClelland, Morrison, & Holmes, 2000; Tseng, Liang, & Tsai, 2014; Winters et al., 2008). However, few existing research on the aspect of SRL is seldom inclusively discussed and applied to the research on TPACK of pre-service teachers. Therefore, in the study, the researchers used a cognitive stimulation tool designed according to the area of cognitive regulation in the SRL model proposed by Pintrich (2000), to help pre-service teachers practice activating and regulating their mental processes as they learn and apply TPACK to the final course project in their collaborative learning group.

THEORETICAL FRAMEWORK

TPACK Framework

Koehler and Mishra (2005) initially proposed the Technological pedagogical and content knowledge (TPACK) framework, which contains seven elements:

1. Content knowledge,
2. Pedagogical knowledge,
3. Technology knowledge,
4. Pedagogical content knowledge,
5. Technological content knowledge,
6. Technological pedagogical knowledge, and
7. Technological pedagogical content knowledge.

TPACK is originated from the PCK concept (Shulman, 1986, 1987) that illustrates teachers' pedagogical knowledge, content knowledge and PCK. TPACK depicts a new direction in helping researchers understand the complex interrelationships among content, pedagogy (Schmidt, Baran, Thompson, Mishra, Koehler, & Shin, 2009) and technology and serves as a tool to develop projects related to the concept for teacher education (Baran, Chuang, & Thompson, 2011).

TPACK is the package of knowledge integrated whole for the three kinds of knowledge addressed: technology, pedagogy, and content (Thompson & Mishra, 2007). Jang and Tsai (2012) revised TPACK including the seven sub-components and contexts, content knowledge (CK) indicates the subject knowledge to be learned by students and taught by teachers. Technological knowledge (TK) refers to the knowledge of various ICTs such as computers and digital technologies. Pedagogical knowledge (PK) consists of the learning and instructional practices and strategies that involve processes and procedures. Pedagogical content knowledge (PCK) is similar to the PCK proposed by Shulman (1986) and is related to the knowledge of representations and formulation of subject concepts and instructional techniques, which can make subject concept difficult or easy in learning and teaching, and contribute to an understanding of students' prior knowledge. Technological content knowledge (TCK) indicates how teachers use technology to represent the subject content to learners. Technological pedagogical knowledge (TPK) refers to the knowledge of how teachers use technology to help instruction related strategies. Finally, technological pedagogical content knowledge (TPCK) involves the knowledge of integrating technology into the subject content and implementing pedagogical strategies in teaching. The contexts might include students' prior knowledge and learning difficulties, students' interactions, culture and educational policy, student knowledge evaluation, etc. (Jang & Tsai, 2012) as Figure 1.

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