

## Chapter 7

# Preservice Teachers' Knowledge Construction with Technology

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### ABSTRACT

*Today's teachers are expected to use digital technologies in their teaching. However, teacher education programs do not yet effectively develop teachers' capabilities to teach with technology. In order to search for best approaches, this chapter starts with an epistemological discussion on knowledge, and then moves to a more specific discussion about the nature of preservice teachers' learning about using technology to teach. Using the framework of Technological Pedagogical Content Knowledge, the chapter argues that methods courses of a teacher education program are the key space where preservice teachers can be trained to use technology in subject teaching. Particularly, the Microteaching Lesson Study approach in methods courses was considered an effective way for the development of technology proficiency. A recent study supports the arguments and articulates the success and challenges of the Microteaching Lesson Study approach.*

### INTRODUCTION

Integrating technology in teaching has become a highly recommended practice for school teachers. This can be verified by the international movement of the development and revision of educational technology standards for teachers (ISTE, 2008; Zhang, 2007). Teacher education standards and

curriculum policy documents have also explicitly suggested teachers use technology in teaching school subjects (National Science Teachers Association, 2003; Ontario Ministry of Education, 2008). Unfortunately, although teacher education programs have implemented various measures to develop preservice teachers' capacity to use technology (Kay, 2006), there are continuous

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studies reporting that preservice teachers and beginning teachers are not well prepared in this area (Kay, 2006; Pope, Hare, & Howard, 2002; Selinger, 2001; Zhou, Zhang, & Li, 2012). In this context, it becomes a timely and serious issue to re-examine what teacher education programs have been doing and search for effective paths for teacher preparation. To this end, we need to understand the nature of preservice teachers' learning. On one hand, preservice teachers are learners just as the students from other majors on a university campus. On the other hand, they are different since preservice teachers learn how to teach subjects rather than the subjects themselves. The picture gets even more complex when digital technology is brought into subject teaching. What type of knowledge do preservice teachers actually need to develop?

To answer this question, and others, this chapter starts with a discussion of *knowledge* and explores how digital technologies can help with its development. This is followed by an examination of the nature of preservice teachers' learning about using technology to teach. With this background, we consider methods courses as the effective context for developing teaching-with-technology skills. An exploratory study of a teacher education program contextualizes this argument.

## **BACKGROUND**

### **What is Knowledge?**

When my son Albert was about 16 months old, my daughters had successfully taught him to drink using a straw. One day, my wife and I observed him attempting to drink milk using a Chinese chopstick. While we were laughing at his cuteness, I commented that this was a mere mechanical imitation, which hints that Albert did not understand the theory behind drinking with a straw. However, my wife disagreed. She thought

Albert was so smart that he transferred what he learned about the straw to another object with a similar shape.

The dispute between my wife and me reflects the difficulty for people to agree when talking about knowledge and learning. Actually, philosophers have been working hard on providing a definition for knowledge for thousands of years, but the argument still exists today. The classic definition of knowledge as justified truth entails three conditions of knowledge: truth, belief, and justification. This definition has received a great amount of attention from modern epistemologists, particularly in the late 20<sup>th</sup> Century; unfortunately no analysis of knowledge has been widely accepted (Ichikawa & Steup, 2012).

Despite the existing debate about the definition of knowledge, many of us are content to operate within a more general notion of what *knowledge* means, without examining it explicitly. According to Denning (2009, para. 1) *knowledge* is “the fact or condition of knowing something with familiarity gained through experience or association...the fact or condition of being aware of something...the circumstance or condition of apprehending truth or fact through reasoning...[or]the fact or condition of having information or of being learned.” Thus, knowledge has different levels. Some knowledge refers to awareness of something or possession of information about it; another type of knowledge links to reasoning and processing information. There is another layer of knowledge: action. Knowledge is considered as “the ideas or understandings which an entity possesses that are used to take effective action to achieve the entity's goal(s)” (ibid). This definition of knowledge points out that knowledge is specific to the entity which created it. This *active knowledge* informs an individual's actions towards specific goals.

Anderson, Krathwohl, Airasian, et al. (2001) categorize four types of knowledge: factual, conceptual, procedural, and metacognitive. Factual

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