Chapter 18
Technology Capacity Building for Preservice Teachers through Methods Courses:
Taking Science as an Example

George Zhou
University of Windsor, Canada

Judy Xu
University of Windsor, Canada

ABSTRACT

Technology proficiency has widely been considered a necessary quality of school teachers, yet how to help teachers develop this quality remains an unanswered question. While teacher education programs often offer one technology course as a solution to this issue, scholars have recently argued that such technical skill-oriented courses are not sufficient to develop preservice teachers' ability to use technology in teaching. This paper argues that the use of technology in teaching requires integrated knowledge between technology, pedagogy, and subject content, and this highly blended knowledge is best developed through the methods courses of a teacher education program. The key message is that preservice teachers need to be consistently exposed to technology and regularly be required to practice it in many aspects of instruction.

INTRODUCTION

Education reform movements supported by the National Research Council (NRC) and the National Science Teachers Association (NSTA) advocate the use of Information and Communication Technology (ICT) to help middle and high school students learn science (NRC, 1996; NSTA, 2003). Technology proficiency has therefore been widely considered as a viral quality of today's school teachers. However, there are fewer consensuses regarding the solution of how a teacher

DOI: 10.4018/978-1-4666-2949-3.ch018

education program effectively prepares teachers to use technology. This paper will review the current practice and research in this area, discuss the significance and challenges of integrating technology in methods courses, and outline the possibilities for future research. It can serve as a guide for the methods course instructors, curriculum designers, and researchers to improve the practice and research of teacher education in building preservice teachers' technology capacity.

BACKGROUND: THE NEED FOR TECHNOLOGY PROFICIENCY

Over the last two decades, the use of ICT has been an important topic in education. First, scholars have advocated a need to develop school students' technology literacy given the fact that ICT has stepped into every aspects of our lives. Schools therefore should take ICT into their curricula. Second, scholars have argued that the younger generation is tech-savvy. Technology represents the preferable way this generation is accustomed to learning. And particularly, studies have shown that ICT can enhance teaching and learning. For example, in science and mathematics education, scholars have documented that the use of ICT can improve students' conceptual understanding, problem solving, and teamwork skills (Fund, 2007; Hannafin, Hannafin, & Gabbitas, 2009; Tao & Gunstone, 1999; Zhou, Brouwer, Nocente, & Martin, 2005). From this perspective, technology is seen as a "mind tool" (Jonassen, 1996) that teachers should use in planning and conducting instruction to achieve curriculum standards. In essence, teachers teach with technology. Similar to the difference Jonassen described between "learning with technology" and "learning about technology," teaching with technology is different from teaching about technology. It considers technology as a tool that teachers creatively use for the purpose of instruction, instead of a teaching subject.

Given the significance of ICT, most curriculum policy documents state the importance of ICT for education and encourage school teachers to use it. Particularly, ICT becomes a key factor that has lead to school curriculum reforms in many regions. For example, in Canada, the provincial Ministry of Education of Alberta has introduced an ICT program of studies into its school system (Alberta Education, 2001). The ICT program of studies provides a broad perspective on the nature of technology, how to use and apply a variety of technologies, and the impact of ICT on student themselves and the society. It specifies what students from kindergarten to grade 12 are expected to know and be able to do with respect to technology. It also provides illustrative examples and an assessment tool kit. The illustrative examples clarify the intent of the outcomes and convey their breadth and depth. The assessment tool kit provides a support framework for determining student competencies in the ICT outcomes within core subject courses. With a belief that technology is best learned within the context of applications, the ICT program of studies is structured as a 'curriculum within a curriculum', using the core subjects of English Language Arts, Math, Science and Social Studies as a base. In other words, the ICT program of studies is not intended to stand alone, but rather to be infused within core courses.

Scholars and administrators have realized that, for various reasons, it is not an easy task for teachers to use ICT in their classrooms (Barron, Kemker, Harmes, & Kalaydjian, 2003; Cuban, 2001; National Center for Education Statistics, 2010; Williams & Kingham, 2003). To support abovementioned curriculum initiatives, both preservice and inservice teachers need to be trained as how to integrate ICT with their teaching (Batane, 2004; Jacobsen, Clifford, & Friesen, 2002; Mitchem, Wells, & Wells, 2003; Yildirim, 2000).

The International Society for Technology in Education (ISTE) has had some influence on the initiative of developing teacher quality in using technology by defining and revisiting