

# Chapter 12

## Contextual Influences on Science Teachers' TPACK Levels

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### ABSTRACT

*The contextual factors influencing teachers' use of technology as well as teachers' Technological Pedagogical Content Knowledge (TPACK) levels were investigated through multiple embedded case studies of five science teachers who were regular users of technology in their teaching. The case studies reported in this chapter revealed that teachers used technology to support inquiry learning through a wide range of ways in lower levels of high school but mostly to clarify concepts and theories for senior level students. This chapter identified that teachers demonstrated different TPACK levels of expertise and engagement in the use of technology when transferring different types of knowledge from one teaching and learning context to another and for addressing differences amongst learners. The context of assessment driven teaching influences science teachers' TPACK for integrating technology in instruction. The chapter noted that having teachers actively evaluate the effectiveness of the technology on students' learning may help increase teachers' TPACK levels.*

### INTRODUCTION

The benefits and the potential of technology in education in general and science classrooms in particular have been well documented (Bingimlas, 2009; Lai & Pratt, 2008). This has shifted the debate from whether computers and for that matter

technology should be incorporated and used in teaching and learning (Valanides & Angeli, 2008) to how best technology should be integrated into education for effective teaching and learning to occur. The mere introduction of technology into the classroom will not necessarily yield the needed results of students maximizing their learning (Koe-

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hler & Mishra, 2005; Osborne & Hennessy, 2003; So & Kim, 2009). The teacher is required not only to have knowledge of specific technology but also the knowledge of the affordances and constraints of the technology, use adaptive strategies coupled with how to use these properties of technology to enhance comprehensive learning (Kereluik, Mishra, & Koehler, 2011). This knowledge construct is referred to as technological pedagogical content knowledge (TPACK) (Koehler & Mishra, 2005; Mishra & Koehler, 2006; Niess, 2008).

This study investigated how the contextual factors of class level influenced and affected science teachers' TPACK levels in New Zealand. The idea was to identify how science teachers teaching different levels of classes used and appropriated the affordances of technology in their classrooms. These science teachers TPACK levels (Niess, 2008; Niess et al., 2009) therefore depicted based on how they used technology in their teaching.

## BACKGROUND

The debate about technology in education has shifted from whether it should be used in the classroom to the challenges for integrating technology into teaching and learning (Angeli, 2005; Sutherland, Facer, Furlong, & Furlong, 2000). Earlier attempts to use technology in teaching and learning focussed on teaching technology skills to preservice teachers (Angeli & Valanides, 2005; Thompson & Mishra, 2007). However, educators have recognized that the acquisition of technology skills alone is not effective in the pursuit of teaching (Angeli & Valanides, 2009; Chai, Koh, & Tsai, 2010; Graham et al., 2009; So & Kim, 2009) or preparation to teach (Hardy, 2010) with technology. Angeli and Valanides (2009, p. 157) identified that "technology in and of itself is not a transformative mechanism... rather a tool invoked by its users to reconstruct the subject matter from the knowledge of the teacher into the content of instruction." Successful technology integration,

as argued by Harris and Hofer (2009), is not dependent on the smart use of new or emerging educational technologies but rather influenced by curriculum content and the processes through which students engage with such content.

Therefore, there is a need to support teachers as they begin to make the shift from just teaching technological skills to identifying with the notion that they should incorporate technology knowledge into their teaching. Thus, as suggested by Niess (2005), it has become pertinent that teachers develop and nurture an overarching conception of their subject matter with respect to technology and what it means to teach with technology. Koehler and Mishra (2008) argued that "at the heart of good teaching with technology are content, pedagogy and technology and the relationships between them" (p. 11-12). They put forward that the effectiveness of technology in education is dependent on the interactions between, and among, technology, pedagogy and content and that the knowledge of these interactions accounts for the varying degrees of the effectiveness of use of technology in teaching. Their Technological Pedagogical Content Knowledge (TPACK) framework presents an effective structure for thinking about the integration of technology in learning environments (Polly & Brantley-Dias, 2009). The TPACK framework is an extension of Shulman's (1986) concept of pedagogical content knowledge, which identifies the distinctive features of knowledge for teaching. The constructs are intertwined and interwoven and therefore it is not sufficient for teachers to just learn about technology, content or pedagogy alone and independently of each other as seen in Figure 1. The implications of this are that teachers need to integrate the three constructs when planning and implementing teaching.

Koehler and Mishra (2008) explained TPACK as

*... different from knowledge of all three concepts individually. It is the basis of effective teaching with technology and requires an understanding of*

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