Interactive Whiteboards: Preparing Secondary Mathematics Teachers to Avoid Catch-22

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EXECUTIVE SUMMARY

This chapter examines the literature on the use of Interactive Whiteboards (IWBs) in secondary mathematics instruction and notes barriers and achievements. The chapter links the use of IWBs to models for teaching Technological Pedagogical Content Knowledge (TPACK). Specifically, it proposes ways in which pre-service secondary mathematics teachers can be prepared to use IWBs to help their students develop understanding of critical mathematics ideas while engaging with worthwhile mathematical tasks and engaging in meaningful discourse.

INTRODUCTION

In Joseph Heller's (1961) novel, *Catch-22,* World War II pilots were confronted with a paradoxical problem:

There was only one catch and that was Catch-22, which specified that a concern for one's own safety in the face of dangers that were real and immediate was the process of a rational mind. Orr was crazy and could be grounded. All he had to do was ask; and as soon as he did, he would no longer be crazy and would have to fly

more missions. Orr would be crazy to fly more missions and sane if he didn't, but if he was sane, he had to fly them. If he flew them, he was crazy and didn't have to; but if he didn't want to, he was sane and had to. (p. 52)

The paradox in *Catch-22* appears to be equally applicable in modern educational technology. A new technology appears and early adopters promise wonderful changes for those who engage with the new tool, including improvements in student achievement. In order for the new tool to work as advertised, however, the adopters need professional development on how to use the tool properly, and new curriculum materials that take advantage of its capabilities. Unfortunately, funding for such professional development and for new curriculum materials requires demonstrating that the use of the new tool yields measureable gains in student achievement—Catch-22. Thus, a challenge in secondary mathematics teacher education is how to maintain focus on educating teachers to use any technological tools long enough, and with careful enough attention to proper implementation, that any possible benefits can be measured and attributed to use of the tools. How can we develop a measurable framework for evaluating teachers' abilities to use a particular technology for pedagogical purposes before the educational establishment's attention is drawn elsewhere? As Chamblee (2013) points outs, implementation of any new technology in the mathematics classroom may be subject to troublesome patterns of implementation and use that have been observed with earlier technologies.

Preparing secondary mathematics teachers requires a long process. In addition to mastering a large volume of mathematical content, usually accomplished by completing a bachelor's degree in mathematics or mathematics education, candidates must also learn a sizeable amount of material pertaining to general and subject-specific pedagogy and must also learn how to use technology effectively in teaching. Each of these topics has spawned exceedingly large areas of educational research: mathematical knowledge for teaching; pedagogical content knowledge; technological pedagogical content knowledge, and others. The dilemma for teachers of pre-service secondary mathematics methods courses is that there is a very limited amount of instructional time to initiate candidates into the profession, especially when one considers the amount of time dedicated within methods courses for internships and field experiences, while there is a vast amount of information to be shared and many professional skills to develop. The challenge becomes how to decide what topics can best be conveyed to novice teachers within the limited timeframes and how to model the types of instructional decisions and actions that one wishes to see teacher candidates enact in their future classrooms. This chapter will: 1) review relevant literature concerning the use of IWBs in teaching secondary mathematics; 2) make connections to the literature concerning Technological Pedagogical Content Knowl-