Chapter 16
Integrated Experiences:
Teaching Grade 9 Mathematics with iPad Tablets

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ABSTRACT

This chapter discusses the integrated experiences of a group of instructors who are using tablets to teach mathematics to adolescents and young adults. iPad technology offers learners in different educational streams and with different knowledge bases an environment that fosters the growth of a community of learners engaged in mathematical concepts and processes. The authors present an in-depth examination of the design of a tablet-based mathematics education environment and provide a statistical analysis to highlight the full richness of their classroom-based experiments. The results are presented using the five foundational aspects of a conceptual framework for the successful implementation of technology in a K-12 environment.

INTRODUCTION

There is a body of research that challenges the divide that exists between practitioners and theorists in the pedagogical field (see e.g., Goodyear, de Laat, & Lally, 2006) and calls for establishing both a common ground and a shared language between them. This recommendation is especially important in discussions about the use of digital technology (Martinovic, Magliaro, & Pugh, 2011) where a surfeit of examples of "good practice" (Dressman, 2000, p. 50) tends to downplay the complexities of using such technology and therefore may end up being counterproductive. As proponents of technology use in education as well as leaders in our professional domains, we know firsthand that technological innovations may fail if, as Zhao, Pugh, Sheldon, and Byers

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(2002) point out, (a) these innovations need too much investment (e.g., human, financial), (b) they diverge from set school values and/or prior school practice, or (c) they require human, educational, or technological support that is "beyond control of the teacher" (p. 501–502).

For teachers to become informed users of computer technologies, it is important that they:

- See its value in student engagement and achievement;
- Develop an attitude of going beyond using it superficially in teaching;
- Have access to technology as well as technical and administrative support; and
- Have ready-made educational resources at hand for use with the technology (Martinovic & Zhang, 2012).

Also worth noting is that despite the challenges identified above by Zhao et al. (2002), joint work and constructive discussions between innovators at all levels of schooling may facilitate systemic changes, thereby preparing both teachers and their students for the coming round of technological changes.

In this chapter, we will:

- Investigate and evaluate the implementation of tablets in teaching mathematics to adolescents;
- Integrate the experiences of secondary-school and college-level leaders in tablet use in the classroom; and
- Provide insights valuable for teacher practitioners, education researchers, and teacher educators.

BACKGROUND

Teaching using digital technology to create an environment that fosters the growth of a community of learners engaged in mathematical concepts and processes challenges the traditional norms of teaching and learning. Using the theory of social constructivism, we consider teaching mathematics as if the subject were an ill-structured discipline—a domain in which multiple interpretations, arguments, and debate are called for and natural (Resnick, 1988). Constructivism, when based on the principles of Piaget, is a theory of learning that describes an individual's ability to construct meaning and thereby become knowledgeable about his or her world (Phillips, 1997). For constructivists, learning is not achieved from direct instruction or from drill and practice (Anderson, Reder, & Simon, 1997, "Claim 1"); rather, students learn while actively resolving problems. As Cobb, Yackel, and Wood (1992) emphasized, both teacher and students in a classroom situation try to make sense of the subject matter through the process of negotiating meaning where the basis of their communication is a "taken-as-shared" mathematical reality (p. 16).

The theory of constructivism that we use as our lens in this chapter is not a unified theory of learning, but instead more a continuum of different theories (Doolittle & Camp, 1999). One such theory is social constructivism, which is rooted in the work of Soviet psychologist Lev Vygotsky, who believed that from birth, a child's learning development is a social process assisted and fostered by collaboration with others (Tudge & Winterhoff, 1993). Vygotsky postulated that to study the mind of the child, it is necessary to examine the social environment for learning (Goldman-Segall & Maxwell, 2003), and he introduced the concept of a zone of proximal development (ZPD), which is the place where learning occurs. The ZPD marks the fuzzy boundary between where the child is and where s/he can be with the help of others. When learning mathematics, the ZPD refers to the difference between what the child can do on his or her own and the level of problem-solving achievable when the child works with an adult or

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