Chapter 14

Two Classroom Portraits Demonstrating the Interplay of Secondary Mathematics Teachers’ TPACK on their Integration of the Mathematical Practices

Jessica Taylor Ivy
Mississippi State University, USA

Dana Pomykal Franz
Mississippi State University, USA

ABSTRACT

This chapter examines the practices and beliefs of two secondary mathematics teachers with similar demographic backgrounds. The influence of their practices and beliefs on teaching and student learning is considered through the lens of the TPACK Development Model and through evidence of student engagement in the Mathematical Practices. Even though they face common barriers to instructional technology integration, both teachers speak to their successes and positive impacts on student learning. Rich descriptions of conversations, classroom observations, and self-report survey data highlight critical contrasts between the practices of the two teachers. These differences represent the unique challenges faced by instructional technology researchers and other educational stakeholders. The purpose of this chapter is to highlight these subtle, yet far-reaching, areas of distinction in which the teachers unknowingly provide different levels of opportunity for teaching and learning in the mathematics classroom.

DOI: 10.4018/978-1-4666-4086-3.ch014
INTRODUCTION

Instructional technologies such as graphing calculators offer invaluable opportunities for teaching and learning in mathematics classrooms. According to the National Council of Teachers of Mathematics (NCTM) Technology Principle, technology has the potential to offer access to multiple representations and deeper mathematics by allowing students to explore mathematical patterns, make conjectures, and test those conjectures in ways that would not be feasible without technology (NCTM, 2000). Instructional technology is constantly evolving, and it is becoming more available for use in classrooms. Unfortunately, this increase in availability often does not translate to an increase in the actual use of instructional technology in the classroom (Dunham & Hennessy, 2008). The abundance of possibilities for enhancing student learning is promising; however it is up to teachers to use technology in ways that most benefit students.

With the recent introduction of the Common Core State Standards for Mathematics (CCSS-M), the issue of appropriate instructional technology use has gained more visibility. Among the Standards for Mathematical Practice described in the Common Core document is that students should “use appropriate tools strategically” (Common Core State Standards for Mathematics, 2010, p. 7). Through engagement in this standard, students should use technology in ways which allow them to gather information, analyze information, make and test conjectures, and develop generalizations. This type of engagement is markedly different than practices which involve the use of calculator programs solely for checking computations or completing procedures previously learned with paper and pencil. Yet, at first glance, these differences may not be obvious.

This chapter presents a comparative case study analysis of two teachers who both have access to graphing calculators in secondary-level mathematics classrooms. These data were obtained as part of a larger project, which examined seven secondary mathematics teachers’ perceptions of their integration of instructional technology. At face value, both teachers appeared to integrate instructional technologies in ways which exemplify strategic use of graphing calculators. Through conversations, observations, and classroom artifacts, we gain a better understanding of the vast differences between two teachers’ perceptions and integrations of instructional technology.

BACKGROUND

TPACK and the Standards for Mathematical Practice

Data obtained through this study was examined through the lens of an established development model, described briefly in this paragraph. The knowledge needed to teach mathematics with technology is known as Technology, Pedagogy, And Content Knowledge (TPACK; Niess et al., 2009). This construct grew out of an identification of the types of knowledge necessary for teaching. This unique type of knowledge, known as TPACK, encompasses the intersection of content knowledge, pedagogical knowledge, and technological knowledge. This chapter assumes a familiarity with the themes and levels described in the TPACK Development Model (e.g., Niess et al., 2009).

The ability to foster students’ engagement in the Standards for Mathematical Practice (SMP) is connected to a teachers’ own understanding of each of the standards. Further, the teacher must have a developed understanding of TPACK with a given technology to be able to apply it to the SMPs. Clearly if students in a classroom are going to use technology to “make sense of problems”, “model with mathematics”, or “use appropriate tools strategically”, the teacher must understand the interplay of the relevant technology, pedagogy,

Recommend this product to your librarian:
www.igi-global.com/e-resources/library-recommendation/?id=1

Related Content

Deconstructing the Politics of Identity and Representation in Cyberspace: Implications for Online Education
www.igi-global.com/chapter/deconstructing-politics-identity-representation-cyberspace/48883?camid=4v1a

Posting Articles about Excavations in Electronic Forums
www.igi-global.com/chapter/posting-articles-excavations-electronic-forums/9127?camid=4v1a

Modeling Gameplay Enjoyment, Goal Orientations, and Individual Characteristics
www.igi-global.com/article/modeling-gameplay-enjoyment-goal-orientations-and-individual-characteristics/116519?camid=4v1a

Technological Infrastructure and Implementation Environments: The Case of Laptops for New Zealand Teachers
www.igi-global.com/chapter/technological-infrastructure-implementation-environments/47250?camid=4v1a