Chapter 15
The Influence of Professional Development on Primary Teachers' TPACK and Use of Formative Assessment

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ABSTRACT

Formative assessment continues to be heralded as a high-leverage teaching practice that has empirical links to student achievement. This chapter describes the design and influences of a year-long professional development project focused on supporting primary grades teachers' with formative assessment skills in mathematics. The professional development was a blended format that included face-to-face workshops as well as classroom-based activities that were presented and facilitated through an online asynchronous format. Findings from the study indicated that teachers' enacted evidence of various aspects of TPACK, but there was variance in terms of how teachers implemented pedagogies. Implications for the design of professional development focused on formative assessment include the need to situate teachers' learning in their classroom, and provide ongoing multiple modes of support to help teachers enact formative assessment practices.

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INTRODUCTION

Formative assessment is a cyclical process that involves examining students' thinking, collecting data, analyzing the data, and then implementing instructional activities based on the data collected (Wiliam, 2007a, 2010). While formative assessment is a term used widely by educational researchers and educational leaders in mathematics, formative assessment needs to include rich assessment tasks embedded in the context of the classroom that allow teachers to better understand their students' abilities and mathematical thinking (Joyner & Muri, 2011; Wiliam, 2010).

Prior research has found that while formative assessment has the potential to positively impact students' mathematics achievement (Ringer, 2013; Wiliam & Thompson, 2007; Polly et al., 2014a), teachers often struggle with its process (Martin & Polly, 2015; Polly, Martin, Wang, Lambert, & Pugalee, 2015). At times, teachers pose tasks that are not rich or that lack rigor, and therefore do not allow an opportunity to collect valuable information about students' thinking (National Council of Teachers of Mathematics [NCTM], 2014). Additionally, it is documented that teachers struggle to carry out the subsequent steps after collecting assessment data. Collecting data without taking the next steps to make data-based decisions makes the work of assessing students relatively germane if the information collected does not inform future instruction (Martin & Polly, 2015; Ringer, 2013).

Technology has the power to facilitate the processes related to formative assessment (Beatty & Gerace, 2009; Polly, Little, & Rodgers, 2015; Wiliam, 2010). In literacy, programs such as M-Class/Reading 3D allow teachers to assess students by entering information in a web-based program while students read a passage and answer comprehension questions. The program provides teachers a summary of students' performance, tracks their progress over time, and provides instructional recommendations (Amplify, 2015). Likewise, in mathematics, programs such as *AMC Anywhere* (Didax, 2012) allow teachers to enter information in a web-based system while students solve mathematical tasks and answer questions about number sense (Math Perspectives, 2015).

This chapter focuses on professional development aimed at supporting the use of *AMC Anywhere* in primary grades classrooms. The chapter provides a description of the Assessment Practices to Support Mathematics Learning and Understanding for Students (APLUS) professional development project funded by the North Carolina Department of Public Instruction grant program and designed to support primary grades teachers in implementing formative assessment practices. We provide an overview of the professional development project and the goals of the project. We then detail how the project was revised or modified across the three year-long cohorts of implementation, and share outcomes from the project as a synthesis of our research studies. Lastly, we provide implications for the design of professional development focused on formative assessment or other high-leverage teaching practices.

BACKGROUND

Formative assessment practices in mathematics have been empirically linked to gains in students' mathematics achievement (Wiliam & Thompson, 2007; Polly et al., 2014a) as well as gains in teachers' awareness of their students' successes and struggles (Black & Wiliam, 1998; Wiliam, 2007b). Further, these gains have been observed in impoverished schools with students who chronically struggle in mathematics (Fuchs & Fuchs, 1986; Wiliam & Thompson, 2007). Recently, NCTM (2014) identified