

Chapter 20

Supporting Teachers’ Use of Standards–Based Mathematics Pedagogies: Leveraging Learner–Centered Professional Development Efforts

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ABSTRACT

In order for professional development in the STEM fields to be effective, empirical studies point to opportunities for teachers to simultaneously develop their knowledge of related content, research-based pedagogies, and analysis of how students learn the content as well as common student misconceptions. In this chapter, the authors explicate the construct of learner-centered professional development and describe the implementation of mathematics professional development projects designed to support elementary school teachers’ mathematics teaching. They include a synthesis of findings from their professional development research and provide implications for the design of learner-centered professional development programs in mathematics.

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OVERVIEW

The Need for Mathematics Professional Development

Researchers and national organizations focused on improving teaching and learning in STEM fields continue to emphasize the importance and potential of the design and implementation of teachers' professional development efforts (Borko, 2004; Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009; Desimone, 2009; NCTM, 2014; NSTA, 2006; Marrongelle, Sztajn, & Smith, 2013; Polly & Hannafin, 2011). In mathematics education, professional development has the potential to provide teachers to have a robust understanding of mathematics content and are also prepared to enact the most effective strategies in their classrooms (Loucks-Horsley, Love, Stiles, Mundry, & Hewson, 2010; United States Department of Education, 2008).

In the United States, this has been especially true with an increased adoption of both standards-based (reform-based) mathematics curriculum and the Common Core State Standards in Mathematics ([CCSSM]; Common Core State Standards Initiative, 2010). More school districts than ever before have adopted standards-based mathematics curriculum; these sets of instructional resources are described by having alignment with the National Council for Teachers of Mathematics (NCTM) (2014) *Principles to Action*, in that students learn mathematics by exploring cognitively-demanding mathematical tasks and mathematics games, engaging in discussions about mathematical tasks and concepts, and reasoning and justifying their paths to solving tasks and problems.

Learner-Centered Professional Development

Large-scale syntheses of research studies on professional development have yielded components of highly effective learning experiences for teachers (Garet et al., 2001; Darling-Hammond, et al., 2010). The construct learner-centered professional development (LCPD) (Polly, 2006; Polly & Hannafin, 2011; Hawley & Valli, 2000) has been used to describe professional development programs that focus on meeting the specific professional needs of teachers and align with the American Psychological Association's *Learner-centered Principles* (hereafter *Principles*) (APA Work Group, 1997). The *Principles* were grounded on empirical findings related to teaching and learning and reflect both cognitivist and constructivist views of how people learn (Alexander & Murphy, 1998). Hawley and Valli (2000) identified nine primary design recommendations associated with LCPD:

1. LCPD should focus on content that students need to learn and problems that students face learning that content
2. LCPD should be driven by addressing the difference between goals and standards for student learning and actual performance
3. LCPD should involve allowing teachers to identify their own learning needs, and when possible, involve them in the design of professional learning activities
4. LCPD should be primarily school based and integral to school operations
5. LCPD should relate to individual learning needs but should include collaborative problem solving
6. LCPD should be continuous and ongoing involving follow-up and support for further learning

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