

# Chapter 14

## Mathematics Teacher Educators' TPACK and MKT Knowledge Domains: Designing Online Discussion Blogs

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### ABSTRACT

*In this chapter, two Mathematics Teacher Educators (MTEs) describe a study that examined the ways that they drew upon their knowledge domains, grounded in the TPACK framework and the Mathematical Knowledge for Teaching (MKT) framework, to design and utilize online discussion blogs as instructional tools to enhance preservice elementary teachers' learning of geometry and measurement. The findings indicate that more attention is warranted on the interrelationships between TPACK and MKT knowledge domains, specifically when MTEs engage in collaborative planning. This work is significant because it illuminates the need for further coding granularity consideration driven by the complexities resident in the construct of Pedagogical Content Knowledge, when analyzing MTEs' engagement with mathematics activities that use technology.*

### INTRODUCTION

Deepening preservice teachers' understanding of the mathematics that they will be responsible for teaching in K-12 classrooms requires mathematics teacher educators (MTEs) to draw upon their own knowledge of mathematics content and pedagogical practices for effectively teaching that content. Furthermore, given that standards documents for K-12 mathematics education (e.g., National Council of Teachers of Mathematics [NCTM], 2000, 2014; National Governors Association Center for Best Practices [NGA Center] & Council of Chief State School Officers [CCSSO], 2010) identify technological resources as

DOI: 10.4018/978-1-5225-0120-6.ch014

important tools to support mathematics learning, MTEs are charged to model for preservice teachers how technology can be used in effective and efficient ways that foster mathematics learning (Conference Board of the Mathematical Sciences, 2001, 2012). We, two MTEs, embarked upon a journey exploring how to effectively use technology to efficiently deepen preservice elementary teachers' (PSTs') understanding of geometry and measurement by connecting our learning from in-class activities to online discussions. Although both of us had experience with PSTs, we differed in our affinities to teacher knowledge-based frameworks. One of us viewed our instruction through the Technological Pedagogical Content Knowledge (TPACK) framework (Mishra & Kohler, 2006) and the other aligned her teaching philosophy with the Mathematical Knowledge for Teaching (MKT) framework (Ball, Hill, & Bass, 2005). Although these frameworks differ in how they propose teacher knowledge domains coincide (TPACK) or subdivide (MKT), both frameworks present Pedagogical Content Knowledge (PCK) as an integral aspect of teacher knowledge.

We did not launch our investigation of online discussion blogs with the intention of conducting a comparative analysis of TPACK and MKT; however, the study's research methodology involved coding our collaborative planning discussions in terms of teacher knowledge domains, which resulted in the identification of inconsistent interpretations of PCK between the two frameworks. Intrigued by the opportunity to explore synergies between the two frameworks, we focused on how the MKT framework subdomains might offer a vehicle for discriminating meaningful variation in TPACK-based PCK relevant to the knowledge of teaching and knowledge of student learning. This approach offered a way for us to analyze the data with a more granular attention to how MTEs may view online discussion blogs as an instructional technology tool that supports the teaching and learning of geometry and measurement.

This chapter presents the findings of an autoethnographic view of our journey to collaboratively design and implement an instructional strategy using technology in a simple and pervasive manner. This study reflects the qualitative research tradition of autoethnography because it provides "an autobiographical genre of writing and research that displays multiple layers of consciousness, connecting the personal and the cultural" (Patton, 2002, p. 85). Specifically, this study combines:

1. Data comprised of collaborative planning discussions and reflection journals,
2. Data analysis that probes two MTEs' perspectives on teacher education strategies, and
3. An ethnographic lens that envelops the culture of teacher educators in an authentic setting.

By examining how the TPACK and MKT frameworks coincide when coding collaborative MTEs' planning discussions, we exposed some intricacies of how we drew upon different knowledge domains. It is not the goal of this chapter to identify precisely how our knowledge should be classified; rather, the goal is to share how this study illuminates the ways we called upon and shared our teacher knowledge when collaboratively planning learning activities for PSTs.

The work described in this chapter is part of a larger research project that seeks to understand

1. How the design of online discussion blog prompts that include visual representations evolved as a result of our collaborative planning, and
2. How using online discussion blog prompts influenced PSTs' learning of geometry and measurement.

We define a discussion blog prompt as an instructional message in an online context followed by a series of items that require a response. The prompts may be in the form of a question or in the form of a

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