Chapter 1
Teacher Knowledge for Teaching with Technology:
A TPACK Lens

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ABSTRACT

Technology, pedagogy, and content knowledge (TPACK) is a dynamic lens that describes teacher knowledge required for designing, implementing, and evaluating curriculum and instruction with technology. TPACK strategic thinking incorporates knowing when, where, and how to use domain-specific knowledge and strategies for guiding students' learning with appropriate digital, information, and communication technologies. This chapter maps historical responses to the question of the knowledge that teachers need for teaching amid the emerging views of and challenges with TPACK. A review of empirical progress serves to illuminate potential insights, values, and challenges for directing future research designed to identify a teacher's learning trajectory in the development of a more robust and mature TPACK for teaching with current and emerging information and communication technologies.

TEACHER KNOWLEDGE: A HISTORICAL VIEW

What knowledge do teachers need for teaching? Responses to this question have evolved over the past centuries, with significant changes at the

beginning of the 20th century (Parkay & Stanford, 2008). Up through the 19th century, the prevailing notion was that teachers needed to know the content they were to teach. This view shifted to the importance of knowing how to teach; teachers needed to be prepared to implement new teaching and learning (or pedagogical) practices along with an even more in depth understanding of the
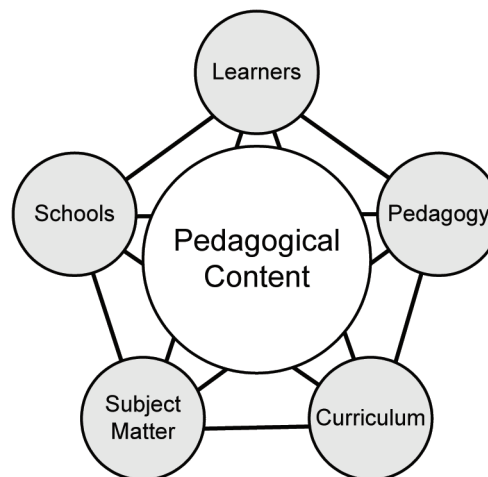
content they were planning on teaching (Grimmett & MacKinnon, 1992; Parkay & Stanford, 2008). The late 1980s signaled another significant shift in views on this question. Shulman (1987) challenged teacher educators and researchers to reconsider the knowledge that teachers need indicating that, at a minimum, teacher knowledge included:

- Content knowledge
- General pedagogical knowledge
- Curriculum knowledge
- Pedagogical content knowledge
- Knowledge of learners
- Knowledge of educational contexts
- Knowledge of educational ends, purposes, and values

Figure 1. Visual display of the relationships and interactions of the six teacher knowledge domains

Among these more extensive knowledge domains, pedagogical content knowledge (or PCK) was identified as the knowledge that represented "that special amalgam of content and pedagogy that is uniquely the province of teachers, their own special form of understanding … of how particular topics, problems, or issues are organized, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction" (Shulman, 1987, p. 8).

This identification of teacher knowledge (Wilson, Shulman, & Richert, 1987) was markedly different from previous views, resulting in extensive research and scholarly discussion about the nature of PCK and the types of programs needed to adequately prepare teachers such that they develop this knowledge (Gess-Newsome, J., 2002; Niess, 2005). At my institution, this change encouraged the faculty to redesign the science and mathematics teacher preparation program to explicitly develop this more comprehensive teacher knowledge called PCK. Figure 1 provides the visual description we used to guide the program redesign. This visual recognized the importance of multiple knowledge domains of teacher knowledge - learners, pedagogy, curriculum, subject matter, and schools (describing the

educational contexts, ends, purposes and values) - as being a complex and interconnected whole with PCK at the hub connecting all the domains. As a result, this graduate level, content-specific teacher preparation program was focused on an integration of the multiple domains of knowledge viewed as integral to teaching and learning science and mathematics (Niess, 2001). Courses contained subject-specific pedagogical modeling rather than a generic pedagogy class. The emphasis was to have the preservice teachers think about and reflect upon the multiple domains as they investigated each topic or assignment. The overall goal was to guide the preservice teachers in developing an integrated, interconnected knowledge for teaching that incorporated PCK.

Amid the evolving views on the knowledge teachers need for teaching, a technological knowledge explosion significantly enhanced humans' abilities "to change the world" through the invention of computer-based technologies (American Association for the Advancement of Science, 1989). While iron horse technologies fueled the Industrial Age of the 20th century (Hillstrom & Hillstrom, 2005), the invention of the computer and the Internet paved society's way into the

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