

## Chapter 20

# A Framework for Supporting In-Service Teachers to Use Domain-Specific Technologies for Instruction

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### ABSTRACT

*Domain-specific technologies, which are used for analysis, representation, and production in real-world contexts, differ from basic technologies, such as word processing software and Internet search tools. They cannot be used effectively without adequate command of fundamental domain-specific content knowledge. They can be used to deepen students' understanding of content, but these technologies bring distinct classroom-integration challenges. This chapter presents a framework for supporting in-service teachers to integrate these technologies. The research team derived this framework from data collected during an extended TPACK-style (Technological Pedagogical Content Knowledge) workshop that engaged 13 life science community college instructors in integrating bioinformatics technologies into courses. This chapter presents a case study about the challenges community college teachers faced in implementing these tools—and the strategies they used to address them. Challenges included activity translation, problem definition, implementation, and assessment.*

### INTRODUCTION

Technology has become a ubiquitous tool in most domains in academia and industry, and has raised the degree of professional judgment and skill expected in the workplace (Autor, Levy, & Murnane, 2003). Domain-specific technologies include tools for data visualization and data analytics in the physical and life sciences, rapid prototyping tools in engineering, schematic tools in manufacturing, and animation

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and sound manipulation tools in the arts. This class of tools not only has the potential to enhance student learning through real-world application but also presents distinct classroom integration challenges. The central concern is that domain-specific technologies fundamentally differ from basic productivity technologies, such as word processing software and Internet search tools. Thus, teachers cannot use them effectively without adequate command of essential domain-specific content knowledge. This prerequisite means that teachers face a series of challenges to use such technologies for teaching fundamental knowledge in any given field.

The promise of domain-specific technologies cannot be realized without addressing the usual concerns associated with integrating any type of classroom technology: lack of teacher awareness of the rapid technological advances (O'Bannon & Thomas, 2014; Oh & Reeves, 2014), doubts about students' capacity to learn with technology (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012), and lack of support for shifting classroom pedagogy from traditional instruction to more student-driven inquiry with real-world problems (Ertmer & Ottenbreit-Leftwich, 2013; Lawless & Pellegrino, 2007; Webb & Cox, 2004).

To address the issues about the use of domain-specific technologies, this chapter has the following objectives: (a) present the background about the unique challenges of domain-specific technology use; (b) offer some solution approaches that refine the TPACK framework (Technological Pedagogical Content Knowledge) for supporting in-service community college teachers to use domain-specific technologies; (c) illustrate how the classroom use of domain-specific technologies involved a new set of teacher concerns with technology integration that the research team observed during a case study; and (d) discuss the implications for and refinements of the new domain-specific technology integration framework for designing and delivering in-service professional development.

## **BACKGROUND**

The following section describes past research into basic technology integration and identifies the context factors that drive integration of domain-specific technologies into classrooms, an analysis of the skills needed by teachers to support such integration, and a framework describing the added features needed in current systems for organizing teacher professional development programs around domain-specific technology integration.

### **A Review of Perspectives on Faculty Integration of Technology**

To understand the challenges of integrating domain-specific technologies, it is helpful to review what research has said about the conditions that support the integration of *basic* technologies. Research indicates that effectively using technology in the classroom depends on three factors of a teacher's work life: context, skills, and social support.

#### **Teacher Context and Classroom Technology Integration**

Context drives teachers' decisions about how to incorporate any learning material into the classroom. Instructional decision-making theory (Lattuca & Stark, 2011) illustrates the wide range of contextual influences: teaching experience, instructional approach, knowledge of the content domain, perceptions

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