

Chapter 8

Digital Tools for Accelerating Preservice Teacher Effectiveness

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ABSTRACT

In this chapter, the authors describe one model for how teacher preparation programs can use research and technology to facilitate the development of preservice teachers and accelerate their effectiveness. Our work illustrates a collection of teacher preparation tools including our online Encyclopedia of Algebraic Thinking, online Video Case Database, online Formative Assessment Database and our collection of Virtual Algebra Manipulatives (iOS Apps). We situate our work in the content of algebra because it has been shown to be a gatekeeper to future mathematics (Moses & Cobb, 2001). However, our model could be applied to other subjects and content areas. Case study data indicate that our tools impact preservice teacher practice regarding the anticipation of student thinking. We have made these resources freely available to the profession so that we might begin to create consistently reliable tools for facilitating effective instruction, particularly for preservice and early career teachers.

INTRODUCTION

Teacher education in the 20th century has largely been perceived as a launching pad for new teachers to enter into the professional ranks and never to be seen or heard from again. The objective has been to provide preservice teachers with the tools they need to be effective instructors in classrooms with paper, pencils, and textbooks. The technological capabilities of the 21st century force teacher educators to re-evaluate that model, those assumptions,

and the definition of “effective.” In an age with information and powerful cognitive tools what is the purpose for preservice teachers having these tools at their fingertips?

As teacher educators reflect on that question, consider that the same can be said of teachers working with their K-12 students. A parallel argument can be made that the technological landscape is changing the nature of teaching in K-12 schools. As the number of laptop, tablet, and bring your own device programs gradually make technologi-

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cal access truly ubiquitous in elementary and secondary classrooms, the act of instruction is being transformed. From flipped classroom strategies to computer simulations, educational gaming, and continual assessment and data gathering, how K-12 students learn is being redefined. What are the implications for teacher educators? Given the technology influenced environmental conditions students and early career teachers are finding in their schools, the perspective our research brings to the conversation is a redefinition of the role of teacher educators.

Also of significance is the fact that over 1.5 million veteran teachers are set to retire within 10 years (National Commission on Teaching and America's Future, 2010). This dramatic loss of human capital will definitely affect education as novice teachers are not as effective as veteran teachers (Henry, Bastian, & Fortner, 2011), lack confidence in formative assessment (Ewing & Manuel, 2005), and struggle to make sense of student thinking (Peterson & Leatham, 2009). The first three to five years of a teacher's career involve significant improvements in their practice (Hanushek, Kain, O'Brien, & Rivkin, 2005). With increasing national expectations of students as the Common Core State Standards (Common Core State Standards Initiative, 2014) are implemented, early career teachers do not have the luxury of enhancing their skills for teaching over their first five years. Students, parents, and the community expect early career teachers to have the knowledge and skills they need from the start. Teacher quality is the most important school-related factor influencing student achievement (King-Rice, 2003). Students' learning cannot be sacrificed during those early years. Teacher education programs need to not only meet the increasing demand for new teachers, but also address the experience and effectiveness gap between veteran and preservice teachers. What role should teacher education programs have in accelerating new teachers' ef-

fectiveness and supporting their first few years of teaching?

In our work, we have asked whether the use of research and technology facilitate the development of preservice teachers and accelerate their effectiveness in their early careers. In the following chapter, we use that experience to present a model of utilizing technology to solve the problem of underprepared and insufficiently supported early career teachers. While our context is mathematics education, and even more narrowly, secondary students' algebraic thinking, we believe the structure and approach is applicable across content and grades. We use technology to orient preservice teachers towards students' thinking and create a continuum of support that bridges teacher education and early career teaching. We argue that teacher education needs to be reimaged as part of the early career teaching process with the help of technology. This chapter illustrates a wide range of digital resources that we have developed to aid preservice and early career teachers to better anticipate and respond to student thinking in algebra.

We begin with the background of our project and then describe the digital resources we have developed: the online Encyclopedia of Algebraic Thinking, the online Video Case Database, the online Formative Assessment Database, and our collection of Virtual Algebra Manipulatives (iOS Apps). We then describe two Instructional Modules we have developed for use in Mathematics Methods courses. Both modules draw heavily from the project resources, but each has a different emphasis. The first module illustrates how our Video Case Database can be used in teacher preparation and the second module illustrates instruction that incorporates one of the Virtual Algebra Manipulatives. Finally, the chapter closes with the presentation of a case study that was developed to measure the impact of the project resources on two teacher candidates.

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