Chapter 23
Digitizing Students’ Voices: Assessing Mathematical Justification

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ABSTRACT
This chapter focuses on how assessment for learning can be used to promote the development of student understanding of mathematics and mathematical practices as described in the Common Core State Standards for Mathematics while emphasizing the affordances of digital technologies. The mathematical focus centered on the families of functions connected to the mathematical practice of constructing viable arguments when using the digital technology tool, VoiceThread. The chapter describes an iterative model for implementing assessment for learning practices where VoiceThread gave voice to preservice teachers’ mathematical justifications. Findings are taken from a study set in an algebra course designed for preservice elementary teachers working towards a minor in mathematics. Preservice teachers noted the positive impacts of using VoiceThread in improving their justification skills and the benefits of assessment for learning practices on their learning process.

INTRODUCTION
Assessment is a key factor in the teaching and learning process. The general process of assessment has evolved from only examining the “end game” results (summative) to a process that permeates learning from the beginning and carries forward (formative); from a process where teachers were the only catalysts to promote the design and enactment of assessment to one where students and teachers are both engaged. Language regarding assessment has evolved as well, to help
reflect the change in thinking about the process. Assessment for learning is described by Black, Harrison, Lee, Marshall, and Wiliam (2004) as:

"Any assessment for which the first priority in its design and practice is to serve the purpose of promoting students’ learning. It thus differs from assessment designed primarily to serve the purposes of accountability, or of ranking, or of certifying competence. An assessment activity can help learning if it provides information that teachers and their students can use as feedback in assessing themselves and one another and in modifying the teaching and learning activities in which they are engaged. Such assessment ... is actually used to adapt the teaching work to meet learning needs (p. 10)."

Based upon this thinking, we envision assessment for learning as a teaching practice involving students in a dynamic process that includes the following three components: (1) teachers and students have a shared understanding of expectations for learning and assessment, (2) teachers use student assessments to make instructional changes, and (3) teachers and students use assessment information to provide continual feedback about the teaching and learning process (Engelman, Noakes, & Rogers, 2011). Engelman, Rogers, and Noakes (2013) performed a summary of research on formative assessment and assessment for learning in mathematics education in an attempt to differentiate and clarify the definitions of assessment for learning and formative assessment. From their research summaries, they developed a three-dimensional model (See Figure 1) that displays a relationship between four assessment-for-learning practices: Learning and Assessment Expectations, Instructional Changes and Feedback with Student Involvement as the base of the pyramid. The Feedback component was a key feature in our work as the preservice teachers developed their self- and peer-assessment abilities. We believe there is a strong connection between these assessment for learning practices and students’ proficiencies with doing mathematics.

The Common Core State Standards for Mathematics (CCSSM) initiative intends to bring a set of more focused and coherent mathematics standards into the United States school mathematics curriculum, minimizing the number of mathematical topics presented to students within a given

![Figure 1. Assessment for learning model (Engelman, Rogers, & Noakes, 2013)](image-url)
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