Video Case Analysis of Students' Mathematical Thinking to Support Preservice Teacher Candidates' Functional Reasoning and Professional Noticing

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Using a design-based research approach, we are developing a series of online video-based instructional modules to engage secondary mathematics teacher candidates in case analyses of students' functional reasoning and to improve their own mathematical and pedagogical understandings. We present our project framework for module development, implementation, and revision, with an end goal of identifying preliminary hypothetical learning trajectories for candidates' functional reasoning and professional noticing.

Keywords: Functional Reasoning, Hypothetical Learning Trajectory, Preservice Teacher Preparation, Video-Based Learning, Professional Noticing

Video Case Analysis of Students' Mathematical Thinking (VCAST) Module Development

To advance student understanding of mathematics, teachers must pay careful attention to and then interpret evidence of student thinking. This requires a specialized mathematical knowledge of common patterns in students' reasoning and how their ideas are related and represented (Ball, Thames, & Phelps, 2008; Stein & Smith, 2011). Video-based modules can offer purposefully selected student evidence (i.e. case studies) to highlight important mathematical ideas.

Our module development process is informed by the literature on functional reasoning (Cooney, Beckmann, Lloyd, & Wilson, 2010; Oerhtman, Carlson, & Thompson, 2008), the use of video to support preservice teacher learning (Coffey, 2014; van Es, Cashen, Barnhart & Auger, 2017), design-based research (Anderson &Shattuck, 2012; Reeves, Herrington, & Oliver, 2005), professional noticing (Jacobs, Lamb, & Philipp, 2010), and hypothetical learning trajectories (HLTs)(Lobato & Waters, 2017; Simon, 1995; Simon & Tzur, 2004).

Project Framework

We approach our module design through iterative improvement of HLTs while leveraging video cases' affordances for presenting specific episodes of students' reasoning. This entails identifying learning goals for teacher candidates, hypothesizing increasing levels of sophistication in reasoning toward those goals, developing learning activities which target those goals, and iteratively refining each as candidates engage in the modules (see Figure 1).

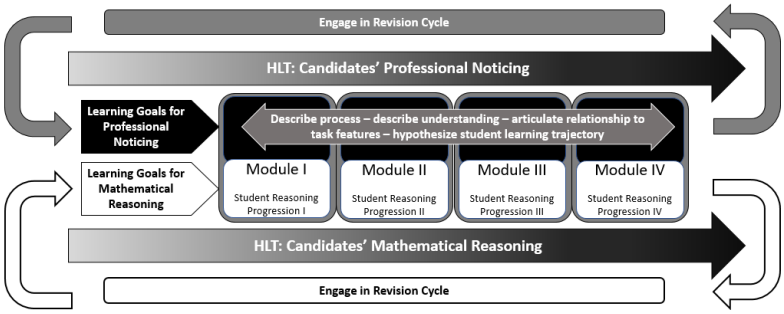

Figure 1. HLT development in relation to the learning modules built around student reasoning progressions

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