Conceptions of Continuity: An Investigation of High School Calculus Teachers and their Students

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Dissertation Abstract

This study was designed around a models and modeling perspective on teachers’ and students’ thinking. The participants were 13 high school calculus teachers and their students. The aims of this study included (a) elaborating on known results involving students’ thinking about continuity, (b) setting a baseline for teachers’ ways of thinking about continuity both pedagogically and as a mathematical concept, and (c) investigating the nature of the relationship between teachers’ and students’ ways of thinking about continuity.

The major contribution of this study is setting a baseline on teachers’ thinking about continuity. I found that (a) teachers who saw continuity as important were likely to view it as a concept and a difficult topic whereas teachers who saw continuity as unimportant were likely to view it as a procedure and an easy topic, (b) teachers have a tendency to conflate the ideas of connectedness and continuity and do not relate these ideas to the domain of the function in question, (c) some teachers have trouble delineating the relationship between continuity and differentiability, and (d) teachers see their students as adept in interpreting the ways that the graphing calculator represents points of continuity including asymptotes and holes.

Additionally, most of the teachers identified common student misconceptions including confusions involving (a) continuity and differentiability, (b) continuity and limits, and (c) continuity and the function being defined. I also found little correspondence between differences in the ways that teachers think about continuity and differences in the ways that their students think about continuity.

Confirming previous results, I found that students (a) assume that functions given to them are continuous, (b) confuse the concepts of continuity and differentiability, and (c) confuse the concepts of a function being defined, a function being continuous and a limit existing.
Extending previous results, I found that students do not associate continuity with limits. Contradicting previous results, I found that students (a) prefer to think about issues of continuity graphically, and (b) are adept at interpreting the ways that the graphing calculator represents points of discontinuity.