Aim of Research

The intellectual merit of this project is in its contribution of new and important insights about teachers’ conceptions of proof, student thinking about proof, and the nature of knowledge that is useful for teaching and learning proof.

This project promises broader impact on the field of mathematics education. Classroom videos and resources will provide teachers with a vision of what this approach to teaching proof looks like.

Research Questions

1. How do teachers introduce proof in geometry?
2. When engaging in lesson study based on introducing proof by first teaching particular sub-goals of proof, how do teachers respond to and execute the lesson plans?
3. How do students respond to these lessons?
4. How do students in the control and experimental groups think about proof and perform on a set of proof tasks?

Introduction

This design and development research study focuses on secondary students’ success with mathematical proof. The goal of the Proof in Secondary Classrooms (PISC) project is to develop an innovative intervention to support the teaching and learning of mathematical proof.

Methods

Four Core teachers implemented 16 special PISC lessons for two years. Fifteen non-Core teachers’ students functioned as a control group. Analyses of 1161 students’ pre-test and post-test scores indicated a positive effect from the PISC curriculum. After controlling for grade level and pre-test scores, Core students scored 6.61 NCE points higher on post-test.

Decomposition of Practice

Grossman and colleagues (2009) described “decomposition of practice” as the breaking down of a practice into its constituent parts for the purposes of teaching and learning.

For students to learn to engage in a complex practice, they may need opportunities to practice the different parts before integrating them fully.

Data Collected

• Pre Tests (Administrated 2015)
• Post Tests (2015)
• Teacher Interviews
• Student Interviews
• Classroom Observations

What is the estimated impact of the PISC curriculum on students’ post-test scores?

Student Scores on CDASSG by Teacher & Year

• Teacher 1
• Teacher 2

Conclusions

• Introducing proof by decomposing the proof process is a promising strategy for teaching proof in secondary mathematics.
• The PISC curriculum materials were educative for teachers, particularly in terms of math content knowledge.
• Teachers’ attention to student thinking supported their efforts to improve the teaching of proof.
• Professional development on classroom discourse, particularly eliciting and responding to student thinking, played a critical role in the outcomes.
• When interviewed, teachers stated that the PISC PD model was extremely effective.

Dissemination & Future Work

• The Core teachers presented at a national research conference, and they presented two sessions at a national teachers’ conference.
• One Core teacher co-presented at a research colloquium at an R1 university.
• A future study will explore under what conditions the treatment is most effective and what supports are needed for teachers.

Acknowledgements

I appreciate the teachers and their students for allowing me to conduct this research. I also thank Henry May, Jenifer Hummer, and Amanda Seiwell for supporting the data collection and analysis. The research reported in this poster was supported with funding from the National Science Foundation (NSF; Award #1453493, PI: Cirillo). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the NSF.