ASU School of Mathematical and Statistical Sciences
Arizona State University

MEMORANDUM

DATE: 04/24/2023

TO: Faculty and Students

FROM: Professor(s)   Kyeong-Hah Roh

Chair/Co-Chairs of   Derek Eckman

Defense for the   PhD   in Mathematics Education

Committee Members

Dov Zazkis
Jason Martin
John Spielberg
Marilyn Carlson

DEFENSE ANNOUNCEMENT

Candidate: Derek Eckman

Defense Date: 06/22/2023

Defense Time: 2:00 PM

Virtual Meeting Link: https://asu.zoom.us/j/85711685522   Live Attendance: WXLR 546

Title: Students' Personal Algebraic Expressions as a Reflection of their Meanings: The Case of Infinite Series

Please share this information with colleagues and other students, especially those studying in similar fields. Faculty and students are encouraged to attend. The defending candidate will give a 40 minute talk, after which the committee members will ask questions. There may be time for questions from those in attendance. But, guests are primarily invited to attend as observers and will be excused when the committee begins its deliberations or if the committee wishes to question the candidate privately.

ABSTRACT
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ABSTRACT

Over the last several centuries, mathematicians have developed sophisticated symbol systems to represent abstract ideas often imperceptible to their five senses. Although conventional definitions exist for these notations, individuals attribute their personalized meanings to these symbols during their mathematical activities. In some instances, students might (1) attribute a non-normative meaning to a conventional symbol or (2) attribute viable meanings for a mathematical topic to a novel symbol. This dissertation aims to investigate the relationships between students' meanings and personal algebraic expressions in the context of one topic: infinite series convergence. To this end, I report the results of two individual constructivist teaching experiments in which first-time second-semester university calculus students constructed symbols (called *personal expressions*) to organize their thinking about various topics related to infinite series. My results comprise three distinct sections. First, I describe the intuitive meanings that the two students, Monica and Sylvia, exhibited for infinite series convergence before experiencing formal instruction on the topic. Second, I categorize the meanings these students attributed to their personal expressions for series topics and propose symbol categories corresponding to various instantiations of each meaning. Finally, I describe two situations in which students modified their personal expressions throughout several interviews to either (1) distinguish between examples they initially perceived as similar or (2) modify a previous personal expression to symbolize two ideas they initially perceived as distinct. To conclude, I discuss the research and teaching implications of my explanatory frameworks for students' symbolization. I also provide an initial theoretical

framing of the cognitive mechanisms by which students create, maintain, and modify

their personal algebraic representations.