

Supporting Mathematical Connections Between Abstract Algebra and Secondary Mathematics for Preservice Teachers

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The numerous mathematical connections between abstract algebra and secondary school mathematics have led professional organizations and mathematics education researchers to identify abstract algebra as an important course for preservice mathematics teachers (CBMS, 2001; CBMS, 2012; Wasserman et al., 2017). Despite what experts might say are clear mathematical connections between abstract algebra and secondary mathematics, many preservice teachers do not see the relevance of an undergraduate abstract algebra course to their teaching practice. In fact, many of them see no relation at all between abstract algebra and secondary school mathematics (Christy & Sparks, 2015; Ticknor, 2012). To address this need for direct connections between mathematical knowledge and pedagogical practice, this poster presents a portion of the results from a larger qualitative study that followed students with an interest in secondary mathematics teaching through their enrollment in an abstract algebra course (Gray, 2021). In particular, the study investigates the types of tasks and course activities that aid preservice teachers in establishing connections between abstract algebra and secondary school mathematics.

For the larger project, survey data was collected from collegiate mathematics faculty and practicing secondary mathematics teachers regarding mathematical connections between abstract algebra and secondary school mathematics. Mathematical connections that these participants identified as important were subsequently utilized to create short instructional tasks that were situated in secondary school mathematics contexts. The abstract algebra course involved in the larger study included undergraduate and graduate students with various majors meaning that the course was not explicitly designed for preservice teachers. The instructional tasks were implemented as warm-up activities before and after the relevant abstract algebra material was taught. This was an adaptation of Wasserman and his colleague's (2017) model *building up from/stepping down to teaching practice*. While all students in the course completed these activities, this study focuses on seven participants: six undergraduates, all of whom expressed interest in teaching careers, and one graduate student with secondary teaching experience. Data collection for these participants included written work on eight warm-up activities, two written student questionnaires (pre/post course), two individual interviews, one midsemester group interview with the undergraduate participants, and classroom observations of 38 class sessions.

Grounded theory coding (Charmaz, 2006) was used to analyze all data sources. The most common mathematical content connection that the participants made is the connection between algebraic structures and their properties in abstract algebra to various concepts in secondary school mathematics. For example, one task asked participants to solve a system of linear equations and justify/explain each step. Six of the seven participants were able to connect this secondary mathematics problem to abstract algebra concepts like inverse and identity. The seventh participant could identify that connections exist making abstract algebra an important course for preservice teachers but did not display evidence of making any connections. Results suggest that abstract algebra instructors can support preservice teachers by providing them opportunities to explore connections themselves.

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