November, 2015

An exploratory Analysis of Pre-service Middle School Teachers' Mathematical Arguments

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AN EXPLORATORY ANALYSIS OF PRE-SERVICE MIDDLE SCHOOL TEACHERS' MATHEMATICAL ARGUMENTS

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Keywords: Middle School Education; Teacher Education-Preservice; Learning Trajectories

Calls for increased focus on mathematical argumentation in school mathematics are critical for teacher educators charged with preparing prospective K-8 teachers (PST) to foster mathematical argumentation in their future classrooms. This is because research suggests that middle school years are crucial for students to gain proficiency in creating and critiquing mathematical arguments. Supporting PSTs' strong understanding of what it means to *do* mathematics necessitates that teacher preparation programs place an emphasis on mathematical and pedagogical preparation that facilitates PSTs' strong understanding of mathematical argumentation and proving in school mathematics.

Based on problem-based interviews with 22 K-8 PSTs, we report on PSTs' ability to create mathematical arguments in the context of problems that involve reasoning and generalizing about patterns. The research question was: *How do pre-service middle school teachers reason about change in problem situations that require analyzing patterns and what is the nature of the arguments they create?* We selected this curricular topic because the reasoning about change and patterns is essential for learning concepts related to functions, algebraic thinking, and measurement. Records of the interviews were analyzed qualitatively (Strauss & Corbin, 1998) to first identify the specific problem solution trajectory. Then, using Toulmin's argumentation framework (2003) as a guide, we examined the structure of arguments pre-service teachers generated. Due to the space limitation, in this proposal, we only report the selected results from one task where participants were asked to generalize about the number of matchsticks to make a rectangle made up of R-rows and C-columns.

The vast majority of the PSTs reasoned about this task by first noticing the invariant characteristics of the given structure and focusing on horizontal and vertical change in the number of sticks. In the process of initially limiting the number of rows to only one and "unfolding" the consecutive numbers of columns they were able to develop the correct rule e.g., 4+3(c-1), or 4 + 3(r-1) if reasoning about change in rows, and later account for change in the second variable arguing that the number of sticks in *any* figure could be determined by a rule 4 + 3 (c-1) + [3 + 2(c-1)] (r-1). Overall however, they demonstrated limited ability to justify *why* their rule works. Most of those PSTs who used this strategy did not articulate clear links between the context of the problem and their rules. Instead, they supported the validity of their claims with specific examples (43% used one example, 21% two or more specific cases). Only a few were able to contextualize their rules using specific characteristics of the problem they solved. While in this proposal we only highlight selected findings from one task, this study documents reasoning paths PSTs at the beginning of their teacher education program generate and contributes to the knowledge of PST's ability to create mathematical arguments.

References

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