Pre-Service Teachers' Mathematical Understanding of the Area of a Rectangle

Betsy McNeal*   Sayonita Ghosh Hajra**   Ayse Ozturk*   Wyatt Ehlke**   Michael Battista*
*Ohio State University **Hamline University

This poster will share contrasting responses of two pre-service teachers (PTs) to problems that were part of an ongoing study of PTs' conceptions of area of a rectangle. They were asked to a) find the area of a rectangle in terms of a non-square rectangular unit and relate that to multiplication, and b) interpret a fictional child's attempt to connect the area formula with counting square units. These cases showed that an ability to explain a systematic covering of a 2D space with an area unit does not imply an ability to respond to a student who might think "the corner square gets counted twice". Further, the ability to describe this structure, L rows with W area units per row, does not imply readiness to understand the area formula for a rectangle.

Keywords: area, rectangle, geometry, pre-service teachers

Numerous studies indicate that when teachers obtain appropriate knowledge of mathematics, their instructional practices change in ways that improve their students' mathematics learning (e.g., Cobb et al., 1991; Fennema et al., 1996). As mathematics educators who design and teach mathematics courses for future teachers, we are constantly reevaluating our course curriculum and goals in light of our current understanding of what mathematics will be needed by our PTs in their careers. In our courses, explanations of all mathematical ideas are emphasized, and our role is to orchestrate sharing of different answers, ideas, questions, and solution methods. In our daily observations of their work in class, we developed theories of the PTs' conceptions of area and its measurement that are explored in our research.

This study took place at a public university in a mid-western state with ten PTs who were enrolled in a geometry course for future elementary teachers. We conducted clinical interviews (Clement, 2000) with these PTs outside of class. These focused on (a) the idea of measuring the area of a rectangle with non-square units and explaining the meaning of the covering process used, and (b) the interpretation of a fictional child's thinking about the connection between the area formula and counting square units. Each interview was videotaped and transcribed. Videos and transcripts were analyzed to capture the progression of PTs' thinking from task to task (Auerbach & Silverstein, 2003). Specifically, each of the researchers read the transcripts multiple times, and documented the changes over the interview sessions. Key excerpts were flagged, reviewed, and examined closely for insights about PTs' reasoning.

The poster will present data from interviews with two of the PTs. These were selected because of contrasts across their own answers as well as contrasts with each other's answers. One PT covered a rectangle with rows of area units and used this to explain why multiplication will yield the total number of units. The same PT then had difficulty assisting a fictional student who, looking at an array of squares, was worried that the corner square was counted twice. The second PT also iterated the unit to cover the rectangle. She got confused when trying to explain this process in terms of "L x W", but then clearly explained to the imaginary student how to use multiplication to count the squares. These PTs' responses prompted questions and ideas that we wish to consider with the other researchers and the RUME audience.

References

Auerbach, C. & Silverstein, L. B. (2003). *Qualitative data: An introduction to coding and analysis*. New York: New York University Press.

Clement, J. (2000). Analysis of clinical interviews: Foundations and model viability. In Lesh, R. and Kelly, A., *Handbook of research methodologies for science and mathematics education* (pp. 341–385). Hillsdale, NJ: Lawrence Erlbaum.

Cobb, P., Wood, T., & Yackel, E. (1991). A constructivist approach to second grade mathematics. In von Glaserfield, E. (Ed.), *Radical Constructivism in Mathematics Education* (pp. 157–176). Dordrecht, The Netherlands: Kluwer Academic Publishers.

Fennema, E., Carpenter, T. P., Franke, M. L., Levi. L., Jacobs, V., & Empson, S. (1996). A longitudinal study of learning to use children's thinking in mathematics instruction. *Journal for Research in Mathematics Education, 27*, 403–434.