Essential Aspects of Mathematics as a Practice in Research and Undergraduate Instruction

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A gap between mathematics as used by mathematicians and mathematics as experienced by undergraduate mathematics students has persistently been identified as problematic; A commonly proposed solution is to provide opportunities for students to do *mathematics and* be *mathematicians (e.g., Whitehead, 1911; Harel, 2008). Conceptions or beliefs about what this means may vary depending on a mathematician's research and experience. The authors explore mathematicians' expressed conceptions of mathematics in their research and in their teaching.*

Keywords: conceptions, beliefs

A gap described between meanings of mathematics as used in mathematical research and mathematics as experienced by students has persistently been identified as problematic, potentially preventing students from knowing mathematics in the expected deep and complex ways (e.g., Whitehead, 1911; Harel, 2008). One solution proposed by mathematicians and mathematics educators for all levels is to provide opportunities to students to *do mathematics* and *be mathematicians* (e.g., Whitehead; Harel; Ball, Lubienski, & Mewborn, 2001; Stein, Grover, & Henningsen, 1996). This solution depends, however, on the conceptions or beliefs held about the nature of mathematics itself (e.g., Skemp, 1978). We asked: How do mathematicians at Georgia Southern University view mathematics as a practice in their own mathematical research? What aspects of mathematics do they try to teach their undergraduate students?

We developed 12 broad statements about aspects of mathematics based on descriptions of the nature of mathematics from mathematicians and mathematics educators (e.g., Ball et al., 2001; Ernest, 1989; Harel, 2008; Stein et al., 1996; Whitehead, 1911). Mathematics is: (a) a mass of details and procedures; (b) strategies and solutions with internal or external validity; (c) ideas that can be theoretically interesting, elegant, and beautiful; (d) ways of thinking systematically and analytically; (e) ways of precisely communicating; (f) a powerful tool for interacting with real world and everyday situations; (g) productive struggle through framing and solving problems; (h) experimentation through making and testing conjectures, examining constraints, and making inferences; (i) the study of patterns; (j) the abstraction of properties and characteristics apart from emotions or sensations; (k) a human endeavor, continually growing through the dynamic process of creating knowledge through purposeful activity; and (l) a crystalline structure existing in complete, static, pure form, discovered through logical reasoning.

We selected 10 mathematics faculty with different research interests and experience. We asked each participant to respond to two open-ended questions and two questions that involved a card-sorting task. We used separate open-ended questions to ask them to describe the nature of mathematics as it appears in their research and that they intend to teach to their undergraduate students. We used the 12 statements in separate think-aloud card-sorting tasks. In each, the participant chose to keep, discard, or edit each card or to add new cards. They selected four aspects of mathematics they felt were most critical in 1) their research and 2) their teaching.

We analyzed faculty participants' selections and reasoning to understand how they view the nature of mathematics and how they hope their students will view the nature of mathematics. In this poster, we present their views to explore more deeply what it would mean for students to *do mathematics* and to *be mathematicians* in different areas within undergraduate mathematics.

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