MATHEMATICS IS EVERYWHERE: INTERSECTION OF PST PERCEPTIONS AND NON-MATHEMATICS-EDUCATION FACULTY PERCEPTIONS AND OBSERVABLE ACTIONS

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Mathematics traditionally has been taught as a discrete set of content areas related to numbers and operations, algebra, geometry, measurement, and data analysis and probability. And, while the National Council of Teachers of Mathematics [NCTM] (2000) has stressed the need for students to make connections between these mathematical content areas, to other disciplines, and to the real world, these connections have been weak. These weak connections are consequential. When students of mathematics do not make these connections, they are limited in their development of mathematical thinking. They may be able to attain procedural fluency, but they are unable to continuously develop conceptual understanding, necessary for the understanding of more abstract mathematical concepts. Without such connections, they do not develop the strategic competence and adaptive reasoning necessary to problem solve successfully. Too, these weak connections perpetuate long-standing cultural beliefs that mathematics is irrelevant to other content areas and/or to the real world.

Within teacher-preparation programs, instruction is frequently given in a discrete fashion in which pre-service teachers [PSTs] receive mathematics instruction from one professor in one class, social-studies instruction from one professor in another class, and so on. This lack of integration among disciplinary methods reinforces the lack of connection that is encouraged in the NCTM and Common Core [CC] process standards for children to become fully proficient in their mathematical thinking. While structurally this discrete division of content appears overt, my suspicion was that most of the non-mathematics-education professors were integrating mathematical practices in their instruction. This assumption guided the study and was confirmed in the triangulated analysis of a three-part, data-collection process of (1) 180 PSTs' alignment of the CC Standards of Mathematical Practices [MSPs] with instructional examples from their non-mathematics education courses (Spring '14 to Spring '18); (2) 19 non-mathematics-teacher educators' survey data on how they use the MSPs in their instruction; and (3) 11 full-class, video-taped observations of two social-studies, two science, two English-and-language-arts, one creative-arts, and one physical-education/health teacher educators who were surveyed (Spring 2018). While PSTs and their non-mathematics education professors initially held exclusive views of their definitions of mathematics and mathematical thinking, project results reveal that even in non-mathematics-focused courses, most of the MSPs are being reinforced.

Overall, the objective of this project is to provide evidence that mathematical thinking occurs everywhere, despite beliefs about its discrete nature. Educators, no matter their disciplinary expertise, can strengthen students' mathematical thinking in meaningful ways. Through a more united front in helping students develop their mathematical thinking, we can strengthen the connections students make between mathematical content areas, other disciplines, and the real world. Only in making these connections will students be able to attain all five strands of mathematical proficiency: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive dispositions (NRC, 2001).

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