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Prospective secondary mathematics teachers' understanding and cognitive difficulties in making connections among representations.

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Summary: This study investigates prospective secondary teachers' cognitive difficulties and mathematical ideas involved in making connections among representations. We implemented a three-week teaching unit to help prospective secondary mathematics teachers develop understanding of big ideas that are critical to formulating connections among representations, in the context of conic curves. Qualitative analysis of data showed that most undergraduate mathematics majors and minors in this study struggled with variation, the Cartesian connection, and other affiliated ideas such as graph as a locus of points. Furthermore, they were unable to identify basic metric relations encoded in algebraic expressions such as the distance between points, which further compounded their difficulties in making connections among representations. We argue that mathematics teacher education needs more focus on these ideas so that their graduates can successfully teach these big ideas in their future instruction.

Classification: G79 H39 I29 D79 C39

Keywords: representations; connecting; understanding; cognitive difficulties; mathematical ideas; conic curves; variation; Cartesian connection; graph as a locus of points

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