Students' Understanding of Trigonometric Functions in an Active-Learning Course

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Minimal research has been conducted surrounding how best students learn trigonometric functions in a precalculus course. Using motivation from a study conducted by Weber (2005), results from this study indicate that students who participated in a college level precalculus course where the unit circle was taught before right triangle trigonometry were better able to utilize a unit circle but struggled to conceptualize some of its properties. This report has implications for mathematics programs looking to determine best practices for the instruction order of precalculus courses.

Keywords: Precalculus, Trigonometric Functions, Student Thinking and Learning

In the mathematics education community of researchers, there is the understanding that the goal of mathematics is to learn mathematics with deep understandings – methods that go beyond memorizing facts and formulas to provide correct solutions on worksheets and examinations (Common Core State Standards Initiative, 2010). Students should be able to use procedures and explain why they are appropriate and justify why concepts in mathematics have the properties they do (Weber, 2005). With this being said, researchers have noted that this does not always apply to the teaching and learning of trigonometric functions in trigonometry or precalculus classrooms (Thompson, Carlson, & Silverman, 2007; Weber, Knott, & Evitts, 2008). They are often geared towards the memorization of mnemonic devices or acronyms.

Weber (2005) states that the form of instruction that students receive will influence how they learn trigonometry. Generally, there are two forms of instruction commonly associated with the learning of trigonometric functions: (1) the method involving special right triangles, where the trigonometric functions are defined as ratios of the lengths of the sides in the right triangles, or (2) the unit circle method where the cosine and sine of an angle is defined to be the x- and y-coordinates of the point that rests at the terminal side of the angle that intersects the unit circle (Kendal & Stacey, 1998). Researchers have tested which instructional strategy will lead to a better understanding of trigonometric functions in order to aid students in overcoming their misconceptions they may have with them (Kendal & Stacey, 1998; Weber, 2005).

This case study is a smaller part of a larger mixed methodological exploratory research study designed to introduce active learning components to study how these new practices are implemented and how they affect student outcomes (Keene, Skrzypek, Downing, & Kott, 2017). Motivated by the dichotomous approaches to learning trigonometry by the work of Weber (2005) and Kendal and Tall (1998), the goal of this study is to see the extent to which students are able to reason through trigonometric concepts after engaging in team activities, in which students worked each other to work through conceptually-based tasks.

The poster will provide the preliminary findings to students' understanding through a semi-structured task-based interview. These results show that students were able to draw upon their experiences with team activities to aid them through tasks. use the unit circle at least as a reference, however, they struggled to conceptualize why it has the properties it does.

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