1145-AK-2319 **Aaron D Wangberg*** (awangberg@winona.edu), 322 Gildemeister Hall, Winona State Universit, 175 W. Mark St., Winona, MN 55987, and **Brian Fisher** (brian.fisher@lcu.edu), **Jason Samuels** (jsamuelsbmcc@gmail.com), **Tisha Hooks** (thooks@winona.edu) and **Elizabeth Gire** (giree@oregonstate.edu). *Raising Calculus to the Surface: Using physical manipulatives to discovering multivariable calculus concepts.*

The Raising Calculus to the Surface project (NSF DUE-#1246094) utilizes physical manipulatives to help students explore the fundamental concepts behind multivariable calculus. Using dry-erasable 'surfaces', contour maps, and tools, students are able to draw, measure, make conjectures, and discover properties of new mathematical objects. Contextualized small group activities ask students to investigate key ideas and relationships before a formal introduction in lecture, thereby helping students develop geometric understanding of multivariable calculus, imbue meaning in the algebraic formulas, and practice applying mathematics to scientific settings. Professional development workshops supported by the project have helped instructors at more than 50 institutions utilize the materials.

In this presentation, we will describe the project's key features, its impact on instructor teaching beliefs and practices, and highlight how the materials are helping us understand how students learn multivariable calculus concepts. (Received September 25, 2018)