

**ZMATH 2016c.00862**

**McGee, Daniel; Moore-Russo, Deborah; Martinez-Planell, Rafael**

**Making implicit multivariable calculus representations explicit: a clinical study.**

PRIMUS, Probl. Resour. Issues Math. Undergrad. Stud. 25, No. 6, 529-541 (2015).

Summary: Reviewing numerous textbooks, we found that in both differential and integral calculus textbooks the authors commonly assume that: (i) students can generalize associations between representations in two dimensions to associations between representations of the same mathematical concept in three dimensions on their own; and (ii) explicit discussions of these representations are not necessary. For example, in the presentation of partial derivatives, textbook presentations assume that students will understand the slope in a specified direction in  $\mathbb{R}^3$  without it ever being explicitly presented. Our preliminary interviews indicated that such assumptions may be erroneous, so we created and tested materials that explicitly use representations commonly omitted in textbook presentations of the differential and integral calculus of functions of two and three variables. This paper discusses the classroom activities that were created to include these missing representations, as well as the results when they were implemented in classroom instruction.

*Classification:* I65 I45 I55

*Keywords:* multivariable calculus; representations; derivatives; integrals; slope; three dimensions

doi:10.1080/10511970.2015.1038858