The research community shares a concern for students’ conceptual understanding of calculus and commonly advocates for student-centered approaches as a way to promote it. In this study, we investigated the effect of different instructional approaches on 151 undergraduate students’ conceptual understanding of differential calculus in context-specific, natural settings. We collected data on the pre and posttest of the Calculus Concept Inventory in three classes. In one class, most of the time was dedicated to conceptually oriented problem solving (COPS). Another class implemented practice problems (PP) in a lecture hall. The third class, also taught in a lecture hall, utilized primarily direct instruction (DI). The Calculus Concept Inventory (CCI; Epstein, 2007), a measure of conceptual understanding of differential calculus, was administered in all three classes at the beginning and end of the semester. A total of 151 undergraduate students participated in the study.

We conducted an ANCOVA test to determine the differences in the posttest CCI scores between the classes controlling for the pretest scores. The results showed that students in three classes did not differ in their conceptual understanding of differential calculus by the end of the semester controlling for their initial understanding, $F(2, 147)=1.07, p=0.35$. The original means on the posttest were 7.33 (SD=3.60; N=49) for the COPS class, 9.28 (SD=3.77; N=64) for the PP class, and 7.29 (SD=3.16; N=38) for the DI class. Our findings suggest that students’ conceptual understanding of differential calculus is independent from the instruction type when measured by a validated instrument, considering each class individually. Such an ex post facto design provides a more comprehensive picture of instruction implementation. However, its particulars may lead to different outcomes and be challenging to identify. Future research should explore context specific variations in approaches’ implementation to determine commonalities between the effective ones.
References


