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The Role of Graphing Calculators in Students' Approaches to Solving Calculus Problems

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(Abstract Page)

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Results will be presented from a study investigating use of multiple representations and the graphing calculator as students solved limit and derivative problems. Examination included representational mode(s) chosen; whether the graphing calculator was used and by what type of students; and the calculator's use as an exploratory or confirmatory tool.

(Full Paper)

The Role of Graphing Calculators in Students' Approaches to Solving Calculus Problems

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Advances in calculator technology have provided an opportunity for representations of mathematical concepts to be presented externally through a multiple representational approach. This study investigated the use of multiple representations and the graphing calculator as students solved limit and derivative problems. It examined the representational mode(s) chosen; whether the graphing calculator was used; and the calculator's use as an exploratory or confirmatory tool.

Sixty-five students enrolled in a first-term university calculus course participated in the study. Course instruction emphasized a multiple representational approach and required students to use graphing calculators. Students' written solutions to six limit tasks and five derivative tasks were examined and coded for correctness, graphing calculator use including exploratory or confirmatory purposes, and representational approach(es) (graphical, numerical, algebraic, or a combination of these). Quantitative and descriptive analyses determine when and how students used the graphing calculator, which representation or combination of representations students chose to use, and the relation of these to student success.

Results show that students used the graphing calculator primarily as an exploratory tool to solve limit and derivative problems. Although there was no overall significance between graphing calculator use and correctness, there was a significant association of correctness when the calculator was used for exploratory purposes on unfamiliar limit problems. Furthermore, results indicate that students solved limit and derivative problems differently, showing greater variance in representational approaches for limit problems than for derivative problems. When a

multiple representational approach was used, it was likely to be a combination of algebraic and graphical representations. When the most successful students (in the top quartile of the class) used two representational approaches, they predominantly combined algebraic with another representation (numerical for limit tasks, graphical for derivative tasks).

After taking a calculus course taught with a multiple-representational-view-of-concepts model of instruction and with integral use of the graphing calculator, students demonstrated knowledge of a multiple representational approach to problem solving, and they made use of the graphing calculator as they solved calculus problems. This approach to calculus instruction has become more common. The results and conclusions of this study endorse the use of these instructional practices.