The Effects of Writing to Learn Mathematics on Conceptual Understanding
and Procedural Ability in Introductory College Calculus

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Dissertation Abstract

Initially, the primary goal of this study was to investigate the effects of writing to learn
mathematics on the conceptual and procedural understanding of students in an introductory
college calculus course.  As the study began, an additional goal emerged:  to develop a system
for classifying students’ errors in calculus that could be used to analyze the data in this study and
future ones.

To achieve these goals, the examinations of students in two sections of introductory calculus
were studied.  The instruction of the two groups was very similar:  both groups had the same
instructor and were taught with a focus on the concepts of the course.  However, in one group,
students used writing activities; in the other, students used related activities that did not involve
writing.  The writing and nonwriting activities were similar in their focus and both groups of
students discussed the activities in class.  The only major difference between the two groups was
that one group used writing to learn mathematics in their activities and the other group did not.

Using the errors made by both groups on their examinations, a classification system for
errors in calculus was developed, which had not previously been done.  This classification
system consisted of two procedural error categories and four conceptual error categories.  Using
this system, the errors of the students in the writing and comparison groups were categorized and
the data were statistically analyzed for information about the students’ conceptual and procedural
understanding.

No significant differences were found between the two groups in terms of their conceptual
errors, nor for their procedural errors, which suggested that the writing activities did not have a
different effect than the related nonwriting activities on students’ conceptual and procedural
understanding.
If students who engage in nonwriting activities that focus on concepts and involve discussion can achieve the same level of conceptual and procedural understanding as students who use writing activities, then mathematics instructors have a viable alternative to using writing activities. This study indicated a need for further research into this matter.