Executive Summary: Impact of the Wisconsin Emerging Scholars First-Semester Calculus Program on Grades and Retention from Fall `93-`96

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Executive Summary

During the Fall semesters from 1993 to 1996 the UW-Madison Department of Mathematics ran a total of 11 Wisconsin Emerging Scholars (WES) sections distributed over several first-semester calculus (Math 221) lectures. The students considered here were all first-semester freshman with no advanced standing, were 18 or 19 years old, and had enrolled in Math 221 in one of those four Fall semesters. Overall, we compared 169 WES students to 3,871 non-WES students.

We examined the WES program in terms of its impact on students:

1. success in calculus
2. retention in science, math, engineering, or technology (SMET) majors.

"Success" in calculus was quantified in terms of the proportions of students receiving a B or above in calculus. Specifically, for the various groups of students of interest, we analyzed the "odds of success," defined as the ratio of the number of students in the group with a B or above to the number with a BC or below. This measure was chosen because it concisely captures the most relevant part of the distribution of grades for our purposes. In contrast, differences in "mean" grades, for example, leave unanswered the question of whether one groups' higher average was due simply to more Cs in proportion to Ds, as opposed to more As and Bs in proportion to Cs and Ds. See (1,2) for some analyses in terms of mean grades.

Both of these factors were broken down by several other factors of interest. These include prior achievement or preparation (e.g., ACT, SAT math scores, UW-math placement scores, etc.), calculus lecture, gender, minority status, and whether the student was in the College of Engineering.

1. **Impact of WES on success in calculus**
   Roughly speaking, we can characterize the impact of the WES program on success rates in calculus by saying that no matter how we cut the data--by gender, minority status, engineering status, or prior achievement--the odds that WES students received a B or above in calculus were observed to be about twice that of their non-WES counterparts with a 95% confidence interval for this odds of success ratio of about (1.5, 3.0).

2. **Impact of WES on retention in SMET majors**
   The story here is also quite simple: there was no statistically significant association between persistence in a SMET major or more specifically persistence in engineering, and participation in the WES Math 221 program. That is, retention rates for the various groups were about the same for the WES participants as their non-WES counterparts. In fact, for some groups the retention percentages for WES were actually lower, although not statistically significantly so. Although another study of UW-Madison freshman enrolled in both math and chemistry in their first semester indicated that success in calculus is strongly correlated with persistence in SMET majors (6), if we use 1st semester enrollment in the College of Engineering as a proxy for enrollment in chemistry we find that our WES sample is too small (57 students) to say anything conclusive. In other words, even statistically "significant" (or insignificant) differences should not be interpreted as providing definitive conclusions when only a handful of students is in question. In fact, conclusions drawn from the total WES sample of 169 should also be treated with caution. See Appendix B.