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BOARD # 323: An S-STEM Program for Commuters at a Regional, Public University

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Retaining Students in STEM on a Commuter Campus: Early Results from an S-STEM Program at a Regional, Public University

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Introduction

Retention and graduation rates in STEM (science, technology, engineering, and mathematics) are critical to the innovation economy and to address complex global problems through research and development. However, on many university campuses nationwide, success rates in attaining STEM credentials are typically lower than non-STEM fields, with many students leaving before completing their degree. Additional barriers are faced by low income and commuter students, especially those that live at home [1]. While a strong sense of belonging is known to increase academic persistence, this sense of connection can be more difficult to achieve on a commuter campus, where students are physically on campus for limited times and their support networks, including family and friends, are off campus.

This paper examines the first two years in an S-STEM program sponsored by the National Science Foundation (NSF). The program supports high achieving, low income students at the University of Michigan-Dearborn, a public, regional university where 100% of students commute. The S-STEM program supports 50 students, called STEM Scholars, with full tuition scholarships and additional programming over a six year period. The goals of the program are to increase one and two year retention rates, both on campus and in STEM fields, to increase degree completion rates in STEM, and to close equity gaps between low income students and their peers. The program includes evidence-based practices to improve retention and completion including an adapted (scaled down) cohort model, a freshman seminar, and a research experience [2], [3], [4]. Activities are optimized with commuter students in mind [5].

Program history and components

The STEM Scholars Program was launched in Fall of 2022 and includes three cohorts of high achieving, low income students. Current students in the program are freshmen, sophomores, or juniors, with data for this report taken only from the sophomores and juniors. To date, none of the students have graduated, as they are all enrolled in four year programs.

Students are eligible for the program provided they meet the financial need requirement and are U.S. citizens, permanent residents, or have status as a US national or admitted refugee, have a high school GPA of 3.0 or better, place into calculus I, and declare a STEM major in one of the following areas: Biological Sciences, Biochemistry, Computer & Information Science, Engineering, Electrical Engineering, Industrial and Systems Engineering, Mechanical Engineering, Computer Engineering, Mathematics, Environmental Science, Bioengineering, or Chemistry. The majors were chosen because all of them require calculus I. Eligible students participate in a group interview, with program faculty and other students, before being admitted.

The application process is inclusive: every single applicant has been invited to interview and every student who has interviewed has been offered a seat in the program.

The University of Michigan-Dearborn draws students from a large metropolitan region and approximately 75% of students hold jobs to cover expenses for themselves or their families. Additionally, 41% of new students are first generation college students. With this in mind, the program developed supportive elements that were flexible, allowing participants to attend events online whenever possible. One key feature of the program is a limited cohort model, where students are placed together only during the first semester in a calculus I course, a freshman seminar course, and, for those majors that require it, a general chemistry lab and recitation. The purpose of the cohort was to increase students' sense of belonging and connection to campus, as well as to provide a robust array of peer mentors, which is sometimes a missing element on a commuter campus.

Along with the first semester classes, student have access to a paid research experience in their junior year, regular professional development opportunities, faculty mentoring, and a dedicated, part time advisor. The program advisor, coordinator, and faculty mentors understand that most students work or have family commitments that impede their ability to participate in activities, so events are typically hosted monthly in a hybrid mode.

Results

In this section, we compare results from the 25 study participants from STEM Scholars with a control group, who did not participate in the program. The study participants began their first semester in college in Fall 2022 or Fall 2023 and are now sophomores and juniors, with 12 participants from the Fall 2022 cohort and 13 participants from the 2023 cohort.

Like the students participating in STEM Scholars, the 359 students in the control group were also low income, based on Pell grant eligibility, and selected one of the eligible STEM majors (Biological Sciences, Biochemistry, Computer & Information Science, Engineering, Electrical Engineering, Industrial and Systems Engineering, Mechanical Engineering, Computer Engineering, Mathematics, Environmental Science, Bioengineering, or Chemistry) during their first semester, Fall 2022 or Fall 2023. To ensure the comparison group had a similar academic background, the control group also placed into and enrolled in calculus I, the same math class that STEM Scholars enrolled in during semester 1. In terms of demographics, the STEM Scholars group is more diverse than the control population, especially in terms of gender, but less so in terms of residency status. The table below shows the demographic breakdown of each population.

	Male	Female	Asian	Black or African American	Hispanic	Multi-Racial	White	In State	Out of State
STEM	32%	68%	4%	8%	20%	8%	48%	100%	0%
Control	65.6%	34.5%	12.5%	4.2%	7.5%	6.4%	56.8%	88.3%	11.7%

One and two year retention rates, collected at the start of the second Fall semester for the study group and the control group are shown in the table below. While some students did change their major, they were counted as being retained in STEM if their new major is designated by the U.S. Department of Homeland Security as eligible for the OPT STEM Extension [6]. Note that only one cohort, the class starting in Fall 2022, has two years of data available.

	One Year Retention			Two Year Retention	
Start term Fall 2022/23	On Campus	In a STEM major	Start term Fall 2022	On Campus	In a STEM major
STEM (N=25)	100% (N=25)	96% (N=24)	STEM (N=12)	100% (N=12)	83.3% (N=10)
Control (N=359)	89.1% (N=320)	82.5% (N=296)	Control (N=177)	78.0% (N=138)	71.2% (N=126)

Student outcomes in several gateway courses have been linked to university retention rates in the literature as well as in internal data reported on campus. For example, campus level data shows a significantly decreased one-year retention rate for students who are unsuccessful in precalculus, calculus I, and general chemistry.

Increased academic success, as measured by GPA on a 4.0 scale, was observed in all three of the cohorted classes taken during the first semester: calculus I, the freshman seminar course, and, for some participants, general chemistry I. Additionally, and even more promising, academic success continued beyond the first semester in more notorious STEM gateway courses including calculus II and general chemistry II where students were not cohorted. Note that a campus policy is to replace a grade when a course is retaken, so this data reflects the final, or most successful, attempt by the student. The table below shows a comparison in the STEM gateway courses, with STEM Scholars outperforming the comparison group by at least 0.4 grade points in all four courses.

	GPA Cohorted Classes		GPA Non-Cohorted Classes	
Start term Fall 2022/23	Calculus I	General Chemistry I	Calculus II	General Chemistry II
STEM (N=25)	3.36	3.17	3.13	2.72
Control (N=359)	2.69	2.71	2.69	2.33

Discussion and future work

The limited cohort model and flexible support structure appears to significantly increase one year and two year retention rates, both on the campus and in STEM majors. Additionally, the program

seems to be associated with more successful outcomes in some challenging gateway courses. While the comparison group in this report was chosen with characteristics similar to STEM Scholars, data on the economic equity gap, between these students and non-Pell eligible students, still needs to be compared. Additionally, with an eye toward scaling this program in a cost efficient manner, understanding which intervention (limited cohort, flexible support, mentoring) had the greatest impact will be discerned through survey data. Finally, as the first cohort of students reached their junior year, the efficacy of the research experience needs to be assessed.

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IRB approval

This study has been approved by the University of Michigan Health Sciences and Behavioral Sciences IRB under study ID HUM00201927.

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