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BOARD # 339: Change from within, not tearing down walls: Small S-STEM program success instigates institutional-level change at a private STEM university.

Ms. Jessica Anne Rosewitz P.E., Worcester Polytechnic Institute

Dr. Jessica Rosewitz is a teacher and project advisor, interested in industry and community engagement, project-based education, and continual improvement of engineering education at all levels. Her experience in design and construction enables her to draw upon regional engineering firms, and she is dedicated to early engineering education via outreach with local vocational schools, community organizations, and pre-K-12 programs.

Dr. Katherine C. Chen, Worcester Polytechnic Institute

Dr. Katherine C. Chen is the Executive Director of the STEM Education Center at Worcester Polytechnic Institute (WPI). Her degrees in Materials Science and Engineering are from Michigan State University and MIT. Her research interests include pre-college science and engineering education, as well as teacher education. She is especially interested in equity and inclusion in education.

Brianna Raphino, Worcester Polytechnic Institute

Brianna Raphino is a Ph.D. Candidate at Worcester Polytechnic Institute (WPI) in the Mechanical Engineering Department. She received her Bachelor's Degree in 2020 from Merrimack College. She then entered WPI graduate school with a GEM Fellowship, WPI Presidential Fellowship, and a supplemental grant from the Koerner Family Foundation. She has a passion for STEM education outreach and mentorship, and has participated in numerous programs, including WRAMP (Women's Research and Mentorship Program) at WPI.

Change from within, not tearing down walls: Small S-STEM program success instigates institutional-level change at a private STEM university

The Connecting Mentor Partners for Academic Success of Undergraduates in Science, Engineering, and Mathematics (CoMPASS) program (NSF award #1930461), an S-STEM scholarship program, is ending in September 2025 at Worcester Polytechnic Institute (WPI), a private, small, STEM, predominantly white institution (PWI). The program provides an assets-based framework of wrap-around support for 20 high-achieving, low-income students from Worcester, MA, a racially and ethnically diverse [1], high-poverty [2], local urban area, with the goal of supporting graduates to become STEM professionals. This program supports a portion of the cost of on-campus housing and is paired with a commitment from WPI to support the demonstrated financial need with scholarships in completing 4-year baccalaureate degrees. All students in this program are 1st-generation college students. The 1st cohort of 10 participants was recruited for Fall 2020 entry, and the 2nd cohort of 10 in the following year.

An intended long-term project outcome has been to build institutional programming for holistic support of low-income, 1st-generation students. The key personnel who regularly meet with students, discuss their situations, and provide support academically and emotionally are one faculty (PI), a program director (Co-PI), an assistant dean (Co-PI), and a graduate student peer mentor. Ad hoc support is provided by one staff in Academic Advising and one DEI professional. The small team has been with the cohorts during their entire time in college and have a holistic view of their experiences, which has led to high engagement of the scholars. A sense of belonging, safety, support, and care has been created. This number of staff appears to be appropriate for the 20 students based on outcomes. However, scaling this support to more with the same personnel may thin the necessary personal connections to a non-functional level.

This cohort model with high levels of interconnected support has been used to pilot changes in institutional priorities and practices with personnel in different leadership positions, connected by a mission of serving the student and promoting academic success in STEM. Prior to CoMPASS, a parallel program was in-place, a full financial need-based scholarship for a small number of students but it did not include support programming. The CoMPASS program includes a wide breadth of support activities, stemming from the need for high frequency academic advising in a fast-paced project-based education system. Cohorts participated with quarterly check-in meetings and near-peer mentoring with a current graduate student. As cohorts matured, support evolved to address a variety of topics: navigating within a constrictive university bureaucracy, mentoring for life and career path choices, personal finance, pursue graduate school or enter the workforce, mental health and well-being strategies, setting and achieving goals, choosing mentors and advocating for student-led mentoring sessions.

The CoMPASS program goals, methods of investigation and implementation, and outcomes are summarized in Table 1. Some outcomes have a broader reach across the institution and are discussed after. The momentum and energy to pursue them lies with the key personnel on this project, who have different job responsibilities and career paths but have same, clear goals of increasing the numbers of 1st-generation, low-income, transfer, and commuter students in STEM

and building institutional support at all levels. This program provides a vehicle for these individuals to pilot ideas before scaling up.

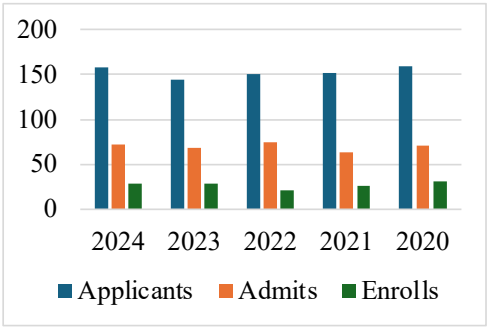
Table 1: Summary of project goals, methods of investigation and implementation, and current outcomes, as of December 2024, which is 9-months before project completion.

Objective	**Method**	**Outcome**
(1) Increase the number of low-income, academically talented, and 1st–generation students from the local urban area that apply, enroll, and graduate with a STEM baccalaureate degree from the university.	Investigate application, admittance, and enrollment rates since program initiation.	Data shows no change of low-income, 1st–generation students from the local urban area since program start.
	Compare participant retention rates to university data.	1 of the 1st cohort withdrew and was replaced, 20 retained since.
	Compare duration of B.S. degree obtainment to university data.	1st cohort: 10 graduated in 4-yrs. 2nd cohort: 9 to graduate in 4-yrs, 1 in 5-yrs.
(2) Financially, academically, and emotionally support participants with holistic, intentional, and research-backed programming to adapt over time from starting college to succeeding, to becoming a STEM professional.	Partner with a parallel program to cover the full financial need of participants.	Decline of partner program funding over time as cost burden moved to donors.
	Identify staff across university offices to track participant progress.	Staff retention made continuity of support difficult, proving the need to retain key personnel.
(3) Develop, implement, and investigate an assets-based framework with a mentor network (peer, near-peer, and faculty/staff) and workshops that will lead to sustainable, institutional change to support students of different identities.	Community building programming: quarterly check-in meetings; near-peer mentor meetings twice per quarter; events with industry sponsors; quarterly academic advising progress reviews; and bi-weekly PI/Co-PI meetings.	Bi-weekly PI/Co-PI meetings are critical to maintain flow, consistency, and timing across all programming.
(4) Examine the ways in which our students navigate and experience the institution over time that influence support student retention and graduation.	Evolve navigational capital programming with student-driven topics and events.	Quarterly check-in meetings are used to set future student-led programming content
	Quantitatively assess students' self-efficacy via the Longitudinal Assessment of Engineering Self-Efficacy (LAESE) [4, 5, 6].	Students expressed moderate self-efficacy in all domains, feel they can handle difficulties, and learned navigational capital.

The goal to improve matriculation, retention, and graduation rates of students from the local public school district shows no appreciable change in number of applicants, admittances, and enrollments; admissions data from 2020-24 is essentially flat over 5 years, Table *2*. This may be due in part to changes in financial aid packages across the university and admissions priorities.

Table 2: Admissions data for the University for first-year Fall admission by start year of enrollment, who are from the local urban area. Data from internal university reporting.

Year	**2024**	**2023**	**2022**	**2021**	**2020**
Applicants	158	144	150	152	159
Admits	72	68	74	63	71
Admit rate	45.6%	47.2%	49.3%	41.4%	44.6%
Enrolls	28	28	21	26	31
Yield	38.9%	41.2%	28.4%	41.3%	43.7%



Graduation rate success in Table 1 is attributed to students' abilities and the team, who meet bi-weekly to report 1-on-1 interactions, discuss paths forward, and plan just-in-time development programming. Meetings among key personnel involve quarterly academic reviews, which prompt actions for almost all participants, such as major changes, course selections for success, capstone project selection, graduate school admissions, and advocating for themselves. Through careful attention, participants have so far achieved a 100% 4-year graduation rate, surpassing the university's 83% 6-year graduation for the same cohort and the university's 73% 6-year graduation rate for Pell-awarded students (data from internal university reporting).

Mentoring has been a continued effort on this project, with several options for students. Regularly, about half of participants engage in 1-on-1 mentoring with key personnel. The near-peer mentor role fulfilled by a graduate student has been impactful for assisting the students. On more than one occasion, students have found the near-peer mentor to be a thoughtful listener, consider their concerns and issues, and provide timely advice on a variety of topics, such as mental health, well-being, self-care, major selection/change, career paths, friends and roommates, and family matters.

Bridge programs, summer courses, and summer research experiences have been influenced by this project. The number of CoMPASS participants who took advantage of these bridge and summer opportunities is summarized in Table 3. The bridge program is a 1-week pre-orientation bridge program aimed at empowering students, especially those from under-represented populations, through educational programming, professional development, and networking to build community. Participants were offered up to 2 pre-enrollment no-cost summer

Table 3: Number of CoMPASS participants by year who enrolled in the bridge program, no-cost summer courses, and the paid summer research experience.

Year	**Bridge program**	**Summer courses**	**Summer research**
2020	9	5	0
2021	8	13	5
2022	--	11	4
2023	--	10	2
2024	--	6	0

courses before their 1st year and every summer after. Undergraduate research is a high impact practice with benefits to opening future opportunities for students in STEM fields [3]. Summer research programs provided participants with their first paid research experience. The PI for this project is also the program coordinator for the summer research program, which is a competitive internal program for students with no prior experience, or those who have no prior relationship with a faculty to obtain a position. Building on their summer research experience, seven CoMPASS participants continued to engage in research during the following academic year and then attended a research conference or professional association meeting.

Quantitative methods are used to assess students' self-efficacy using the validated instrument, Longitudinal Assessment of Engineering Self-Efficacy (LAESE) [4, 5, 6]. Baseline data was established with each cohort upon enrollment, and each semester cohorts were invited to participate in surveys, thus longitudinally tracking students over time. The surveys also collected data on connections with peers, sense of belonging, and expectations regarding academic progress. A summary of the most recent (AY 2023-24) LAESE survey results is presented in Table 4, showing moderate self-efficacy in all domains.

Table 4: Summary of assessment of self-efficacy domains of S-STEM scholars, 2023-24 LAESE survey result on a Likert scale from 1 = Strongly Disagree to 7 = Strongly Agree (n=7 out of 10).

Domain	**Qualitative score**	**Outcome**
Engineering Career Success Expectations	Min: 5.57, Max: 6.86, Mean: **5.98** (SD: 0.55)	On average, students "agreed" or "somewhat agreed", leading to an overall assessment of moderate self-efficacy in these domains.
Engineering Self-Efficacy I	Min: 4.80, Max: 6.80, Mean: **5.91** (SD: 0.68)	
Engineering Self-Efficacy II	Min: 5.67, Max: 7.00, Mean: **6.38** (SD: 0.42)	
Feeling of Inclusion	Min: 3.50, Max: 5.75, Mean: **4.61** (SD: 0.71)	Reduced scores, however students feel they will be accepted in STEM careers upon completion.
Coping Self-Efficacy	Min: 5.00, Max: 7.00, Mean: **5.98** (SD: 0.65)	This domain is in general strong, students report they are confident with coping strategies.
Math outcome expectations	Min: 2.00, Max: 7.00, Mean: **5.10** (SD: 1.60)	There is no lack of confidence in math skills, but there is variability in understanding its use in careers.

Horizontal organizational learning [7] has occurred, in part due to this project. Observing scholars navigate the university has afforded personnel to suggest changes to create a more supporting and inclusive institution for these students whom the university was not originally designed for [8, 9]. There is a renewed focus at WPI to support commuter, transfer, and 1st-generation students. Experiences from this grant have contributed to re-written job duties at the Assistant Dean-level to build systemic supports for vulnerable students and collaborative support for all students, oversee summer session offerings, working to leverage summer activities (research fellowships, free summer courses, and pre-enrollment bridge programs) to support strategic initiatives. This formalizes support for vulnerable students at an institutional level.

Yet there is more work to be done to build institutional support across divisions for these students. The CoMPASS program has impacted the scholars' successes. The unique insight of seeing how scholars navigate the university has afforded the team to suggest initiatives to support many other students. The fraction of 1st-generation students is small at this university but represents 42.5% of the U.S. Population under age 18, driving continued need for this work [10].

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