Board 350: Preliminary Results from Community Colleges Collaborating in STEM

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Dr. Melanie Butler is the Principal Investigator for C3STEM: Community Colleges Collaborating in STEM, which is an S-STEM Track 2 National Science Foundation grant that has established pre- and post-transfer support, co-curricular, and career development activities for supporting recruitment, retention, and student success in STEM. She is a professor of mathematics in the Department of Mathematics and Computer Science at Mount St. Mary's University.

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Abstract

C3STEM: Community Colleges Collaborating in STEM is an S-STEM Track 2 National Science Foundation grant, started in fall of 2020, that has established pre- and post-transfer support, co-curricular, and career development activities for supporting recruitment, retention, and student success in STEM. Specifically, C3STEM uses institutional partnerships between community colleges and small private universities to promote transfer capital and student engagement in STEM transfer students. There are four objectives of the project. The first objective is to increase the number of academically talented and low-income students that transfer from community colleges to four-year institutions. The second objective is to improve the retention and graduation rates of CC transfer students in STEM fields by providing them with evidence-based curricular activities, co-curricular activities, and support services. The third objective is to increase the number of students placed into STEM graduate programs or professional positions by providing intensive faculty mentoring and research opportunities. The final objective is to generate new knowledge about how partnerships between CCs and small private universities can promote broader participation of academically talented, low-income CC transfer students in STEM. While the grant is ongoing, this poster will provide preliminary quantitative survey results of community college students about transfer capital, qualitative results from interviews of community college partners, and quantitative and qualitative survey results of curricular and co-curricular support services of scholars enrolled in the program. Preliminary results indicate that the primary obstacles to students transferring to small private universities are financial and logistical with community colleges and large state schools offering support services and pathways for students that small, private colleges either do not offer or do not advertise sufficiently. These support services can include food banks, childcare, low-cost housing, part-time degree paths, and evening and online classes.

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Introduction

C3STEM: Community Colleges Collaborating in STEM is an S-STEM Track 2 National Science Foundation grant, which is a partnership between Mount St. Mary's University (MSMU), Montgomery College (MC) and Frederick Community College (FCC). MSMU is a small, private liberal-arts institution with 2000 undergraduates in a rural area of Maryland north of Washington, D.C. MC is a large, urban two-year school in the Washington D.C. suburbs. FCC is a two-year school in Frederick, MD, a moderately sized city north of Washington D.C.

The project began in fall of 2020 with four objectives:

1. Increase the number of academically talented and low-income students that transfer from community colleges to MSMU,
2. Improve the retention and graduation rates of community college transfer students at MSMU in STEM fields by providing them with evidence-based curricular activities, co-curricular activities, and support services,
3. Increase the number of MSMU students placed into STEM graduate programs or professional positions by providing intensive faculty mentoring and research opportunities, and
4. Generate new knowledge about how partnerships between CCs and small private universities can promote broader participation of academically talented, low-income CC transfer students in STEM.

The project's aim was to recruit three cohorts of ten students each during the 2020-2021, 2022-2022, and 2022-2023 academic years. Students were required to meet the following eligibility requirements:

- Have completed 60 community college credits by fall of transfer year.
- Demonstrate financial need determined by Pell eligibility at MSMU.
- Be a U.S. citizen, permanent resident or an alien admitted as a refugee.
- Have a minimum 3.0/4.0 GPA in their STEM community college classes and overall.
- Intend to major in biology, chemistry, data science, environmental science, math, computer science or cybersecurity.

Recruitment efforts began in fall of 2020, but were hampered by the COVID-19 pandemic, which meant that most classes at both partner institutions were online. Recruitment efforts and results were as follows.

Academic Year	Recruitment Efforts	Number of new community college students recruited
2020-2021	• Webpage created (www.msmary.edu/c3stem) • News release • Targeted recruitment emails to students, STEM-related student organizations, STEM instructors, General Studies advisors, and transfer counselors at MC and FCC • MSMU Admissions advertised the program at three virtual transfer fairs. • Two one-hour recruitment webinars led by the C3STEM team. • One-on-one virtual consultations offered for prospective applicants. • Digital ad campaign on MSMU social media • Virtual information session held at MC during STEM advising week	0
2021-2022	• Targeted recruitment emails to students at MC and FCC • Print flyers distributed at MC and FCC campuses. • Recruitment emails included in FCC's email news digest. • Transfer newsletter distributed to FCC and MC students. • Two Ready, Set, Transfer! Events hosted at MC and FCC • Two STEM Open House events at MSMU for MC and FCC students (transportation provided) • Expanded recruitment to regional community colleges beyond MC and FCC	1
2022-2023	• In-person classroom visits by MSMU faculty • In-person classroom visits by FCC and MC faculty • STEM Open House at MSMU with transportation provided. • Admissions representative for C3STEM at various area community college events • Emails to transfer coordinators at area community colleges with information on C3STEM. • Targeted recruitment emails to Pell eligible students at MC and FCC	3

	• Table at Maryland STEM conference for community college students • Participation in virtual fair for Maryland community colleges • Emails and other information to STEM advisors/faculty at MC and FCC • MSMU hosted STEM trivia night with student groups	

Transfer Surveys

During this time, recruitment efforts were aimed at increasing transfer capital among community college students. To measure transfer capital, a survey was sent to community college students at MC and FCC. Results of the three surveys from 2020-2022 are summarized in Table 1. Significant differences between genders and ethnicity (Hispanic vs. Non-Hispanic) were determined using a t-Test and among racial groups (Asian, Black and White) by a one-way ANOVA (alpha = 0.01).

Table 1: Transfer Capital Survey Responses

Category	Survey Question	Overall	Female	Male	Hispanic	Non-Hispanic	Asian	Black	White
		Agree	*Agree*		*Agree*			*Agree*	
Self-Efficacy	I am confident that I will be able to transfer to a 4-year institution.	4.7 ± 0.7	4.7 ± 0.6	4.6 ± 0.7	**4.5 ± 0.9**	**4.7 ± 0.6**	4.8 ± 0.6	4.7 ± 0.5	4.7 ± 0.7
Self-Efficacy	I am aware of the procedures involved in transferring to a 4-year institution.	3.9 ± 1.1	3.9 ± 1.1	3.9 ± 1.2	3.7 ± 1.2	3.9 ± 1.1	**4.0 ± 1.0**	**4.1 ± 1.0**	**3.5 ± 1.3**
Self-Efficacy	I know how I can get more information about transferring to a 4-yr institution.	4.2 ± 1.0	4.2 ± 1.0	4.2 ± 1.0	4.1 ± 1.2	4.2 ± 1.0	4.3 ± 0.9	4.2 ± 1.0	4.1 ± 1.1
Self-Efficacy	I think my grades are good enough to get accepted to a 4-year institution.	4.3 ± 0.8	4.2 ± 0.8	4.3 ± 0.9	4.2 ± 0.8	4.3 ± 0.9	4.4 ± 0.8	4.2 ± 0.8	4.2 ± 0.9
Self-Efficacy	I have the skills and ability to succeed at a 4-year institution.	4.5 ± 0.7	**4.4 ± 0.7**	**4.6 ± 0.7**	4.4 ± 0.7	4.5 ± 0.7	4.5 ± 0.7	4.5 ± 0.7	4.5 ± 0.6
Self-Efficacy	I know the classes I need to take to get accepted to a 4-year institution.	4.1 ± 1.0	4.2 ± 1	4.1 ± 1.1	**4.0 ± 1.1**	**4.2 ± 1.0**	4.3 ± 1.0	4.2 ± 0.9	4.1 ± 1.1
Self-Efficacy	I am excited about a career in the STEM fields.	4.6 ± 0.7	4.7 ± 0.6	4.6 ± 0.8	4.6 ± 0.8	4.7 ± 0.7	4.5 ± 0.9	4.7 ± 0.6	4.7 ± 0.7
Self-Efficacy	I am concerned about my ability to pay for my education at a 4-year institution. *	1.8 ± 1.1	**1.7 ± 1.0**	**1.9 ± 1.2**	**1.6 ± 1.0**	**1.8 ± 1.1**	**1.8 ± 1.0**	**1.6 ± 1.0**	**2.0 ± 1.2**
		Frequency	*Frequency*		*Frequency*			*Frequency*	

Self-Efficacy	Consulted with a Program Advisor about courses and major requirements.	2.7 ± 0.9		2.7 ± 0.9	2.7 ± 1.0		**2.5 ± 1.0**	**2.7 ± 0.9**		**2.9 ± 0.8**	**2.7 ± 1.1**	**2.6 ± 0.9**
Self-Efficacy	Consulted with a Program Advisor about career plans.	2.2 ± 1.1		2.3 ± 1.0	2.2 ± 1.1		2.2 ± 1.1	2.2 ± 1.1		**2.4 ± 1.0**	**2.3 ± 1.2**	**2.1 ± 1.0**
		Agree		*Agree*			*Agree*			*Agree*		
Peer Support	I have friends among the STEM majors here.	3.7 ± 1.4		3.6 ± 1.4	3.8 ± 1.3		**3.4 ± 1.5**	**3.7 ± 1.3**		**4.0 ± 1.2**	**3.6 ± 1.3**	**3.6 ± 1.4**
Peer Support	I know others who are interested in transferring to a 4-year institution.	4.3 ± 1.1		4.4 ± 1.0	4.3 ± 1.2		**4.0 ± 1.3**	**4.4 ± 1.0**		4.4 ± 0.8	4.3 ± 1.1	4.2 ± 1.2
		Frequency		*Frequency*			*Frequency*			*Frequency*		
Peer Support	Studying with fellow STEM students	2.3 ± 1.1		2.4 ± 1.1	2.2 ± 1.1		2.3 ± 1.1	2.3 ± 1.1		**2.5 ± 1**	**2.3 ± 1.1**	**2.2 ± 1.1**
Peer Support	Working on a collaborative group project for a STEM class.	2.2 ± 1.1		2.2 ± 1.1	2.2 ± 1.0		2.2 ± 1.1	2.2 ± 1.1		2.3 ± 1	2.2 ± 1.1	2.2 ± 1.1
Peer Support	Participating in a student club or organization.	1.9 ± 1.1		1.9 ± 1.1	1.8 ± 1.1		1.8 ± 1.1	1.9 ± 1.1		**1.9 ± 1.1**	**2.0 ± 1.1**	**1.7 ± 1.0**
Peer Support	Hanging out (either virtually or in person) with fellow STEM students off campus	2.0 ± 1.1		2.0 ± 1.1	2.0 ± 1.2		1.9 ± 1.1	2.0 ± 1.2		2.2 ± 1.1	2.0 ± 1.2	1.9 ± 1.1
		Agree		*Agree*			*Agree*			*Agree*		
Academic Advising	I have spoken to faculty or admissions staff at a 4-year institution about transferring.	3.3 ± 1.4		**3.4 ± 1.4**	**3.1 ± 1.5**		3.2 ± 1.4	3.3 ± 1.5		3.5 ± 1.4	3.2 ± 1.4	3.2 ± 1.6
Academic Advising	Information received from Program Advisors is helpful.	4.2 ± 1.0		4.2 ± 1.0	4.2 ± 1.0		4.1 ± 1.1	4.2 ± 1.0		4.2 ± 0.9	4.2 ± 1.0	4.1 ± 1.0
Academic Advising	I meet regularly with a STEM Program Advisor.	2.5 ± 1.3		2.5 ± 1.3	2.5 ± 1.3		**2.2 ± 1.2**	**2.6 ± 1.3**		**2.8 ± 1.2**	**2.7 ± 1.2**	**2.3 ± 1.3**

Academic Advising	STEM Program Advisors care about my success	3.9 ± 1.0		3.9 ± 1.0	3.9 ± 1.0		**3.6 ± 1.1**	**4.0 ± 1.0**		3.9 ± 1.0	4.0 ± 1.0	3.9 ± 1.0
		Agree		*Agree*			*Agree*				*Agree*	
Experience with Faculty	I have had positive interactions with a faculty member in STEM.	4.0 ± 1.1		4.0 ± 1.1	3.9 ± 1.0		3.9 ± 1.2	4.0 ± 1.0		4.0 ± 0.9	3.9 ± 1.1	4.1 ± 1.0
Experience with Faculty	STEM faculty show an active interest in my educational goals and pursuits.	3.9 ± 1.0		3.9 ± 1.0	3.9 ± 1.0		**3.6 ± 1.1**	**4.0 ± 1.0**		4.0 ± 0.9	4.0 ± 0.9	3.9 ± 1.0
Experience with Faculty	Spoke with a STEM faculty member outside of class.	2.2 ± 1.2		2.3 ± 1.2	2.2 ± 1.2		2.2 ± 1.2	2.2 ± 1.2		**2.4 ± 1.2**	**2.1 ± 1.2**	**2.3 ± 1.2**

'*Question scored in the inverse (i.e., "Strongly agree" equals a score of 1)

Of the 1,192 responses received from the three surveys in 2020, 2021 and 2022, 695 met the criteria for our study (enrolled at MC or FCC, 18 years of age, answered at least 5 questions, STEM major, intending to obtain a bachelor's degree). In terms of demographics, 32% of respondents identified as Black, 21% as Asian, 26% as White and 21% as other races or declined to respond. Females slightly outnumbered males.

Survey questions were distributed among four categories of transfer capital: Self-efficacy and attitude, peer support, academic advising quality, and experience with faculty. Each question refers to an action or feeling that contributes to Transfer Capital. The Likert questions were graded from 1(strongly disagree) to 5 (strongly agree). In the Self-efficacy and attitude category, overall average scores ranged from 3.9 to 4.7 (out of 5.0) suggesting they generally felt in control of their college plans and had the information, skills, and abilities to transfer to a 4-year institution. However, most of the students expressed strong concerns about being able to afford the 4-year institution (score of 1.8 ± 1.1). Thus, financial concerns are a potential obstacle. Most students (82%) had consulted with an advisor about course work, but fewer had spoken with them about career plans (62%).

Transfer capital scores were lower in the Peer Support category ranging from 1.9 to 4.3. In particular, the questions that referred to how often they socialized with like-minded students had the lowest scores (1.9 to 2.3). This is an area that could be improved with programs to encourage more socialization among students.

Academic Advising Quality exhibited a wide range of scores. Although a minority of students met regularly with their STEM advisor, most felt the information they received was helpful (4.2±1.0). The Experience with Faculty category exhibited relatively high scores for positive interactions (4.0±1.1) and for faculty being interested in the students' goals (3.9±1.0). However, it was less common for students to talk with faculty outside of class (2.2±1.2)

The results for each question were then disaggregated by gender (M/F), Hispanic ethnicity (H/Non-H), and race (Asian/Black/White or A/B/W). For gender, there were just two significant differences in responses. Males had greater confidence in being able to transfer to a 4-year institution whereas more females than males had spoken to an advisor about transferring to a 4-year institution.

Hispanic student scores were almost always lower than non-Hispanic scores. Many of the significant differences appeared in relationships with advisors. Hispanic students did not meet as often with faculty or program advisors and fewer felt that advisors cared. Fewer Hispanic students knew others who were planning to transfer. Notably, Hispanic students were more concerned about being able to afford a 4-year institution compared to non-Hispanic students.

Several questions exhibited racial differences. Asian students generally showed greater Self-Efficacy than Black and White students. Bear in mind, however, that overall students scored high on these questions (3.9 to 4.7). Asian students also scored higher than White and Black students in Peer Support. Black students were most concerned about being able to afford a 4-year institution (1.6±1.0) and White students were less concerned (2.0±1.2)

Overall students scored highest in the Self-Efficacy category and lowest in the Peer Support. To increase transfer capital, institutions should focus on expanding opportunities for students to interact and socialize with each other, incentivize students to meet with program advisors or expand advisor outreach, and develop programming or opportunities for faculty and students to interact with each other.

Project Management Team Interviews

During this time interviews with four community college faculty members on the project team were also conducted by an external evaluating agency. Results from these surveys, while anecdotal, indicate the following need to be addressed institutionally for more community college transfer students to enroll and be successful:

- Increase support available for non-traditional students, commuter students, and students experiencing financial and other challenges.
- Advertise supports prospective transfer students.
- Make MSMU programs more accessible to students experiencing various enrollment challenges by holding online or hybrid classes, evening, or weekend classes, and holding classes at MSMU's Frederick campus.
- Advertise these accessible opportunities to prospective transfer students.

Through working with the Dean of the School of Natural Science and Mathematics, these results have been disseminated to the university administration.

Scholar Interviews

During the 2021-2022 recruitment cycle, the NSF gave permission to include native MSMU students who met all other eligibility requirements in the project. With this change, the total size of the fall 2023 cohort of students is 15. Since there was one student recruited previously the total number of C3STEM scholars enrolled at MSMU in fall 2023 was 16. The cohort comprises 50% female students, 59% students of color, 41% first generation students, and 18% commuter students. With a sizable number of students in the program, post-transfer support, co-curricular activities, and career development opportunities increased. During fall 2023, C3STEM students engaged in a mixer with STEM faculty, a STEM activities fair, intensive one-on-one advising, STEM career/graduate school development, and informal lunches with STEM faculty.

In December of 2023, C3STEM scholars were surveyed about the support and co-curricular services provided by the grant. The grant surveyed students using a 5-point Likert scale on a variety of topics including motivation, community support, financial concerns, and ways in which C3STEM scholars engage with the campus community as well as supports offered as part of the C3STEM scholarship. Eleven of the sixteen scholars completed the survey.

Students indicated that they are in general personally motivated and excited for a career in a STEM field (average=4.6±0.5), have friends in the STEM majors at the Mount (average=4.5±0.7), that they are confident that they know what classes they need to complete their degree (average=4.9±0.3), but were less confident that their post-graduation plans will come to fruition once they complete their degree (average=3.9±0.7). Regarding community engagement, most students indicated that they were frequently engaged with student groups (average=3.7±1.8) although some students had never engaged with student groups; students who engaged with groups indicated they were more likely to engage with degree-related clubs or student organizations such as the Black Student Union (BSU) and Students of Color in STEM (SOCS). Informal social activities varied widely among students surveyed. Only 36% of students mentioned they studied with friends at least once a week with 18% of students indicated they have never studied with friends; similarly, 55% of students surveyed said they spend time together socially with their peers with 27% indicating they have never socially associated with their peers. The students who do not socialize or study with their peers are typically involved in team sports or are non-traditional students and have additional barriers to engaging in these activities.

Students in the C3STEM scholarship program showed a much stronger engagement with faculty and administrative supports vs community support. In general, students meet frequently with their advisor (average=4.7±0.7), have positive interactions with them (average=4.9±0.3), and trust that the faculty care

about the student's success (average=4.8±0.4). Most students indicated a preference for supports that can be accessed on their own schedule with 82% of students using announcements from C3STEM, 72% using the LMS site with resources and information about C3STEM and campus activities, and 64% of respondents scheduling one-on-one meetings with advisors. The least-utilized resources were lunches with faculty (9%), peer mentoring networks (18%), and Zoom meetings with our Career Center (18%). The trend for C3STEM scholars to seek individual support was also supported by the frequency of meetings with advisors where 55% said they meet regularly to discuss career plans with their advisors; students similarly indicated they rely on faculty support outside of class times with 73% of students indicating they seek additional help at least once per month from faculty. The most prevalent concern among C3STEM scholars is financial with students indicating they are concerned about being able to afford completing their degree (average=3.9±0.7).

Taken together, there is a trend among students for support which are informal, self-scheduled, and are individual- rather than group-oriented. Students are more likely to engage with faculty and advisors versus their peers. When they do engage with the faculty and administrative support, they have had positive experiences and leave satisfied that faculty and advisors care and are interested in them. Students struggle most with financial concerns, as well as concerns that their post-graduation plans may not come to fruition.

Conclusion

While recruitment efforts were hampered by the pandemic, broad institutional changes are required for a clear pathway to transfer to MSMU for community college students. When it was possible, the project management team received the most positive feedback from visiting community colleges in person or bringing community college students to MSMU's campus.

In terms of supporting students who have chosen to transfer, flexibility and individual attention are valued by students. Students continue to have financial concerns and anxiety over their future career path. Additional work can be completed to explore how to help students deal with or overcome these anxieties and to include the opinions and experiences of diverse groups.