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The SEECRS Scholar Academy at Whatcom Community College: Three Cohorts of S-STEM Scholarships Later

Eric Davishahl, Whatcom Community College

Eric Davishahl holds an MS degree in mechanical engineering and serves as associate professor and engineering program coordinator at Whatcom Community College. His teaching and research interests include developing, implementing and assessing active learning instructional strategies and auto-graded online homework. Eric has been a member of ASEE since 2001. He currently serves as awards chair for the Pacific Northwest Section and was the recipient of the 2008 Section Outstanding Teaching Award.

Prof. Tommaso Alessandro Vannelli, Whatcom Community College

Dr. Tommaso A. Vannelli is an Assistant Professor of Chemistry at Whatcom Community College in Bellingham, WA. He holds a B.S. in Chemistry with a minor in Environmental Studies from Tufts University. He earned his M.S. and Ph.D in Chemistry from the University of California at San Diego. He is the co-Principal Investigator (co-PI) of the NSF-funded S-STEM scholarship program at Whatcom Community College. Tommaso is actively developing a research program at Whatcom Community College and is interested in providing students with authentic practice of science experiences through their courses and independent study.

Dr. Michael Jason Babcock, Whatcom Community College

Jason Babcock is the Director of the Learning Center at Whatcom Community College. Dr. Babcock earned his Ph.D. From the University of Washington in 2017. His teaching and research interests center on the development of STEM identity, and the negotiation of belonging by students holding identities traditionally underrepresented in STEM fields.

Dr. Dan Hanley, Western Washington University

Dan Hanley directs an educational research and evaluation team at Western Washington University. Over the past 15 years, Dan has developed and conducted studies and evaluations for numerous organizations, including the National Science Foundation, Washington State OSPI, Washington Student Achievement Council, the Office of Naval Research, and the Colorado Department of Education. In 2000-2001, Dan was the recipient of a prestigious Fulbright Scholarship, where he examined Norway's system of school-based evaluation. His current research interests include preK-16 STEM education reform and STEM teacher preparation.

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Abstract

The *STEM Excellence through Engagement in Collaboration, Research, and Scholarship* (SEECRS) project at Whatcom Community College is in year four of a five-year NSF S-STEM funded program aiming to support academically talented students with demonstrated financial need in biology, chemistry, geology, computer science, engineering, and physics. This program offered financial, academic, and professional support to three two-year cohorts of students and is in the final year of the third and final cohort of the currently funded grant cycle. The SEECRS project aimed to utilize a STEM-specific guided pathways approach to strengthen recruitment, retention, and matriculation of STEM students at the community college level. Over the course of the program 39 individuals received scholarship support.

The program supported scholarship recipients through participation in the SEECRS Scholars Academy, a multi-pronged approach to student support combining elements of community building, faculty mentorship, targeted advising activities, authentic science practice, and social activities. Key elements of the program are: a required two-credit course that emphasized STEM identity development, course-based undergraduate research experiences (CUREs) in Biology, Chemistry and Engineering courses, funded summer research opportunities, and paring of each scholar with a faculty mentor.

This paper presents data from the first four years of the program including participant outcomes and feedback on their experiences. Results from project evaluation activities such as pre and post surveys, focus groups, exit interviews, and faculty surveys are also presented and analyzed to compare how gains reported by program participants regarding such attributes as their STEM identities and sense of belonging compare to responses from a control group of students who did not participate in the program. Preliminary identification of some program best practices will also be presented.

Introduction

Whatcom Community College (WCC) is a two-year open enrollment institution in the Pacific Northwest serving 6,795 students in 2019-20. WCC is situated in a county that experienced a 14% growth rate between 2010 and 2019, with a current population of 229,247 people [1]. The population of students at WCC has been steadily diversifying, with those identifying as a student of color increasing from 24.9% in 2009-10 to 33.4% in 2019-20. The college offers students access to the initial coursework necessary to complete a Bachelor degree in STEM, with articulation agreements allowing students to matriculate into universities within the state. Associate in science transfer degrees are also offered in biology, chemistry, engineering, environmental science, as well as a general science transfer degree option.

Access to these degrees and transfer opportunities is not equitably distributed. Women were less likely to pursue STEM disciplines. Aggregating enrollments in STEM pathway courses in chemistry, computer science, engineering, geology, and physics, men represented 69.2% of students, even though they only represented 41.3% of the general student population.

Historically under-served students of color were similarly underrepresented in STEM courses (15.2%) compared to enrollment patterns in the general student population (21.7%). Disparities in enrollment are partnered with inequitable rates of course completion, with historically underserved students completing 71% of these courses with a grade of C or better, compared to an 82% course success rate for their peers. These demographics mirror national demographic trends that indicate student access to degree and career opportunities in STEM offered by two year colleges disproportionately favors students who identify with hegemonic norms in STEM [2],[3]. The SEECRS project represents one institutions attempts at designing programming to dismantle structures that reproduce these disparities.

Beginning in 2018, Whatcom Community College started implementing an NSF S-STEM program with five objectives. While the specific design of this program has been previously reported [4], it is worth recalling that the objectives of this program included; improving students' STEM self-identity, increasing the rate of STEM recruitment and retention, increasing rates of STEM degree completion, increasing transfer rates of STEM students to four-year universities, and developing an adaptable model for implementing a STEM guided pathways approach at other community colleges. This program included a core focus on faculty mentoring, a cohort model for students, and close collaboration with student support services (see Figure 1). Also included in this program design were eighteen additional elements, some contained within the college, and others based on collaborative efforts with industry partners and a neighboring university.

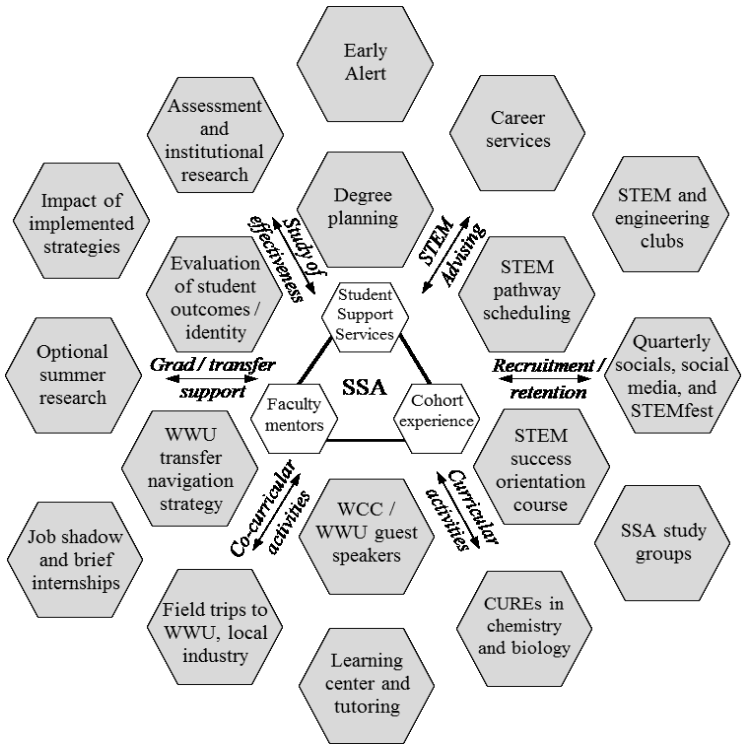

Figure 1. Framework for SEECRS Program

Previously reported findings [4] focused on the first year of the program, with attention paid to a course intended to develop students' STEM identity, and the development of a faculty mentorship program. Since that initial reporting, two additional cohorts have participated in the SEECRS program. While the program was intended to build relationships with a neighboring university and local industry, the program has focused largely on campus based interventions. While there have been difficulties extending SEECRS programming beyond the college, on campus efforts have yielded positive impacts. This paper intends to share findings from the three cohorts of students served by the SEECRS program, and to identify how findings can be utilized to inform similar support structures at STEM support programs going forward.

Methods

The SEECRS project relies on both formative and summative evaluations from an external evaluator that includes student surveys and student focus groups. This paper intends to share out intermediate findings of a much larger investigation that will utilize hierarchical linear modeling to analyze the impacts of the program on three cohorts of students when compared to a peer group not enrolled the SEECRS program. The research group, is currently collecting retention, success (GPA), graduation, and transfer data on all SEECRS and AST students who have completed the pre/post-survey over the past three cohorts and have given their consent for us to collect these data. Evaluation focused on: 1) STEM orientation course, 2) course-based undergraduate research experiences, 3) STEM advising and mentoring, and 4) social activities.

For this paper, we rely on report out focus group interviews and surveys conducted by our external evaluator to obtain their feedback on these components of the program and their suggestions for improving each component. The focus group interview contained two questions, one that asked students about the benefits of the SEECRS program and one that asked for their suggestions for improving various aspects of the program. In groups of three, students discussed the prompts and recorded their responses. Then the evaluator captured groups' responses to the two questions on the whiteboard, and each student individually rated the extent to which each benefit and suggestion was true for them, on a Likert scale from 1 to 5, with 1 being "Not at all" and 5 being "To a great extent". The two guiding questions for the focus group interview were:

> Question #1: In what ways have you benefited from participating in the SEECRS program? (Think about the ways the various aspects of the program have impacted you, including the fall orientation course, faculty advising/mentoring, social activities, and industry or research experiences.)
>
> Question #2: What suggestions do have to improve the following aspects of the SEECRS program: a) Fall orientation course, b) Faculty advising/mentoring, c) Social activities, and d) Industry or research experiences?

SEECRS student participation in the focus groups included eight in the first cohort focus group, ten from the second cohort, and seven students from the third cohort. The most recent cohort completed their group in February 2020, prior to any COVID-19 disruption.

Surveys were designed by the project's external evaluator. To assess the objectives of the program, questions included the following:

- Slightly modified 12 items from the Science Identity Questionnaire (Wolfe, 2013) that asks about students' connections to various STEM communities and the extent to which they view themselves as a "STEM person".
- Slightly modified version of the Chemistry Motivation Questionnaire (Glynn & Koballa, 2005), which includes 30 items that measure the following six student factors: Intrinsic Motivation, Extrinsic Motivation, Self-Efficacy, Self-Determination, Goal-Orientation, Anxiety-Related Motivation.
- The Sense of Belongingness scale [8], which is part of the National Survey of Student Engagement, used by Higher Education Research Institute at UCLA and the Center for Post-Secondary Research and Planning at Indiana University. This instrument operationalizes "belongingness" in a number of different contexts, including belongingness in student/peer groups, programs/departments, college-at-large, and communities outside of the institution. (Post-survey only in Year 1, Pre/post Year 2)

For each survey, SEECRS participants were asked to complete the survey by a co-PI of this research who taught a gateway course for each cohort. For a comparison group, Whatcom Community College sent a link to all AST students (which includes the SEECRS students) through an email and text messages, with at least two follow-up emails/texts sent to students asking them to complete the survey. We incentivized AST students in the comparison group to complete the pre-survey each Fall by entering the students who completed the pre-survey into a raffle to win a $25 Amazon gift card. Then, at the end of each Spring quarter, we asked only those students who completed a pre-survey to take the post-survey, and we offered each student a $10 gift card for completing the post-survey. The number of SEECRS and AST survey respondents is presented in Table 1.

Table 1. Participant count for SEECRS and AST students.

Time	Surveys Sent	Pre-Surveys	Post-Surveys	Pre/Post Match
Year 1 (2017-18)	281	SEECRS: 13	SEECRS: 10	SEECRS: 10
		AST: 54	AST: 37	AST: 10
Year 2 (2018-19)	345	SEECRS: 16	SEECRS: 8	SEECRS: 8
		AST: 35	AST: 14	AST: 14
Year 3 (2019-20)	364	SEECRS: 13	SEECRS: 8	SEECRS: 8
		AST: 29	AST: 10	AST: 10
TOTAL	**990**	**SEECRS: 42**	**SEECRS: 26**	**SEECRS: 26**
		AST: 118	**AST: 61**	**AST: 34**

External evaluation also collected data from participating WCC faculty during the 2019-20 school year to determine how the mentoring, advising, and student research components impacted faculty mentors. Nine out of the twelve faculty in the SEECRS program completed an

online survey at the end of the Spring 2020 quarter regarding their attitudes about, and experiences with, mentoring/advising students and engaging students in research. The survey also measured changes in faculty members' understanding of STEM degree requirements, strategies for mentoring students, factors supporting students' success in STEM degree programs, and STEM career opportunities.

Findings

The SEECRS program was found to impact both students and their faculty mentors. We begin by sharing impacts on SEECRS students, and will then share findings related to faculty mentors.

Student Impacts

Survey data indicates that the SEECRS program was able to impact the behaviors students employed in pursuit of a degree, when compared to their AST peers (see Figure 2). SEECRS students were more likely to study with peers outside of class and to work with academic tutors. SEECRS students were also more likely to meet with Faculty and advising staff, to participate In STEM related clubs or activities, and to participate in STEM related research opportunities.

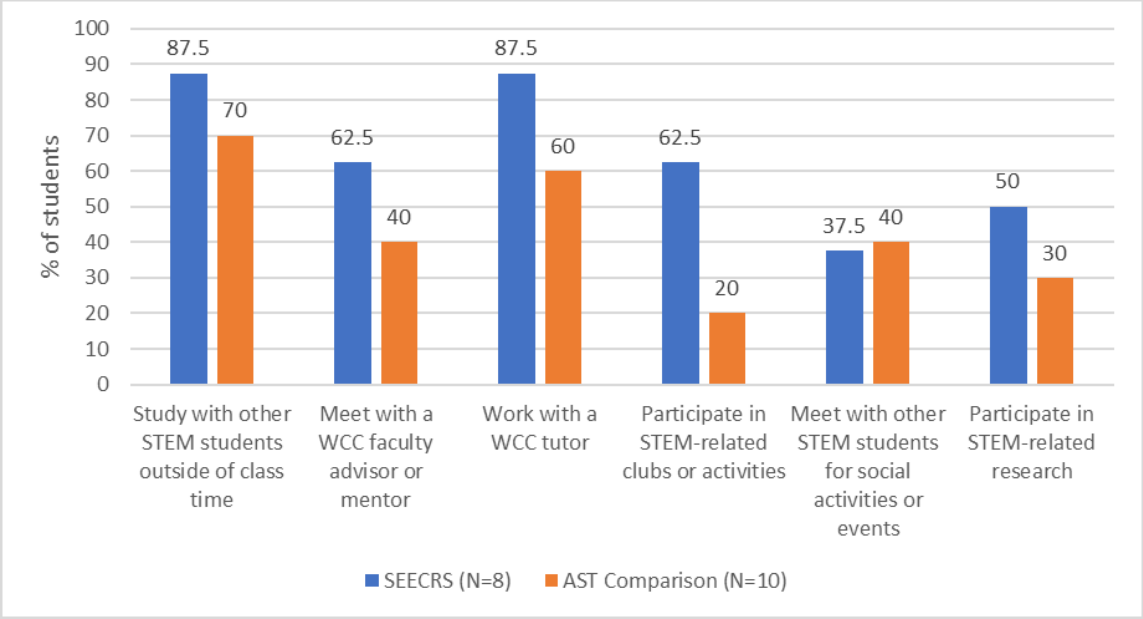

Figure 2. Comparison of SEECRS and control AST students' involvement in STEM activities.

While survey data demonstrated that SEECRS students were more engaged with faculty, support services, and STEM oriented social opportunities, data collected from focus groups conducted with the first (Table 2), second (Table 3), and third (Table 4) cohorts of SEECRS students offer insight into how the SEECRS program impacted students. Themes arising from the focus groups indicates that formal relationships with a STEM interested peer group was important. This importance was evident in the statement from a student in the second cohort who shared,

It (the SEECRS program) connected me with other students and helped me build a community that has helped with classes and club participation. It also helped build connection with professors that has encouraged me to reach out when I'm finding content difficult. It also helped shape my mindset and prepare me for the difficult quarters.

Students clearly valued being part of a STEM community, and saw that community as including peers and the faculty mentors. Echoing the idea that faculty mentors and academic peers constituted a larger learning community that students were a part of is evident in another student who shared,

Meeting with my SEECRS mentor and academic adviser has helped me stay on track and encouraged me to keep up with courses. I have also shifted a focus towards research as I attended a few interesting seminars and I am taking a STEM research course through the SEECRS program. It has been great to have connections with other SEECRS students.

The theme of community carried through all three cohorts, with a member of the third cohort commenting noting,

SEECRS helped connect me with mentors in the school that would've otherwise been hard for me to build a personal relationship with. Additionally, I gained a community of students that were going to be taking or had taken the same courses.

Table 2. Cohort 1 Perceived Benefits from Participating in the SEECRS Program
1 = Not at all, 3 = Somewhat, 5 = To a great extent.

Benefits from Participating in the SEECRS Program	Mean	SD	N
Helped me financially	4.75	.71	8
Met like-minded students	4.62	.74	8
Developed a sense of belongingness in college	4.5	.75	8
Received encouragement from other students	4.5	.53	8
Received encouragement from faculty	4.37	.52	8
Improved documents to help transfer (e.g., personal statements)	4.28	.95	7
Developed a supportive peer group	4.25	1.16	8
Developed a group that held me accountable	4.00	1.31	8
Increased my engagement in school	3.87	1.12	8
Mentorship for professional growth	3.87	1.36	8
Learned how to transfer to other colleges	3.50	.92	8
Leaned how STEM disciplines are related/fit together	3.37	.92	8
Increased understanding of career possibilities	3.37	1.41	8
Learned about study skills	3.12	1.12	8
Participated in research opportunities in my field	1.5	1.41	8

Table 3. Cohort 2 Perceived Benefits from Participating in the SEECRS Program
1 = Not at all, 3 = Somewhat, 5 = To a great extent

Benefits from Participating in the SEECRS Program	Mean	SD	N
Faculty mentors were good role models/examples of people who succeeded in STEM	4.9	.7	10
Helped increase my confidence that I could be successful in a STEM career	4.6	.5	10
The program inspired me to pursue other curricular activities in STEM (like the learning contract)	4.5	.7	9
Faculty feedback/critique to my writing helped me improve my writing	4.2	.8	10
My faculty mentor helped me with my transfer applications/next steps in STEM education or career path	4.2	1.0	10
I made connections with other students pursuing STEM degrees (i.e., the other SEECRS scholars)	4.2	1.0	10
Faculty mentoring helped me understand how I could make it through a STEM program	4.2	1.2	9
I benefited financially from the SEECRS program.	4.1	.3	10
Helped me clarify what my STEM identity is (which I could use in subsequent applications, essays, etc.)	4.1	1.0	10
Honest, critical feedback to assignments made me feel valued as a student here at WCC	4.1	1.0	10
The seminar course kept me informed about STEM opportunities and deadlines.	4.1	1.0	10
Faculty mentoring helped me connect with STEM faculty	4.1	1.1	10
The seminar course helped increase my social/peer support network outside of my specific STEM discipline	4.0	.9	10
Research opportunities helped bring together theory with practice	4.0	1.0	9
Clarified why I am a STEM student	4.0	1.1	10
The seminar course held us more accountable to meet deadlines, etc.	4.0	1.2	10
The seminar course motivated me to keep up my GPA and go to classes	4.0	1.3	10
The social connections and financial support allowed me to attend activities (social, clubs, etc.)	3.8	1.2	9
Clarified what potential STEM field I might pursue	2.9	1.2	10

Table 4. Cohort 3 Perceived Benefits from Participating in the SEECRS Program
1 = Not at all, 3 = Somewhat, 5 = To a great extent

Benefits from Participating in the SEECRS Program	Mean	SD	N
Financial benefits/money for school was helpful *"Not having to work as much or at all- or just being able to attend school while affording life's necessities."*	4.9	.38	**7**
Helped me develop essays for scholarships and transfer applications	4.5	.84	**6**
Connecting with other STEM students (SEECRS)	4.4	.79	**7**
Helped me understand my STEM identify *(Students talked about writing their identity essays)*	4.2	.75	**6**
Faculty helped with advising/courses to take	3.9	1.2	**7**
Helped me learn about STEM career options	3.7	.95	**7**
Connecting with STEM faculty	3.7	1.1	**7**
Study groups for course/programs	3.7	1.5	**7**
Prepared me to recognize and survive the challenges of a STEM program (not the demands or how demanding the STEM program is, but challenges, such as "how to exceed the societal pressures" of being from a minoritized group in STEM)	3.6	.79	**7**

Faculty Impacts

Mentoring

All faculty respondents reported that they mentored one or two SEECRS students during the 2019-20 school year. When describing the changes they made to how they mentored STEM students as a result of their participation in the SEECRS program, faculty stated that they were more proactive about scheduling meetings with the SEECRS students, held regularly scheduled meetings, and were more intentional in addressing students' needs. As one mentor stated, "I am more methodical in my approach to mentoring by asking my mentee where she is struggling and working with her to brainstorm actions/solutions". Faculty mentors talked about how they supported their mentees both academically and emotionally. As two mentors commented,

- We had a student who went on probation and did a significant intervention, developing a plan with weekly check-ins. Final grades are not in yet, but at least in our conversations with the student it seems he has adopted some new practices and habits and is on track to have a more successful quarter.
- My mentee did not feel that many faculty and students at Whatcom related to them, their particular experiences at Whatcom. My mentee said it was comforting knowing they could candidly talk about their experiences and feel validated that they were not the only one feeling that way.

At the end of Year 1 of the SEECRS program in Spring 2018, faculty mentioned numerous areas they wanted to learn more about to better support their mentees, including information about WCC's STEM degree programs, requirements, and existing support programs. Now, faculty no

longer cite these as areas for their professional growth. A third of faculty respondents reported a high level of understanding of the "Various STEM degree programs at WCC", "WCC degree requirements for STEM programs", and the "Various pathways through STEM degree programs at WCC". And nearly half of faulty respondents felt very knowledgeable about "WCC programs designed to support STEM students", "STEM careers that might interest students", and "Clubs or groups that support STEM students".

Lastly, in light of COVID-19, faculty wanted to learn more about effective practices for remotely mentoring students.

Student Research

Three of the nine faculty respondents reported that they had one or more SEECRS students participate in research during the 2019-20 academic year. Several students participated in a new two-credit research course developed and taught by one of the SEECRS faculty. Course feedback indicated that students "developed better understandings of their intended majors and could better see themselves working in the field". Faculty wanted "more continuous engagement in research opportunities for all students throughout the academic year", as well as "paid opportunities on top of the scholarship that could perhaps further offset the need for students to have other part time employment unrelated to their major".

Broader Impacts and Improvements

Lastly, several faculty members discussed the broader impacts of the SEECRS program on themselves, their department, and/or institution. As two faculty commended:

- I think that the SEECRS program has made us closer as a department. Working together to come up with strategies to support students creates a cooperative working environment.
- I am definitely more aware of the students who are in STEM tracks at WCC. I have also learned a lot about how our advisors support our STEM students.

In previous years, faculty members' suggestions about how to improve the SEECRS program has focused on the support strategies for SEECRS students. At the conclusion of the third cohort, suggestions focused more on program-level aspects. Faculty comments included having a "kick off" meeting with all SEECRS faculty and students at the start of the school year to create a broader support network, compiling a list of resources and best practices to support students for faculty, more direction and structure from leadership about what faculty should be doing with their mentees with periodic reminders of their tasks, and creating a "smaller leadership team that is compensated with enough reassigned time to focus more on developing the program".

Suggestions for Program Improvements

Faculty cited several areas where they would like to learn more to better support their mentees. First, faculty wanted to learn more about students' lived experiences, how to foster a trusting relationship, and inclusive, anti-racist mentoring practices. Faculty also wanted to create a

broader support network for the students by having all of the SEECRS students get to know all of the STEM faculty mentors, and by having structures to engage the students in peer mentoring.

Discussion & Conclusion

Evidence suggests that the SEECRS program is supporting students in their pursuit of a future in STEM. That support is attributable to the development of a supportive community of practice that includes faculty mentors, dedicated advising staff, and a cohort of peers with similar objectives. Financial support is also helpful for students who have difficulty affording college tuition. These findings are not surprising given the body of research used to inform the design of the program. Research has already demonstrated that students are supported when they receive financial support, mentorship, and explicit identity development supports [9],[10],[11],[12]. Our research complements and strengthens the idea that those supports help students navigate community college STEM pathways.

Where this research offers new insight is in considering how a program intended to support students pursuing a future in STEM might utilize faculty mentorship to deconstruct racist and sexist structures that perpetuate inequity. Early in this project, mentors were concerned with transfer requirements, campus resources available to support students, and helping students identify degrees that would be a "good fit" for their interests. As Ebony McGee points out, programs like SEECRS traditionally attempt to support diverse students by preparing them to survive in contexts that are not welcoming of students with diverse racial/ethnic and gender identities. McGee [13] notes colleges and universities, "institutionalize diversity mentoring programs designed mostly to fix (read "assimilate") underrepresented students of color while ignoring or minimizing the role of the STEM departments in creating racially hostile work and educational spaces (p. 1)." A focus on supporting diverse student assimilation into existing systems was evident in initial faculty concerns regarding their mentorship, and in students noting, "Faculty mentoring helped me understand how I could make it through a STEM program." As an institution, we envisioned mentorship as equipping students with coping strategies for potentially hostile university and workplace contexts.

Shifting faculty concerns speak to how the mentoring relationship has resulted in faculty growth. The most recent faculty surveys found faculty commenting on students' identities and experiences at the college. Mentors noted "I am definitely more aware of the students who are in STEM tracks at WCC," and, "My mentee did not feel that many faculty and students at Whatcom related to them...my mentee said it was comforting knowing they could candidly talk about their experiences and feel validated that they were not the only one feeling that way." The external evaluator noted that faculty were asking for anti-racist mentoring practices at the end of the third cohort of students. These shifts point to benefits unforeseen in the initial objectives of this project. The SEECRS project initial focus was on student recruitment into, and support within, STEM at the community college. The idea that the college is becoming more student ready [14] from our mentoring relationships is important in educational research settings that tend to focus their attention on interventions aimed and students, and measuring the outcomes on those students.

Faculty's request for anti-racist mentoring practices and shifts in faculty mentoring practices that center students' experiences offers insight into how a college might work to do more than prepare students to assimilate to potentially hostile workplaces. The act of mentoring appears to decenter a rigid focus on course taking sequences and careers in STEM. Faculty mentoring offers a mechanism by which those in 2-year public institutions might create a more inclusive experience for students beginning their higher education careers in STEM.

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