2026 ASEE ANNUAL CONFERENCE June 21–24, 2026 | Charlotte Convention Center, NC
Host Sponsor UNC Charlotte
ASEE AMERICAN SOCIETY FOR ENGINEERING EDUCATION
Paper ID #50175

An Interdisciplinary S-STEM Program at Fairmont State University

Dr. Robert J Niichel, Fairmont State University

Dr. Robert J Niichel is an associate professor of mathematics at Fairmont State University in West Virginia. He is or has been the principal investigator on several major grants, including an NSF S-STEM grant, and NSF REU grant, and an ARC POWER grant. His grant work is focused on improving the STEM pipeline in his region, including student persistence and job placement. In addition to his own publications, he also guides undergraduate research projects to publication.

Andreas Baur, Fairmont State College
Jojo Joseph, The Ohio State University

An Interdisciplinary S-STEM Program at Fairmont State University

Robert J. Niichel, Andreas Baur, Abby Chapman, Jojo Joseph

Introduction

Situated in northern West Virginia, Fairmont State University is a regional comprehensive university that serves roughly 2,900 undergraduate students, with approximately 60% being first generation, and 46% Pell-eligible. Within the University, the College of Science and Technology houses what have traditionally been identified as the science, technology, engineering, and mathematics (STEM) programs. The department of Natural Sciences trains bachelor's graduates in Biology, Chemistry, and Forensic Science; the Department of Computer Science and Mathematics contains its namesake bachelor's programs, as well as a cybersecurity concentration. The Department of Engineering Technology is home to BSET programs in Civil, Electronics, Mechanical, and Surveying and Geomatics Engineering technology, as well as a BS degree in Occupational Safety.

Being in Appalachia presents several challenges for STEM disciplines, as evidenced by national and regional statistics. Bachelor's completion rates are lower for Appalachian colleges and universities (25.7%) than the national rate (32.9%)[1]. When it comes to STEM education, only 30.8% of bachelor's degrees in Appalachia are in STEM fields, whereas the US figure is 35.0%[2]. West Virginia, like many other states in Appalachia, suffers from poor infrastructure[3], inhibiting business growth and economic development. While these challenges are serious, they also make Appalachian colleges and universities excellent candidates for the NSF S-STEM program. High levels of childhood poverty in the region[4] means that many talented students here are in need of the scholarships that S-STEM provides to low-income families.

Typically, S-STEM proposals focus on one or two academic areas. Given the high need among all of our college's students, faculty grant-writers believed it would be best to focus on all eligible majors in the college rather than focus on one or two, and wrote a proposal that was awarded in 2022.

Program Features

From 2022 to 2025, the project recruited 28 S-STEM scholars across three cohorts, with representation from all majors (Figure 1). One of the primary goals of the S-STEM program is to increase participation in STEM, and so finding talented students who might be overlooked using traditional metrics like high school GPA was a priority for our program. We therefore kept the minimum high school GPA at 2.75, and implemented two other metrics to assess student aptitude.

The first was a basic skills assessment, consisting of a numeracy exam and a scientific reasoning exam. The second was an in-person "field day" in which students visited campus and worked in groups to build a water filter out of common household items. Students were evaluated in this activity by faculty and their peers. We specifically evaluated students' communication and teamwork skills. The top-rated students were then selected.

Building a strong cohort identity across diverse disciplines has been challenging. To accomplish this goal, the project successfully developed a first-year bridge program and first-year seminar course[5]. We developed short seminars on classroom skills like note-taking, keeping a calendar, and dealing with math and chemistry anxiety. We also spent time on practical skills like a library tour, a tutoring center introduction, and showing students where their individual classes would be held when classes began. We implemented a "speed-networking" activity to help students form relationships and become more comfortable with their future professors. We also had faculty who were active in research give short presentations to students about what they studied and invite them to participate when they had taken some coursework.

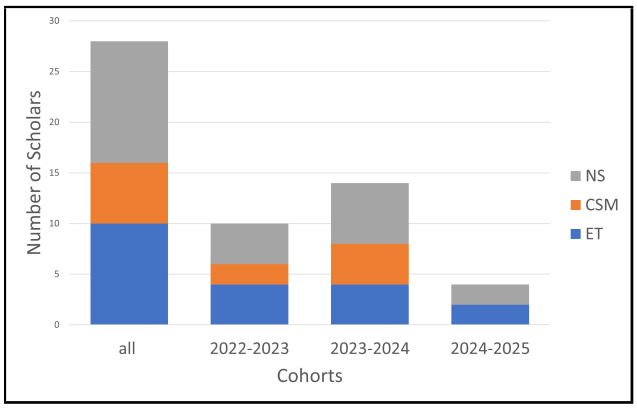

Figure 1: The number of S-STEM scholars in the different programs of the College of Science and Technology (NS = Natural Sciences, CSM = Computer Science and Mathematics, ET = Engineering Technology)

Another popular set piece of most S-STEM programs is cohort-building through common coursework. Because our selection of majors (10 in total) was so diverse, this was not possible for us. For example, high school mathematics preparation was so varied among our scholars that they were usually spread over algebra, trigonometry, and calculus in their first semester. Nevertheless, common curricular experiences are important[6,7], and so we wanted to have at least one course that all of our scholars could take together.

For this reason, we also developed a new First-Year Seminar (FYS) course for our scholars. Although we understood the value of freshmen having a common experience in their first semester, we felt that the order of the topics covered was not optimal for STEM majors. For instance, test-taking skills were discussed in the course at the end of the semester, whereas STEM students could use this training in week two or three. We therefore sought to develop a FYS course of our own, tailored to STEM majors and their experiences.

Because our curricular component was minimal, we knew that our efforts outside the classroom would play a key role in building a cohort mentality among our scholars, one of the key asks of the S-STEM program. So, we combined efforts with another STEM-focused grant (First2 Network: NSF Award #HRD-1834586 and others) on campus to develop a student club, the STEM Student Council. S-STEM scholars attend once a month to respond to questions from mentors and grant personnel about how the project is going from their perspective.

Club members plan social events and field trips, supported directly by grant funds. STEM-themed events have included movie nights, field trips to museums and the Green Bank Observatory, and an astronomy night. Other social events like dinners and game nights have also occurred. We have also included events to bring students and faculty together for Impromptu Lectures. Here, a student and faculty member are paired to deliver a lecture on slides they have never seen before, from other professors in the College of Science and Technology.

One aspect of our proposal was the development of a STEM-focused career fair, for which the club has been an important component. Our campus has a long-standing spring career fair for all majors, but we instituted a new one in the fall to focus on STEM. The fair has grown from 45 employers in 2023 to 60 in 2025. As part of the club activities, together with our campus' Encova Career Development Center, we have conducted several workshops to prepare our scholars for the fair. These have included resume-building, appropriate career fair attire, building an effective LinkedIn profile, and developing an elevator pitch. Workshops are open to other students as well.

Student and Faculty Support

Each freshman S-STEM scholar is paired with a peer mentor[8]. Peer mentors are slightly older students (preferably juniors and seniors) who can answer questions that scholars may not feel comfortable asking a faculty member. Ideally, scholars are assigned peer mentors based on common interests and career plans, though a shortage of mentors often made this difficult.

Scholars are also assigned faculty mentors to meet with them individually[9]. Faculty mentors have assigned topics to discuss with students throughout the year (see Table 1), though we do not insist on any order or schedule for the topics, preferring rather to allow the relationship to grow more organically. Students meet every other week with their faculty mentor in their freshman year, scaling down to once a semester by their senior year. Nevertheless, scholars often opt to meet more frequently with their mentors.

Scholar support doesn't stop with mentoring, however. Scholars participate in structured accountability practices, such as goal setting for GPA[10], time management[11], and professional development. In addition, course-specific tutors and recitation sessions in academically challenging courses like chemistry and calculus are provided[8].

Grant personnel also closely monitor scholar academic progress throughout the semester and stage interventions when needed to help students build additional time management and/or study skills. The interventions focus on developing a plan of action, so that students feel empowered by the meetings and not discouraged. One of our co-PIs, Abby Chapman, meets regularly with struggling scholars to help them learn how to meet deadlines and hold themselves accountable.

A significant component of this coaching relationship involves addressing students' reluctance to seek help due to fear of appearing "unprepared" or "incapable," and intentionally building trust so that students felt safe engaging with faculty and support staff. While most students were referred for academic reasons, one scholar proactively self-enrolled to strengthen time management skills before they became a barrier to academic success. Of the six students who participated in these

First Year	Time management skills; campus resources available to improve academic performance; finance management; understanding financial aid; balancing social and entertainment needs with academic responsibilities; managing family life; letters of recommendation; thinking about GPA and grade performance[12]; talking to course professors[13,14]
Second Year	Extra-curricular activities to boost leadership capabilities; identifying internship and research opportunities (e.g. REUs); identifying potential graduate programs (if scholar wishes to pursue graduate studies); identifying potential references and letter of recommendation writers; stress management
Third Year	Writing applications for internships/REUs, organize meetings with the Encova Career Development Center on campus; promoting undergraduate research experiences
Fourth Year	Resume-building and review; cover letter practice; networking; job/graduate school applications; mock interviews

Table 1: The initial Advising topics as laid out in our proposal.

interventions, five have remained in STEM-related majors and are on track to graduate in their respective disciplines.

One of the other more unique features of the program is its emphasis on improving faculty mentorship through training and regular collaborative work. Faculty mentors participate in training workshops and meet throughout the semester to troubleshoot common issues that students are facing[15]. Training activities have included a workshop on life coaching, reading and discussing academic papers on mentorship, reading and discussing Saundra McGuire's *Teach Yourself how to Learn*[16], and meeting with staff in financial aid to discuss student issues. This networked mentoring approach has produced positive feedback from both students and faculty.

Results & Discussion

The initial results of the project are promising. The retention rates for S-STEM scholars from 2022 to 2025 were 86% (90% for Engineering majors). With three cohorts having advanced into their sophomore year, the overall first-year retention rate for S-STEM scholars is 89% and 90% within engineering technology, clearly showcasing the impact of our program. More broadly, the retention rates for 2017-2020 were 60% (college) and 67% (engineering technology).

When asked how much meeting with their peer mentor had a positive effect on their college experience, the response over six semesters was overwhelmingly positive (Figure 2); nearly all scholars report a positive experience.

The peer-mentoring program was also highly rated every semester (4.4-5.0 on a 5-star scale). When asked what the most beneficial change in yourself was as a result of the peer-mentor-mentee relationship, the open-response data showed strong themes including mentorship and support, academic growth, career and future planning, confidence, and adjustment. Faculty mentoring also impacted the scholars' experience. Faculty mentors reported the discussion topics for each of the meetings with student scholars. Scholars struggled with adjusting to college life (e.g.

time/stress/social life/academic life management, talking to professors).

Student scholars also rated faculty mentoring highly (3.7-3.9 out of 4) when asked about the quality of the mentoring, availability of faculty, time spent, and program and course information. The student scholars also strongly appreciated the effect of faculty mentoring on the scholars' interests, abilities, life and career goals, and non-academic skills.

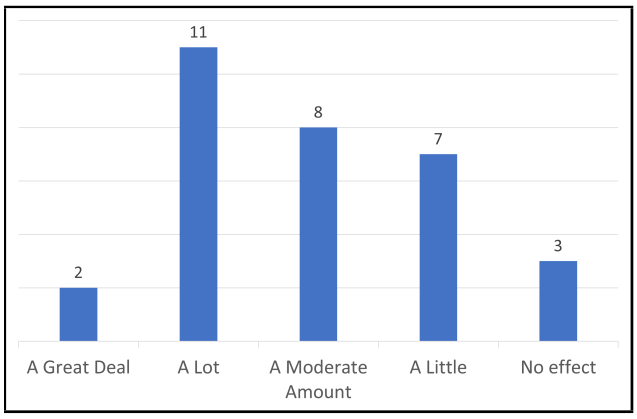

Figure 2: How much did the meetings with your [peer] mentor have a positive effect on your college experiences this semester?" (n=31, 6 surveys 2022-2025)

Conclusion

The question for many will be: "would this work for my university?" The success of the mentoring program likely hinges on student financial support through scholarships or other incentives. Another campus STEM organization attempted to replicate the faculty mentorship component of our grant without the associated S-STEM scholarships. Even though students opted in to the program, they simply did not attend scheduled meetings with their mentors. This experience indicates that sustaining high-engagement mentoring programs may be challenging without the scholarship support and structured accountability mechanisms provided through S-STEM.

Some of the efforts we have made could be institutionalized. The bridge program has continued past the S-STEM cohorts through the First2 Network. Costs are modest (mostly food and activities for the students), and likely sustainable without grant funding. The first-year seminar class also satisfies a general education requirement for students, and at one credit hour it is reasonably cost-effective to run the course. The STEM career fair requires effort (recruiting employers) and funding (for room and catering), but could be subsumed into a regular career fair for all majors with strong input and legwork from STEM faculty.

Overall, we believe our interdisciplinary model is effective at promoting STEM retention among our low-income students as indicated by the first-year retention rate for S-STEM scholars. The program appears to be well-received by students, faculty, and administrators. Because of that, we are working to institutionalize the funding.

Acknowledgments

The authors would like to acknowledge the NSF S-STEM grant #2130106, under which this project is being conducted. They would also like to thank the reviewers for their helpful comments.

References

[1] J. Armstrong and K. Zaback. College completion rates and remedial education outcomes for institutions in appalachian states. Technical report, Appalachian Regional Commission, 2014.

[2] Kelvin Pollard and Linda A. Jacobsen. The appalachian region: A data overview from the 2014–2018 american community survey. Technical report, Appalachian Regional Commission, 2020.

[3] 2025 Committee for the Report Card on West Virginia's Infrastructure. West virginia infrastructure report card. Technical report, West Virginia Report Card Committee, 2025.

[4] U.S. Census Bureau. Small Area Income and Poverty Estimates (SAIPE) Program. `https://www.census.gov/programs-surveys/saipe.html`, 2019.

[5] Crystal S. Rozek, Gerardo Ramirez, Rachel D. Fine, and Sian L. Beilock. Reducing socioeconomic disparities in the stem pipeline through student emotion regulation. *Proceedings of the National Academy of Sciences*, 116 (5):1553–1558, 2019.

[6] Jennifer R. Keup and Betsy O. Barefoot. Learning how to be a successful student: Exploring the impact of first-year seminars on student outcomes. *Journal of The First-Year Experience & Students in Transition*, 17(1): 11–47, 2005. doi: 10.65005/154230705813695146.

[7] Michael Graham, Ivan Wayne, Susannah M. Moore, Brittany Coffey, and Angela L. Vaughan. Academic first-year seminar: Four-year retention and graduation for all first-time students and students at additional risk. *Journal of The First-Year Experience & Students in Transition*, 35(1):111–127, 2023. doi: 10.65005/154230723836949031.

[8] Alexander W. Astin and Helen S. Astin. Undergraduate science education: The impact of different college environments on the educational pipeline in the sciences. Technical report, Higher Education Research Institute, Graduate School of Education, 1992.

[9] J. Deshler, E. Fuller, and M. Darrah. Supporting students through peer mentoring in developmental mathematics. *Learning Assistance Review*, 24(1):87–112, 2019.

[10] David F. Shelley. Academic success for stem and non-stem majors. *Journal of STEM Education: Innovations and Research*, 2010.

[11] James A. Ejiwale. Barriers to successful implementation of stem education. *Journal of Education and Learning*, 7(2):63–74, 2013.

[12] A Christopher Strenta, Rogers Elliott, Russell Adair, Michael Matier, and Jannah Scott. Choosing and leaving science in highly selective institutions. *Research in Higher Education*, 35(5):513–547, 1994.

[13] O Homer Erekson. Joint determination of college student achievement and effort: Implications for college teaching. *Research in Higher Education*, 33(4):433–446, 1992.

[14] James C Hearn. Impacts of undergraduate experiences on aspirations and plans for graduate and professional education. *Research in Higher Education*, 27(2):119–141, 1987.

[15] Kevin Eagan et al. Becoming stem protégés: Factors predicting the access and development of meaningful faculty–student relationships. In *Proceedings of the Association for Institutional Research Annual Forum*, 2011.

[16] Saundra Yancy McGuire. *Teach Yourself How to Learn: Strategies You Can Use to Ace Any Course at Any Level*. Stylus Publishing, Sterling, VA, 2 edition, 2018.