



National Science Foundation: Division of Undergraduate Education (DUE) Scholarships in STEM (S-STEM) Track 1: DUE 1833781: \$650,000 (7/1/19-6/30/24)

Josephine Rodriguez, Galen Sedo, Trevor Makal, and Bruce Cahoon

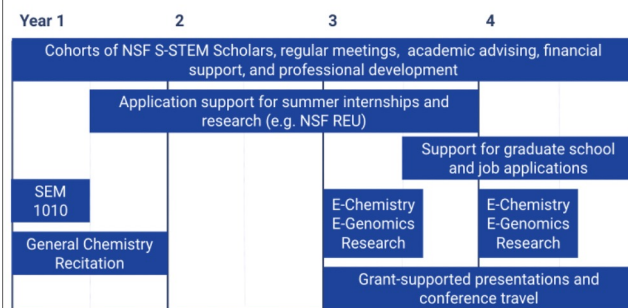
Department of Natural Sciences – 1 College Ave. – The University of Virginia's College at Wise – Wise, VA 24293

Impacts and Outcomes of NSF S-STEM Capacity Building Supports, Interventions, and Mentoring at UVA Wise

Intellectual Merit: The NSF S-STEM at UVA Wise tested the impacts of the following interventions and supports: SEM 1010, General Chemistry Recitation, a cohort and mentoring experience, and research-based courses in Environmental Genomics and Environmental Chemistry. The URSSA (Weston and Laursen, 2015) instrument was given to both Scholars that participated in various summer internships or research as well as the research-based courses.

Broader Impacts: This NSF S-STEM currently has 20 Scholars at UVA Wise, the liberal arts division of UVA in rural southwest Virginia. The project supports 1st-year students and community college transfers, many of which are 1st-generation college students. The project had five graduates May 2022.

Overview of NSF S-STEM Supports, Interventions, and Mentoring



SEM 1010 First-Year Success Seminar: There have been 17 participants since Fall 2019. Three have become SEM 1010 mentors, which serve as teaching assistants for SEM 1010. Overall, SEM 1010 is effective in providing supportive peer relationships and facilitating the transition to UVA Wise. Selected feedback from the Fall 2021 assessment is below.

- "I did not know any of the NSF S-STEM members before starting the Fall semester. Now, I know multiple members and have made some great friends within the program. I know that I have people who are willing to help me if I need assistance and will support me."
- "I have developed supportive relationships with the members of NSF S-STEM. The members are always willing to give advice and talk about how classes are."

Assessment of the NSF S-STEM Mentoring (May 2022)

Strongly Agree=5, Agree=4, Neutral=3, Disagree=2, Strongly Disagree=1 (n=14)
(average)

I feel that I am part of a cohort	4.65
I feel that the cohort provides supportive peer relationships	4.54
I understand where to seek campus services such as tutoring and counseling	4.85
I am willing to seek campus services such as tutoring and counseling	4.92
I am interested in pursuing undergraduate research	4.83
I understand my STEM career options after UVA Wise	4.92
I understand my STEM graduate training options after UVA Wise	4.69
I have the time-management skills necessary to be successful in my coursework	4.69
I have the note-taking skills necessary to be successful in my coursework	4.69
I have the study skills necessary to prepare for my exams	4.54

General Chemistry Recitation

Since Spring 2020, 14 students have participated. Students found the intervention effective in fostering the critical thinking skills required to be successful in General Chemistry and more advanced courses. One previous participant is now the General Chemistry tutor. Three students participated Fall 2021 and the assessment is below.

Assessment (Fall 2021)

Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree = 1 (n=3)	(average)
Instructor explained concepts clearly	5
Instructor increased my ability to work out problems:	5
Instructor helped improved my knowledge of General Chemistry:	5
Instructor helped me better prepare for exams:	5
Instructor used a variety of explanations and approaches to help me understand the material:	5
The General Chemistry Recitation met my expectations:	5

The Undergraduate Research Student Self-Assessment (URSSA) E-Genomic or E-Chemistry Research and Summer Internships/Research

How much did you gain in these areas because of your most recent research experience?
Gains scale: 1 → 5; 1 = no gains, 5 = great gains

Thinking and Working Like a Scientist	Research Groups (n=5)	Summer (n=5)
Analyzing data for patterns:	4.4	4
Figuring out the next step in a research project:	4.8	4.6
Problem-solving in general:	4.6	5
Formulating a research question that could be answered with data:	4.8	4.4
Identifying limitations of research methods and designs:	4.8	4.8
Understanding the theory and concepts guiding my research project:	4.8	4.8
Understanding the connections among scientific disciplines:	4.4	4.8
Understanding the relevance of research to my course work:	4.6	4.6

Personal Gains

Confidence in my ability to contribute to science:	4.8	4.6
Comfort in working collaboratively with others:	4.8	4.6
Confidence in my ability to do well in future science courses:	4.6	4.8
Ability to work independently:	4	4.4
Developing patience with the slow pace of research:	4.4	4.8
Understanding what everyday research work is like:	4.4	4.6

Skills

Writing scientific reports or papers:	3.8	3.4
Making oral presentations:	4.4	4.6
Defending an argument when asked questions:	4	4.4
Explaining my project to people outside my field:	4.8	5
Preparing a scientific poster:	4	4
Keeping a detailed lab notebook:	4	4.8
Conducting observations in the lab or field:	4.6	5
Using statistics to analyze data:	4.2	3.6
Calibrating instruments needed for measurement:	4.2	4
Understanding journal articles:	4.6	4.6
Conducting database or Internet searches:	4.6	3.8
Managing my time:	4.4	4

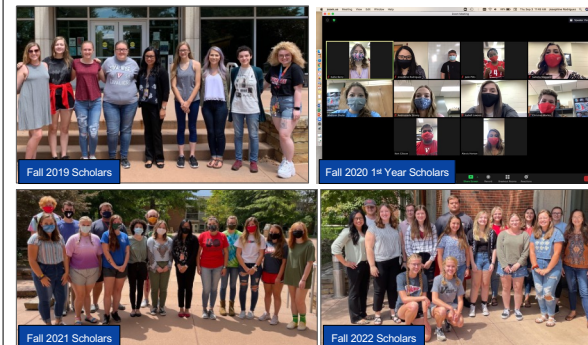
Attitudes and Behaviors

Engage in real-world science research:	4.8	4.8
Feel like a scientist:	4.8	5
Think creatively about the project:	4.8	5
Try out new ideas or procedures on your own:	4.8	4.2
Feel responsible for the project:	4.6	4.6
Work extra hours because you were excited about the research:	3.8	4.8
Interact with scientists from outside your school:	4	4.8
Feel a part of a scientific community:	4.4	5

Environmental Genomics: The research project, "Testing Various Collection Methods for Freshwater Microbial Environmental Metabarcoding" was presented at the 83rd Associate of Southeastern Biologists (ASB) Meeting in Little Rock, AR. Two students extended on this research Summer 2022. A manuscript is now in preparation.

Environmental Chemistry: Research titled the, "Biophysical Characterization of Metal-organic Frameworks as Potential Microbial Growth Inhibitors" was presented at the UVA Wise Research Blitz. Another student synthesized a series of metal-organic frameworks (MOFs) using varying amounts of modulating agents (acetic acid, benzoic acid, salicylic acid) and were characterized via powder X-ray diffraction, thermogravimetric analysis, and ¹H NMR spectroscopy; this student attended the 2022 American Chemical Society Meeting and is now employed as a water chemist at the Rivanna Sewer Authority in Charlottesville, VA.

Student Positions and Outcomes: Support for securing summer research and internships was effective. Summer 2020: research funded by the UVA Wise Fellowship in the Natural Sciences (FINS). Summer 2021: research funded by NSF REU at U. of South Florida, NSF REU at UVA, NSF MRI; internships with VA Cooperative Extension, Carbon Research and Development, Inc., and Wetlands Estonia Outdoor Learning Center. Summer 2022: research funded by REU at ECU, NSF MRI, USDA, and FINS. Mentoring and support to prepare Scholars beyond UVA Wise was also effective. There were five graduates May 2022. They secured employment at the Rivanna Water and Sewer Authority, UPM Pharmaceuticals, Natural Tunnel State Park, and one entered graduate school in Chemistry at UNC Chapel Hill.



References: Weston, T. J., & Laursen, S. L. (2015). The Undergraduate Research Student Self-Assessment (URSSA): Validation for Use in Program Evaluation. *CBE - Life Science Education*, 14(3), w103. <https://doi.org/10.1187/cbe-14-11-0208>

Acknowledgements: UVA IRB-SBS #3933; Frackson Mumba (UVA); Becky Huffman, Sabrina Qureshi, Emily Dotson, Alan West (UVA Wise)