

BOARD # 462: The Role of the NSF S-STEM funded ACCESS Project in Recruiting and Supporting Cybersecurity Students

Prof. Katerina Goseva-Popstojanova, West Virginia University

Dr. Katerina Goseva-Popstojanova is a Professor at the Lane Department of Computer Science and Electrical Engineering, West Virginia University, Morgantown, WV. Her research interests are in software engineering, cybersecurity, and data analytics, as well as in higher education focused on these areas. She has served as a Principal Investigator on various NSF, NASA, and industry funded projects. She leads the B.S. in Cybersecurity program and serves as Academic Coordinator of the M.S. in Software Engineering Program at West Virginia University. She has served on program and organizing committees of many international conferences and workshops.

Daniel Mackin Freeman, University of Washington

Daniel Mackin Freeman is a doctoral candidate in Portland State University's Department of Sociology and a Research Scientist at the University of Washington Center for Evaluation and Research for STEM Equity. He received his BFA in General Fine Arts with a focus on social practice from the Pacific Northwest College of Art and his MS in Sociology from Portland State University. With a background in the philosophy of art and education, Daniel's current research focuses on how school structure and curricular emphases both result from and perpetuate social inequalities.

Dr. Robin A.M. Hensel, West Virginia University

Robin A. M. Hensel, Ed.D., is a Teaching Professor in the Benjamin M. Statler College of Engineering and Mineral Resources at West Virginia University and an ASEE Fellow Member. As a mathematician and computer systems analyst, she collaborated in engineering teams to support energy research before entering higher education where she taught mathematics, statistics, computer science, and engineering courses, secured over \$5.5M to support STEM education research, led program development efforts, and served in several administrative roles. She has been recognized for her teaching, advising, service, and research and as an Exemplary Faculty Member for Excellence in Diversity, Equity, and Inclusion.

The Role of the NSF S-STEM funded ACCESS Project in Recruiting and Supporting Cybersecurity Students

1. Introduction

In today's world, cybersecurity is crucial because it protects individuals, businesses, and organizations from malicious cyberattacks. Even more, protecting the critical infrastructure and government systems from cyberattacks is vital for national security. However, there is a significant shortage of qualified professionals available to fill cybersecurity jobs. Currently there are close to half a million job openings for cybersecurity experts [1]. And, based on the Bureau of Labor Statistics, the employment of information security analysts, which is one of many cybersecurity career pathways, is expected to grow 33% from 2023 to 2033, at a much faster rate than the projected average growth of 4% for all occupations [2].

To contribute towards addressing the enormous unmet need for cybersecurity professionals, a new B.S. in Cybersecurity degree [3] and an Area of Emphasis (AoE) in Cybersecurity [4] were developed at the West Virginia University (WVU), Morgantown, WV. These programs started enrolling students in fall 2018. The B.S. in Cybersecurity program was accredited by ABET in 2022, for a period of six years. The program is also designated by the NSA as a National Center of Academic Excellence in Cyber Defense Education (CAE-CD) through the academic year 2027. WVU is also a National Center of Academic Excellence in Cyber Research (CAE-R).

Soon after establishing the new B.S. and AoE in Cybersecurity, the Attracting and Cultivating Cybersecurity Experts and Scholars through Scholarships (ACCESS) project was funded by the NSF S-STEM program. The ACCESS project has the following objectives: (1) increase the annual enrollment of students in the Cybersecurity B.S. major and AoE at WVU; (2) enhance the co-curricular activities and student support services; (3) strengthen partnerships with employers from the public and private sector; and (4) investigate the impact of the ACCESS activities on students' success. The ACCESS project incorporates several co-curricular professional development and student engagement elements, including social events, seminars, mentoring, undergraduate research, and participation in cybersecurity-related student organizations. Participating in social and professional development events fosters social connections and development of life skills such as discipline, self-esteem, and ethical behavior [5]. Faculty mentoring and professional development seminars encourage persistence in students' academic paths and prepare them for their future careers by providing career guidance, relevant information, and networking opportunities [6]. Participations in subject-based student organizations and competitions increase student satisfaction, enhance personal and professional development, motivate students to succeed academically, and increase student commitment to their future careers [5]. Furthermore, these community connections foster increased student retention and persistence to graduation [7]. Undergraduate research has positive impacts on student self-efficacy, professional identity, academic success, and retention. Additionally, long-term engagement in research keeps students connected to their academic goals, and the research community, and fosters a sense of belonging within the academic community [8].

To evaluate the ACCESS project impact on scholars' success, in the spring semester each year the information about scholars' experiences and their opinions are collected by (1) an

anonymous survey administered in four classes at different levels and (2) focus group interviews conducted using Zoom by the evaluation team from the University of Washington, Seattle, WA.

2. Recruitment activities and ACCESS scholarship awards

Thus far, 96 annual scholarships, each in an amount of \$5,000, have been awarded to 63 unique students from five cohorts. Out of these, the latest Cohort 5 consists of 14 students. The successful selection of ACCESS scholars was due to a wide variety of recruitment efforts that reached students at different academic stages and across different identities.

The outreach activities for high school students included presentations by the ACCESS team and by the Statler College of Engineering and Mineral Resources (Statler College) recruiters. Also, ACCESS scholars were asked to share scholarship information with their high schools, friends and peers. Finally, emails with information about ACCESS were sent to prospective and admitted students. Many recruitment activities targeted the current WVU students. Thus, the ACCESS team gave in-person presentations for undecided freshman engineering students and the instructors of freshman engineering classes made in-class announcements. Details about the scholarship were also included in the Statler College ENews and shared in-person with twelve large undergraduate classes in the Lane Department of Computer Science and Electrical Engineering (LCSEE). More targeted advertising was done by sending information to various WVU professional and honors societies and student organizations.

Over the five cohorts, 35% of the new scholars were recruited while they were still in high school, which demonstrates the value of the ACCESS scholarship for recruiting talented incoming freshmen. That led to achieving ACCESS project's objective to increase the annual enrollment of students in B.S. and AoE in Cybersecurity (objective 1). Thus, since the start of the ACCESS project, the enrollment has steadily increased from 50 students in spring 2020, to 69 in 2021, 106 in 2022, 107 in 2023, and 111 in 2024. The spring 2025 enrollment of 184 students is more than three times higher than the enrollment at the beginning of the ACCESS project in 2020.

The program has a very high retention rate of 83%. Specifically, 52 out of 63 scholars had their annual scholarships renewed. In spring 2025, there are 31 students in the ACCESS program. At that point, 21 ACCESS scholars have graduated. Of these, 19 started full-time jobs and two enrolled in graduate studies.

3. Activities that support students' academic success and building professional identity

To aid students' success, the ACCESS project **developed and offered numerous co-curricular activities** such as social events, mentoring, participation in the CyberWVU student organization, and conducting undergraduate research (objective 2). As can be seen in Figure 1, all students who responded (i.e., 83%) perceived the social events as very or somewhat valuable. The **Award Ceremony** received less positive feedback, with 34% providing very valuable or somewhat valuable responses. The higher percentages of neutral and missing responses in this case were likely because the Award Ceremony was a celebratory event that did not explicitly contribute to students' development as cyber-professionals.

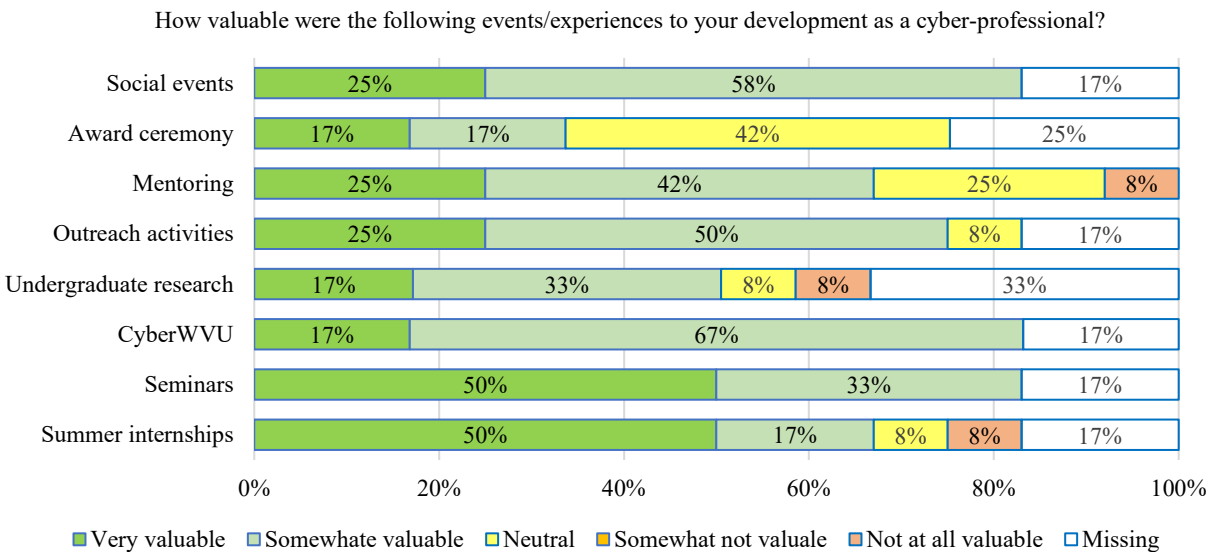


Figure 1. Students' evaluation of the co-curricular activities and support services (n=12)

Each ACCESS scholar was assigned a **mentor** and required to meet with them at least once each semester. Eight faculty who teach cybersecurity classes at the LCSEE department served as mentors in Year 5. As shown in Figure 1, 67% of ACCESS scholars found the meetings with their faculty mentors to be very or somewhat valuable. Overall, scholars' feedback about mentoring in Year 5 was similar as in Year 4 [9] and is consistent with the observation that mentorship programs often encounter difficulties in aligning faculty and student expectations, pointing to institutional barriers that hinder faculty mentorship [10].

One of the ACCESS project's **outreach activities** engaged the current ACCESS scholars, as described in Section 2. As can be seen in Figure 1, 75% of scholars felt that the outreach activities were very or somewhat valuable. ACCESS project activities also included publicizing **undergraduate research** opportunities at WVU and other universities. As shown in Figure 1, 50% of scholars found the undergraduate research to be very or somewhat valuable. Note, however, that this question had the highest number of missing responses (33%), most likely because these students did not participate in research which is an optional co-curriculum activity. (Note that "non-participation" was not one of the available response options in the survey.)

ACCESS scholars were also invited to actively participate in **CyberWVU** student organization whose members organize training sessions and participate in cybersecurity competitions. Even though this is another optional activity, as shown in Figure 1, 84% of scholars found it to be very or somewhat valuable. The higher appreciation is likely due to CyberWVU focus on developing hand-on skills, which aligns well with students' career goals to pursue full-time employment.

The ACCESS project has strengthened the existing and created new partnerships with many cybersecurity employers (objective 3). From fall 2020 to fall 2024, **the ACCESS team organized 21 seminars that were given by renowned cybersecurity experts** from the public and private sector. Of these, six were organized in Year 5. All scholars who responded (n=10) to the relevant survey question found the seminars to be somewhat or very valuable. In the focus

groups in Year 5, as in past years, students consistently discussed the value of the seminars, stating that because of them, they now have a more realistic understanding of the field and that they would feel comfortable reaching out to presenters. Scholars also felt that presenters were genuinely interested in their career prospects and eager to provide them with opportunities. It is important to emphasize that all seminars were open to all WVU students. Consequently, in addition to ACCESS scholars, these events directly benefited other WVU students.

ACCESS scholars were also encouraged to secure **internship** positions. The ACCESS team supported this activity by working with numerous employers to provide specific **internship** opportunities. As a result, majority of ACCESS scholars had summer internship positions. Those who did not have internship positions were mostly rising sophomores, for whom there are fewer internship opportunities. As can be seen in Figure 1, 67% of scholars found the internship experience very or somewhat valuable. Since getting an internship position is another optional activity, the neutral and missing responses may be due to the lack of a “non-participation” response option in the survey, similarly as in case of undergraduate research.

4. Evaluation of the ACCESS project impact on scholars’ success

It is important to investigate the impact of the ACCESS activities on scholars’ academic success and development of their professional identity (objective 4). As shown in Figure 2, scholars provided overwhelmingly positive feedback about the benefits from the ACCESS project. Thus, in Year 5, all ACCESS scholars strongly or somewhat agreed that they learned about career opportunities they would not have otherwise known about, were more confident about starting a career in cybersecurity, had the opportunity to learn from cybersecurity professionals, and were able to access resources that will help them in their field. A large majority of students strongly or somewhat agreed that they have received hands-on experience in cybersecurity (92%) and a smaller majority (75%) that they have developed relationships with other cybersecurity students. Overall, 100% of ACCESS scholars were very likely or somewhat likely to recommend the ACCESS program to their classmates.

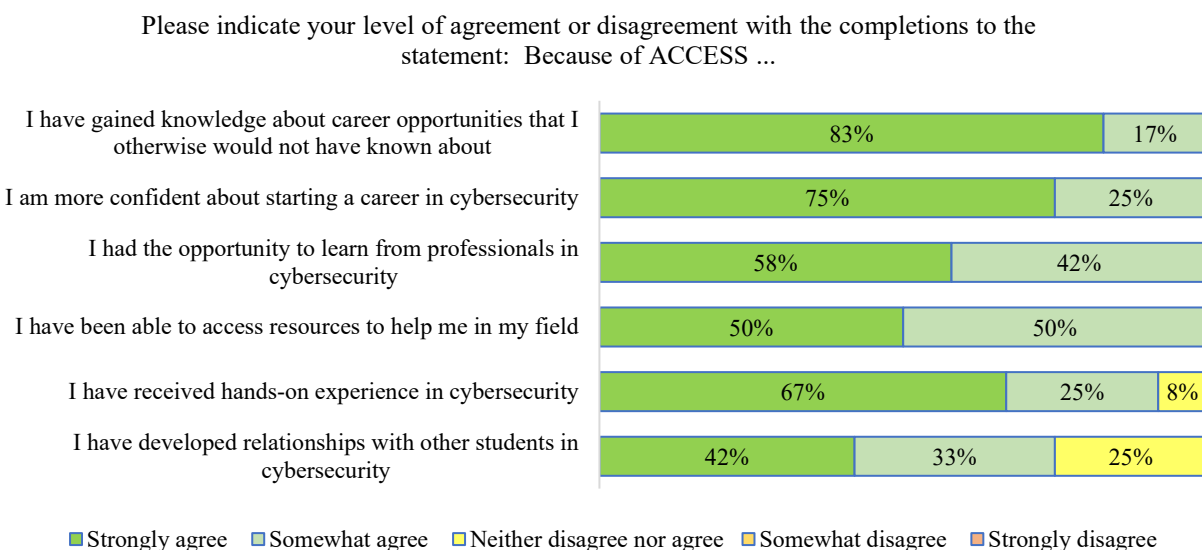


Figure 2. Students’ feedback about benefits from the ACCESS project (n=12)

5. Acknowledgment

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