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Academic Experiences of NSF Cyber Scholar Grant Recipients

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Abstract

The cybersecurity field faces a critical shortage of qualified professionals. To help to build a robust and diverse workforce, federal programs like the National Science Foundation (NSF) fund grants to support the recruitment and retention of academically talented, low-income, and underrepresented students. This qualitative study examines the academic experiences of the final student cohort funded by a five-year NSF Cyber Scholars grant at Robert Morris University (RMU). The study seeks to understand the factors that drive students to choose cybersecurity and other IT majors, their experiences with the scholarship program, and their overall academic journeys. Semi-structured interviews were conducted with six junior and senior Cyber Scholars. The data were transcribed and analyzed using a six-stage thematic analysis approach. The study found that career choice was heavily influenced by early technology exposure, mentorship from family members or teachers with STEM backgrounds, and hands-on experiences during high school (such as bootcamps and cyber competitions), as well as a desire to merge technical skills with public service. Students highly valued applied hands-on labs that were intellectually challenging and strong, supportive relationships with faculty and peers. Inconsistency in course delivery and passive evaluation methods (e.g., multiple-choice exams) were noted as areas for improvement. Overall, the study highlighted that while financial aid served as a vital need for low-income and underrepresented scholars, institutional community-building and hands-on learning are crucial for long-term retention and student self-efficacy.

Keywords: NSF, STEM, Cyber Scholars, cybersecurity, workforce

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1. Introduction

With the steadily increasing demand for information technology professionals, the Bureau of Labor Statistics projects over 300,000 new positions from 2024 to 2034. Based on the data from the past two years, the median wage for these positions is reported as being $50K higher than the median wage for all occupations (BLS Occupational Outlook Handbook, 2025). To meet these demands, the information sector is projected to be the third fastest-growing sector, with a 6.5% growth rate, which is twice as high as the 3.1% overall growth in the employment rate (BLS Monthly Labor Review, 2026). This growth is especially high in certain IT areas, such as cybersecurity, cloud computing, and AI management. According to the BLS 2025 report, employment demand for cybersecurity analysts and similar positions is expected to grow by 29%, which is almost twice the growth in all IT employment.

To accommodate the current and projected growth, colleges need to take extra steps to recruit more IT majors and to educate potential students about the changes in the job market. Realizing this need for training qualified IT professionals, the government funds multiple grants to support the colleges in recruiting talented students to their STEM and IT programs. Examples of such programs include a broad group of CyberCorps Scholarship for Service (SFS) grants and multiple NSF grants similar to NSF Cyber Scholars.

In addition to recruiting prospective students from high schools, recruiting transfer students from community colleges and 2-year programs is a promising effort (Igoche et al., 2019). In 2019, Robert Morris University (RMU) received a 5-year NSF Cyber Scholars grant to support the recruitment and funding of 30 academically talented, low-income students from underrepresented groups such as first-generation college graduates and minorities. This grant was later extended due to the lack of recruiting activity during the pandemic years. The final cohort of the Cyber Scholars is currently at the completion stage of their programs. The goal of this research is to determine their current academic experience, aimed at improving the experiences of future grant recipients of similar academic grants. This study contributed to the existing pool of research in the area; however, most of this research is quantitative, and there is a need for qualitative studies for a deeper perspective on the students' experience. The following research questions stem from the research goal.

RQ1: What are the reasons Cyber Scholars choose their major?
RQ2: What is the students' experience with the NSF Cyber Scholar grant?
RQ3: What is the overall academic experience of the recipients of the NSF Cyber Scholar grant?

2. Literature Review

The goal of this literature review is to discuss the academic studies related to similar grants and the impact they have on the grant recipients, at the same time linking these studies to the research questions. The review starts with the introduction of the research about STEM grants and their impacts in general. We then narrow down the focus to the three areas specific to the S-STEM grant in our research. First, we discuss research describing the specific needs of the students majoring in Cybersecurity and other IT fields. Second, we review the studies about the impacts of similar grants specifically on the students from low-income families (one of the main specifics of our own S-STEM grant). Finally, the third group of studies is dedicated to the impact of STEM grants on underrepresented groups of students. In conclusion, we identify the gap in academic research that this study attempts to close.

The necessity of funding academically talented students and the benefits of such funding are well established in academic research. Nguyen, Kramer, and Evans (2019) conducted a systematic review of research studies about grant recipients' performance, retention, and degree completion. These studies provide consistent evidence that federal and state grants, along with other need-based financial

aid, significantly improve students' academic performance and increase their retention and graduation rates. A more recent study (Davis et al., 2025) includes a comprehensive evaluation of NSF scholarships in STEM areas (S-STEM programs) and reports evidence of such programs causing "increased academic confidence, strengthened research skills, and enhanced career preparedness", in addition to increased retention and program completion rates. Aside from financial relief, which is a determining factor for many students, researchers report supplementary factors that increase the students' academic and professional success. Professional and hands-on support has been constantly reported among the most valued factors by multiple researchers. For example, Sherman et al. (2018) reported that a collaborative hands-on project that engaged SFS students created a "powerful learning and professional identity formation" for them. Financial incentives are found to be an important motivating factor among the students who are otherwise in equal positions. Dong et al. (2021) compared two groups of students: those who accepted the NSF-STEM grant and those who qualified but decided not to participate in the grant. They demonstrated significantly higher GPAs and retention rates among the grant recipients. Overall, any type of financial incentive, even as small as professional certification funding such as vouchers, has proven to substantially enhance professional motivation (Li et al., 2024).

2.1 Cybersecurity and Other IT Programs

Hands-on training is essential for all IT majors; researchers have emphasized this for a long time, ever since IT, MIS, and similar majors started to emerge in colleges. Wittman (2010) was one of the first studies to demonstrate that IT students who complete lab training experienced greater success in their education and career opportunities. Cybersecurity students were the largest group of S-STEM grant recipients in this research; therefore, it is worth mentioning the studies dedicated specifically to practical training in cybersecurity. Narian et al. (2025) demonstrated that a cybersecurity curriculum with a high presence of hands-on content results in significantly higher perceived value among the students. Towhidi and Pridmore (2022) explored the feedback of cybersecurity students about their program and noted that they perceived their hands-on labs as the most motivating factor, shaping their "professional identity and persistence". "Skill-first" pedagogical approach in the cybersecurity curriculum has been found to cultivate self-efficacy and professional confidence among students (Stavrou and Piki, 2024). Remarkably, transfer students often demonstrated more awareness and interest in cybersecurity careers, having been exposed to the field in their early college years. Crandall et al. (2019), in their survey of high-school students, found that many of them reported little or no occupational interest in cybersecurity as a career, often due to a lack of exposure to the field or its incorrect representation. Mishra et al. (2024) confirm that lack of exposure is one of the key factors deterring students from the field. This fact is not limited to Cybersecurity; similarly, a lack of exposure to technology fields in general prevents students from choosing an IT-related major. Liu, Conrad, and Blazar (2024) showed that taking a CS class increases the likelihood of students declaring a CS major by 10 percentage points. Finally, many research studies focus on the reasons for prospective students to choose IT as their major, and funding/cost is reported among the determining factors. For example, Chipidza, Green, and Riemenschneider (2019) demonstrated that positive beliefs about the resources required to major in IT/MIS correlate with the students' intent to pursue this major.

2.2 Effects on students with financial challenges

External funding similar to NFS S-STEM programs has been found to substantially increase retention rates, particularly among students with financial difficulties. In addition to funding, various types of support, such as academic, emotional, research, and professional, have been found extremely effective in determining the students' success in their programs (Wright et al., 2021). Having to fund their education on their own without substantial family support, the students question their future employability more seriously; students with families and working students appreciate accommodations and flexibility (Wright et al., 2021). It is worth noting that need-based scholarship recipients are often found to demonstrate greater academic gains than merit-based scholarship recipients. Zia et al. (2025) found that both merit-based and need-based scholarships increased the students' commitment, resilience, and self-efficacy. At the same time, their research demonstrated that for need-based recipients (especially male recipients), financial relief resulted in even greater academic gains following the ability to study full-time. Additional grant aid was found to significantly increase the likelihood of completing a bachelor's degree for students from low-income families (Goldrick-Rab et al., 2016).

2.3 Effects on students from underrepresented groups

A substantial part of the students receiving need-based grants are from the underrepresented groups, such as first-generation college students, rural students, older or working students, and, in many STEM-IT fields, female students. It is important, therefore, to review the research dedicated to these specific groups. According to Promotion Inclusivity in Computing (PINC), women and underrepresented minorities benefit greatly from such grants, especially in combination with peer mentoring, research, and hands-on experience (Dong et al., 2021).

College students from rural areas are a substantially underrepresented group among college students. While this group of students is relatively well-supported in K-12 programs, their post-secondary education support is largely overlooked (McNamee and Ganss, 2023). Rural students, facing a variety of barriers to their college education, such as socioeconomic, geographic, and educational (prior education), can benefit greatly from S-STEM scholarships (Henley and Roberts, 2016). McNamee and Ganss (2023) sampled 41 examples of such scholarships and made a strong case for developing rural-based scholarship programs as a key to the students' success in this population of college students.

Another vulnerable group in this category includes first-generation college students. According to a systematic review of the literature on the subject presented by Ives and Castillo-Montoya (2020), many research studies identify specific challenges that these students face in college: low academic engagement and retention, and therefore lower graduation rates. In their longitudinal study of 13 first-generation college students, Salusky et al. (2022) determined that social belonging is especially valuable to the students from this group; however, it is difficult to achieve due to social, psychological, and other value differences.

Finally, gender is an important factor in identifying the correct approach to STEM-IT education. Despite government and academic programs to promote the representation of women in STEM fields, the number of women in cybersecurity remains disproportionate. Cheryan et al. (2017) found this to be due to three main reasons: the masculine culture of fields such as computer science and cybersecurity can discourage women's participation, women have fewer opportunities for early educational experiences in STEM fields, and gender gaps in self-efficacy. Francis et al. (2024) conducted a study where they provided a capture-the-flag exercise for participants and measured results based on gender. They found notable differences between males and females. Male participants' best performance was in reverse engineering and cryptography, while the females performed better in cyber forensics and web exploitation challenges. In general, the studies showed differences in aptitudes and level of performance by gender for various IT fields. These findings highlight the importance of a tailored approach to mentorship for newcomers to the field in order to bridge the gender gap.

In conclusion, there are several groups that are still underrepresented in the field of cybersecurity, and specialized programs are necessary to attract more professionals to the field from these areas in order to build a more robust and diverse workforce. While some funding programs, such as CyberCorps SFS, have been in existence for a longer time, programs similar to NSF Cyber Scholars are still relatively new and not well-studied in research. There is a particular gap in qualitative research about the Cyber Scholars' experiences in their programs.

3. Methodology

In this qualitative interpretive study, we conducted interviews with all students from the current cohort of Cyber Scholars grant recipients, which included six students. To protect the privacy of the students, we used fictitious students' names while reporting the results: Bryan, Carol, Cole, Dennis, Jane, and Ron. Each interview included demographic questions and three sections connected to the research questions: reasons for choosing Cybersecurity as a major, the students' experience with the grant, and their overall academic experience (Table 1). During the interviews, the students were not limited in time when answering the interviewer's questions; in fact, if their answers were very brief or incomplete, the interviewer asked clarifying questions. Despite that, the interviews were brief, each lasting up to 15 minutes; the interviews were conducted and transcribed through Google Meet. We chose systematic thematic analysis as the method in this study, and its six stages, identified by Ahmed et al. (2025): (1) familiarization with data, (2) generating initial codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) writing the report. On stages 2 and 3, we used Claude.ai,

backed by manual analysis, to identify the initial set of themes. Manual analysis was used to reduce the possibility of missed themes, incorrect interpretation of the interviewee statements, and other issues. The results were combined into a unified set of themes. Theme reduction was later applied to merge the initial set of themes into broader categories and to identify the final set of themes, which are discussed in Results.

3.1 Demographics

Demographics	● What is your current major? ● Where are you in your program (junior/senior)? ● Are you planning to start a Graduate program? ○ If yes, what program(s) are you interested in?
RQ1. Reasons for choosing my current major	● What were the reasons for your choosing your major? ○ Events impacting your decision ○ People impacting your decision ○ Resources you've used for information (websites, school counselors, search engines, etc.) ● Did the cyber scholar grant guide you in choosing to study cybersecurity or another IT major?
RQ 2. Students' experience with the NSF Cyber Scholar grant	● What were your experiences as a Cyber Scholar grant recipient? ● Did the Cyber Scholar Grant guide your decision to attend RMU? ● How did the Cyber Scholar grant help you in your program? ● What recommendations would you give to future Cyber Scholar students?
RQ 3. Students' overall academic experience	● What was your overall experience in the program? ● What was your overall experience at RMU?

Table 1. Interview Questions

Of the six interviewed students, four were male, and two were female. According to the grant specifics, all recipients are funded to complete the last two years of their undergraduate degree, so the group we interviewed included only juniors and seniors. As the grant is not restricted to any specific majors, our group included students from different majors, with Cybersecurity being the most represented one. In this case, we had an equal number of three students in both categories. The majority (four students) were Cybersecurity majors, one majored in Accounting (switched from Cybersecurity), and one in Computer Science. The interviews revealed that, unlike typical undergraduate students, all grant recipients were working professionals and highly motivated to complete their programs. Three students admitted that they definitely plan to pursue graduate degrees after graduation; the remaining three were either unsure or intended to take a break before applying for a graduate degree. The list of graduate programs that the students considered or planned to apply for included Cyber Investigations and Intelligence, Artificial Intelligence, and Engineering Management.

4. Results

4.1 Reasons for choosing a major

A thematic analysis of the data revealed five themes related to the first research question. Each theme below is followed by the number of students who mentioned the theme in parentheses.

- Theme 1: Interest in technology from an early age (67%)
- Theme 2: Influence of a specific person (83%)
- Theme 3: A turning-point experience in a class (67%)

- Theme 4: Desire to combine multiple interests or to help others (50%)
- Theme 5: Program reputation and accreditation (50%)

Many students claimed that their interest in the chosen field developed in their childhood, long before college. As such, one participant (Ron) explained that he wanted to "turn being chronically online into a career"; another participant (Bryan) admitted he became interested after his brother showed him his day-to-day work in the field, and one more participant (Cole) recalled his childhood coding experience on Scratch.

Most students noted that a significant person inspired them to pursue a career in their field. For example, in Ron's case, this was his robotics teacher; for Cole, this person was his father, who worked in graphic design, and his coding teacher. Dennis admitted having "friends who were into hacking"; Carol's aunt worked at Cisco, and for Bryan, this influential figure was his father, who worked with technology at PNC Bank. It was clear from the students' answers that their family members with a STEM background were particularly influential.

Several students recalled a special event such as taking a class or enrolling in a camp that played a deciding role in their career choice: a cybersecurity bootcamp for Ron, an AP course in computer science for Jane, coding competitions for Cole, and a cybersecurity basics course for Carol that she took in community college. Interestingly, the students who chose to pursue Cybersecurity were often motivated by their desire to merge multiple fields of interest into one and to help people. As such, Dennis wanted to combine his interest in criminal justice and IT, while Carol's interests were both in cyber and law/forensics. Some students admitted their interest in the ethical side, such as a desire to "help protect information" (Ron).

Finally, half of the interviewed students noted the importance of the reputation and quality of the program in their decision, mentioning RMU's NSA Center of Academic Excellence (Dennis, Bryan), while Carol admitted that she compared her current program to a similar one in a larger school in the area and made her choice due to the program's reputation.

4.2 Students' experience with the NSF Cyber Scholar grant

After analyzing the answers to the second research question, we identified the following four themes associated with the students' experience with the NSF Cyber Scholar grant:

- Theme 1: Financial relief (100%)
- Theme 2: The Grant being a deciding factor for their enrollment (67%)
- Theme 3: Motivation and accountability (67%)
- Theme 4: Extracurricular opportunities (83%)

Financial contribution was the first and most important reason named by all students as the most valuable experience with the grant. As such, one student admitted that it "pretty much saved" him, as he was working full time and paying rent. Other students noted "financial motivation" and the reduced fear of "crippling debt" (Ron). For some students, such as Jane, the grant was the deciding factor: "pretty much made my decision" to attend RMU. Overall, the grant was noted to function not as a supplemental helpful resource but as a material lifeline. For the students who were choosing between multiple institutions, the grant was the tipping point in their decision. It helped cover their room and board (Cole); in addition, students admitted that other schools were "way more expensive" (Bryan). Overall, the grant was an important enrollment differentiator.

Besides the financial aspect, students reported that the grant helped improve their sense of academic motivation and responsibility, e.g., it "made me work harder because I was getting a scholarship" (Carol). Other students described it as providing "nice motivation" to succeed in the program. Overall, the grant created a sense of obligation, which translated into higher academic achievements.

Another important message articulated by two students was the possibility of extracurricular activities and participation in community life outside of the classroom. The students admitted that clubs such as Top-Secret Colonials (TCS) and CS3 "broadened" their education by giving them hands-on experience that they were not getting in low-level classes (Ron). The students emphasized the importance of teamwork in cyber classes such as cyber forensics and network security (Bryan). They specifically

recommended that the new students "get engaged with the two cyber clubs here". At the same time, commuter students expressed regret about not being able to actively participate in extracurricular activities and were not "really able to be a part of some of the things that go on campus" (Dennis). Commuting students often valued the flexibility of online classes (Jane).

Interestingly, several students mentioned that they were unaware of the grant before choosing to enroll in their programs (Ron, Dennis); therefore, for those students, the grant was not a motivating aspect.

4.3 Overall academic experience

A thematic analysis of the students' responses to the 3rd research question revealed the following four themes:

- Strong sense of learning and intellectual challenge (67%)
- Hands-on learning (83%)
- Strong faculty relationships (50%)
- Inconsistency in course quality (33%)

Students consistently admitted that they enjoyed being challenged with the tasks that don't "just feel like busy work" (Ron) but are valuable skills that they will need in their future careers. In that aspect, they noted their program engagement and challenges were very different from what they were, for example, in high school. Students called the program "fantastic" (Carol) and emphasized that the sense of meaningful learning helped them keep a positive attitude throughout their academic experience.

Many students valued the applied side of their programs, such as hands-on and lab-based courses. For example, the network forensics class was complimented for allowing them to be "in a lab doing hands-on work" (Dennis); the same forensic class was mentioned by Carol as her favorite. Another student mentioned that he had a great experience as part of the "blue team" in a forensics class and the fact that the faculty "really showed me different things I can do" (Bryan). At the same time, the students saw less value in non-applied activities such as online multiple-choice quizzes.

Meaning relationships with professors and peers were one of the key themes mentioned by multiple students, e.g., "I've made a lot of … good relationships with some of the professors here that I know would be able to help me on personal projects as well as any projects in my classes" (Cole). It was noted that a cohort model, where the students take multiple courses together, adds to their positive experience. Some students described the program as "a community where you can ask someone if you're having trouble" (Bryan).

While the overall sentiment about the program was positive, several students mentioned the inconsistent quality of the courses; for example, having a Python class where the professor "didn't even know Python" (Bryan). While many students admitted that the applied knowledge they gained in some classes was most helpful, they mentioned other classes that felt like "just multiple-choice quizzes online" (Dennis).

5. Discussion and Conclusion

Overall, the study supported the need for NSF Cyber Scholars and similar scholarships. In addition to the obvious benefit of university enrollment, the grants benefit students and the field by providing talented students from underserved groups a gateway into the field. This research revealed a few important themes that echoed and complemented the directions defined in existing studies.

First, the study supported several main reasons for the students to major in Cybersecurity or IT in general: being influenced by a specific person, interest in technology from an early age, and turning points such as enrolling in a tech class are all mentioned in the literature among the top reasons (Mishra et al., 2024; Liu, Conrad, and Blazar, 2024). Other reasons mentioned by a smaller number of students included the possibility of combining several areas of interest, accelerated programs, and program reputation. The importance of accelerated programs is an important finding that echoes other studies such as Zia et al. (2025), who characterized need-based recipients as motivated, self-efficient students ready for challenge and faster completion of the program.

Additionally, the study supported the importance of hands-on learning, demonstrated by Serman et al. (2018) and Towhidi et al. (2022). Learning meaningful hands-on skills and professional experiences was one of the two top requirements noted by the Cyber Scholars. Another aspect noted by virtually all students was the importance of building strong faculty-student relationships and mentorship, which supports the findings of Davis et al. (2019) and other researchers. This is especially important for the first-generation students (Ives & Castillo-Montoya, 2020).

While the students admitted the value of relationships they built with some faculty and the importance of their mentorship, they noted their dissatisfaction with the faculty who were not qualified or did not make a noticeable effort in teaching their course, subsequently implying the importance of the courses being taught by qualified full-time faculty. While many researchers reported grant recipients' dissatisfaction with institutional recognition and support beyond funding (Zia et al., 2025), no such evidence was found in this research, and the students noted that they were happy with the support and the accommodation they received throughout their programs.

In addition to hands-on skills and relationships with the faculty, our results showed that the sense of social belonging and engagement was of great value to the Cyber Scholar students. This conclusion is supported by multiple studies, such as Salusky et al. (2022), Means and Pyne (2017), and similar studies stating that the importance of social integration is detrimental, especially to students from underrepresented groups, such as first-generation college students. The same researchers found that if the students do not have this sense of belonging, they feel dissatisfied with the process. Fortunately, the students from the RMU Cyber Scholars cohort did not report such dissatisfaction.

As another key takeaway, NSF Cyber Scholars and similar grants need to be advertised to prospective students. Surprisingly, we found out that not enough publicity was given to the financial relief programs, such as NSF Cyber Scholar funding, as several students admitted they learned about this opportunity only after they enrolled in their programs, while this could have been a pivotal point in their enrollment decision.

The main limitation of this study is a small group size; however, this happens to be a normal situation with S-STEM grants. Many similar research studies were conducted with student cohorts close in size; for example, Sherman et al. (2018) conducted their research with a six-student cohort, Salusky et al. had a group of 13 students in their longitudinal study, and Means and Pyne worked with a group of 10 students. Another important limitation was the length of the interviews due to the small number of questions and their narrow focus.

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