

The Impact of a Targeted Scholarship Program on Cybersecurity Career Development: An Analysis Through the Lens of Social Cognitive Career Theory and Career Identity

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Abstract—The demand for skilled cybersecurity professionals continues to outpace supply, necessitating effective educational and workforce development programs. This exploratory study analyzes the influence of a scholarship and support activities on participants' career development through the theoretical frameworks of Social Cognitive Career Theory and career identity literature. Findings suggest that the Metropolitan State University Cyber Defenders Program bolstered participants' self-efficacy beliefs related to their academic and career pursuits, fostered positive outcome expectations regarding cybersecurity careers, and strengthened their career goals and engagement. The scholarship itself and peer interactions emerged as key supports. While overall results are positive, areas concerning perceptions of diversity within the field and the ease of finding employment warrant further exploration.

Keywords—cybersecurity, education, scholarships, support programs, career identity, self-efficacy

I. INTRODUCTION

Higher education institutions play a critical role in addressing cybersecurity workforce shortages by developing programs that not only impart technical skills but also foster the confidence, motivation, and professional identity necessary for students to persist and succeed in cybersecurity careers. Funded by the National Science Foundation, The Metropolitan State University Cyber Defenders program provides substantial scholarships to undergraduate students majoring in cybersecurity-related fields.

Understanding the impact of such targeted interventions such as scholarships and associated support structures (mentoring, community building) for students pursuing cybersecurity education is crucial for refining program design and informing broader workforce development strategies. This paper evaluates the perceived impact of the Cyber Defenders Program on its scholarship recipients. Drawing upon the foundational principles of Social Cognitive Career Theory (SCCT) [1] [6] and established concepts within career identity literature, this study analyzes survey data from program participants. The primary aim is to understand how the program influenced key factors in career development, including self-efficacy, outcome expectations, goals, perceived supports and barriers, and the formation of a cybersecurity career identity. This work is grounded in established theories,

SCCT and Career Identity. One study on of the impact of cybersecurity competitions used a similar framework [6]. While this is an exploratory study, SCCT provides a robust explanatory framework to begin exploring why the program's interventions are effective. The SCCT framework has also been applied to rigorous studies in STEM and medical education [3-5].

II. LITERATURE REVIEW

A. Social Cognitive Career Theory (SCCT)

Developed by [1], SCCT provides a robust framework for understanding how career and academic interests develop, how choices are made, and what determines performance and persistence. SCCT posits that career development is shaped by the interplay of three core variables: self-efficacy beliefs, outcome expectations, and personal goals, all operating within a context of perceived supports and barriers [1] [6].

For studies in competency development, self-efficacy beliefs are individuals' judgments of their capabilities to succeed in specific educational tasks (e.g., difficult coursework) or occupational requirements. High self-efficacy is linked to greater interest, choice, and persistence in related domains [1]. Outcome expectations drive career interests and choices. Individuals are more likely to pursue paths they believe will lead to valued outcomes, such as financial security, personal satisfaction, or social contribution. Goals help organize and direct behavior. Supports (e.g., financial aid, mentoring, peer networks) can facilitate career progress, while barriers (e.g., lack of funds, discrimination, family responsibilities) can impede it [7]. Perceptions of supports and barriers can directly influence career choices and moderate the relationship between interests and choices.

The Cyber Defenders Program, through its scholarship (financial support), potential mentoring, and cohort structure (peer support, vicarious learning), is hypothesized to positively influence SCCT variables among participants.

B. Career Identity

Career identity refers to the clarity and stability of one's goals, interests, and talents as they relate to career choice [8]. It involves developing a coherent sense of self in relation to the world of work [9]. A strong career identity is associated with

greater career commitment, job satisfaction, and career decision-making confidence [10] [11]. Developing a career identity is an active process involving exploration, experimentation, and reflection [12]. Key factors influencing its formation include: Experiences, direct work experience, internships, and relevant coursework which provide opportunities to test interests and abilities [13]. Exploration, actively seeking information about careers and engaging in self-assessment, helps clarify identity [14]. Social influences, feedback from mentors, peers, and supervisors, shapes selfperceptions related to career roles [10]. And, professional engagement, joining professional organizations, attending industry events (like club meetings or competitions), and pursuing certifications, signal commitment and reinforce identification with a field.

By providing opportunities for specialized coursework, potential internships, peer interaction, faculty mentoring, and encouraging engagement in activities like cybersecurity clubs and competitions (e.g., CCDC), The Cyber Defenders Program potentially fosters the development of a stronger cybersecurity career identity among participants.

III. METHODOLOGY

This study employed a descriptive research design using survey methodology to assess the perceived impact of the scholarship program.

A. Participants

The target population consisted of 28 students who received the Cyber Defenders scholarship. A summative survey was administered, yielding 17 responses (a 61% response rate). Seven respondents (41%) had graduated with a BS degree, while 10 (59%) had not yet graduated; this represents a higher proportion of non-graduates compared to the total recipient pool (54% graduated, 46% not yet graduated). Approximately half the respondents were aged 18-25, aligning with traditional or slightly extended undergraduate timelines. The other half were 26 or older, indicating a significant presence of non-traditional students [15].

B. Instrument

A survey instrument was developed specifically for this study. The survey questions were grounded in SCCT [1] and career identity literature, targeting key constructs including personal factors, self-efficacy, outcome expectations, goals, perceived supports, and barriers. The survey included Likertscale items (implied by the "agreement" data), multiple-choice questions (e.g., certifications, club meetings), and open-ended questions allowing for qualitative feedback (e.g., student final thoughts, challenges). Specific items assessed confidence, career goals, perceptions of the field, program impact on job

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Participants demonstrated clear academic and career goals. Near-unanimous agreement existed for "I know why I am in college and what I want out of it," "I feel that a

effectiveness and potential, engagement activities, and confidence-building factors.

IV. RESULTS

A. Career Identity 1) Prior Experience

10 out of 17 respondents (59%) reported having prior work experience in a computing-related job before or during the scholarship. Limited research has suggested that the number of jobs related to a specific career is an indicator of career identity [16].

2) Post-Scholarship Employment

The data also indicated a shift towards recipients working in cybersecurity fields after receiving the scholarship, suggesting progress in aligning employment with their chosen field.

3) Certifications

Participants demonstrated active engagement with professional credentialing. Seven respondents passed CompTIA Security+, with others passing Network+ and CySA+. Several were preparing for further exams, including Network+, Security+, CISSP, and CySA+. The scholarship requirement of earning industry-recognized certifications is a strong indicator of professional identity development and career commitment.

4) Extracurricular Engagement

Participation in cybersecurity clubs varied, with 8 respondents attending 2 or more meetings and 6 reporting no attendance. Notably, 4 respondents participated in Collegiate Cyber Defense Competitions (CCDC), a significant experiential learning and confidence-building activity.

B. SCCT

Participants showed high levels of agreement on survey items related to core SCCT constructs:

1) Self-Efficacy

There was unanimous or near-unanimous agreement (among those who responded) on items reflecting academic and career self-efficacy, such as "I work hard to perform well in cybersecurity courses," "I am confident that I will graduate," and "I am confident in my choice of majors and am sure I will be successful." While 7 respondents admitted to procrastinating, 8 did not, suggesting generally positive academic work habits. Only 4 respondents felt they didn't handle unexpected problems well.

2) Outcome Expectations

Strong positive outcome expectations were evident. Nearunanimous agreement was found for statements like "A job in computing or data science will provide the income I want," "Getting a college degree is important to me," "I aspire to make a difference to the success of my future employer," "I believe I will be treated fairly by my future employer," and "I believe that I will find a job in my field." 3) Goals.

cybersecurity work is what I am meant to do," "I can explain my career goals if someone asks," and strong disagreement with having "no control over whether I graduate." 14 respondents indicated they had participated in or planned activities to help decide on a job.

4) Supports

When asked what built their confidence for success, the scholarship itself was the most cited factor (12 respondents), followed closely by "Hanging out with other students out of class" (11 respondents). Other significant supports included internships (7), working on group projects (7), campus clubs/organizations (6), earning a certification (6), and faculty mentoring (5). One student explicitly mentioned CCDC participation as a major confidence factor. The qualitative comments overwhelmingly praised the support from faculty and the Cyber Defenders team, emphasizing the scholarship's critical role in enabling their education.

5) Barriers

Age and prior cybersecurity experience was noted by one respondent as a barrier. "I would say that [sic] most difficult part of my education journey so far is my age. Being right out of high school and joining my junior year has post [sic] some challenges with finding other students within my age group. A lot of students have experience with Cyber Security while I do not."

However, in general, respondents reported relatively few significant barriers. The most common challenge was the "Increased difficulty of coursework" (7 respondents). However, common barriers such as math, writing papers and lack of preparation were not cited as barriers. The perceived increased difficulty might be connected to the reported "Lack of time", "Family responsibilities" (5 respondents each), and "Test taking anxiety" (4 respondents). The increased difficulty may also be related to academic achievement or grades which one large study connects to dropping out in engineering students [17]. Students may feel that they need more time to address the increased difficulty of coursework so that they do not receive a poor grade.

Notably, factors often cited as barriers in STEM persistence, such as uncertain goals, lack of commitment, difficulty choosing a major, or lack of same-race/ethnicity peers on campus, were not considered challenges by these respondents.

C. Self-Reported Program Impact 1) Job Effectiveness

All 16 respondents who answered the relevant question reported that the scholarship positively impacted their current job effectiveness, even if the job was not in cybersecurity.

2) Career Potential

14 out of 17 respondents (82%) felt the scholarship impacted their career potential "a lot," even if their job was not in cybersecurity. Two respondents stated they currently have their "dream job."

D. Areas of Concern/Exceptions

Two survey items yielded less consensus: "I believe computing and data science careers are attractive for minority and female workers": Only 9 respondents agreed,

1 disagreed, and 7 provided no response or marked N/A. This suggests potential ambivalence or concern regarding diversity and inclusion within the field, even within a relatively diverse program cohort.

"Finding a job I want to do is/was easy": Responses were split, with 6 agreeing and 7 disagreeing (4 N/A/No Response). This contrasts with the high confidence expressed in eventually finding a job and may reflect awareness of the competitive nature of the job market or specific challenges encountered during the job search process.

V. DISCUSSION

The findings from the Cyber Defenders Program summative survey, when viewed through the lenses of SCCT and career identity theory, suggest the program has had a substantial positive impact on participants' career development trajectories.

A. Influence on SCCT Variables

The program appears to have effectively bolstered key SCCT constructs. The high levels of self-efficacy reported – confidence in graduating, succeeding in the major, and performing well in courses – align with SCCT's emphasis on this variable as foundational for persistence [1]. The financial support of the scholarship likely reduced financial stress, allowing students to focus on their studies, thereby increasing opportunities for successful performance experiences. Furthermore, the importance placed on peer interaction ("hanging out with other students") suggests that vicarious learning and social support within the cohort also contributed to confidence, consistent with [18] sources of self-efficacy. Faculty mentoring, though cited less frequently than peer interaction in this specific confidence question, was highlighted as exceptional in qualitative comments, indicating its role as a likely source of social persuasion and support.

Positive outcome expectations were also strongly evident. Participants reported they believed cybersecurity careers would provide desired income and that they would find employment and be treated fairly. The scholarship itself, by signifying institutional investment and belief in their potential, may have reinforced these positive expectations. The program seems to have successfully linked academic pursuits to desirable future outcomes.

Participants demonstrated clear personal goals related to their education and careers. Their confidence in their major choice, understanding of why they are in college, and ability to articulate career goals suggest the program fostered goal clarity and commitment. The low reporting of barriers like lack of commitment or uncertain goals further supports this interpretation. The primary reported barrier, "increased difficulty of coursework," while a challenge, can also be interpreted positively within SCCT; overcoming challenging tasks is a potent source of self-efficacy [19], provided adequate support (like time and potentially tutoring) is available. The fact that students persisted despite this

difficulty underscores their commitment and potentially enhanced self-efficacy upon success.

B. Fostering Career Identity

The program facilitated several experiences crucial for career identity development. The shift towards employment in cybersecurity roles post-scholarship indicates a strengthening alignment between participants' professional activities and their chosen field. Active engagement in pursuing industry certifications (CompTIA, CISSP, etc.) indicates a commitment to professional standards and identification with the cybersecurity community. Participation in CCDC, while limited to four respondents, represents a significant immersion experience that strongly shapes professional identity and confidence. The value placed on peer interactions suggests the cohort experience itself helped solidify a shared identity as future cybersecurity professionals.

C. Addressing Challenges and Exceptions

Despite the overall positive findings, the ambivalence surrounding the attractiveness of the field for minority and female workers is noteworthy, especially given the program's diverse composition. This may reflect participants' awareness of broader industry challenges related to diversity and inclusion, suggesting that while the program provides a supportive environment, concerns about the external field persist. Further investigation into the roots of these perceptions is warranted.

Similarly, the split opinion on the ease of finding a job, despite high confidence in eventually securing employment, highlights the practical realities of the job market. While the program may equip students with skills and confidence (high self-efficacy and outcome expectations), navigating the application and interview process remains a distinct challenge that may require targeted support (e.g., enhanced career services, networking opportunities).

D. Limitations

The conclusions drawn from this exploratory study are subject to several limitations. The sample size (n=17) is small and may not fully represent the experiences of all 28 scholarship recipients. The reliance on self-reported data introduces potential biases. Most significantly, the lack of a comparison group (e.g., cybersecurity students without the scholarship, students who left the program) makes it difficult to definitively attribute all observed outcomes solely to the Cyber Defenders Program. The sample also underrepresented graduated students compared to the overall cohort. Therefore, the findings indicate positive trends and perceptions among the responding participants but should not be generalized without caution.

E. Conclusion and Implications

This study provides valuable preliminary evidence on the positive impact of the Metropolitan State University

Cyber Defenders Program. Analyzed through SCCT and career identity frameworks, the survey data suggests the program may enhance students' cybersecurity-related self-efficacy, foster optimistic outcome expectations, clarify career goals, and promote the development of a professional identity. Key program elements contributing to these outcomes appear to be the financial support of the scholarship, the creation of a supportive peer cohort, opportunities for professional engagement (certifications, CCDC), and dedicated faculty mentoring.

The findings offer practical implications for Metro State and similar programs. The importance of fostering peer connections and providing strong faculty support alongside financial aid is clearly highlighted. Continued support for activities like CCDC participation and certification preparation seems beneficial. However, the program may need to address student perceptions regarding diversity in the broader field and potentially enhance support for navigating the job search process.

Future research should aim to overcome the limitations of this study. Utilizing larger sample sizes, incorporating comparison groups, employing longitudinal designs to track development over time, and complementing survey data with qualitative interviews would provide a more robust understanding of the program's impact and the mechanisms driving student success in the cybersecurity pipeline. Despite its limitations, this study underscores the potential of well-structured, theoretically informed scholarship programs to cultivate the next generation of cybersecurity professionals.

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