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From Pre-Apprenticeship to Career: A Cohort-Based Approach to Engineering Technology

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Abstract

The semiconductor manufacturing and data center industries offer high-growth, well-compensated STEM career opportunities, yet many community college students remain unaware of these pathways or lack targeted preparation. The Engineering Technology Career Scholars (ETCS) was developed to address this gap through a one-year, cohort-based model leading to a certificate in engineering technology. Grounded in Social Cognitive Career Theory (SCCT), ETCS integrates structured peer networks, contextualized industry experiences, and targeted academic/professional support to enhance students' self-efficacy, outcome expectations, and career identity. Using a Design-Based Research approach, this study examined the experiences of 19 ETCS participants through surveys, feedback, and observational data collected over one academic year. Thematic analysis revealed three key mechanisms supporting persistence and workforce readiness: (1) community engagement via block time, providing opportunity building relationships and mutual accountability; (2) wraparound support beyond coursework, addressing academic, administrative, and professional skill development; and (3) industry engagement with career awareness, providing authentic exposure to STEM-based workplace norms and networking opportunities. Findings highlight the potential of intentional cohort structures to strengthen STEM persistence in community colleges, particularly when coupled with industry partnerships. ETCS illustrates how integrated academic, social, and industry-aligned supports can bridge the gap between technical education and high-demand workforce needs.

Keywords: STEM, cohorts-based learning, engineering technology, career pathways, community college

Introduction

The semiconductor manufacturing and data center industries represent high-growth sectors offering well-compensated, family-sustaining career opportunities for individuals with postsecondary technical training [1]. Entry-level positions often pay over $30 per hour with key benefits that include, tuition assistance, and internal upskilling programs [2, 3]. Yet, despite strong demand, community college and secondary students face barriers such as limited awareness of these career pathways, and a lack of targeted educational programming. To address these challenges we developed a cohort-based STEM program called the Technician Pathway Program (ETCS) that prepares students to earn a certificate in engineering technology and transition into the workforce within a year.

National and regional investments in semiconductor manufacturing and data center infrastructure, have been accelerated by the CHIPS Act [Creating Helpful Incentives to Produce Semiconductors; 4], which has intensified the need for sustainable talent pipelines. Additionally the rapid need for cloud computing and storage due to artificial intelligence has fueled a boom in data center construction across the country. Both industries share a low public profile and limited visibility of associated career pathways, despite their high demand for entry-level technicians

possessing overlapping skills and competencies. Employers increasingly seek partnerships with higher education to align technical training with workforce demands [5, 6]. The ETCS program, which leverages apprenticeships and cohort-based learning, is designed to capitalize on these industry partnerships by providing accessible, high-impact educational pathways tailored to meet workforce needs. Research has shown that cohort based models improve student persistence by fostering peer networks, collaborative learning, and mutual accountability [7, 8, 9]. ETCS builds on these benefits by pairing a structured cohort experience with high-impact educational practices like contextualized industry experiences and targeted academic advising [10, 11]. The focus of this paper is to look at how a cohort-based program supports STEM students in community college technical pathways.

Literature Review

Cohort-based learning models are recognized as effective strategies for improving persistence, engagement, and academic success among community college students, particularly in STEM fields [12, 9]. By progressing through a structured sequence of courses and co-curricular experiences together, students build peer networks that foster mutual accountability, collaborative learning, and shared problem-solving [13, 14]. These networks can alleviate the isolation often experienced by community college students that include balancing work, family, and academic demands, while also serving as a platform for critical supports such as tutoring, advising, and mentoring [15, 16]. Research shows that even modest increases in peer interaction and faculty engagement through cohort models can improve first-year persistence and course completion in community college contexts [9].

When integrated with contextualized industry experiences, cohorts can also influence students' career trajectories by exposing them to workplace norms, role models, and structured pathways into employment [17, 18]. Programs like the Meyerhoff Scholars Program, which combine bridge activities, intentional cohort design, and industry or graduate study pathways, demonstrate the potential of coordinated academic, social, and professional support to improve STEM retention and identity formation [1, 19]. While cohort models are often looked at in four-year university contexts, they remain underexplored in community colleges. ETCS draws from these models, combining high-impact cohort structures with workforce-aligned learning to address the unique challenges of community college students.

Conceptual Framework

While many studies document retention and course performance improvements, fewer studies address how cohorts transform, such as how students see themselves as STEM professionals. Building on these limitations, we use social cognitive career theory [SCCT; 17] to frame this work. The SCCT framework is used for understanding career development and educational decision-making through the lens of social cognitive psychology.-This framework has three core constructs: self-efficacy beliefs, outcome expectations, and personal goals. Self-efficacy refers to an individual's confidence in their ability to perform specific tasks or succeed in particular career domains. Outcome expectations involve beliefs about the likely results of performing certain behaviors, including anticipated rewards or barriers. Personal goals serve to organize and direct behavior, providing motivation and a basis for persistence. In the context of

cohort-based community college programs, SCCT provides a lens for exploring how educational structures influence career development. Also, social persuasion from peers, instructors, and mentors within the cohort can positively influence students' beliefs about their capabilities and career prospects.

Research Design

This study employed a Design-Based Research (DBR) approach to develop, implement, and refine a cohort-based program at a Mid-Atlantic community college supporting students pursuing engineering technology. DBR is used to address the dynamic and context-specific challenges within STEM education, where student needs and industry partnerships continually evolve [20]. As the program coordinators and implementers, Worsley maintained close engagement with students, gathering ongoing feedback to identify emergent issues. These real-time insights guided iterative modifications to curriculum, co-curricular activities, and industry engagement strategies. These refinements aimed to strengthen students' career identity, technical self-efficacy, and sustained peer connections.

Context and Participants

The ETCS enrolled 19 students (15 males and 4 females), ages 18 to 40 selected from a pool of 45 applicants. First, Russell and Labrie reviewed their questionnaire responses and then proceeded with one on one interviews via Zoom. From this pool 22 applicants were chosen, 2 were removed during orientation due to frequent tardiness and not s we hold lateness and non completion of coursework. Since ETCS prepares students to transition into a technician role, lateness and non completion of coursework are held to the highest standards of accountability for students. Repeated failures to complete work and show up on time would result in removal of the program. During the fall semester one student removed themself upon realizing engineering technology was no longer a pathway they wanted to follow. This brought the number down to 19 students. In the ETCS Worsley served as one of the Project Coordinators and had the most contact hours with students. Labrie served as one of the Project Directors and Russell led internal evaluation and research.

Data Sources and Analysis

The data presented in this proposal was collected from August 2024 - May 2025. Data included two open-ended surveys that were administered at the end-of-semester, ongoing participant feedback, and reflective memos from planning and instructional activities. Program adjustments were often informed by student input during classes and activities. Data were triangulated to enhance validity and analyzed thematically [21]. This process aligned with the SCCT framework [17], illustrated how intentionally designed cohort structures can support career identity formation, self-efficacy, and professional community building in community college STEM pathways.

Findings

Analysis of participant feedback, survey responses, and program observations revealed three central themes illustrating how the cohort model supported students' academic and career development in the ETCS: community engagement via block time, wraparound support beyond coursework, and industry engagement with career awareness.

Community engagement via block time

Students consistently emphasized the cohort as a critical source of peer support and relational connection. The structured cohort experience fostered a shared identity and mutual accountability, helping to reduce the isolation and uncertainty commonly felt by first-time college students [10]. Throughout the year, students engaged deeply with one another via a summer bridge program [1], concurrent coursework, and industry visits. Central to these interactions was "block time," a mandatory, twice a week, two-hour session built into the schedule where students could debrief, complete assignments, interact with guest speakers, and receive direct support from Worsley. Block time provided students with regular opportunities to communicate their needs with coordinators providing individualized support through informal one-on-one conversations. For example, some students requested check-ins to help manage the stresses and transition into their first year of college. One student reflected, "*I think it's mainly block that makes me feel a belonging because we always are here doing our work together and if not we are just chilling and having a laugh and to me that makes me feel like we are one big family."* These consistent, structured engagements show the importance of supportive environments in sustaining persistence and self-efficacy [17, 22].

The cohort's social bonds extended beyond scheduled activities. Students built a close-knit community, often studying together outside of class, sharing meals, and coordinating informal gatherings via self-formed group chats. One student noted "*Our cohort has fostered a tight knit relationship with each other, after our classes sometimes we would hang out and study together as a group for upcoming exams. We would even go to get food together after class."* These self-initiated interactions created a sense of shared responsibility and mutual support, helping students manage academic pressures and personal challenges. To further strengthen this community, social activities were integrated into block time, including an escape room challenge designed to promote communication and teamwork. Groups were composed based on student personalities (personality compass – north, east, south, and west) to foster positive interactions, and staff participation helped deepen relationships. A student reflected, "*When we would be celebrated by either taking out to the escape room, Round One, or a potluck, it made me feel as though I was in a community*." These activities contributed to the development of interpersonal skills, social capital, and self-efficacy, which was influential in shaping academic and career persistence [22].

Wraparound support beyond coursework

Participants described ETCS as providing wraparound support that went well beyond traditional academic instruction. This included assistance with administrative tasks, time management, and stress management strategies, which were essential for helping students balance personal and academic demands. One student reflected on the significance of the cohort model, stating, *"The most helpful aspect of the program so far has been the cohort aspect of it. It was really helpful having a group of people who were all having the same struggles as I was*

facing, and it was relieving to have classmates to depend on." This highlights how peer networks and structured supports can buffer challenges and strengthen persistence in STEM pathways [17]. Many students noted this was their first experience with an adult holding them accountable in a sustained, structured way. This accountability extended beyond maintaining good grades, to developing interpersonal, organizational, and professional skills essential for future career success. For example, early in the program students had to complete the college application. This involved navigating multiple online forms, uploading documents, and interacting with the administrative offices. Many were unfamiliar with the process, so coordinators provided step-by-step guidance often reviewing notifications with students and directing them to the appropriate offices. This targeted, real-time support demonstrated the importance of contextual support as a key factor in helping students reach their goal [23].

Industry partner feedback also influenced program topics, especially emphasizing communication skills. The program coordinators reinforced the importance of punctuality when engaging in professional dialogue, and time management to ensure deadlines were met. A formal point system was implemented to track behavioral and participation expectations; students began each semester with zero points, with points added for lateness, absences, or policy violations. This system served both as a means for accountability and as a tool for reinforcing workplace-ready behaviors, echoing Lent and colleagues [17] emphasis on learning experiences that strengthen self-regulation and efficacy. One specific challenge was students' unfamiliarity with email etiquette, such as acknowledging receiving an email, replying for confirmation, or sending requested documents by the deadline. While some verbally confirmed receipt in person, program coordinators explained the importance of documented email communication in academic and professional contexts (i.e. paper trail). Some students read messages but did not reply, reflecting a gap in understanding professional correspondence. The program coordinators addressed this by modeling appropriate responses, sharing real-world and personal examples, and providing immediate feedback. This deliberate skill-building reinforced the development of adaptive skills in authentic contexts, which enhanced both academic persistence and career readiness.

Industry engagement with career awareness

Direct interaction with industry partners through networking events, site visits, and internships/apprenticeships was a vital part of the cohort experience. Many students noted that prior to joining the program, they were interested in certain STEM-based careers but had never visited the related workplaces or interacted with professionals in those fields. To address this gap, a central feature of ETCS was arranging industry site tours to regional employers in the data center and semiconductor manufacturing sectors. These tours lasted for about 2.5 hours, and included facility tours, panel discussions with early-career professionals, and Q&A sessions with hiring managers. These experiences provided students with tangible exposure to workplace environments, expectations, and demands of technicians, which provided invaluable insight. Throughout the year, industry representatives also visited ETCS during block times to share insight on career pathways and engage in informal conversations, enabling students to ask specific questions about hiring criteria and essential skills. One participant reflected, *"The support from the team leaders, as well as the classes provided, the connection to industry leaders and employees have also boosted my chances."* This ongoing, structured engagement helped students build confidence, normalize professional interactions, and gain a clearer understanding

of career pathways supporting the idea that outcome expectations play a role in shaping career-related motivation and decision-making.

ETCS's sustained emphasis on industry engagement also fostered strong networking skills among students. Students created LinkedIn profiles, practiced professional introductions, and strategically collected contacts from the industry professionals they met. These practices reinforced the importance of networking for career development and allowed students to maintain professional connections beyond the program. By the end of the year, students had established robust professional networks that proved valuable when applying for internships/apprenticeships. While program staff facilitated access to some opportunities, students also independently leveraged their LinkedIn connections to identify additional positions. For one student in particular, this skill set was crucial after not securing an immediate job offer; he continued to reach out to his professional contacts, ultimately securing an internship. This outcome reflected how proactive engagement with contextual support, like industry networks, can enhance persistence and resilience in pursuing engineering technology careers.

Discussion

The findings of this study highlight how cohort-based models shaped students' academic and career development within the ETCS. Rather than seeing the cohort as a set of shared courses, participants experienced it as a primary source of belonging, accountability, and persistence. Block time, in particular, served as a core relational element where students could seek support, decompress, and receive immediate guidance. These interactions strengthened students' confidence during their first year of college and normalized asking for help. The wraparound support structures addressed barriers common among community college students, including navigating administrative processes, managing time, and developing networking skills. Students described these supports as essential to professional and personal development, especially the consistent access to staff who were proactive to their needs. Industry engagement further expanded students' understanding of career trajectories, workplace expectations, and pathways into technical roles. Exposure to technicians, hiring managers, and real work environments enabled students to refine their goals and envision themselves in technician positions. The development of LinkedIn profiles, professional introductions, and post-visit networking demonstrated how students began to shift industry exposure into action.

Conclusion

This study shows that the ETCS's integrated cohort approach strengthens students' persistence and emerging professional identities in engineering technology. Community colleges can draw on these insights by embedding industry connections and structured support systems within their pathways to better prepare students for high-demand technical careers.

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