DUE Collaborative Research: Gateway or Gatekeeper: Understanding Why Students Choose Engineering Technology or Engineering and the Implications of This Choice - Phase 2

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Dr. Anne M. Lucietto has dedicated her research to advancing engineering technology education. She particularly emphasizes understanding the experiences, motivations, and career trajectories of engineering technology students. Her work contributes to developing effective academic pathways that align with workforce needs and student aspirations.

In the classroom, Dr. Lucietto employs an active learning approach that fosters engagement, collaboration, and the development of practical, hands-on skills. Her teaching style encourages students to apply theoretical knowledge to real-world challenges, preparing them for success in both academic and professional environments. Currently, she is exploring student perceptions of workforce readiness, industry engagement, and the impact of experiential learning opportunities on career development. Her research is part of a broader effort to inform curriculum design, faculty practices, and institutional strategies that support student success in STEM fields.

Dr. Lucietto's commitment to student-centered education and her contributions to engineering technology research make her a valuable leader and a strong advocate for continuous improvement in STEM education.

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This poster paper presents findings from Phase 2 of an NSF-funded study investigating workforce development and academic/career pathways for students enrolled in engineering technology (ET) bachelor's programs. Building on the qualitative insights from Phase 1 which explored student motivations, barriers, and career perceptions [1], Phase 2 adopts a quantitative approach using a structured survey instrument. The survey was designed to reflect the themes identified in Phase 1, enabling comparative analysis and broader generalizability across institutions in Phase 3.

Phase 2 engaged a sample of ET students from two academic institutions, collecting data on educational experiences, career aspirations, industry engagement, and perceptions of workforce readiness. This approach allowed the research team to validate and expand upon Phase 1 findings, while also uncovering new trends that may inform future interventions.

Preliminary results underscore the importance of experiential learning, industry-aligned curricula, and clearly defined career pathways in promoting student success. The data also reveal nuanced differences in student experiences based on institutional context, and program structure. These insights are critical for developing scalable strategies aligned with NSF's goals of broadening participation and strengthening the STEM workforce. This paper summarizes the implications of Phase 2 findings for engineering technology education, offering recommendations for curriculum development, faculty engagement, and industry collaboration. It also outlines next steps for dissemination and future research, contributing to the national dialogue on effective workforce development in STEM education.

Keywords: Engineering Technology, Workforce Development, Student Pathways, STEM Education, Quantitative Research

Introduction

The growing national demand for a skilled engineering technology (ET) workforce has intensified the need to understand how students enter, navigate, and succeed within ET bachelor's degree programs [2, 3]. As industries increasingly rely on technology-driven processes, automation, and applied engineering skills, institutions are under pressure to prepare graduates who are workforce-ready and capable of contributing to rapidly evolving technical environments. Addressing this need requires a deeper examination of student experiences, motivations, and the pathways that shape their academic and career trajectories.

Phase 1 of this NSF-funded study provided foundational qualitative insights into these pathways by exploring ET students' motivations for selecting their programs, the barriers they encounter, and their perceptions of career opportunities. Themes such as the importance of hands-on learning, flexible program structures, and uncertainty about long-term career options emerged as significant influences on student decision-making and persistence. These findings established a thematic framework for subsequent stages of the research. Building on this foundation, **Phase 2** employs a quantitative methodology to validate and extend the Phase 1 findings through a structured survey administered at two institutions. This phase enables broader comparative analysis, offering a more generalizable understanding of student experiences and workforce readiness indicators across diverse ET programs [4].

This paper presents key results from Phase 2, highlighting trends in student pathways, educational experiences, and career aspirations, and discusses their implications for curriculum development, faculty practice, and industry collaboration. By integrating insights from both phases, the paper contributes to ongoing efforts to strengthen ET workforce preparation and supports strategic decision-making for educators, institutions, and policymakers [5].

Background and Relevant Literature

Engineering technology (ET) programs play a vital role in preparing the applied engineering workforce that industry depends on [5]. As companies continue to face shortages of technically skilled professionals, the question of how ET programs support student learning and workforce readiness has become increasingly important. These programs are designed to blend theory with hands-on practice, and understanding how students move through them is key to strengthening the broader STEM workforce pipeline [6].

Students arrive in ET programs through many different pathways. Some transfer from two-year colleges, others transition from the military or skilled trades, and many choose ET because they prefer practical, applied learning. These varied backgrounds shape the expectations students hold for their education and careers. Prior studies have shown that students are often motivated by opportunities for hands-on work and real-world problem-solving, but they may also encounter barriers such as limited awareness of ET career options or uncertainty about how their degree will translate into long-term employment. Research has also highlighted that experiences like internships, industry engagement, and collaborative projects can significantly influence students' confidence and sense of workforce readiness.

This study contributes to that growing body of work by examining ET student experiences on a larger scale. Phase 1 offered important qualitative insights into what motivates students, the challenges they face, and how they envision their careers. Phase 2 builds directly on that foundation by using a structured survey to test these themes across multiple institutions. By combining the depth of the qualitative work with the broader reach of the quantitative phase, this

research provides a more complete picture of the factors shaping ET pathways and identifies opportunities to improve student support and workforce preparation.

Research Design and Methods (Phase 2)

Phase 2 used a quantitative design to extend themes from the earlier qualitative phase. Drawing on motivations, barriers, and career perceptions identified in Phase 1 interviews, the team developed a survey to capture these factors across a broader sample of engineering technology (ET) students. The instrument included items on educational experiences, hands-on learning, industry engagement, workforce readiness, and clarity of academic and career pathways, combining Likert-scale questions with limited open-ended prompts. ET faculty and education researchers reviewed the survey for face validity and alignment with Phase 1 constructs.

Students from two ET-granting institutions were recruited, representing different program structures and contexts. The electronic survey was voluntary and anonymous. Descriptive statistics and cross-tabulations were used to examine patterns by academic year, institution type, and student background, allowing the team to assess the consistency of Phase 1 themes and identify new trends emerging from a larger sample.

Results

The findings from Phase 2 echo several themes identified in the qualitative phase while also uncovering new patterns in how students experience ET pathways. Students consistently reported that hands-on learning, lab-based instruction, and real-world applications were central to their engagement and confidence in the program. Many indicated that these experiences were the primary reason they chose ET over other STEM majors.

Students also highlighted the importance of clear and well-supported pathways through their academic programs. Those who reported positive advising experiences and strong faculty interactions also tended to report higher levels of confidence in their career readiness. However, the data revealed differences across institutions: students in programs with structured industry partnerships, required internships, or active student organizations reported stronger connections to the workforce and more clarity about potential career opportunities. Barriers identified in Phase 1 were also reflected in the survey results. Some students expressed uncertainty about the range of careers available to ET graduates, while others noted challenges related to course sequencing, scheduling, or balancing work and school responsibilities. These findings point to opportunities for strengthening support structures within ET programs.

Overall, the results suggest that experiential learning, industry engagement, and transparent academic pathways play central roles in shaping students' perceptions of their readiness to enter the ET workforce.

Discussion

Taken together, Phase 2 findings provide a clearer view of ET student experiences and workforce preparation. The strong alignment between Phase 1 themes and Phase 2 data underscores the central role of hands-on learning and applied problem-solving in attracting students and supporting professional readiness.

Results also highlight how faculty guidance and institutional structures shape students' confidence in their academic and career pathways. Programs with consistent advising, aligned curricula, and strong industry connections appear to better support workforce preparation, suggesting that internships, industry partnerships, and applied projects can meaningfully influence student outcomes.The survey also identifies ongoing challenges, including uneven advising, limited awareness of ET career options, and workload or scheduling barriers, pointing to areas where programs can strengthen student support.

Phase 3 will broaden the survey across more institutions, enhancing generalizability and enabling deeper analysis of institutional differences. Combined insights from all phases will inform program design, support workforce development priorities, and contribute to national conversations about ET education.

Implications for Engineering Technology Education

The findings from Phase 2 point to several important implications for engineering technology (ET) programs as they work to strengthen student learning experiences and support workforce preparation.

Curriculum Development. Survey responses reinforce the central role of applied hands-on learning in student engagement and confidence. ET programs may benefit from expanding opportunities for project-based coursework, integrating emerging technologies into lab activities, and ensuring that course sequences clearly support skill development tied to industry needs. Aligning curricula more intentionally with workforce competencies, including troubleshooting, teamwork, data literacy, and industry-specific technical skills, can help students better understand how their academic preparation connects to real-world expectations.

Faculty Engagement. Faculty play a significant role in helping students navigate academic and career pathways. The results suggest that consistent advising, clear communication around course planning, and faculty availability contribute to students' sense of preparedness. ET programs may consider supporting faculty development initiatives focused on advising, mentoring, and incorporating industry-relevant content into coursework. Creating structured opportunities for faculty–student interaction—whether through capstone projects, student

organizations, or informal mentoring—can also strengthen connections that support student persistence.

Strengthening Industry Collaboration. The data indicate that students who engage early and often with industry—through internships, co-ops, guest speakers, or sponsored projects—report higher confidence in their workforce readiness. Expanding these partnerships can help programs stay closely aligned with evolving industry needs while giving students valuable exposure to workplace expectations. Institutions might explore building or formalizing advisory boards, deepening relationships with local employers, or co-developing curriculum modules with industry partners. Such collaborations ensure that ET programs remain responsive and relevant.

Alignment with NSF Priorities. The survey findings also highlight opportunities to advance NSF goals related to broadening participation and strengthening STEM workforce pathways. Students entering ET programs from diverse educational routes may require targeted supports—including bridge courses, flexible scheduling, or enhanced advising—to reduce barriers and improve retention. Results from Phase 2 can guide the development of interventions that promote equity, expand access to applied learning experiences, and create clearer connections between academic programs and high-demand technical careers. By doing so, ET programs can help broaden participation in STEM while contributing directly to national workforce development goals.

Overall, the implications from Phase 2 suggest that coordinated efforts across curriculum, faculty practice, and industry engagement can make a meaningful difference in preparing ET students for successful careers. These findings can help programs refine their approaches as the study moves into Phase 3 and expands to include a broader set of institutions.

Next Steps and Future Work

Phase 2 established a solid baseline on all engineering technology (ET) students' experiences and workforce preparation while revealing avenues for deeper analysis. Phase 3 will broaden the survey across more institutions varying by region, size, and program model to enable stronger cross-institutional comparisons of how context, structure, and industry partnerships shape student pathways. We will integrate qualitative and quantitative findings, triangulating Phase 1 narratives with Phase 2 trends to confirm convergences, surface discrepancies, and refine conclusions about drivers of success and readiness. The survey will be updated based on Phase 2 results retaining items aligned with Phase 1 themes, revising lower-clarity or lower-reliability items, and adding questions on emerging industry needs, belonging, and experiential learning. Long term, we will deliver evidence-based recommendations, benchmarking tools, faculty resources, and industry-engagement guidance to help ET programs create environments where diverse students thrive.

This paper was streamlined using Enterprise Copilot to meet the five-page limit and Grammarly to check punctuation and spelling..

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