Strategies to Increase Awareness, Recruitment, and Success in Community College Advanced Technical Education Programs

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Abstract: Community College Advanced Technological Education programs are prime sources for educating students for employment into the Skilled Technical Workforce, such as micro nanotechnology, biotechnology, and autonomous technologies. However, community college technical education programs struggle to make students aware of program availability, recruitment, and graduate students into the workforce. Recruitment and retention are fundamental to any workforce pipeline. Therefore, programs in biotechnology, nanotechnology, advanced manufacturing, autonomous technologies, and other Skilled Technical Workforce certificate and associate degree programs must increase awareness and recruitment strategies or continue with low enrollment and eventual discontinuation of programs. Strategies used to increase awareness of technical education programs to the public, community college students, administrators, and industry partners will be described in this manuscript.

Keywords: Recruitment, Success, Program Completion

Introduction

It is expected that 3.4 million skilled technical jobs will need to be filled by 2022 [1]. Many of these jobs are filled through community college technical workforce programs, which recruit and prepare students with the knowledge, skills, and abilities vital for successful employment in these advanced technological industries. The National Science Board (NSB) therefore recommended the following to increase Skilled Technical Workforce (STW) opportunities [2].

1. **"Change the Message"**: The NSB, National Science Foundation (NSF), and national leadership in science and engineering will communicate the importance of the STW and raise awareness of STW careers and educational pathways to parents, educators, and students. The keys to increasing awareness among education stakeholders are to demonstrate how crucial the STW is to science and industry, advertise the multiple educational pathways into today's knowledge-and-technology-intensive world and publicize the variety of career opportunities within the STW.
2. **"Focus on the Data"**: NSF will promote partnerships among industry/academic stakeholders within STW training institutions to collect, share, and analyze data leading to the development of STW education practices.
3. **"Leverage the Portfolios of Federal Investments"**: The NSF will analyze its STW investments across education, research, infrastructure, data collection, and analysis to determine optimal strategies to build awareness of funding opportunities and leverage these investments to maximize impact.

4. **"Build Partnerships"**: NSF will foster a community of partnership among K-12, two-year colleges, four-year universities, workforce development programs, and industry leaders to grow an STW program tailored to the needs of local communities.

These NSB recommendations are ideal to be implemented in community college technical education programs. However, current recruitment and success in many technical education disciplines, such as micro nanotechnology, biotechnology, advanced manufacturing, and autonomous technologies, among others, has three major challenges:

1. The overemphasis and recruitment of four-year research university baccalaureate and doctorate students into STEM Skilled Technical Workforce positions.
2. The low enrollment and understanding of students to opportunities provided through community college technical education programs.
3. General awareness and connection with new and emerging technologies.

One example that demonstrates these challenges was displayed at community meetings with Biotechnology Program Department Chairs and faculty at community colleges. The number one challenge for the Biotechnology programs was recruiting students [3]. The consensus was that community college workforce programs, such as Biotechnology, suffer from the wrong brand identity. Parents, even many parents who work at the community college, do not support their children attending a community college to gain a well-paying job. The idea that a person would need to attend a baccalaureate-granting university to gain a well-paying job is challenging, especially in fields where industry also feels they should hire students from universities granting higher degrees. Biotechnology is one of these industries. So, community colleges have developed biotechnology certificates for post baccalaureates and now are starting to offer four-year biotechnology degrees. But there is a place for the biotechnology associate's or technical certificate degree in industry and therefore for the student who earns this degree. In fact, a study done by Genentech showed increased persistence of community college students in entry-level technician jobs compared to four-year students [3]. Students in the Genentech study from technical education programs were more likely to stay in their jobs longer than four-year university students. It is essential to match the student with the job to ensure expectations both on the student and the employer sides are properly matched to retain the workforce.

In addition, emerging or breakthrough technologies often disrupt a defined degree pathway to a career. The Massachusetts Institute of Technology recently defined emerging or breakthrough technologies as "a technology, or perhaps even a collection of technologies, that will have a profound effect on our lives" [4]. Autonomous Technologies are proving to be precisely that. According to the Rocky Mountain Institute, the rise of automated mobility services could be one of the most interesting and complex disruptions of the modern era [5]. The personal mobility market is a $1 trillion market, with 41% of users indicating that they would use autonomous vehicles. The managing director of one of Silicon Valley's leading venture capital firms sees it like this:

> *"The PC revolution gave us major computer manufacturers, big disk drives, and memory companies. So with the internet companies like Google, and already from mobile phones, we have seen breakout successes from a new breed of mobile-focused companies. Expect the same from the transportation revolution. Somewhere out there, in garages and dorm rooms, entrepreneurs are beginning work on the company that will do for autonomous vehicles what companies like Intel did for PC processing, what companies like AT&T did for mobile phone networks, and what companies like Norton and McAfee did for PC security"* [4].

The PC revolution created new occupations and demanded skills unheard of even 15 years ago. Think app developer, podcast producer, cloud architect, and social media manager, to name a few. In just that way, Autonomous Technologies are innovative, transformative, and need skilled technicians for job titles that are just being created and those that do not yet exist. Advancing technician education in all the different careers that the ubiquity of autonomous technologies will create is rapidly evolving and critical to maintaining the role of the United States as a competitive global leader in this fast-moving field.

Technical education educators within the Advanced Technological Education (ATE) program must identify strategies to increase awareness, recruitment, and completion of technical education programs. In addition, partnerships must be built with industry to provide graduating technical education students placement in industry jobs.

Strategies to Increase Awareness

Recently, Pasadena City College surveyed 645 community college students enrolled in lower-division chemistry courses to determine awareness and interest in technical education as an academic and career choice. Over 94% of students selected transfer as one possible outcome compared to 41% who aim to earn an Associate's Degree and only 11% who desire to obtain a Certificate of Achievement or Occupational Certificate (Figure 1). The overall transfer rate for California Community Colleges is less than 10%. There is an obnoxious disconnect between the expectations and availability of opportunities for STEM students at community colleges to transfer to baccalaureate-granting institutions. Many Associate's Degrees earned at Pasadena City College are Associate's to Transfer degrees, not necessarily degrees used to apply for employment in the STW. Students must be made aware of the limited transfer options and guided to more available technical education degree programs that can lead to employment directly from community colleges.

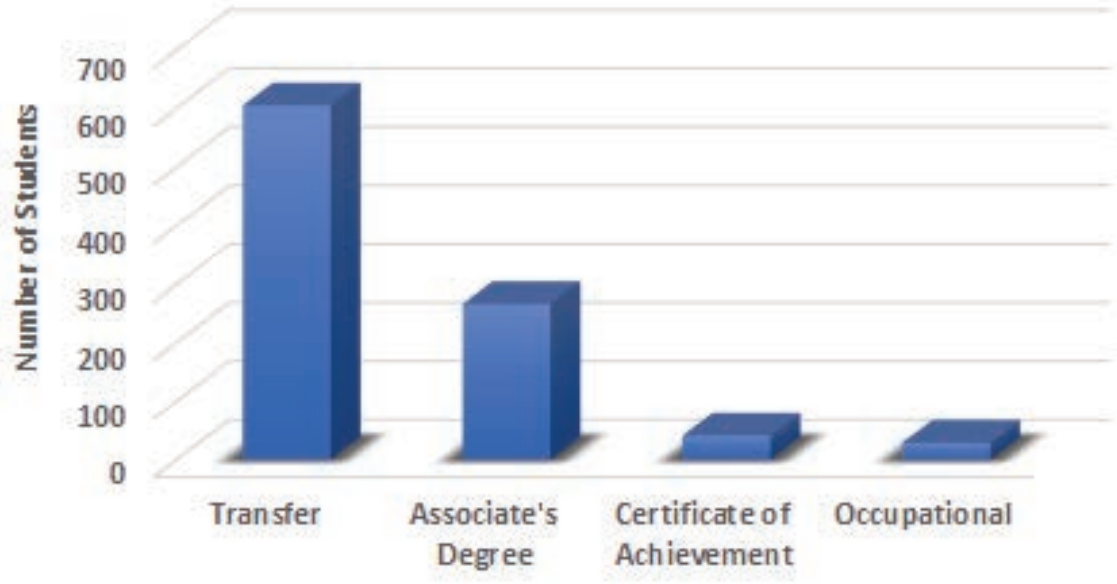

Fig. 1. Outcomes Students Have Considered at Pasadena City College

Pasadena City College has 141 Associate Degrees and 99 Certificate of Achievement Degree programs. Certificates of Achievement include Biotechnology, Laser Technology, Geotech, and Computer Information Systems. A total of 155 students had considered earning a degree in one of these programs (24%), with the majority 107 indicating that biotechnology was a degree pathway of interest (Figure 2). Over the last 20 years, biotechnology has developed into a robust technical education program with opportunities across the country. It is vital that additional technical education programs develop sustainable models like biotechnology to build a foundation of advanced technological education degrees that can increase degree and employment opportunities.

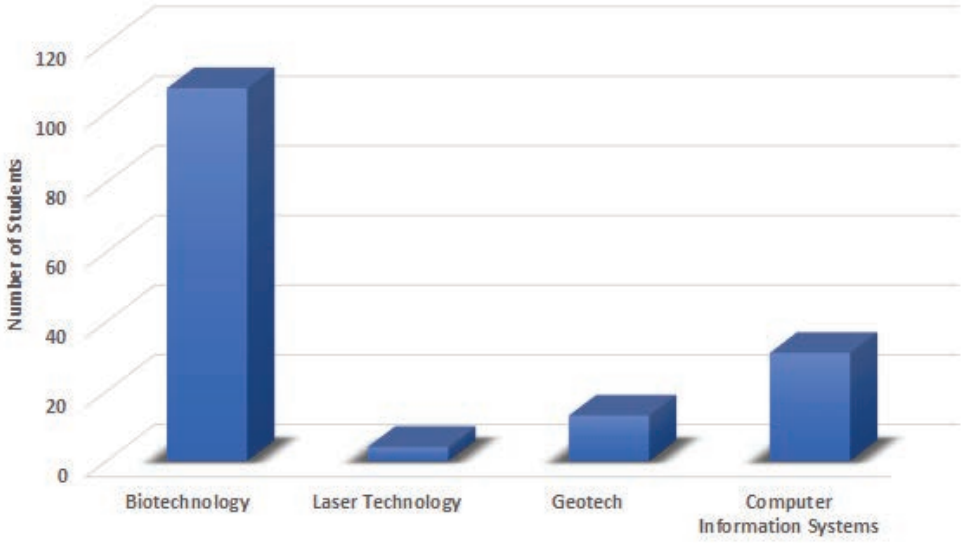

Fig. 2. Technical education pathways that community college students are interested in at Pasadena City College

Surveys conducted by the supplemental instruction program in chemistry asked students if they were aware of any other technical education pathways at community colleges that lead to STW jobs. Out of 620 students, only 33, or just over 5%, were aware of different technical education programs. However, in a follow-up question, if students would be interested in a Nanotechnology degree program at community college, 223 or 35% said they would be interested. The challenge is not the interest students have in advanced technological education programs. Instead, students are not aware that these programs exist.

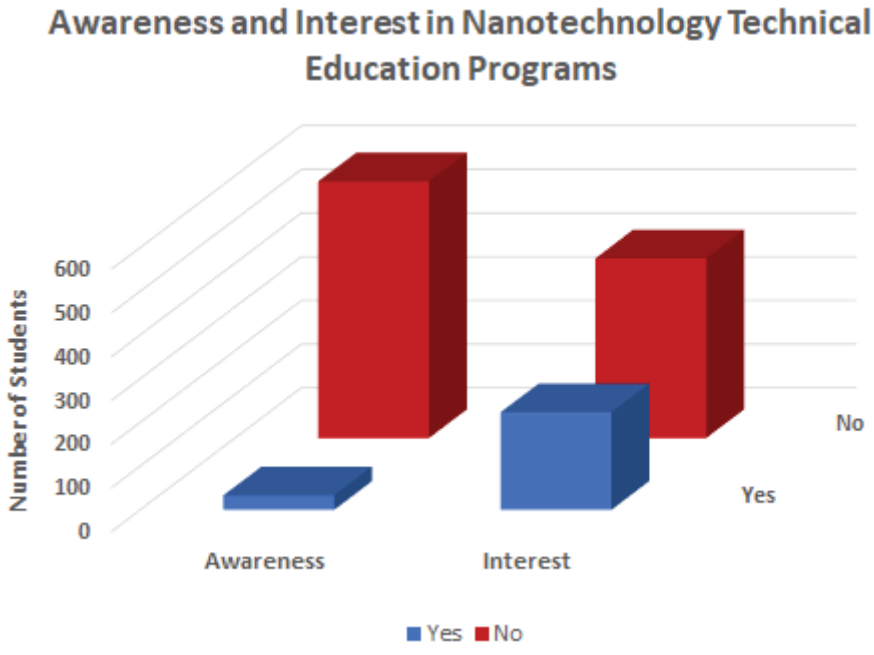

Fig. 3. Awareness and interest in a Nanotechnology technical education program at Pasadena City College

The advanced technological community should focus on creating outreach and dissemination programs tailored to increase awareness of community college students into certificate and associate's degrees that lead to jobs. Three focus areas on increasing awareness can be:

- **Better use of Social Media:** Work with social media experts to create content on social media platforms students currently use, such as Tik Tok, not on platforms such as Facebook that students do not commonly use at community college.
- **Increase buy-in from the administration:** Work with community college administrations to create programs and recruit newly hired faculty to organize and lead technical education programs at community colleges. Focused professional development on these new faculty, who are are more likely to implement the strategies shared at professional development workshops.
- **Increase engagement from industry:** Develop Business and Industry Leadership Teams to provide industry a strong voice in determining optimal pedagogy and share the future trends needed to be taught by technical education programs.

An additional NSF ATE program in autonomous technologies, the National Center for Autonomous Technologies, was launched in 2019. In the second year of operation, NCAT's primary focus on outreach has strengthened communities, promoted engagement, and created partnerships with educators, industry, and government agencies. Over a year, NCAT delivered 45 events, engaging more than 5,200 individuals through in-person and virtual workshops, presentations, webinars, and STEM events. The events ranged from workshops, webinars, presentations, and conferences, to STEM/AT specific events and numerous professional development experiences. In addition, through targeted social media outreach, NCAT had over 300,000 interactions, drawing more than 15,000 users to the robust library of education resources on NCAT's website.

Success in using social media as a means of communication and outreach is expanding to reach a more diverse audience. Social media channels (LinkedIn, Twitter, Instagram, and YouTube) offer a way to build relationships and connect with the AT community, increasing visibility and credibility by sharing expertise and thought-leadership in autonomous technologies technical education. In addition, the use of social media as a connection, collaboration, and engagement tool expand beyond the physical classroom or office. It allows a platform to create a better public understanding of the emerging technology.

NCAT has also partnered with government organizations such as the Federal Aviation Administration (FAA) to bring together communities of educators with certificate and degree programs in unmanned aircraft systems technology. NCAT has taken a significant leadership role in the FAA Unmanned Aircraft Systems Collegiate Training Initiative (UAS-CTI). Since 2020 this initiative has had a significant coast-to-coast impact, reaching more than 84 member organizations across 39 states. Most of the organizations are community colleges. The UAS-CTI mission is to collaborate with selected colleges and other organizations to deliver up-to-date UAS training tools, resources, and guidelines to prepare students for UAS careers. As the designated repository and resource hub for the UAS-CTI community, NCAT provides access to its extensive collection of interactive educational content, curriculum, workshops, presentations, and other resources. The website has become a forum for exchanging ideas and launching new initiatives. This type of relationship with the FAA is a model for how academia and government organizations can work together to create resilient partnerships that prepare the nation's workforce for the future.

Forming a collaborative environment that includes industry leaders, technical education community college faculty, community college administrators, and current and former technical education students will provide the best chance to increase awareness in community college technical education programs.

Strategies to Increase Recruitment

Community college STEM programs have typically focused on transfer over earning a degree that leads to employment. The minimization of certificate degrees vested by industry, leading to Skilled Technical Workforce jobs, is a disservice to students. This trend is especially true since the number of transfer opportunities for community college students is limited. Focus on recruiting students into Associate or Certificate degree programs that lead straight to employment would benefit an abundance of students when completed at community college. To increase the recruitment of students into these degree pathways industry needs to provide mechanisms to support the learning of technical education students. Industry can get actively involved in recruitment through:

- Partnering with technical education programs through Business Industry Leadership Teams where industry assists in curriculum guidance to improve technical education curriculum to current trends in industry will make programs more engaging and lead to current jobs within the technical education community. It is essential in the recruitment phase to provide possible outcomes from technical education programs.
- Recruit students through course-based undergraduate research experiences (CUREs) embedded within the introductory STEM courses at the start of a student's STEM academic pursuit. Use CURE's within the course to introduce students to technical education pathways and outcomes available through this path.
- Utilize informal supplemental instruction sessions to expose students to everyday life applications of Nanotechnology, Biotechnology, Autonomous Technology, and more and the availability of the related technical education programs.
- Highlight technical education as an attractive path through "Careers in STEM" summits and series, which can be provided through campus affiliations, such as clubs, Veteran's resource centers, or campus organizations like the Mathematics, Engineering, Science Achievement Program (MESA).
- Utilize social media in outreach and organize a website that shows each technical education program, discipline, and campus across the United States.
- Provide faculty-mentored undergraduate research experiences and industry apprenticeships that provide advanced experiences in preparation for employment into the STW.
- Have program alumni participate in speed networking sessions with potential students to share their job experiences with potential candidates. Students listen to previous students (now alumni and on the job) because they identify with them.

Recruiting students into careers rapidly impacted by technology can create challenges in defining a clear path. In some cases, the technology, industry application, and career titles move so quickly that educational programs lag in catching up. NCAT views extracurricular activities such as student competitions as a way to engage students in thinking about a variety of tracks that support developing the 21st-century workplace skills desired by industry partners. For example, the MATE ROV Competition challenges students worldwide to engineer Remotely Operated Vehicles (ROV) to complete a set of mission tasks based on real-world workplace scenarios. Students transform their teams into start-up companies that, in addition to their robots, prepare technical reports, create marketing displays, and deliver engineering presentations.

A 2020 report [6] discusses the competition's impact on developing skills critical to the future of work. Eighty-nine percent (89%) of the alumni credited the ROV competition with having at least a little influence on their educational or career path. Roughly one-third (34%) indicated that the competition influenced them to a great extent, and 38% marked that the competition influenced them somewhat. Students engaged in competitions learn skills, explore technology applications, and see the landscape of career opportunities, which can help inform their educational pathways.

Strategies to Increase Completion

The last component of a successful technical education program is student completion. According to the American Association of Community Colleges Voluntary Framework of Accountability, only 59% of community college students successfully complete an outcome in six years. More worrisome is using the Integrated Postsecondary Education Data System measure only 25% of community college students have a successful outcome within three years of beginning their academic journey. Technical education degrees provide a less time-consuming opportunity to earn a satisfactory outcome within two years of enrollment. The majority of technical education programs can be completed within two years. More importantly, programs can develop class strategies and program opportunities to increase successful completion.

Technical education programs can increase success and completion by implementing active learning strategies within program design. For example, course-based undergraduate research experiences and industry-derived projects have been shown to increase success by providing students with in-class research projects focusing on critical thinking, communication, and teamwork skills. These skills are beneficial to the technical education jobs students pursue and provide opportunities to develop essential STW knowledge, skills, and abilities. In addition, partnering with industry and research universities to provide paid internships or apprenticeships will foster greater engagement with industry and begin networking within technical education industries. These two components will significantly increase success and completion among technical education pathway students.

Discussion and Conclusion

Technical education programs provide excellent opportunities to community college students to earn a degree and directly enter the workforce. Obviously, this message is not being heard as many programs, especially micro nanotechnology, biotechnology, and autonomous technologies, suffer from low enrollment and are often discontinued. Therefore, the message concerning what community college technical workforce programs can provide needs to be changed. Approaches to change this message are as follows: (1) Provide students with direct examples and role models of individuals working in the field from various backgrounds to strengthen their scientific identity and shift stereotypes around who works in science for community college students [7]. (2) Produce outreach materials, such as the *Talking Technicians* podcast, to provide stories from working technicians to share with community college students interested in obtaining a technical education degree. (3) Establish an alumni network for the purpose of setting up speed networking events where alumni talk with potential or existing students sharing their experiences. Most importantly, partner with industry leaders in creating recruitment strategies and developing an engaging curriculum that focuses on the current needs of industry.

The message needs to be based on data. Programs, industries, and others need to collect data to demonstrate the effectiveness of these workforce programs. One example of a data-driven organization is based on a Pew Research Center saying that social media is an effective tool for raising awareness and creating sustained movements [8]. Utilizing data, outreach, and decimation strategies can be planned and implemented through partnerships among NSF ATE Centers and programs. Leverage the federal portfolio and build partnerships with other federally funded initiatives that intersect with the ATE portfolio, such as the Manufacturing Institutes. For example, InnovATEBIO partners with both BioMADE and NIIMBL manufacturing institutes to help spread the message that community college biotechnology workforce programs are doing an excellent job of producing the technicians needed by industry. Finally, building partnerships with industry, policymakers, and others are also the way to change the message. Community College technical education programs cannot be the choir for their success. Industry partners outside of the community college arena need to promote us. Community College technical education programs cannot only rely on promoting themselves.

It is imperative that technical education programs actively recruit and support community college technical education students. Industries need workers, students need jobs, and advanced technical education can provide the support and opportunities to satisfy both.

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