

Advancing Two-Year Degree Students Towards a Bachelor's Degree in Engineering Technology: A Pilot Study

Dr. Md. Ali Haider, Austin Peay State University

Dr. Md. Ali Haider is an Assistant Professor at Austin Peay State University, serving as the concentration coordinator for Electronics and Electrical Engineering Technology. His research interests include Biomedical Signal Processing, Brain-computer interface, Image processing, Artificial Intelligence, Machine Learning, and the Internet of Things (IoT). Dr. Haider has authored multiple publications on signal and image processing and serves as a reviewer for several international conferences and peer-reviewed journals, including IEEE WF-IoT, IEEE EIT, IEEE Signal Processing Letters, Journal of Signal Processing Systems, and Remote Sensing of Environment.

Dr. Hossain Ahmed, Austin Peay State University

Hossain Ahmed earned an M.S. in mechanical engineering from Lamar University and a Ph.D. in mechanical and energy engineering from the University of North Texas. Dr. Ahmed is an assistant professor in the Department of Engineering Technology at Austin Peay State University, TN. His research interests are computational fluid dynamics (CFD), corrosion, and structural health monitoring (SHM). Dr. Ahmed has authored many journals, conference articles, and book chapters. He also serves as a reviewer for several international conferences and peer-reviewed journals.

Mahesh Kumar Pallikonda, Austin Peay State University

Dr. Mahesh Kumar Pallikonda is a faculty member in the Department of Engineering technology at Austin Peay State University (APSU). Prior to his academic career, he gained valuable industry experience in roles ranging from New Product Development to Process Control. He holds a Ph.D. and a Master's degree in Mechanical Engineering from Cleveland State University, as well as a Bachelor's degree in Manufacturing Engineering from the National Institute of Advanced Manufacturing Technology. Prior to joining APSU, he served as a faculty member at Ohio Northern University, where he taught courses on the fundamentals of electronics, including electrical circuits. At APSU, Dr. Pallikonda instructs courses specializing in Robotics and its applications, Engineering Economics, CAD and Manufacturing processes. Dr. Pallikonda is passionate about educating and inspiring the next generation of engineers, technologists, and innovators through his lectures. He is deeply committed to advancing the fields of robotics and manufacturing through interdisciplinary research in connected devices and Industrial Internet of Things (IIoT). His research interests span Manufacturing, Material Science, pedagogy, Lean Six Sigma, and Industry 4.0

Prof. Ravi C Manimaran, Austin Peay State University

Ravi C Manimaran is a Professor and Chair of the Department of Engineering Technology, Austin Peay State University, Clarksville, Tennessee. His education includes two Master of Science degrees in Electrical and Computer Engineering and Electronics and Control Engineering. He has been actively involved in higher education leadership in various capacities as a Dean, Department Chair, PI, Project Director, and a faculty member since 1997. He has served as the PI / Project Director for multiple agencies including NSF, DOL, DOD, and Perkin's Grant. His research interests include Industrial Automation Systems, VLSI, ASIC, and FPGA. Other areas of interest are Active Learning, Innovative Pedagogy, Higher Education Leadership and Accreditation including ABET.

Advancing 2-Year Degree Students Towards a Bachelor's Degree in Engineering Technology: A Pilot Study

Abstract:

The majority of the students who complete a 2-year degree program often find themselves perplexed, and uncertain about their chosen major and potential career paths. This uncertainty is partly due to their limited exposure to the local industrial landscape, which hinders them from making informed decisions about their future. Consequently, these students may encounter difficulties as they strive to transition from the confines of a smaller community college to a larger, more comprehensive institution, especially when aiming to pursue a major in engineering technology. This comprehensive study is dedicated to investigating the multifaceted process of transitioning from a 2-year degree program to a 4-year curriculum, focusing specifically on Engineering Technology. The primary objective is to identify the challenges and opportunities inherent in this educational journey and to formulate effective strategies for its refinement. Several challenges, including apprehensions about adapting to a larger campus environment, concerns about the advanced curriculum, anxiety related to mathematics, and uncertainties about interactions with future instructors may play key factors that can leave students in community colleges feeling hesitant and unprepared for the academic leap to a 4-year program. This study highlights the opportunities that can either eliminate or alleviate such hurdles. It aims to identify the contributing factors and the barriers to achieving a more accessible and prosperous pathway for students as they transition from a 2-year degree to a 4-year program in Engineering Technology.

Introduction:

The process of obtaining a 2-year Engineering Technology education degree is usually viewed as an efficient way to enter the workforce quickly. However, graduates of these programs may face limitations in terms of career opportunities. A literature review was conducted to understand the factors that influence the decisions of engineering transfer students.

The literature review emphasized the importance of supporting the transfer of STEM majors from community colleges through relevant initiatives. Such initiatives offer advanced scientific knowledge, and laboratory experiences, and inspire aspirations for graduate school, thereby enabling these graduates to pursue a comprehensive education that opens up numerous career options. However, the review also highlighted the challenges faced by community college students and faculty in participating in these initiatives[1].

It was reported that effective transfer strategies were developed to customize research experiences for community colleges and establish long-term partnerships with four-year institutions, to improve accessibility and tackle obstacles [2]. These initiatives aim to expand opportunities for community college students and broaden their career prospects. Extending Engineering Technology programs to incorporate a more comprehensive curriculum offers numerous potential benefits for graduates and the economy. By providing students with a deeper understanding of their field and a broader skill set, these programs aim to better prepare graduates for the modern workforce. With a stronger educational foundation, graduates are poised to secure higher-paying jobs and contribute more effectively to economic growth.

Graduates seeking employment in modern industries must be proficient in advanced technologies. A deep understanding of these tools and techniques can be gained through extended degree programs. By spending more time studying, students can explore these technologies in greater detail and gain hands-on experience that aligns with industry needs. This is necessary because modern industries rely heavily on advanced technologies, and graduates must remain competitive in the job market. The incorporation of specialized courses and internships into the curriculum provides students with a deeper understanding of industry-specific knowledge and skills[2].

Indeed, the availability of extended degree programs and specialized courses and internships in the curriculum allows students to develop practical skills and industry-specific knowledge that enhances their employability upon graduation. Moreover, the inclusion of a broader range of general education courses in extended degree programs offers students a well-rounded education without the need for additional coursework or degrees in other disciplines.

Occupational and Economic Benefits:

Literature suggests that individuals who pursue two-year Engineering Technology programs may have a higher chance of securing immediate employment opportunities. However, these programs may have certain limitations that could hinder their career growth in the long run. For instance, graduates of these programs may have a limited skill set that may restrict their ability to adapt to rapidly changing industry trends or take on more complex job roles. Moreover, shorter programs may not provide graduates with a comprehensive understanding of engineering principles, project management, and problem-solving abilities, which are crucial for career advancement. As a result, individuals who pursue four-year degrees may have a distinct advantage over those who opt for shorter programs, as they are better equipped to handle the dynamic nature of the engineering and technology fields[3]. Additionally, individuals with four-year degrees may earn higher salaries throughout their careers compared to those with two-year degrees[4].

Economic Opportunity:

Short-duration Engineering Technology programs play an essential role in providing immediate workforce entry opportunities. However, extending the program duration to four years can unlock a broader range of career possibilities and enhance the overall economic prospects for graduates. By offering a more comprehensive education that covers a wider spectrum of skills and knowledge, students are better prepared to adapt to industry changes, advance in their careers, and make significant contributions to the economy[5].

Therefore, it is essential to strike a balance between short and long-term programs to provide a general approach to Engineering Technology education, catering to diverse student needs and aspirations. In a recent survey involving 19 students, it was discovered that all of them experienced advantages when transitioning to a four-year program[6]. This transition provides them with opportunities to acquire fresh practical skills and engage in research experiences, which in turn ignites their motivation to pursue higher degrees. It is worth noting that just two students expressed concerns about the financial burden or time commitment associated with their

higher education pursuits. Nonetheless, the benefits of a four-year program far outweigh the costs, and the investment can lead to better career prospects and a more fulfilling life[7].

The Prospect of Diverse Occupations:

To succeed in engineering and technology disciplines, graduates need to have a diverse skill set that can adapt to emerging technologies and trends. Longer programs that cover a broader range of topics, such as advanced mathematics, engineering theory, and design principles, can provide students with a more comprehensive education and equip them with the necessary skills to succeed in their careers[8], [9]. Pursuing a four-year program can also help graduates develop valuable skill sets that can be applied to various roles and industries. In addition, graduates with more extensive education are better positioned for career advancement opportunities. They can pursue roles in research, development, project management, or even entrepreneurship. A four-year program allows students to adapt to changes in the industry by staying up-to-date with emerging technologies and trends, providing them with a more extensive knowledge base that can be applied to various industries and roles. The global trend towards more intensive and comprehensive technical education has led to the transitioning of engineering technology education from two-year to four-year degrees, particularly in specialized areas like fluid mechanics[10], [11]. This transition can improve graduates' learning experience and skills, as they will have more time to explore and study complex topics in greater depth. This, in turn, can contribute to economic and occupational freedom by opening up more advanced career opportunities.

Data Collection Framework:

The present study is founded on a framework that proposes the use of a combination of qualitative and quantitative techniques to validate hypotheses. The framework proposes the utilization of interviews with industry experts, surveys of current and potential students, as well as the analysis of pre-existing data sources. The data was generated from a public four-year medium-sized institution in a suburban set-up surrounded by many regional industries. By using this multi-faceted approach, we aimed to ensure that the results of the study are robust and reliable. The framework identifies three key stakeholder groups whose perspectives will be critical to our study. These groups include the industrial advisory body from twelve regional industrial facilities, ten students from the 4-year program, and eleven students from the cohort of the 2-year program of the engineering technology department of a 4-year institution. Current 2-year program students are enrolled in AAS (Associate of Applied Science) in Electronics Engineering Technology. 4-year program students major in 4 different concentrations: Electrical, Mechanical, Manufacturing, and Mechatronics Engineering Technology. At this point, the alumni from the last five years were targeted and the university email list was utilized to reach out to the students and alumni. The study employed surveys and interview questions to evaluate students' perceptions of the benefits of the proposed transformation and identify potential obstacles that could hinder progress toward the objective. We also sought insights from the industry body to develop effective strategies aimed at eliminating these barriers and facilitating successful career transitions for students. The survey was launched on February 28, 2024. We anticipate that data collection, compilation, and analysis will be completed within 4 to 6 months.

During this period, we will conduct an extensive review of the collected data to ensure that the study's findings are comprehensive and statistically significant.

With this detailed approach, we hope to generate insights that will inform about factors driving the decisions for making future transitions and addressing the needs that will contribute to the advancement of the field. Our inquiries will focus on their decision-making process, practical skills, knowledge application in their workplace, economic stability, and whether they feel they meet the demand for technically skilled workers in their current roles. We aim to generate valuable insights that can help shape future strategies and programs in this area. More details on question materials are included in appendices A to C.

We will analyze the feedback provided by 2-year degree students in response to the following inquiries:

1. What factors influenced your choice to join the workforce following the completion of your 2-year degree?
2. Do you feel adequately equipped with practical skills and knowledge applicable to your job?
3. How confident are you in the economic stability afforded by your 2-year degree?
4. Do you perceive yourself as meeting the demand for technical proficiency in your current position?

We will also assess employer feedback based on the following inquiries:

1. Which of your employees satisfies the criteria for technically skilled workers?
2. Who exhibits adeptness in adapting swiftly to evolving workplace dynamics?
3. What is your perception of the correlation between job prospects and increased wages concerning employees with advanced degrees and extensive work experience?

Moreover, we will evaluate the responses given by students who have transitioned from 2-year programs to 4-year degree programs regarding the following inquiries:

1. How has increased access to higher education and information influenced your economic autonomy and decision-making?
2. How have these transitions aided you in choosing career paths that resonate with your passions, competencies, and ambitions?
3. What significance does a four-year degree hold in fostering equitable employment prospects, irrespective of variables like gender, race, or socioeconomic status?

Facilitating the Transfer:

A research study has revealed that it is imperative to conduct a more detailed analysis of the efforts made by students to integrate themselves socially and academically both before and after transfer. A more precise identification of these efforts can be accomplished by asking students about their participation in cocurricular activities at the community college and whether they intend to do so at the receiving institution. In addition, students can be inquired about their attempts to engage in non-academic discussions with faculty members after class and how successful these efforts were. It is possible that transfer students are not being proactive enough

in their attempts to become integrated into the institution. Therefore, it is essential to explore the reasons behind this lack of proactivity. Furthermore, it is essential to ask students about what the receiving institution can do to facilitate their integration. Although many four-year institutions offer services to assist transfer students, students often fail to utilize them. For instance, at the university in this study, there are some interest groups for transfer students, but students frequently decline when initially approached to join these groups. To encourage greater use of these services and activities, students can be questioned about the factors that might discourage them from participating in such programs, as well as what can be done to encourage their participation[12]. Therefore, a comprehensive analysis of transfer students' integration efforts is necessary to identify the challenges they face and the necessary support required from the receiving institution. Ultimately, this information will help institutions to provide better support to transfer students, thus increasing their chances of success[13][14]

Conclusion:

The debate between pursuing a 2-year or a 4-year degree is multifaceted and hinges on various factors, including individual career goals, financial considerations, and the specific field of study. A 2-year degree, typically an associate's degree, offers a more streamlined path to entry-level positions in many industries. It allows students to acquire essential skills and knowledge within a shorter timeframe, making it a popular choice for those seeking to enter the workforce sooner or looking for a more affordable option.

Understanding the fit of a student within an institution is a complex process that is influenced by various factors, including the student's initial characteristics, the nature of the institution, the student's interactions within the institution, and the goals and outcomes of college attendance. Recent studies also have suggested that cultural differences can significantly affect the fit of transfer students within receiving institutions. This can be attributed to differences in the size and institutional mission of the sending and receiving institutions. Transfer students from community colleges may have a particular kind of institutional culture and may lack sufficient awareness of the differences between their culture and that of four-year institutions, especially large academic institutions. These findings highlight the need for transfer students to be aware of the cultural differences between institutions while making the transition to ensure a smooth fit within the new institution[15][16]

Certainly, a 4-year degree, such as a bachelor's degree, provides a more comprehensive education and opens up broader career opportunities. It offers a deeper dive into the chosen field of study, along with opportunities for specialization, research, and internships. A bachelor's degree is often seen as essential for advancement in many professions, particularly those in technical or specialized fields, and may result in higher earning potential over the long term. Eventually, the decision between a 2-year and a 4-year degree depends on individual circumstances, including career aspirations, financial resources, and personal preferences. Some students may opt for a 2-year degree as a stepping stone to further education, while others may choose to pursue a 4-year degree for a more comprehensive and well-rounded academic experience.

References:

- [1] J. L. Wood and C. S. Moore, “Engaging Community College Transfer Students,” in *Student Engagement in Higher Education: Theoretical perspectives and practical approaches for diverse populations*, 2015.
- [2] E. R. Winterer, J. E. Froyd, M. Borrego, J. P. Martin, and M. Foster, “Factors influencing the academic success of Latinx students matriculating at 2-year and transferring to 4-year US institutions—implications for STEM majors: a systematic review of the literature,” *International Journal of STEM Education*, vol. 7, no. 1. 2020. doi: 10.1186/s40594-020-00215-6.
- [3] M. A. Haider and J. Alberd, “Design a learning model to integrate IoT applications into Engineering Curriculum.,” in *ASEE CIEC*, Santa Ana, 2023.
- [4] J. C. Arnold, “Student transfer between Oregon community colleges and Oregon University system institutions,” *New Directions for Community Colleges*, vol. 2001, no. 114, 2001, doi: 10.1002/cc.20.
- [5] Y. Li *et al.*, “A systematic review of high impact empirical studies in STEM education,” *International Journal of STEM Education*, vol. 9, no. 1. 2022. doi: 10.1186/s40594-022-00389-1.
- [6] R. Hirst, G. Bolduc, L. Liotta, and B. Wai Ling Packard, “Two-Year Community: Cultivating the STEM Transfer Pathway and Capacity for Research: A Partnership Between a Community College and a 4-Year College,” *J Coll Sci Teach*, vol. 043, no. 04, 2014, doi: 10.2505/4/jcst14_043_04_12.
- [7] M. A. Haider, H. Ahmed, and M. K. Pallikonda, “Empowering Economic and Occupational Freedom through the Transformation of Engineering Technology education from 2 Years to 4 Years Degrees,” in *ASEE CIEC*, Santa Ana, Feb. 2023.
- [8] H. Ahmed, “A Review on Corrosion of All Aluminum Microchannel Heat Exchangers,” in *Corrosion Engineering - Recent Breakthroughs and Innovative Solutions [Working Title]*, IntechOpen, 2024. doi: 10.5772/intechopen.1005180.
- [9] H. Ahmed, “Structural Design and Its Impact on Thermal Efficiency and Corrosion of All-Aluminum Microchannel Heat Exchangers,” University of North Texas, Denton, Texas, 2023. doi: 10.12794/metadc2179279.
- [10] H. Ahmed, H. Sadat, and S. Nasrazadani, “High-Fidelity Conjugate Heat Transfer Simulation of Micro-Channel Heat Exchanger,” *Journal of Advanced Research in Fluid Mechanics and Thermal Sciences*, vol. 106, no. 1, 2023, doi: 10.37934/arfmts.106.1.165181.
- [11] Hossain Ahmed, Seifollah Nasrazadani, and Hamid Sadat, “Comparison of Thermal Effectiveness and Crevice Corrosion Risk of Fin Geometry on All-Aluminum Microchannel Heat Exchangers,” *Journal of Advanced Research in Fluid Mechanics and*

Thermal Sciences, vol. 105, no. 2, pp. 192–203, Jun. 2023, doi:
10.37934/arfmts.105.2.192203.

- [12] M. Hodara, “Supporting the Transition to College: Accelerated Learning Access, Outcomes, and Credit Transfer in Oregon,” 2022. doi: 10.3102/1442439.
- [13] X. Wang, “Baccalaureate attainment and college persistence of community college transfer students at four-year institutions,” *Res High Educ*, vol. 50, no. 6, 2009, doi: 10.1007/s11162-009-9133-z.
- [14] R. C. Manimaran and M. A. Haider, “Strategies for Continuous Improvement in ETAC of ABET Programs: A Novel Approach,” in *ASEE Annual Conference and Exposition, Conference Proceedings, 2023*.
- [15] J. C. Arnold, “Student transfer between Oregon community colleges and Oregon University system institutions,” *New Directions for Community Colleges*, vol. 2001, no. 114, 2001, doi: 10.1002/cc.20.
- [16] E. Nemtcan, R. G. Sæle, T. Gamst-Klaussen, and F. Svartdal, “Drop-Out and Transfer-Out Intentions: The Role of Socio-Cognitive Factors,” *Front Educ (Lausanne)*, vol. 5, 2020, doi: 10.3389/educ.2020.606291.

Appendix A

Questionnaire: Employer Assessments

Questions	Choices
1. Which of your employees satisfies the criteria for technically skilled workers?	<ul style="list-style-type: none"> A. Those who have undergone specialized training or certification programs B. Those who possess advanced degrees or qualifications such as B.S. in Engineering Technology C. An A.A.S. in Engineering Technology is sufficient
2. Who exhibits adeptness in adapting swiftly to evolving workplace dynamics?	<ul style="list-style-type: none"> A. Employees who consistently demonstrate strong problem-solving abilities. B. Who has received positive feedback from colleagues or supervisors. C. Employees who actively seek out opportunities for professional development and skill enhancement. D. Individuals who consistently follow and maintain technical standards and requirements. E. Those who have received recognition or awards for their contributions to the organization. F. Individuals who show resilience and adaptability when faced with unexpected challenges. G. Those who display strong leadership qualities and can motivate others during periods of transition or uncertainty.
3. What is your perception of the correlation between job prospects and increased wages concerning employees with advanced degrees vs extensive work experience?	<ul style="list-style-type: none"> A. Employees with advanced degrees are more likely to secure higher-paying jobs. B. Extensive work experience is more valuable in securing higher-paying jobs. C. Both advanced degrees and extensive work experience contribute to increased job prospects and higher wages, with their importance varying depending on the industry and role. D. Job prospects and wages are primarily determined by factors such as industry demand, individual performance, negotiation skills, networking, and negotiation skills rather than the presence of advanced degrees or extensive work experience alone.

Appendix B

Questionnaire: 2-year degree students Graduated

Questions	Choices
4. What factors influenced your choice to join the workforce following the completion of your 2-year degree?	<ul style="list-style-type: none"> A. Immediate job opportunities available in the local area B. Financial considerations C. Desire for practical experience D. Lack of interest in further education E. Personal circumstances F. Family responsibilities G. Influence of peers or family members
5. Do you feel adequately equipped with practical skills and knowledge applicable to your job?	<ul style="list-style-type: none"> A. Yes, I feel confident in my practical skills and knowledge. B. My skills are sufficient, but there are specific areas where I could use more training or experience. C. Somewhat, but I could benefit from additional training or education. D. I'm unsure, as I haven't had enough time to fully assess my skills in the workplace. E. I feel well-prepared overall, but there are some tasks or situations where I feel less confident. F. I'm unsure, as my job requirements may change over time. G. No, I believe there are gaps in my skill set that need to be addressed.
6. How confident are you in the economic stability afforded by your 2-year degree?	<ul style="list-style-type: none"> A. Extremely confident, I have already secured a stable job in my desired field. B. I'm confident in my abilities but recognize the need for continuous learning to maintain economic stability. C. I feel confident in the skills and knowledge gained from my degree, but economic stability depends on various external factors. D. Somewhat confident, but I have concerns about the job market and economic conditions.

	<p>E. Not very confident, as I'm unsure about the long-term prospects of my field.</p> <p>F. Neutral, I'm still exploring my career options and haven't fully assessed the economic implications of my degree.</p> <p>G. I'm not confident, as my degree may not be directly applicable to my desired career path.</p>
--	--

Appendix C

Questionnaire: Transitioned from a 2-year to a 4-year degree program

Questions	Choices
<p>7. How has increased access to higher education and information influenced your economic autonomy and decision-making?</p>	<p>A. Expanded my career options</p> <p>B. Enhanced my possibility to negotiate for higher wages</p> <p>C. Provided opportunities for career advancement</p> <p>D. Enabled me to make more informed financial decisions</p> <p>E. Expanded my network, leading to more opportunities for collaboration and growth.</p> <p>F. Motivated me to seek continuous learning and skill development to stay competitive in the job market.</p>
<p>8. How have these transitions aided you in choosing career paths that resonate with your passions, competencies, and ambitions?</p>	<p>A. Helped me know about my strengths and interests, guiding me towards suitable career paths.</p> <p>B. Helped me explore different career options in various industries and job roles.</p> <p>C. Such transitions have equipped me with practical skills and experiences relevant to my desired career fields.</p> <p>D. They have connected me with mentors and professionals who have provided valuable guidance and advice.</p> <p>E. They have fostered a sense of purpose and fulfillment by aligning my career choices with my values and aspirations.</p> <p>F. They have encouraged me to seize opportunities for professional growth and development.</p>

	<p>G. Such transitions have empowered me to make informed decisions about my career trajectory and long-term goals.</p>
<p>9. What significance does a four-year degree hold in fostering equitable employment prospects, irrespective of variables like gender, race, or socioeconomic status?</p>	<ul style="list-style-type: none">A. It ensures equal access to job opportunities and reduces disparities in employment outcomes.B. It provides individuals from diverse backgrounds with the necessary skills and credentials.C. It promotes diversity and inclusion in the workforce by encouraging representation from different demographic groups.D. It challenges systemic barriers and biases.E. It empowers individuals to overcome social and economic barriers.F. It contributes to building a more equitable society by nurturing social mobility and economic empowerment.