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Footprint for Engineering Technology Technician Education

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Abstract

Engineering Technology (ET) professionals span the entire industry environment and its related workspaces. The world of two-year degree ET technician preparation extends across the country and can be characterized by its communities of practice. ET program participation elements identify members of these communities. National organizations affiliated with and supportive of these ET communities include (i) the American Society for Engineering Education (ASEE), (ii) the National Science Foundation Advanced Technical Education Program (NSF-ATE), and (iii) the ET-supportive industry sectors.

An assessment of how these three contributors interact with the ET technician preparation process will contribute to a unified and effective execution of this technician creation mission in the United States. As a Work in Progress, this paper begins the examination of four ET community of practice elements: Engineering Technology Technician Preparation Programs, ASEE, NSF-ATE, and the Industry sector, emphasizing their operational ET supportive characteristics. Suggestions for tightening the expectations for these preparation sectors are introduced.

Historic Perspective

Engineering Technology (ET) workforce preparation was one of the first educational impacts of the Industrial Revolution in the United States. The shift from "cottage industry" to dedicated factory production required a trained workforce that did not exist. The 1880s innovation, ET, created colleges completely dedicated to directly supplying needed trained workers to the local factory. Today, the ET focus on preparing the technical workforce has shifted from its narrow single factory worker "job" creation a century and a half ago to a broad and, to some extent, diffuse country-wide technician preparation mission. This expanded mission now embraces targeted contributions from the American Society for Engineering Education (ASEE), the National Science Foundation Advanced Technical Education Program (NSF-ATE), and ET-supportive industry sectors.

Engineering Technology Technician Preparation Programs

Engineering Technology (ET) degree programs are hampered by the vocabulary employed within its communities of practice. It is common practice to identify college courses as electronics, hydrolysis, pneumatics, motor controls, etc. These "titles" are not, nor should they go away. However, identifying the ET skills presented within these course topics helps move their ET skill sets to the forefront.

The authors selected programs from a subset of colleges across the country: BridgeValley Community and Technical College, College of Southern Nevada, Houston Community College, Kansas State Salina, Monroe Community College, and St. Lewis Community College to identify national similarities and differences within ET technician preparation practices. These programs are used to foster national/regional ET skill discussions and are reviewed in the eight tables presented below.

BridgeValley Community and Technical College is in South Charleston, West Virginia. The College has an Associate of Applied Science (A.A.S.) Engineering Technology program. This ET program has three concentrations: Civil Engineering Technology, Electrical Engineering Technology, and Mechanical Engineering Technology. The College also provides associated degree programs that transfer to the 4-year institutions within West Virginia.

Table 1 – Engineering Technology: Electrical (65 Total Program Credit Hours)
BridgeValley Community and Technical College

1st Semester		2nd Semester	
Introduction to Drafting & 2D CAD		Computer Applications for Technicians	
Technical Algebra		Technical Trigonometry	
Circuits I: DC Circuits		Circuits II	
College Success & Career Expectations	(1 hr.)	Digital Devices	
English Composition I		Analog Devices	
General Education Requirement			
Total Hours: 16		Total Hours: 15	
3rd Semester		**4th Semester**	
Power Systems & Industry Devices	(4 hr.)	PLC Fundamentals & Applications	
Circuits III: Analog Techniques & Theorems		Microcontrollers	
Analog Devices II	(4 hr.)	Technical Calculus	
General Physics I	(4 hr.)	General Physics II	
Communications		Program Technical Elective	
Total Hours: 18		Total Hours: 16	

ETAC Accreditation

The BridgeValley Community and Technical College Electrical Engineering Technology concentration is shown in Table 1. Unless otherwise noted, these courses are three credit hours within sixteen weeks. The courses listed for each semester are not prioritized. However, all the courses must be completed before moving forward. The physics and mathematics courses can be replaced with their bachelor's degree counterparts. This flexibility depends upon a student's previous courses or professional experience. The curriculum requires future technicians to complete the extended sequence of circuits and analog devices courses.

The BridgeValley Community and Technical College Mechanical Engineering Technology concentration is shown in Table 2. The program is structured to be completed in a typical 2-year degree calendar. The general education portion of the degree is not included. These college-dictated courses are available in the fall, spring, and summer semesters. The courses that define mechanical engineering technology technician preparation are offered in the fall and spring semesters.

Table 2 – Engineering Technology: Mechanical (65 Total Program Credit Hours)
BridgeValley Community and Technical College

1st Semester		2nd Semester	
Introduction to Drafting & 2D CAD		Computer Applications for Technicians	
Technical Algebra		Technical Trigonometry	
Manufacturing Processes I		Manufacturing Process II	
College Success & Career Explorations in Professional Studies I	(1 cd. hrs.)	Fundamentals of Fluid Power	
English Composition I		Statics	
General Education Requirement		Introduction to Solid Modeling and 3D CAD	
Total Hours: 16		Total Hours: 18	
3rd Semester		**4th Semester**	
General Physics I	(4 cd. hrs.)	General Physics II	(4 cd. hrs.)
DC Circuits		Technical Calculus	
Applications of Fluid Power		Climate Control	
Mechanical Design I		Mechanical Design II	
Strength of Materials		Program Technical Elective	(2 cd. hrs.)
Total Hours: 16		Total Hours: 15	

ETAC Accreditation

The **College of Southern Nevada** is in Henderson, Nevada. The College has an Associate of Applied Science (A.A.S.) in Advanced Manufacturing: Machining. The program of study is shown in Table 3. The table alphabetically presents the courses without their assignment to the two-year, four-semester schedule for degree completion. The program includes three machine skills-related courses. It also contains four CNC courses and two “drafting” related courses. The program requires an Introduction to Workplace Safety course. The remaining thirteen credit hours encompass the College's general education requirements for graduation and are not shown in the table.

Table 4 contains the essential details for the College of Southern Nevada (CSN) Advanced Manufacturing: Automation, A.A.S, degree. This program also resides in CSN's Department of Applied Technology. The Automation program presents courses that support skill development in robotics and material handling automation as well as fluid and mechanical power transmission.

Table 3 – College of Southern Nevada Advanced Manufacturing: Machining A.A.S. Degree (60 Total Program Credit Hours)

Required Courses (37 credit. hr.)

CNC Practice	Introduction to Machine Shop
Computer Aided Manufacturing I	Machine Shop I, and II, and III
Computer Numerical Control I	Machine Shop Practice I
Computer Numerical Control II	Technical Drafting I
Inspection Techniques	Advanced CADD or Solid Modeling & Parametric Design
Introduction to Workplace Safety	

D+, D, D- in any Core course does meet the graduation requirement

Science and Mathematics	Communications
Fundamentals of Electricity (4 cd. hr.)	Applied Communications
Mathematics for Electronics Applications or Applied Mathematics or higher	College Success

The two CSN programs summarized in Table 3 and Table 4 have the same course grade achievement policy. In addition, the program stated mathematics requirements are identical. Two College-wide requirements, "College Success and "Applied Communications, are also included. These courses complement the Department's mission to "develop the skills required for entry-level employment in technologically advanced, high-demand industries across Southern Nevada and the nation". There are 35 degree and certificate options for technician preparation housed in the Department.

Table 4 – College of Southern Nevada Advanced Manufacturing: Automation AAS Degree (60 Total Program Credit Hours)

Required Courses (33 credit. hr.)

Advanced Automation with Robots	Industrial Electricity
Blueprint Reading, Layout & Sketching or Construction Plans & Specifications	Mechanical Power Transmission
Core Computing Competency or Introduction to Information Systems	Material Science I (Ferrous and Non-Ferrous)
Fluid Power (Pneumatics, Hydraulics, Fluid Power Instrumentation)	Applied Communications
	College Success
Industrial & Material Handling Automation	Composition Enhanced

D+, D, D- in any Core course does meet the graduation requirement

Science and Mathematics	
Mathematics for Electronics Applications or Applied Mathematics or higher	Technical Elective: Approved List (2-7 hrs.)
	Networking Literacy: Approved List (3-5 cd.hr.)

Houston Community College is in Houston, Texas. The Houston Community College Electronics Engineering Technology Biomedical Electronics Specialization Associate Applied Science degree is shown in Table 5. The program has a 1st year summer semester within its published graduation requirements.

Table 5 – Houston Community College Electronics Engineering Technology, Biomedical Electronics- Specialization, A.A.S.

1st Semester		2nd Semester		Summer Semester	
Electronic Fabrication		DC Circuits	(4 hr.)	College Physics	(4 hr.)
Computer Networking Tech.		Digital Fundamentals	(4 hr.)	Humanities/Fine Arts Elective	(3 hr.)
College Algebra		Plane Trigonometry			
Learning Framework		Social Science Elective	(3 hr.)		
Total Hours: 13		Total Hours: 14		Total Hours: 7	

3rd Semester		4th Semester	
AC Circuits	(4 hr.)	Biomedical Clinical Instrumentation	(3 hr.)
Solid State Devices	(4 hr.)	Essentials of Medical Terminology	(2 hr.)
Applied Biomedical Equipment Technology (Tech.)	(4 hr.)	Internship Biomedical Technology /Technician	(3-6 hr.)
Programming for Discrete Electronic Devices	(4 hr.)	Linear Integrated Circuits (Capstone)	(3 hr.)
Total Hours: 15		Total Hours: 11	

The biomedical field has a growing need for technicians trained to maintain, troubleshoot, and repair medical equipment for healthcare facilities or research institutions. The

Table 6 – Kansas State Salina Engineering Technology Electronic and Computer Engineering Technology (AS) Graduation Requirement (63 credit. hr.) Degree Required Courses (33 credit. hr.)			
Basic Electronics		Oral Communications	(pick 1)
Circuits I	(4 cd, hr.)	Interpersonal Communications	
Circuits II	(4 cd, hr.)	Public Speaking I	
Digital Logic	(4 cd, hr.)	Public Speaking IA (Honors)	
General Physics I	(4 cd, hr.)	Technical Elective	(pick 1)
Industrial Control Topics	(1 cd, hr.)	Electronic Manufacturing	
Microprocessor Fundamentals	(4 cd, hr.)	Hardware & Network Fundamentals	
Plane Trigonometry		Industrial Instrumentation & Controls	
Semiconductor Electronics			
(30 hr. University Requirements)			

Biomedical Electronics specialization includes a one-semester internship in a medical center, hospital, or medical equipment manufacturer, ensuring exposure to the latest equipment.

Kansas State University-Salina is in Salina, Kansas. The Kansas State Saline Electronics and Computer Engineering Technology two-year degree program is presented in Table 6. The

program includes two circuit courses as well as digital logic and microprocessor fundamentals courses. The university credit hours requirement for this Associate of Science (A.S.) program is distributed within an extensive Art, Humanities, and Social & Behavioral Sciences offering list. There are needed credits within each category. However, students have two independent 3-credit-hour elective selection options.

Monroe Community College is in Rochester, New York. The College offers an Associate of Applied Science Engineering (A.A.S.) degree in several areas. The Biotechnology degree program is presented in Table 7 in the semester format. The inspection of Table 7 reveals the defining characteristics of the program. First, the program has a four-credit-hour course structure. The "extra" hour accommodates the included laboratory in most of the program's required courses. Second, the program's course selection permits higher-level course options in their respective discipline starting in the first semester of study.

Table 7 – Monroe Community College Biotechnology A.A,S. Degree (63 credit. hr.) Required Courses (33 credit. hr.)			
1st Semester		2nd Semester	
College Algebra or higher		Statistics I (grade must be C or higher)	
General College Chemistry I	4hrs	General College Chemistry II	4hrs
College Composition or higher		Introduction to Global Studies	
(Intro. courses below require at least a C grade)			
Introduction to Cell & Molecular Biology or Introduction to Organismal Biology and Ecology	4hrs	"Introduction" course not selected in the 1st semester	4hrs
		Elective: Select from the program list	
Total Hours: 15-16		Total Hours: 15-16	
3rd Semester		4th Semester	
Statistics II		General Microbiology	4hrs
Organic Chemistry I or higher		Organic Chemistry II or higher	4hrs
College Physic I		College Physic II (or higher)	4hrs
Bioanalytical Techniques I	4hrs	Bioanalytical Techniques II	4hrs
Microsoft Office or higher		Molecular Genetics	4hrs
Total Hours: 15-16		Total Hours: 15-16	

St. Lewis Community College is in Florissant Valley, Missouri. Table 8 lists the courses that define the curriculum for the College's 60-63 credit hour Biotechnology A.A.S. degree. Courses within the curriculum have prerequisites. For example, Biotechnology I (grade C or better) is a prerequisite of Advanced Topics in Biotechnology. The Advanced Topics in Biotechnology course is a catalog program tool that allows students to self-schedule required 3-credit-hour classes. The 1st Advanced Topic in Biotechnology selection is required in the fall of the 2nd year. The remaining two course selections must be taken in the 2nd year spring semester. Course options include Plant Transformation, Bioprocesses, Forensics, QCPCR Techniques, RNA Interference, and Bioinformatics. However, permission for a one-course substitution that matches the student's career focus is possible.

Table 8 – St. Lewis Community College: Biotechnology A.A.S. (63 credit. hr.) Degree Required Courses (33 credit. hr.)

Basic Laboratory Methods for Biotechnology	(3 hr.)	Advanced Topics in Biotechnology (3 courses)	(9 hr.)
Biotechnology I	(5 hr.)	Advanced Topic Elective (pick 1) Micropropagation of Plants or Cell Biology	
Biotechnology II	(5 hr.)		
Genetics	(3 hr.)	Precalculus Algebra	
Genetics Laboratory	(2 hr.)	Principles of Biology I & lab	(5 hr.)
Microbiology for Biotechnology	(4 hr.)	Workplace Learning: Biotechnology	(3- 6 hr.)
Quantitative Methods in in Biotechnology	(4 hr.) (2 hr.)	General Chemistry I & lab	(5 hr.)
Research & Presentation Skills for Life Science	(2 hr.)	Oral Communications (select 1) Oral Communications I or Interpersonal Communications	
Civics Requirement			

Technician Preparation Programs Discussion

Tables 1 and 2 present the Associate in Applied Science (A.A.S.) Electrical Engineering Technology and Mechanical Engineering Technology programs are respectively offered at BridgeValley Community and Technical College in their two-year, four-semester structure. The course lists within semesters are not prioritized. The programs have a general education and program technical elective requirement as well as the same English (English Composition I), mathematics (Technical Algebra and Technical Trigonometry) and physical science (General Physics I and II) sequence), drafting/computer-aided design (Introduction to Drafting & 2D CAD), computer (Computer Applications for Technicians), circuits (Circuits I; DC Circuits), and the college orientation (College Success & College Expectations), course requirements. The English course requirement is unique because no other colleges in this review have an expressly stated English course listing.

Tables 3 and 4 present the A.A.S. Advanced Manufacturing: Machining and Advanced Manufacturing: Automation degrees, respectively, at the College of Southern Nevada (CSN) as 2-year programs. The course listings are not prioritized or tagged to a semester. Like the BridgeValley programs, both CSN programs have general education requirements. These two CSN programs require Applied Communications, College Success, and Mathematics for Electronics Applications. Both programs allow technical elective options that might raise the minimum 60 hours total credit graduation requirement. However, the two CSN programs have some distinctive features: The Automation degree requires grades of C or higher in its technical core courses; There is a specific science course (Fundamentals of Electricity) in the Machining curriculum, but no specific science is required in Advanced Manufacturing: Automation.

Tables 5 and 6 illustrate Electronic Engineering Technology curricula requirements at two institutions. The program names indicate the broad applications of the ET program and the. The

Houston Community College (HCC) Electronics Engineering Technology Biomedical Electronics Specialization A.A.S. degree is shown in Table 5. Table 6 details the combined Electronics and Computer Engineering Technology program at Kansas State Saline.

The baseline mathematics expectation, plane trigonometry, is the same for both programs. However, the HCC program also requires college algebra. Another core course, public speaking, required in the Kansas State Salina degree program, is unique to the programs reviewed.

Table 7 and Table 8 Biotechnology A.S.S. programs offered at Monroe Community College in Rochester, New York, and St. Louis Community College in Florissant Valley, Missouri, have distinctive similarities. Both programs have a stated general elective requirement, a civics elective at St. Lewis CC, and Introduction to Global Studies at Monroe CC. Chemistry I with laboratory is a four-credit course at Monroe but a five-credit-hour course at St. Lewis. The algebra expectations, College Algebra at St. Lewis CC and Precalculus Algebra at Monroe CC, are distinctively titled with similar student outcome expectations.

There are also distinct differences between the two programs' communications, science, and mathematics (non-disciplinary) course expectations. The St. Lewis CC communications courses include Research and Presentation Skills for Life Science and an elective selection between Oral Communications I and Interpersonal Communications. Monroe CC extends student science experience to include Chemistry II, Organic Chemistry I and II, Physics I, and Physics II, all with accompanying laboratories. Monroe's mathematics extension is Statistics I and Statistics II.

The label identity of the biotechnology courses in the two colleges is noticeably different. St. Lewis CC has an identified biotechnology course: Biotechnology I and II Sequence, Basic Laboratory Methods for Biotechnology, and Microbiology in Biotechnology. Monroe CC attenuates the biotechnology "handle" by indirectly inferring its biotechnology expectation: Bioanalytical Techniques I and II.

Independent Organization Influence

National organizations affiliated with and supportive of this Engineering Technology (ET) community include the American Society for Engineering Education (ASEE), the National Science Foundation Advanced Technical Education Program (NSF ATE), and ET-supportive industry sector organizations. Each entity has similar holistic activities, but each focuses its resources on specific objectives.

ASEE resources focus on supporting aligned, relevant, and accountable national program expectations for its college and university membership. One tool that encourages quality control is ASEE facilitation for college programs applying for the Engineering Technology Accreditation Committee (ETAC) certification. As suggested during this paper's review process, the ABET ETAC general, Criterion 3, and specific criteria help compare various classes in programs at different colleges. ASEE member education institutions at various ABET credential stages must prominently display and execute all declared program objectives via their related activities with vigor. Thus, the collective details of these objectives suggest a basis for an analysis structure that is valuable for isolating the skill sets needed by ET professionals to be aligned with national expectations.

The NSF-ATE grant-funded resources are directed to specific regional technician preparation programs. These grant funds can be used for curriculum creation and execution, faculty professional development, program enrollment pathways, and student recruitment. NSF-ATE resources may also be invested in projects that develop national interactions and common expectations among regional technology programs. The NSF-ATE project, award # 1839567, "ATE 2.0: Preparing Technicians for the Future of Work," foreshadows ET Skill Set grouping activities. This project utilized its resources to determine "emerging cross-cutting skills" expected in the professional working environment of most current and future technicians.

Both ASEE and NSF-ATE support their community of practice. ASEE 2-year program efforts usually focus on seamless transfer to an Engineering Technology B.S. degree program in the same college. NSF-ATE grant efforts usually direct results toward immediate technician employment. Identifying ET skills taught within both communities will draw these groups together and increase the quality of ET instruction. The challenge of this goal is not the members of these communities. Technician education faculty are always looking for better ways to teach and appreciate the perspective, experience, expertise, and teaching practices of other professionals around the country.

The challenge for college interest in and institutional resource support for ASEE and/or NSF-

ATE commitments is twofold. In some situations, the upper administration does not wish their institution to be involved. In other instances, "the spirit is willing, but the body is weak." In this case, the college administration sees a big-picture merit in investment in and involvement with ASEE and/or NSF-ATE. However, the body, usually the college's resource budget and personnel, cannot be adjusted to support costs associated with the detailed administration of ASEE and/or NSF-ATE activities.

The industry sector, with its supportive organizations, is not a college resource demand problem for ET technician preparation programs. The Gene Hass Foundation is a good example. The Foundation supports manufacturing training programs through facility expansion, faculty professional development, and student scholarship programs. Grants for these objectives are only awarded to tax-exempt organizations with successful track records. The Society for Manufacturing Education, SME, is a "hands-on" supportive organization. It provides members and resources directly to education institutions to promote and support manufacturing education programs nationwide. In addition, ToolingU-SME has a set of online professional development courses for upskilling workers, manufacturing students, and educators.

In addition to these external resources, when meeting technical ET skilled workforce needs, most companies with a growth perspective understand that technical workforce development is critical for their success. Thus, their interest is not the answer to the "why" question but answers to the rest of that well-known question collection group, "What, where, when, and how”? Identifying the skill subset needed for the industry workforce within the college's region is a powerful tool for answering these four classic questions and quickly securing pathways for industry-based resources to execute those answers.

Florida's ET technician two-year degree program practices several direct industry involvement strategies. Over 20 state colleges in Florida offer the A.S.ET degree. This degree program has the same curriculum in the first year. Each college's targeted industry partners identified the second-year engineering technology specializations needed in their service areas. Each of these colleges has an active industry advisory committee that provides positive and constructive information and resources for their specific college's technician preparation program. An extension of this separate college committee structure also exists.

The Statewide Engineering Technology Industry Advisory Board (SETIAB) now meets quarterly to identify and facilitate ET skill instruction to address industry-identified needs across Florida. SETIAB members are manufacturers from the ET degree college regions. The Board interacts directly with the Florida Department of Education (FDOE). The head of the FDOE technical division is also an active member of the SETIAB. There is also a representative from Florida's secondary Career and Technical Education to ensure clear articulations are maintained. In Florida, the FDOE is responsible for curriculum standards and benchmarks (student learning outcomes) that all technical programs must adhere to. The SETIAB also identifies industry resources to support the instruction of board-identified skills at the appropriate state college and participates in ET program events statewide.

Results

Engineering Technology (ET) skills are critical to and embedded within Bachelor of Science in Engineering (B.S.), Associate of Applied Science (A.A.S.), and Associate of Science (A.S.) degree professionals employed within commonly identified career pathways: Automation, Biotechnology, Electronics, Machining, Manufacturing Mechatronics, Process Control, etc. Engineering technology degree programs nationwide offer specific two-year (A.A.S. and A.S.) and/or four-year B.S. ET degrees. Examining these program curricula is a first step towards clarifying specific ET skills that graduates with four-year and two-year degrees and A.A.S. and A.S. professionals need.

The program category examination associated with encapsulated ET skills presents challenges. Authors' selected programs from BridgeValley Community and Technical College, College of Southern Nevada, Houston Community College, Kansas State Salina, Monroe Community College, and St. Lewis Community College help illuminate these challenges. Circuit courses present an example. The DC circuit sequence, Circuits I and II, is required in the Electrical Engineering Technology at BridgeValley Community and Technical College and the Electronic and Computer Engineering Technology at Kansas State Salina. However, only a single DC circuits course is required in the Mechanical Engineering Technology programs at BridgeValley Community and Technical College and Electronics Engineering Technology-Biomedical Electronics at Houston Community College. By contrast, within the authors' selected programs, Circuits III, Analog Techniques & Theorems at BridgeValley Community and Technical College, and AC Circuits at Houston Community College are unique to these two institutions. Identifying specific ET skills common to circuit course instruction is not daunting, but skills-related questions may require a detailed investigation of course lessons. For example, are ET skills within the Circuits II course extensions of skills in the Circuits I course or specific new skills? What ET characteristics of a technical career path only require the ET skill-related instruction in the Circuits I course? There is an AC Circuits course within the Biomedical Electronics program at Houston Community College. None of the other selected programs requires an AC circuits course. What ET skills are taught in that AC circuits course that are uniquely required for a career in the region from the Houston Community College program?

Program categories can also generate career pathway identification challenges. The biotechnology programs offered at Monroe Community College (Table 7) and St. Lewis Community College (Table 8) are good examples. There are two distinctive biotechnology career paths: Diagnostic biotechnology and manufacturing/process biotechnology. From the perspective of the Monroe Community College program's website, "Biotechnology is best defined as the exploitation of biological systems or processes." From the ET technician's viewpoint, diagnostic and manufacturing biotechnologies are "hands-on" skill manipulations within different application audiences. Diagnostic biotechnology professionals will support health care diagnoses and treatment protocols, process troubleshooting, and quality control. The manufacturing/process biotechnologist works on the manufacturing/process floor and is responsible for producing a product with biotechnology characteristics. What ET skills are unique to each career, and which ET skills do the two programs' focus areas share?

Future Work

As an element of this ET Skill Set Work in Progress, degree program characterization leads directly to student Engineering Technology skills acquisition. The focus is on Engineering Technology (ET) related skill needs in technical career paths, not the program selection of courses that lead to that technical career. Courses within career path instruction possess both required ET skills that can be categorized as globally expected and the ET skill subsets that are career specific. That information will be valuable in identifying essential ET skills that will ultimately be executed nationwide and quality inspection ET benchmarks for two-year and four-year ET skill delivery programs that service various regions in the country. The information will also contribute to current discussions on adapting the European Union's 3-year technology programs for the United States.

The absence of a program-stated course within a technical career path could be another trigger for future research. For example, safety in the workplace is only managed and maintained when ET skills apply to operations and safety systems. "Safety First" is not an industry slogan but an industry way of life!

Within the authors' selected programs, only the College of Southern Nevada has a required safety-related course, Introduction to Workplace Safety. A definite work-in-progress future activity is acquiring answers to the classic questions related to the ET skills that assure safety in the workplace. The "who" will be the ET-skilled technician, leaving the "what, where, when, and how" questions unanswered. What skills are emphasized in the required course by the College of Southern Nevada? Where are the safety skills addressed in the other programs' courses as presented in their defined courses? When are safety skills practiced in technician education, and how are programs proactively projecting safety into future ET technicians?

A valuable Work in Progress asset is the emerging skills area topics identified by the NSF-ATE project, award # 18 39567, "ATE 2.0: Preparing Technicians for the Future of Work". The three "skill area" groups with associated skills are shown in the Figure below. These skill areas and their specific skills emerged from the project's research, including direct and indirect interviews and surveys with appropriate-level industry personnel, including plant managers, floor engineers, and technician supervisors.

Emerging Skills Area Topics

- **Data Knowledge & Analysis**
  - **Applied Mathematics**
  - **Basic Programming**
  - **College Algebra**
  - **Computational Thinking**
  - **Data Analysis**
  - **Data Backup/Restoration**
  - **Data Ethics**
  - **Data Flow (origin/end user)**
- **Advanced Digital Literacy**
  - **Additive mfg software**
  - **AI Software Tools**
  - **Automation/robotics**
  - **Blockchain**
  - **Communications**
  - **Cyber-Physical Systems**
  - **Process Control**
  - **Data Fluency/vocabulary**
- **Business Knowledge & Processes**
  - **Agility**
  - **Business Continuity**
  - **Business Cycles**
  - **Business Communication**
  - **Business/Economics Fluency**
  - **Business Ethics**
  - **Company "Branding"**
  - **Confidentiality**
  - **Decision Making**
  - **Entrepreneurship**

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The skills within the Data Knowledge and Analysis, Advanced Digital Literacy, and Business Knowledge and Processes Skill Areas in the above figure are found in all engineering technology work environments. Thus, integrating emerging skills, college ET degree program design, NSF-ATE and ASEE interests, and Industry sector support in identifying ET Skill Sets needed for ET technician success, promotion, and career advancement is the next phase of this project.

In addition to the groupings with their associated skills in the figure, the NSF-ATE centers of excellence have identified additional skills data for engineering technology disciplines. NSF-ATE centers of excellence work with technician preparation programs supported via NSF-ATE grant resources.

The skills within the Data Knowledge & Analysis, Advanced Digital Literacy, and Business Knowledge & Processes arenas shown in the above figure encompass all technician work environments. These environments almost certainly include technicians working in situations where they need ET skills. Thus, integrating emerging skills, college ET degree program design, NSF & ASEE interests, and Industry sector support in identifying ET Skill Sets needed for ET technician success, promotion, and career advancement is the next phase of this project.

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