

Amidst the Abyss: An Update on Undergraduate Technology and Engineering Education Programs

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Abstract

The primary goal of this study was to develop a comprehensive list of active technology and engineering teacher preparation programs (TETPPs) in the United States by cross-referencing reports from Love and Maiserouille (2021) with data from the National Center for Education Statistics (NCES). A secondary goal was to assess the current status of TETPPs through an examination of their enrollments and program structures based on a convenience sample of these programs indicating recent affiliation with the Technology and Engineering Education Collegiate Association (TEECA). Research findings indicated that only 50% of the TETPPs identified in the 2021 list (Love & Maiserouille) were also identified through the NCES search as those preparing teachers in technology and engineering education (TEE). The other 50% of the programs were unique to each list respectively.

Findings regarding the current status of active TETPPs with recent TEECA affiliation indicated enrollment numbers for students pursuing licensure ranged significantly, from 7 to 135 depending on the institution. Findings also revealed that the structure among TETPPs with recent TEECA affiliation also varied significantly depending on the institution, which may hold implications for continued program success. These findings demonstrated that, while the number of TETPPs may be greater than previously thought, many programs with recent TEECA affiliation are struggling to maintain viability in terms of enrollment numbers, and that not enough is known about how TETPPs contribute to the overall supply of TEE teachers in the United States. A major recommendation is that researchers conduct a comprehensive, ongoing survey of supply and demand for TEE teachers in the United States that also addresses the demand for TEE teachers and the impact of alternative certification programs.

Keywords: Technology and Engineering Education, Teacher Preparation Programs, Teacher Shortage, TEE

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Introduction

A nationwide shortage of teachers in Technology and Engineering Education (TEE) has highlighted challenges for undergraduate technology and engineering teacher preparation programs (TETPPs) in meeting the demand for qualified technology and engineering educators (Moye, 2017; Ortiz, 2022; United States Department of Education, 2026). With TEE being a dynamic field with continual evolutions, a systems thinking framework was used to approach this research to evaluate how these evolutions have led to changes in TETPPs. Despite efforts by faculty and leaders to align with educational and industry demands, TETPPs have struggled to survive and succeed in the burgeoning world of academic programs. Understanding the number, enrollment and structure of TETPPs is a vital first step toward identifying successful programs and, ultimately, for addressing these challenges and increasing enrollment and graduation rates (Love & Maiserouille, 2021; Moye, 2017). By identifying the structure and practices of surviving programs, stakeholders can develop targeted strategies to enhance recruitment, improve their program, and support student experiences, all of which are essential to alleviating the teacher shortage (Moye, et al., 2020).

Previous efforts to list TETPPs (Love & Maiserouille, 2021; Volk, 2019) have resulted in incomplete data or other discrepancies that were noted by the authors when reviewing literature as a part of other research, thus providing the rationale for this study. The purpose of this study was to better understand factors that may affect the ability of students seeking TEE teacher certification to enroll in and complete TEE teacher certification programs including the number of available programs, and indicators of the health of these programs such as enrollment and structure. Toward this purpose, the primary goal of this study was to develop a more comprehensive list of active TETPPs by cross-referencing findings reported by Love & Maiserouille (2021) with active programs listed in the National Center for Education Statistics (NCES) Classification of Instructional Programs (CIP) database. A secondary goal was to examine the enrollment and structure of a convenience sample of current TETPPs with recent affiliation (within the past 10 years) with the Technology and Engineering Education Collegiate Association (TEECA). Despite the shared goal of preparing TEE teachers, there are vast structural differences amongst these teacher preparation programs (Love and Maiserouille, 2021). These structural differences may have impacts on enrollment and other potential indicators of program health, thus prompting us to further investigate the enrollment and structure of these programs.

Literature Review

The TEE Identity Crisis

Technology and Engineering Education has transformed multiple times to maintain relevance (Reed & LaPorte, 2015; Wicklein, 2006), leading to an

identity crisis (de la Paz, 2017). Over the last 40 years, the national organization for technology and engineering educators evolved from the American Industrial Arts Association (AIAA) to the International Technology Education Association (ITEA), followed by the International Technology and Engineering Educators Association (ITEEA), reflecting the shift from industrialization to a technological society (Litowitz, 2008). While the intent of the change may have been generally understood or accepted, critics argued that these changes lacked coordination and did not produce fundamental reform (Bybee & Loucks-Hoursley, 2000). It is within this environment that the national Standards for Technological Literacy (STLs) were developed, which began to formalize engineering as a part of technology education in an effort to unify, guide, and direct TEE (Hook, 2001; International Technology and Engineering Educators Association [ITEEA], 2000/2002/2007). However, technology education continued to grow and evolve.

By the year 2000, engineering was gaining popularity in education (Litowitz, 2008; Reed & LaPorte, 2015). Across the nation, states were adopting engineering standards for their curriculum (Carr, et al., 2013; Moore et al., 2015). Carr, et al. specifically found that 41 states had standards related to engineering, including 15 states that had borrowed language from the STL--but there were no nationally accepted standards for the expected skills or knowledge in this instruction (Katehi, et al., 2009). It should be noted that within the United States, authority to determine educational standards rests with individual states; thus, national acceptance here refers to widespread adoption by individual states. Standards developed by one state or a consortium of states, or a professional association (along with any combination of these) may be adopted by other states, with or without modification. In response, groups such as the National Research Council (NRC, 2009), supported the development of standards for engineering education at the K-12 level. While this was received with general agreement, some felt that another name change for the profession was necessary to avoid confusion as to the true nature of technology education (Starkweather, 2008). Starkweather (2011) noted that "the profession's position within the entire education community was thought to be stronger if both technology and engineering content were addressed by our profession and association" (Shaping the Brand, para. 2). In 2010, ITEA added "Engineering" to its name, becoming the International Technology & Engineering Educators Association (ITEEA) (Strimel, et al., 2016). Shortly thereafter, the Next Generation Science Standards (NGSS) were updated to incorporate engineering principles within science education (NGSS Lead States, 2013), highlighting the need for engineering design principles to be integrated in other core subjects (Moore, et al., 2015). Prior to this, Moore, et al. had found that only 12 states had explicitly incorporated engineering into their science standards. In contrast, currently 20 states and the District of Columbia have formally adopted NGSS science standards, while an additional 29 states have used NGSS as the basis for their

science standards (National Science Teaching Association, 2026) In 2020, ITEEA released the updated Standards for Technological and Engineering Literacy, formalizing the addition of engineering as part of the content taught within TEE by a national professional association. Yet, it remains to be determined the extent to which these changes have or will be adopted by individual states within their standards.

With the official adoption of engineering as part of the discipline, some argued that instead of clarification and direction, the changes have precipitated yet another wave of the identity crisis (de la Paz, 2016, p. 8). Rigler (2016) argued that to set TEE apart, TETPPs need to recognize that the core of the profession is still Industrial Arts. He asserted that the changes and additions of technology and engineering are not unwelcome, but that the profession and organization must not erase industrial arts classes. Others argued that the profession must remain focused on technological literacy and transferable skills (Love, 2016), while yet others argued that the focus should be integrative STEM (I-STEM) education to intentionally integrate each STEM element through TEE content and pedagogy (Sanders, 2008; Wells & Ernst, 2012/2015). However, the integration of engineering with technology education curriculum was perceived to show promise with its ability to provide additional opportunities to increase technological literacy and introduce students to more future career options (NRC, 2009).

For TEE teachers to effectively teach current secondary TEE courses, they must be prepared with content and pedagogical content knowledge relevant to their discipline (Wood, et al., 2024). As Moore et al. (2014) noted, “engineering education at the K-12 level should emphasize this interdisciplinary nature, including the integration of [science, math, and engineering]” (p. 5). With the current emphasis on engineering, this should include a robust knowledge of engineering principles and pedagogical content knowledge for teaching engineering. However, TETPPs frequently require no specific coursework in engineering, instead allowing content-area training to come from coursework that aligns with traditional industrial arts curriculum, with courses ranging from energy and power technology to graphic design (Litowitz, 2014). This gap (along with other factors) has helped open the door to competition from other teacher training programs such as Project Lead the Way (PLTW), which provides professional development and training to prepare teachers from any content background to teach engineering at the secondary level, including those with no formal training or background in STEM. Volk (2019) argued that the development of PLTW’s curriculum helped to provide TEE teachers resources and education while also decreasing the need for TETPPs. These alternative training and licensure programs are not the only thing complicating the perception of traditional teacher preparation programs.

Technology and Engineering Education within Career and Technical Education

An additional complication amongst TETPPs is overlap with Career and Technical Education (CTE), which encompasses elective courses (i.e., agricultural education, sewing, foods, computer science) and/or STEM (Science, Technology, Engineering, and Math) curriculum. Most TEE programs at the secondary level are funded in part through federal technical education allocations under the Perkins Act, or state and local funding designated for CTE in America, which emphasizes workforce development and career preparation. In many states, TEE does not function as a discipline separate from CTE but rather fits under the CTE umbrella in terms of funding, administration, and perception within the education system and by the public. In states that have adopted the CTE Pathways model, TEE has been functionally eliminated as a distinct discipline within CTE, as secondary courses previously fitting under this designation are now split between various narrow career pathways which are in some cases administered by multiple pathway specialists who oversee course designations, standards development, teacher endorsements, etc. Thus, the success of TEE programs at the secondary level, as well as TETPPs by extension, is inseparable from trends taking place within CTE.

Previously, fluctuations in financial support from the government at both the state and local level have coincided with a decline in the number of CTE classes offered nationwide (U.S., 2006). Camp and Heath-Camp (2007) argued that the decline in CTE secondary program enrollment was caused, in part, by the implementation of high-stakes testing, No Child Left Behind Act of 2001 (NCLB), which implemented regular standardized testing to evaluate math and reading yearly progress, along with funding patterns in Perkins legislation. It is possible that a decrease in TEE program enrollment may have created a negative feedback loop, where a lack of qualified teachers has led to secondary TEE program closures and a reduced need for TEE teachers, potentially contributing to losses of TETPPs following NCLB (Brown, 2012). More recently, however, Irwin, et al. (2023) argue that federal data has shown that 85% of students participate in CTE courses during their secondary education. Smith & Dougherty (2024) argue that this increased student involvement has increased federal and state-level funding to support TEE course enrollment, potentially increasing the demand for TEE teachers. Concern over unfilled technical positions within industry and student interest has led to a call for increased access to TEE courses (Palaniappan, 2020; USDOE, 2000). How these trends have specifically impacted TETPPs remains unclear. However, without strong TETPPs, student access will continue to be limited as the shortage of qualified teachers increases (Deever, et al., 2020) and declining enrollment in TETPPs (Fletcher & Gordon, 2017; Moye, 2009; Volk, 1997) continues to deepen.

Technology & Engineering Teacher Preparation Programs

The past 45 years have shown a decrease in TEE teacher preparation programs across the nation (Love, 2016; Moye, 2009). In 2015, ITEEA reported 43 existing TETPPs, showing a large decrease in the span of eight years from a reported 72 programs in 2007 (Warner, et al., 2007). Despite efforts to ensure the future of TETPPs, serious questions persist regarding the stability and strength (i.e., enrollment numbers) of these programs, and how to support future sustainability and growth (Love & Love, 2022).

One major issue surrounding the effort to determine the strength of TETPPs is ambiguity as to what constitutes a TETPP. As discussed in previous sections, the profession continues to struggle with a seemingly intractable identity crisis, with mismatches between the name of the profession, content delivered at the secondary level, overlap with other CTE disciplines, and misalignment with TETPPs. It should come as no surprise that previous efforts to catalog and assess the health of TETPPs have delivered conflicting results (Love & Maiserouille, 2021; Volk 2019). Volk (2019) prophesied the impending doom of “traditional” TETPPs, noting the existence of only 32 such programs. However, only three years later Love and Maiserouille (2022) argued that TETPPs have not generally disappeared (notwithstanding several program closures they noted in recent years), but have instead transformed to offer TEE teacher licensure through certificates, emphases, and graduate degrees that not only certify educators of secondary education, but some teacher preparations extend to licensing educators for the Pre-primary education space. The Love & Maiserouille 2021 analysis of Technology and Engineering Related programs in the United States identified a total of 74 teacher preparation programs, three of which were found to be discontinued. This brought the list of *active* teacher preparation programs offering certification to teach TEE-related courses to 71, which is more than double Volk’s count. The disagreement between these two studies seems to stem from different approaches to what constitutes a TETPP. In their 2022 publication, Love & Maiserouille presented a more inclusive approach by including any teacher preparation program certifying teachers in Integrative STEM Education (I-STEM ED), those that existed as emphases, certification programs, and graduate programs, whether associated with ITEEA or not. Volk, on the other hand, seems to have considered mainly four-year undergraduate degree programs that have traditionally been associated with ITEEA.

Because of these conflicting results, which seem to stem from deeper differences in philosophy regarding the name and nature of the profession, the shifting content demands at the secondary level, and overlap with CTE, it remains difficult to conclude what trends are actually occurring with respect to TETPPs, or even how many exist. While the present study does not attempt to resolve the deeper philosophical issues, the purpose of this study was to develop a more comprehensive list of TETPPs, and secondarily to take initial steps to assess the enrollment and structure of existing TETPPs.

Research Objectives

Given the purpose and goals of this study, the following research objectives were developed:

1. Identify existing teacher preparation programs that prepare students for certification to teach technology and engineering education.
2. Identify the enrollment and structure of technology and engineering teacher preparation programs that have been affiliated with TEECA within the past 10 years.

Method

This study engaged a systems thinking conceptual framework evaluating TETPPs as a dynamic system with interconnected components instead of isolated structure. From the evolutions in TEE as well as education, systems thinking evaluates the structure TETPPs from its interconnected parts (i.e., program name or a focus on industry versus education). To better understand the current landscape of TETPPs, this exploratory study employed a combination of data collected from program representatives together with content analysis of primary sources. This dual approach allowed for a thorough investigation of program existence and structure in instances of non-response. The method guiding these processes is outlined below, organized by the study's research objectives.

Research Objective 1: Identifying Teacher Preparation Programs

Due to the debate surrounding the different conceptions of what constitutes a 'true' TEE teacher preparation program (de la Paz, 2016), our process for identifying teacher preparation programs in TEE was two-pronged.

First, we sought to identify the most recent existing lists or directories of TETPPs. Several such lists have been published over the years, including recent lists by Volk (2019), and Love & Maiserouille (2021). In addition to these lists, the ITEEA Council on Technology & Engineering Teacher Education (CTETE) has historically published program directories on a periodic basis. However, in our attempts to locate the most recent directory, it was discovered that the last directory was published prior to the COVID-19 pandemic, and that in a website transition the access to these directories has been lost. This left only the lists by Volk (which drew from the 2017 CTETE directory) and Love & Maiserouille. While only two years more recent than Volk's 2019 list, the list produced by Love & Maiserouille in 2021 also offered the advantage of a wider scope which included the 2019 CTETE directory as well as additional programs identified through a content analysis of university teacher preparation programs related to TEE. This differs from Volk's list which was confined to programs that had been traditionally associated with ITEEA/CTETE via the directory. For this reason, we selected the 2021 Love & Maiserouille's data file as the most recent

and comprehensive list, which identified a total of 74 teacher preparation programs. It is important to note that of the 74 listed in the data file, three were noted as having been discontinued, which brought the list to 71 *active* teacher preparation programs offering certification. However, when publishing their findings in 2022, they indicated that additional content analyses of websites revealed a total of 70 programs across 35 states (p. 11, Table 2). Their 2022 publication did not identify which of the programs listed in the 2021 data file had been excluded.

The second prong consisted of conducting a search using the National Center for Education Statistics (NCES) College Navigator tool, which utilizes the Classification of Instructional Programs (CIP) code to identify post-secondary programs in specific areas. Our search used the CIP code for Technology Teacher Education/Industrial Arts Teacher Education. The results from this CIP code search were then cross-referenced with the list of Technology Teacher Education programs identified by Love and Maiseroulle (2021) to generate a comprehensive list of potential teacher preparation programs, including any programs newly identified through the NCES database. Following this step, an institutional website/catalog search was conducted for each newly identified program to determine whether it was active and led to teacher licensure.

In the current study, a technology and engineering teacher preparation program was defined the same as in Love & Maiseroulle (2022), that is, in summary, a university program offering teacher certification with a curricular focus on technology and engineering literacy and/or alignment with the Standards for Technological and Engineering Literacy (ITEEA, 2020). An *active* TETPP in this study was defined as one which was listed on the respective university departmental website and/or catalog and appeared to be accepting students.

Research Objective 2: Assessing the Enrollment and Structure of TEECA-Affiliated Programs

As a starting point to assess the health of TETPPs, we chose to investigate the enrollment and structure of programs with current or recent membership in ITEEA's pre-professional program, TEECA. Participation in TEECA signifies that the program is providing their students opportunities to network on a national level along with institutional support. We defined recent affiliation as within the 10 years prior to the start of this study (between 2014-2024). While there are clearly more TETPPs available than only those with recent TEECA affiliation, we viewed this as a convenient starting point that should be expanded in future studies.

To gain a better understanding of TEE programs across the United States, program faculty from the 20 programs having been affiliated with TEECA since 2012 were contacted via the TEECA advisor email listserv and asked to explain

the structure and provide enrollment numbers for their teacher preparation program. The request included an invitation for elaboration if they felt that it was necessary or helpful. The specific questions for this study covered the following information:

- The official name of their program
- Whether it was solely licensure or if it was a technical degree with teacher licensure as an option.
- Enrollment numbers: If they had teacher licensure as an option, they were asked to provide enrollment numbers for licensure vs industry path

Faculty members from 13 of the 20 programs responded. Enrollment data were reliant on faculty members having accurate and up to date information for each of their institutions.

Findings

Research Objective 1: Identifying Active TETPPs

The NCES College Navigator search identified 74 universities that have programs listed under the Technology Teacher Education/Industrial Arts Teacher Education CIP code. Based on their 2021 analyses of TETPPs as identified through the 2019 CTETE directory and content analysis of related university teacher preparation program websites, the 2022 publication by Love and Maiseroulle presented an examination of 70 programs from across 35 states. It should be reiterated that Love and Maiseroulle took a broader view of what programs should be considered, including any program which offered TEE-related teacher certification, regardless of program structure, name, and/or affiliation with ITEEA. Furthermore, they noted that several programs they found through these resources had been discontinued. Cross-referencing the NCES and Love and Maiseroulle (2021) data (Table 1) resulted in a combined list of 111 teacher preparation programs related to technology and engineering education. Of these 111 programs, 37 were common to both lists, while the Love & Maiseroulle and NCES lists each had 37 unique programs respectively.

Table 1

Cross-reference of Love and Maiseroulle's (2021) and NCES' comprehensive list of programs

	Educational Institution	Love & Maiseroulle	NCES
1	Appalachian State University	X	
2	Augusta University	X	
3	Ball State University	X	X
4	Bemidji State University		X
5	Berea College	X	X
6	Black Hills State University*	X	X
7	Boise State University		X

8	Brigham Young University	X	
9	California State Polytechnic University-Humboldt		X
10	California State University, Los Angeles	X	X
11	California University of PA	X	
12	Casper College (2+2 with Valley City State)	X	X
13	Central Connecticut State University	X	X
14	Central New Mexico Community College		X
15	Central Washington University	X	
16	Cerritos College		X
17	Chadron State College		X
18	Chicago State University		X
19	Clemson University		X
20	CUNY City College		X
21	Colorado State University	X	
22	Delta College		X
23	Dickinson State University		X
24	East Tennessee State	X	
25	Eastern Illinois University	X	
26	Eastern Kentucky University	X	X
27	Eastern Michigan University	X	X
28	El Camino Community College District		X
29	Fitchburg State University	X	X
30	Florida A&M University	X	
31	Fort Hays State University	X	X
32	Fox Valley Technical College		X
33	Fresno City College		X
34	Fullerton College		X
35	Hofstra University	X	X
36	Illinois State University	X	X
37	Indian Hills Community College		X
38	Indiana State University	X	X
39	Jackson State University	X	X
40	Kansas State University, Polytechnic Campus *	X	
41	Lakeland University		X
42	Lebanon Valley College	X	
43	Lincoln University		X
44	Loyola University Chicago		X
45	Loyola University Maryland		X
46	Marian University		X
47	McDaniel College	X	

48	Millersville University of PA	X	
49	Montana State University	X	
50	Morehead State University	X	
51	Murray State University	X	
52	New Jersey Institute of Technology	X	
53	New York City College of Technology	X	
54	North Carolina A&T University	X	
55	North Carolina State University	X	X
56	Northern Michigan University	X	X
57	Ohio Northern University	X	X
58	Old Dominion University	X	X
59	Pennsylvania Western University		X
60	Pittsburg State University	X	X
61	Purdue University	X	X
62	Rhode Island College	X	X
63	Rider University		X
64	Saint Cloud State University		X
65	San Francisco State University		X
66	Savannah State University	X	X
67	South Carolina State University	X	X
68	St. Catherine University	X	
69	St. Cloud State University	X	
70	SUNY Buffalo	X	
71	SUNY Oswego	X	X
72	Texas A&M	X	
73	The College of New Jersey	X	X
74	The Ohio State University	X	
75	Tufts University	X	
76	University of Arkansas	X	
77	University of Central Missouri	X	
78	University of Georgia	X	
79	University of Idaho	X	X
80	University of Maine		X
81	University of Maryland Baltimore County	X	
82	University of Maryland Eastern Shore	X	X
83	University of Maryland-College Park		X
84	University of Nebraska-Lincoln	X	
85	University of Nebraska-Omaha	X	
86	University of New Mexico-Main Campus		X
87	University of Northern Iowa	X	X
88	University of Puerto Rico-Carolina		X
89	University of Southern Maine		X
90	University of St. Thomas	X	

91	University of Texas El Paso	X	
92	University of Washington-Seattle Campus		X
93	University of Wisconsin, Oshkosh	X	
94	University of Wisconsin, Parkside *	X	
95	University of Wisconsin, Platteville	X	X
96	University of Wisconsin, Stout	X	X
97	University of Wyoming	X	X
98	Upper Iowa University	X	
99	Utah State University	X	X
100	Valdosta State University		X
101	Valley City State University	X	X
102	Vincennes University		X
103	Virginia Tech	X	
104	Viterbo University	X	X
105	Wayne State College	X	X
106	West Chester University of Pennsylvania		X
107	Western Michigan University	X	X
108	Western Washington University		X
109	Westfield State University		X
110	Widener University		X
111	William Penn University	X	X

*Love and Maiseroulle (2021) noted that these programs have been discontinued

While this cross-referenced list of TEE-related teacher preparation programs casts the widest net to date, it remained unclear which of these programs are active and what kind of certification (if any) they provided (e.g., secondary education, elementary education, STEM endorsement, etc.).

Programs Identified Through NCES Database

Of the 111 TEE-related teacher preparation programs initially identified (Table 1), 71 had already been identified and catalogued by Love & Maiseroulle (2020). The Love & Maiseroulle 2021 data file included information such as degree type, whether programs led to teaching credentials, etc. Utilizing the NCES database, an additional 37 programs were identified that did not appear on Love & Maiseroulle's 2021 list. As noted earlier, the NCES database only provided the name of the institution associated with the CIP code, but did not provide any information about whether these programs were active, whether they led to teacher licensure, etc. To alleviate this gap, a search was conducted of the web site for each institution to identify basic information about each of these 37 programs, including whether the program was active, the name of the program, and whether it led to teacher certification in TEE (elementary and/or secondary). The web search included listings of degrees/majors and certificates

available at each respective institution, as well as searches of related majors (e.g., secondary education, industry-focused technology programs, etc.) that might include TEE as a concentration/emphasis option rather than as a standalone degree program. For programs found to exist and be active, website and catalog searches were conducted to determine whether they offered teacher certification in TEE. Table 2 summarizes the results of this search, which for the sake of brevity, only includes active programs.

Table 2

Information on active programs newly identified through search of NCES database

University	Program Name	Licensure	Additional Notes
California State Polytechnic University-Humboldt Cerritos College	Secondary Education – Industrial Technology Career Technical Education	Secondary	They can apply for a single subject credential. No information is provided on the program – it is unclear on its status, licensure, or requirements from a basic web search
Chadron State College	Career and Technical Education Supplemental Endorsement		This is an endorsement focused on teaching Work-Based Learning for grades 9-12 to be added onto secondary licensure in a different content area
Chicago State University	Career and Technical Education – Industrial Technology Education	Secondary	The degree has a concentration in Communication, Energy Utilization, Production, and Transportation
CUNY City College	Technology Teacher Education	Secondary	

Dickinson State University	Technology Education		This is a collaborative degree with Valley City State University who provides all of the content coursework
Fox Valley Technical College	Career and Technical Education Instruction		This is an Associate's Degree
North Carolina A&T University	Technology Education		Only available as a Master of Arts in Teaching
Lakeland University	Technology Education	K-12	
Pennsylvania Western University	Secondary Education – Technology Education	Secondary	Formerly California University of Pennsylvania
St. Cloud State University	Technology Education	Secondary	A Master of Science degrees is also available
University of Southern Maine	Self-Designed STEM Major – Elementary Education	Elementary	No longer accepting students
Vincennes University	Technology – Career/Technical Education Baccalaureate Concentration	Secondary	This is a 2+2 program with an Associate's degree in Education with a Technology concentration.
Westfield State University	Vocational Technical Education	None	Focus is on the trades. Degree not required for licensure in these areas in MA.

Note. Only programs exclusively listed in the NCES database that were currently active were included in this table. All programs are undergraduate baccalaureate programs unless otherwise noted.

Of the 37 additional programs identified through a search of the NCES database, only 14 could be located by searching the respective institution websites/catalogs as described above. One of the 14 programs (University of Southern Maine) noted that students were no longer being accepted. Programs listed in only the NCES database that could not be located through the web search, along with any related information that was located, can be found in Table 3.

Table 3

Programs identified through a search of the NCES database having no internet presence

University	Additional Notes
Bemidji State University	They have an Engineering Technology degree but does not show any path to teaching licensure currently offered.
Boise State University	They have Master of Educational Technology and Doctor of Education in Educational Technology degrees that do not result in licensure but require students to have an appropriate education background. It has the goal to prepare instructional designers, UX designers, etc.
Central New Mexico Community College	Offers an Alternate Teacher Licensure program that can be added to any Bachelor's degree.
Clemson University	They have a Work-Based Learning/CTE endorsement, but it is only available for Agricultural Education
Fresno City College	They have an Applied Technology Division that offers CTE programs, but it is a technical certification that does not include TEE licensure
Loyola University Maryland	They have a M.Ed. in Learning Design and Technology, which is a focus on instructional technology
Marian University	They have a Master's in Education Technology

Note: No information was found for a program at Delta College, El Camino Community College District, Fullerton College, Lincoln University, Loyola University Chicago, Rider University, San Francisco State University, University of Maine, University of Maryland-College Park, University of New Mexico-Main Campus, University of Puerto Rico, University of Washington, Valdosta State University, West Chester University of Pennsylvania, Western Washington University, or Widener University.

Research Objective 1 focused on the identification of existing TETPPs through the cross-referencing of existing approaches to identifying these programs. In doing so, we sought to cast the widest possible net by including those programs identified by Love & Maiserouille (2021) as well as programs identified through a search of the NCES database. Of the 37 additional programs identified within the NCES database, 13 were found to be actively recruiting and preparing TEE teachers. One additional program was active but was not accepting students and was therefore determined to be in the process of closure. Combining the 13 active programs found in the NCES data with that of the 71 active programs included in the 2021 Love & Maiserouille data file, brings the total number of *currently active* TETPPs to 84.

Research Objective 2: Enrollment and Structure of TEECA-Affiliated Programs

Research Objective 2 focused on ascertaining the status of TETPPs, specifically with respect to programs recently affiliated with TEECA. Of the programs included in either list, 20 have been affiliated with TEECA between 2014 and 2024. Findings from data collected through requests sent via email to faculty members of TEECA-affiliated teacher preparation programs revealed differences in program titles, enrollment, and structure. Table 4 presents a summary of the data collected from program faculty, including program name/description, enrollment (including those seeking licensure), and additional contextual information that was provided by faculty from some programs. The reported enrollment numbers ranged from 7 to 175 students ($M = 61.6$ students, $SD = 56.9$). However, for students pursuing licensure, the range was 7 to 135 ($M = 37.0$ students, $SD = 37.4$ (Table 4). The highest enrollment was reported by SUNY-Oswego, with 175 students, 135 of whom were pursuing teaching licensure. Two programs reported an enrollment of seven students, all of whom are seeking teaching licensure. The largest discrepancy between total enrollment and those pursuing licensure was at Fort Hays State University (FHSU), which had 170 enrolled students with only 10 seeking licensure. Out of the 13 programs that responded, six had enrollments exceeding 50 students, and of those, three had 50 or more students pursuing education licensure. Four programs reported enrollments of 100 students or more.

Table 4

Summary of program information collected via email request from faculty in TEECA-affiliated programs

University	Program Name	Enrollment (seeking licensure)	Additional Program Notes
Brigham Young University (BYU)	Technology and Engineering Education (prior to 2020) Technology and Engineering Studies (2020 - present)	75(29)	TEE was teacher licensure only. TES offers licensure as an emphasis alongside a technical-track emphasis.
The College of New Jersey (TCNJ)	Held in the Department of Integrative STEM (iSTEM) under two majors 1. Technology and Engineering Education 2. iSTEM	25(25) TEE 75(75) iSTEM	TEE is a degree to teach in a secondary classroom. iSTEM is a joint major between the Elementary Education and Engineering. Pre-service teachers enrolled in iSTEM can pursue a technology specialization, which certifies teachers to teach technology in K-12
Fort Hays State University (FHSU)	Technology Studies	170(10)	Technology Education is an emphasis within a technical-focused program that offers teacher licensure
Illinois State University (ISU)	Technology and Engineering Education	32(32)	None provided

Millersville University (Millersville)	Technology and Engineering Education	60(60)	Offers teacher technology education licensure for Pre-K-12. TEE is part of the required science curriculum in the state. Vocational education falls under a separate certification
North Carolina State University (NC State)	Technology, Engineering, and Design Education (Major and Minor)	101(27)	The department offers two different technical-tracks The numbers reported for Technology, Engineering, and Design Education combine those enrolled in both the major and minor.
Ohio Northern University (ONU)	Technology Education	7(7)	Each student is trained for teacher licensure, but can opt out of student teaching which prevents them from receiving a teaching license.
Old Dominion University (ODU)	Career and Technical Education with an emphasis in Technology Education	7(7)	None provided
Pennsylvania Western University (PennWest)	Technology Education (prior to 2022) Secondary Education with an emphasis in Technology Education (2022 - present)	19(19)	The change was due to drops in enrollment and was absorbed by Secondary Education
Pittsburg State University (Pitt State)	Career and Technical Education with an emphasis in TEE	20(20)	None provided

Purdue University*	Engineering and Technology Teacher Education	19(19)	None provided
The State University of New York – Oswego (SUNY-Oswego)	Technology Education	175(135)	Also offers an industry track titled Technology Management.
Utah State University (USU)	Technology and Engineering Education (Major and minor)	16(16)	As of 2023-2024, USU started a stackable program for students with certifications from technical colleges to earn teacher licensure. A Masters' degree in TEE is also available but does not include licensure.

*Since the initial data collection, faculty have noted that they are no longer accepting new students and will be closing their program

In addition to overall enrollment, some programs provided their recent graduation rates of licensed teachers (Table 5). Brigham Young University (BYU) also provided the graduation rates from the last two years during which time it was a solely teacher licensure program, as well as graduation rates after the transition to an industrial track program with teacher licensure as an emphasis. The report from Millersville University also specified that graduating with licensure did not mean students chose to become teachers.

Table 5*Graduation reports from TEECA-affiliated teacher preparation programs*

School Name	Graduation reports
BYU	Technology and Engineering Education (licensure program) 2018 = 18 graduates (all teaching) 2019 = 12 graduates (all teaching) Start of Technology and Engineering Studies (licensure emphasis) 2020 = 17 graduates (6 Teaching and 11 Technical) 2021 = 25 graduates (10 teaching, 15 Technical) 2022 = 21 graduates (7 teaching, 14 Technical) 2023 = 15 graduates (6 Teaching and 9 Technical)
Millersville	2022-2023 = 13 graduates (11 intended to teach)
NC State	About 7 teachers/year
SUNY-Oswego	25-30/year
USU	2022-2023 = 5 graduates (all teaching)

Our findings revealed a wide variety of program structure characteristics, such as name, type of program, and type of licensure, as well as program health as measured by enrollment across TETPPs affiliated with TEECA.

Discussion and Recommendations for Future Research

The purpose of this study was to gain a better understanding of contextual factors in the field of technology and engineering education that may impact TEE students seeking teacher certification in TEE. For this study, these factors include the number of available programs as well as the enrollment and structure of existing programs, which may be construed as indicators of program health. The research objectives were developed to address the goals of developing a more comprehensive list of existing TETPPs, inclusive of information regarding program enrollment and structure.

Our study identified an initial list of 108 teacher preparation programs that prepare students for teacher certification in TEE-related subject areas. This list was generated by cross-referencing the work of Love & Maiseroulle (2021, 2022) with programs reporting themselves to the National Center for Education Statistics as Technology Teacher Education/Industrial Arts Teacher Education programs via their CIP code. Of these 108 programs, 71 were previously identified and catalogued by Love & Maiseroulle (2021). An additional 37 programs were identified exclusively in the NCES database; i.e., not found in

Love & Maiseroulle's list. However, from the NCES database it is unclear whether any of the programs actually existed or were active, and, if so, whether they still provided teacher licensure in TEE subject areas. To address the issue, website searches of these 37 institutions were conducted to determine the status of these programs. Searches revealed a total of 13 programs actively preparing and recruiting TETPPs. Combining these 13 with the 71 already catalogued by Love & Maiseroulle, our research indicates that a total of 84 active TETPPs currently exist in the United States.

Status of True TEE Programs

An obvious caveat to this list of 84 programs is that we have not answered the question: What is a *true* technology and engineering education teacher preparation program. Volk (2019) contended that only about 32 programs existed at the time of his article, while Love & Maiseroulle included 71 programs – more than double Volk's estimate. Our list now includes 84 possible TETPPs. The actual number of programs truly preparing technology and engineering teachers to a large degree depends on how one defines a technology and engineering teacher preparation program. A more traditionalist approach, for example, which might restrict inclusion to only those that have historically been associated with ITEEA will lead to a smaller list, while a more inclusive approach that includes teacher preparation programs for STEM educators will lead to a larger list.

One might also argue that Career and Technical Education (CTE) is epistemologically at odds with TEE, and that programs with a focus on preparing vocational education teachers ought to be excluded. A full discussion of the strengths and weaknesses of any of these or other approaches is outside the scope of this investigation; however, we note that this discussion is still relevant, and even crucial to the future of the profession. Without a clear identity and direction for the future, professional organizations and leaders within the TEE profession cannot effectively articulate the importance of technology and engineering to policymakers and other stakeholders on a local, state, or national level. A *big tent* approach is alluring in that it may result in an increase in the number of educators and other professionals who associate themselves with the TEE profession. Historically, this seems to have become a possible strategy to growing the profession as Industrial Arts led to Technology Education, which became Technology and Engineering Education, and has now grown to include Integrative STEM Education. However, a hidden danger may exist in being everything to everyone. If clear boundaries are not drawn as to what does and does not constitute technology and engineering education (and, by extension, what does and does not constitute a TETPP), there is a risk that TEE may lose its identity as a distinct discipline. While we initially set out to build on the work of Volk (2019) and Love & Maiseroulle (2021, 2022) to determine the number of TETPPs still in existence, the results suggest further research is needed to

address the fundamental question: What is technology and engineering education in the 21st century?

Assessing the Health of Teacher Preparation Programs

We also collected information from a convenience sample of 13 faculty members (Table 4) in teacher preparation programs that were affiliated with TEECA within the past 10 years. Our findings from these data indicate wide variability in program structure, with some teacher preparation programs existing as standalone programs focused exclusively on teacher education, and others consisting of a teaching emphasis within or alongside industry-focused degree programs. In addition, some programs included other teaching certification tracks such as elementary STEM or other CTE teacher certifications.

Our findings also indicate wide variability in enrollment, with some programs enrolling fewer than 10 students and others with more than 100 students, and similarly disparate trends for graduation numbers at the time our data were collected. The two programs that reported the highest enrollment rates did have a technical track. However, Fort Hays State University (FHSU) showed that the majority of their students were on the technical track whereas SUNY-Oswego showed the majority of their students pursuing teaching licensure. While drawing conclusions about TETPPs generally from this convenience sample is not advisable, the findings do provide an illustration of the variability across TETPPs, which makes cataloguing and assessing the health of these programs a challenge. While we have tacitly assumed in this study that enrollment is an important indicator of the strength (health) of TETPPs, our findings uncovered other possible factors that could contribute to strong TETPPs.

One of these possible indicators that emerged from our findings was the composition of the home administrative unit of the TETPP. When we initially sought enrollment information from TETPP faculty, several responded asking whether they should include total enrollment or just those seeking teaching licensure. Through this we learned that several of the TETPPs we contacted were housed in administrative units alongside industry-focused programs, or that their entire teacher-education program was an emphasis or concentration within a program that prepared both industry professionals and teachers. This included multiple programs with relatively robust enrollment numbers. Other faculty indicated that their programs were part of administrative units that were focused on CTE teacher-preparation, and included programs such as Agricultural Education, and Family & Consumer Science Education. Still others were in units focused on general teacher education, such as Mathematics, Science, and Language Arts.

Some research has suggested that TEE students became aware of TEE through an initial interest in technical subjects (the content) rather than an initial

interest in teaching (Furse, et al., 2025; Love & Love, 2022; Yoshikawa-Ruesch, 2024). If this holds true, TETPPs that are housed alongside industry-focused programs may have advantages when it comes to recruiting students out of industry-track programs into teaching. These programs could potentially also benefit from access to more robust technical coursework and a broader availability of faculty expertise to teach the technical content associated with TEE. While our data were not sufficient to draw any of these conclusions, a future study could categorize a broad sample of TETPPs by the composition of their home administrative unit (e.g., industry-focused, CTE-focused, education-focused), to determine whether this is associated with enrollment and graduation trends. Other potential indicators of program health should also be explored, such as affiliation with TEECA, the number of faculty, or the presence of graduate programs alongside undergraduate TETPPs.

Refining the List of Teacher Preparation Programs

As Love and Maiserouille (2021, 2022) showed, and our study corroborates the many programs and routes for students to acquire TEE licensure through university-based programs. It is possible that additional programs may have been discontinued since Love & Maiserouille's study and since our data were collected. In addition, while we were able to determine at a basic level which programs listed in the NCES database were still active TETPPs, a more thorough investigation is needed to determine the strength of these programs, including enrollment and graduation trends (and other possible indicators previously discussed), and curricular focus. In practice, this effort should ideally be consistent and ongoing at regular intervals. This effort could be conducted through strategic committee work within the Council on Technology and Engineering Teacher Education (CTETE) and would provide opportunities to strengthen the identity of the profession through increased collaborative effort and professional association among a larger number of TETPPs through organizations such as ITEEA.

Addressing the Demand Side of the Equation

Historic and current efforts to identify TETPPs and ascertain the status of the profession have tended to focus on the supply side of the supply-demand equation. In other words, most researchers have approached the issue by attempting to identify TETPPs directly by either contacting faculty in known teacher preparation programs periodically or by conducting searches and content analyses to identify previously unknown programs.

Another approach remains untried in our field but has been successfully implemented in agricultural education. Since 1965, agricultural education researchers have conducted a national supply and demand survey which, despite obvious challenges in obtaining complete data from all states, has produced beneficial data ranging from nationwide supply and demand for agriculture

teachers to program-specific data regarding the health of their teacher preparation programs (Foster, et al., 2025). One major component of this ongoing project approaches the problem of teacher preparation from the supply side of the equation by collecting state-level data on where agricultural education teachers are being hired, how they are obtaining certification/licensure (e.g., traditional teacher preparation programs versus alternative routes to licensure), and where the demand is greatest for agricultural educators at the K12 level. Similar research should be conducted in technology and engineering education, ideally with direct support from professional associations such as ITEEA through strategic committee work in CTETE.

In summary, these recommendations for future research suggest the need for a concerted effort, supported by professional associations such as ITEEA and affiliated councils such as the Council on Technology and Engineering Teacher Education, to produce a consistent and ongoing effort to gauge, and ultimately strengthen the health of our profession.

Conclusion

While there continues to be great concern for the vitality and strength of TEE, a dearth of largely untapped information continues to exist regarding technology and engineering teacher preparation programs. Although this study, building on previous work, has identified 84 active TETPPs, and assessed the basic enrollment and structure of several programs with recent TEECA affiliation, the structure and enrollment rates across TETPPs vary greatly from program to program. This inconsistency in program structure and visibility negatively impacts the profession.

Of the 84 programs that have been identified, only 43 are currently listed on ITEEA's website for teacher preparation programs. Our findings suggest the need for a concerted effort, supported by professional associations such as ITEEA to produce a consistent and ongoing effort to connect with, assess the health of, and develop a clear identity for technology and engineering education teacher preparation programs. We call for an updated accurate list of TETPPs as well as further studies evaluating the demand for technology and engineering educators in the nation.

Conflict of Interest Statement

The authors have no relevant financial or non-financial interests to disclose.

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