

The Teacher Recruitment Crisis: Examining Influential Recruitment Factors from a United States Technology and Engineering Teacher Preparation Program

Tyler S. Love¹ & Zachary J. Love²

¹The Pennsylvania State University, Capital Campus (Middletown, Pennsylvania, USA)

²Donegal Junior High School (Mount Joy, Pennsylvania, USA)

Author Notes

Tyler S. Love is an Assistant Professor of Elementary/Middle Grades STEM Education at The Pennsylvania State University's Capital Campus. Zachary J. Love is a Technology and Engineering Education teacher at Donegal Junior High School, Mount Joy, Pennsylvania, USA. Correspondence concerning this manuscript should be addressed to Tyler S. Love, Penn State Harrisburg, 777 W. Harrisburg Pike, Middletown, PA 17057, USA. E-mail: TSL48@psu.edu. ORCID: 0000-0002-1161-1443.

Abstract

Decades of declining enrollment trends and additional program closures of Technology and Engineering (T&E) teacher preparation programs in the United States (US) continue to raise concerns about the trajectory and sustainability of the profession. These concerns are not insular to the US though as other countries have also presented data indicating a T&E teacher shortage crisis. In attempts to address these concerning trends, T&E teacher preparation programs in the US have implemented an amalgam of creative recruitment strategies. However, the data continues to show a downward trend in the country, questioning what is the sufficiency of these efforts and which are the most influential? This study surveyed 51 students enrolled in a T&E teacher preparation program in the eastern US to determine which recruitment methods had the greatest influence on their decision to enroll in the program. The findings revealed that face-to-face interactions with secondary level T&E educators, alumni, T&E teacher education faculty members, and an interest in hands-on hobbies related to T&E education were found to have a statistically significant influence on students' decision to enroll in the T&E teacher preparation program. A number of recruitment factors such as secondary school counselors, brochures, and social media platforms did not have a significant influence on students' enrollment decision. Recommendations and implications for T&E teacher preparation programs, teacher educators, program alumni, researchers, secondary level T&E teachers, administrators, and school counselors are provided to help countries facing a similar T&E teacher shortage crisis.

Keywords: Technology and Engineering education, Design and Technology education, teacher recruitment, teacher preparation, teacher shortage, integrated STEM education.

The Technology and Engineering (T&E) Teacher Shortage Crisis in the US

For decades researchers in the United States (US) have raised concerns about the increasing shortage of Technology and Engineering (T&E)¹ teachers (Daugherty, 1998; Edmunds, 1980; Gray & Daugherty, 2004; Love et al., 2016; Moye, 2017; Moye et al., 2020; Starkweather, 1999; Volk, 1993, 1997, 2019). Unfortunately, the continually declining trends in enrollment and active T&E teacher preparation programs support their call for action. Volk (1993) reported that in 1970 there were 203 higher education institutions offering undergraduate industrial arts/technology education (IA/TE) teacher preparation degrees, and in 1990 this number had dropped to 174. In a 2007 study that examined both International Technology and Engineering Educators Association (ITEEA) affiliated and non-affiliated technology education teacher preparation programs, there were 72 programs identified within the US (Warner et al., 2007). That number fell to 43 in 2015 (Love et al., 2016), and Volk (2019) found only 32 undergraduate T&E teacher preparation programs in the US were still accepting applications as of 2018 (Volk, 2019) (Figure 1).

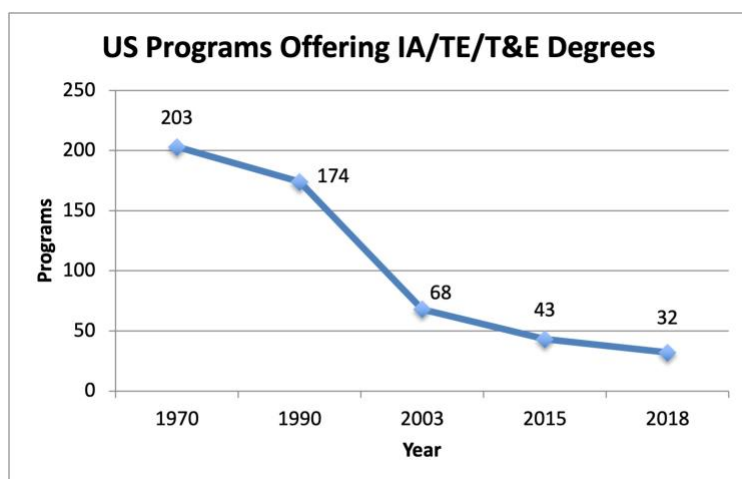


Figure 1. Programs offering Industrial Arts/Technology Education/Technology & Engineering Education Degrees in the United States from 1970 to 2018.

¹Design and Technology Education in the United States is commonly referred to as Technology and Engineering Education.

Volk (1993) also reported that in 1970 there were 6,368 students who received a bachelor's degree in IA/TE, and in 1990 this number had declined to 1,790 students. Soboloski (2003) indicated that number had fallen to 716 per year by 2003, and Love et al. (2016) reported that number had further eroded to 245 by 2015. More recently, Volk's (2019) review of both the ITEEA Council on Technology and Engineering Teacher Education (CTETE) directory and data from the state of California's Educator Preparation Committee found 164 T&E education related bachelor's or teacher certification credentials were awarded in 2018 (Figure 2). Based on past trends, this drastic decline in the number of graduates is destined to lead to further program closures in the US, especially as higher education institutions look for ways to remedy financial difficulties stemming from the steady decline in the US high school age population (Bransberger et al., 2020). One reason existing T&E programs in the US remain in operation may be due to a steady stream of recruits seeking the credentials needed to fill the abundance of secondary level T&E education vacancies across the country (USDOE, 2020).

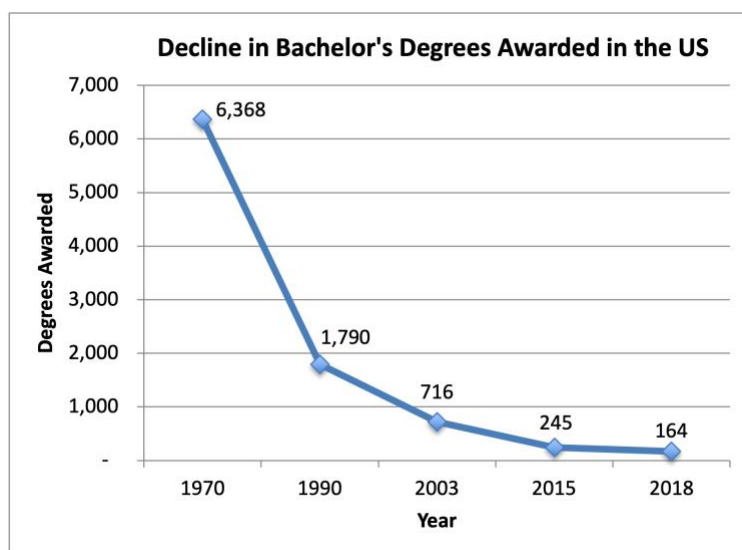


Figure 2. Industrial Arts/Technology Education/Technology & Engineering Bachelor's Degrees Awarded in the United States from 1970 to 2018.

International T&E Teacher Shortage Crises

New Zealand

The T&E teacher shortage crisis is not limited to the US unfortunately. Reinsfield and Lee (2021) highlighted that there are technology education (TE) teacher shortages in some European countries, Japan, New Zealand, and South Africa. They compared the TE teacher shortage in New Zealand as similar to that presented by Love et al. (2016) in the US. In their survey of Technology Education New Zealand (TENZ) members, Reinsfield and Lee found that 68% of schools were using teachers from other content areas to fill TE teaching vacancies. With 42% of the technology educators in their study indicating their intention to retire within the next five years, they identified recruitment of TE teachers to fill these vacancies as a dire concern. Approximately 62% of the schools said there were a limited number or no applicants for their TE teaching openings, 33% believed applicants lacked adequate experience in technology education, and only 6% reported they were able to employ qualified TE teachers. This resulted in 18% of the schools cancelling TE classes or increasing class sizes, 16% increased the workload for qualified teachers to compensate for those hired with no TE background, 23% of the schools had to limit the variety of TE course offerings, and 33% indicated the TE content was being embedded in other content courses or “watered down” by becoming more theory based as opposed to hands-on design based. Reinsfield and Lee concluded that the lack of qualified TE educators was jeopardizing the reputation of TE as a career option, further contributing to low recruitment and retention issues.

Australia

In 2019 the Design and Technology Teachers’ Association of Australia (DATTA Australia) conducted a study involving 404 schools across Australia and found that 96% of those

schools experienced difficulty finding qualified technology educators. The shortage of finding qualified applicants was compounded by the projection that 26% of the teachers were expected to leave the profession due to retirement and stress. Similar to Reinsfield and Lee's (2021) research, the DATTA Australia study also found the teacher shortage was hindering the quality of TE instruction and course offerings. Approximately 42% of the teachers entered the profession from an industry or professional background, and 84% of the schools were currently using unqualified teachers from other content areas to teach TE courses required by National and State curriculum authorities. Seventy percent of the schools believed this was compromising the health and safety of teachers and students (e.g., due to specialized technologies such as hand/power tools and machines that are needed to construct designs in TE courses), which could lead to further course or program closures. Additionally, 39% of the schools reported reducing the amount of TE courses being offered, and 68% believed the quality of the remaining programs were compromised due to the shortage of highly qualified technology educators. From these findings DATTA Australia recommended funding upskilling professional development courses (especially in health and safety), a national recruitment campaign to enhance the perception of TE as a profession (which was described as a major cause for candidates not pursuing a career in TE), subsidizing financial barriers for those interested in enrolling in TE teacher preparation programs, and increase the starting salary for candidates from industry or professional backgrounds. They projected that, "if significant action is not taken as outlined in this report, the Technologies learning area in Australia will be unsustainable by 2025" (DATTA Australia, 2019, p. 3).

England

Furthermore, the continual shortage of Design and Technology (D&T) educators has also

plagued England. In a House of Commons teacher recruitment and retention report prepared for Parliament, the Design and Technology Association (DATA) provided written evidence that the supply of D&T teachers is worse than any other content area and remains in decline (House of Commons Education Committee, 2017). Up until 2012 there were just enough applicants recruited into D&T programs to address the national target needs. However, the number of students entering D&T teacher preparation programs were not even meeting half of the national target needs by 2014 (42%), 2015 (41%), and 2016 (41%). D&T met the lowest percentage of their target needs among any content area in 2016, and was the third lowest in 2021. D&T also had among the highest vacancy rates of any subject area in 2019 (House of Commons Education Committee, 2017; Long & Danechi, 2021). DATA recommended to the House of Commons Education Committee that a greater focus be placed on advertising and promoting D&T as a subject, ensure that it is explicitly mentioned as a part of STEM in ministerial speeches and publications, place a greater priority on D&T in the Teach First Training Programme, and revise the skills tests and training requirements to provide greater opportunities for individuals to become highly qualified D&T teachers (House of Commons Education Committee, 2017).

Potential Causes for Declining Trends in the US

Teacher preparation programs in the US are grappling with similar T&E teacher shortage issues. The United States Department of Education has identified T&E education as a teacher shortage area in many US states since the late 1990's (USDOE, 2020). Moye et al.'s (2020) recent Delphi study reaffirms this notion that the T&E teacher shortage in the US continues to be a critical issue looming over the profession. In Moye et al.'s study, T&E educators from across the country identified the shortage of T&E teachers and low recruitment of teachers as the number one current and future trends and issues facing the profession. They opined that this

problem persists because, “The profession has not adequately addressed this problem. Perhaps leaders are looking at the wrong variables and using ineffective strategies” (p. 43).

Numerous studies hypothesized that the growing shortage of T&E educators was associated with the declining number of T&E teacher preparation programs (Love et al., 2016; Moye, 2017; Volk, 1993, 1997, 2000, 2019). Reasons cited for the decline in programs included steep costs associated with materials and equipment, not replacing faculty upon retirement, political action by education departments, lucrative competing industry employment options, negative perceptions of teaching as a career, and other factors (Volk, 2000, 2019). The continual T&E teacher shortage has led to an alarming number of instructors in the US who are teaching T&E courses with alternative licensure, who are not highly qualified, or who are not certified to teach T&E education (Ernst & Williams, 2015; Love, 2015). Volk (2019) cited Project Lead the Way’s (PLTW) prescribed one- and two-week training models as a growing trend that has undermined the perceived need for a specialized T&E education degree, “Although PLTW now uses certified teachers in any subject to be trained to use their product, PLTW will more likely need to train uncertified teachers to meet increased program demand” (p. 13).

Volk (2019) also proposed there was a mismatch between what is occurring in some secondary level T&E programs and what is expected to occur according to professional associations (e.g., ITEEA) and higher education institutions, “Some would probably be surprised and disappointed to not find the industrial arts courses that they are familiar with in any university’s technology and engineering education teacher preparation or engineering program” (p. 8). He concluded this may be impacting the enrollment and retention of T&E teacher preparation programs. The aforementioned mismatch questions if factors contributing to the T&E teacher shortage are directly related to program recruitment efforts. Examples of additional

contributing factors include low teacher salaries, dissolving pension systems, high academic and ethical expectations of educators, and negative perceptions of the profession from recent strikes publicized in the media (Ujifusa, 2018). The specific influence that these factors have on a student's decision to enroll in a T&E teacher preparation program is unknown. It is also unclear to what extent specific recruitment efforts can reduce the effect of factors unrelated to recruitment.

Research on Prior T&E Teacher Recruitment Factors

Over the past 60 years numerous studies in the US have surveyed teachers, undergraduate students, alumni, department chairs, professors, and state supervisors (Craft, 1980; Devier, 1982; Edmunds, 1980; Sanders, 1986). Foley (1967) conducted a study that examined recruitment procedures and their effectiveness toward recruiting students into industrial arts (IA) programs. His study found that colleges and universities offering IA were using the same recruitment strategies as other teaching disciplines (i.e., English, mathematics and science).

Edmunds (1980) published arguably some of the most insightful pre-internet recruitment findings, which revealed that statistically, contact with IA program alumni proved to be the most successful recruitment method. Two other significant recruitment methods he found were brochures and personal letters sent to secondary level students. As depicted in Table 1, the literature has consistently demonstrated that classroom teachers have a strong influence and are important recruiters for undergraduate T&E education programs (Craft, 1980; Devier, 1982; Edmunds, 1980; Foley, 1967; Gray & Daugherty, 2004; Isbell & Lovedahl, 1989; Izadi & Toosi, 1995; Ressler, 1966; Sanders, 1986). Devier's (1982) research supported this notion that personal contact with IA teachers, especially alumni, was most successful in recruiting students to major in IA. Seven years later Isbell and Lovedahl (1989) also determined that the most

influential technique for recruiting technology educators (formerly called IA) was personal encouragement from high school technology education teachers. Furthermore, their study revealed that 66% of technology education teacher preparation department heads perceived this as one of the top three strategies for recruitment. More recently, Gray and Daugherty (2004) found that the two main attributes that attracted students to technology education were their personal interest and enjoyment of hands-on activities, and the influence of their technology educators. Approximately 42% of the participants in their study believed that their technology education teacher influenced them to enter the profession.

It should be noted that some studies found as many as 75% of students do not make their career choice until after high school (Foley, 1967; Izadi & Toosi, 1995). This can result in students enrolling in higher education institutions without declaring a major. Therefore, higher education students who are uncertain about a program of study are also an important population to target. Sanders (1986) suggested universities maintain a consistent positive working relationship with teachers and alumni to recruit students from non-majors and community colleges. Another key finding from Sanders's research was that recruitment efforts are more successful when divided among multiple faculty members with a common recruitment plan.

Table 1

Notable Recruitment Findings from Previous Studies in the US

Study	Significant Finding
Ressler (1966)	IA teachers were the most influential recruiters.
Foley (1967)	IA used the same recruitment strategies as other disciplines.
Edmunds (1980)	IA alumni had the greatest influence on recruitment. Brochures and personal letters sent to students had a significant influence.
Craft (1980)	IA teachers had a strong influence on recruitment.
Devier (1982)	Multiple recruitment methods were important, especially personal contact with IA teachers and alumni.

Sanders (1986)	Shared recruitment responsibilities and a common plan among multiple TE faculty was critical.
Isbell & Lovedahl (1989)	TE teachers were the most influential recruiters.
Izadi & Toosi (1995)	TE teachers had a strong influence on recruitment and students often made their career choices after high school.
Gray & Daugherty (2004)	TE teachers were the most influential recruiters.

Note. IA = Industrial Arts; TE = Technology Education.

Purpose of the Study

The literature clearly indicates that the shortage of highly-qualified T&E teachers poses some serious concerns about the future of the profession, and the quality and safety of hands-on T&E instruction in the US and a number of other countries. Traditionally, one of the greatest factors that has contributed to declining enrollments in US T&E teacher preparation programs has been the offering of technology and engineering related non-teaching careers such as Industrial Technology, and Applied Engineering (Sinn, 1989; Volk, 1993). This led Volk (1993) to question, “What is being done right, in those few technology teacher preparation programs that are succeeding?” (p. 56). Moreover, Daugherty (1998) summarized the T&E teacher shortage crisis best. His synopsis remains eerily relevant to the status of T&E teacher education decades later:

The urgent need to recruit, prepare, and retain significantly more teachers in technology education is clear. At the same time the population of teachers entering the field is decreasing, the number of teaching opportunities and number of secondary students enrolling in technology education programs is increasing. The low number of individuals entering technology education teacher preparation institutions threatens not only post secondary programs, but the very fabric of the profession through the closing and consolidation of programs (p. 22).

Like many T&E teacher preparation programs in the US, the one examined in this study

had witnessed a declining enrollment trend and implemented a number of strategies to try to reverse this downward trajectory. Historically the program was one of the larger preparers of T&E teachers in the US, graduating between 30-50 students a year with a Bachelor of Science degree in T&E education. However, the program experienced a dramatic decrease from 227 to 79 enrolled students in just a five-year span. When this study was conducted the program had declined to 35% of what it had been five years earlier, with 17 freshman, 12 sophomores, 17 juniors, and 33 seniors enrolled. The program's enrollment decrease within a demi-decade raised questions regarding causes for the trending decline in enrollment. Therefore, this study was conducted to investigate the influence of recruitment factors and inform future recruiting efforts. The continual study of emerging recruitment factors (social media, digital advertising, etc.) is critical for maintaining existing T&E teacher preparation programs, and hopefully can help reverse declining enrollment trends.

Methods

The methods and instruments utilized in a number of previous T&E education recruitment studies were analyzed (Craft, 1980; Devier, 1982; Edmunds, 1980; Gray & Daugherty, 2004; Isbell & Lovedahl, 1989; Izadi & Toosi, 1995; Sanders, 1986; Wright & Custer, 1998). Slight modifications to Gray and Daugherty's (2004) survey instrument were made to account for newer recruitment techniques such as social media, resulting in a 16 question survey examining recruitment techniques and influential factors (Appendix A). To establish face validity, two T&E teacher education professors within the program reviewed the instrument and minor changes were made based on their feedback. The survey used in this study consisted of questions seeking demographic information as well as ratings of recruitment factors that current T&E education majors believed influenced their decision to enroll in the program.

The questions examining the influential recruitment factors were six-point Likert scale items (1 representing no influence to 6 indicating it was the main influence) asking students to identify to what extent select recruitment techniques, personal factors, or perceived job-related characteristics influenced their decision to major in T&E education.

To distribute the survey a five-phase process was implemented. All five phases occurred during a fifteen-day period during the fall semester. The first phase included contacting currently enrolled students on the T&E teacher preparation program's email server list and providing them with a link to the online survey. During the second phase, one of the researchers visited the T&E education classes at the university to encourage students to complete the survey. In phases three and four follow-up emails were sent to students, and lastly in phase five one of the researchers again visited classes at the university to increase student interest.

A total of 51 undergraduate or post baccalaureate-certification students enrolled in the T&E education teacher preparation program participated in this study. This included 11 freshman, 3 sophomores, 11 juniors, and 26 seniors. The participating sample consisted of college students between the ages of 18-50, with 39 males and 12 females. The survey yielded a 65% (51/79) response rate which was well above the mean rate for online surveys (Nulty, 2008). For each recruitment factor the mean rating, number and percentage of students who deemed that factor to be highly influential by rating it a 5 or a 6, and the 95% confidence intervals were calculated (Table 2). For recruitment factors where more than 50% of the observed sample rated that question highly influential a one-proportion z-test was performed. This test was used to compare the observed sample proportions to a theoretical proportion. The normally distributed data met the assumptions for this analysis, which was deemed appropriate to determine if the simple majority of students found specific recruitment factors to be significantly influential

(Argyrous, 1997). The data was collapsed into a binomial variable consisting of two discrete categories: 1) those who rated the recruitment factor highly influential, and 2) those who did not. The observed proportion was the percentage of students who rated that recruitment factor highly influential and the theoretical proportion used in all z-tests was 50% to determine if the factor had a significant influence on the majority of students. A p value of .05 was used in all analyses (Table 3). The survey questions and statistical analyses led to many interesting findings regarding recruitment methods that students found to be highly influential.

Findings

Student Responses

After survey responses were collected the mean rating, number of students who rated the item highly influential, and 95% confidence intervals were calculated for each recruitment factor (Table 2).

Table 2

Student Survey Responses about Recruitment Factors

Recruitment Factor	M	VI n (%)	95 CI
Secondary Level T&E Teacher	5.29	44 (86.2)	76.8-95.7%
Hands-on Hobbies	4.76	34 (66.7)	53.7-79.6%
Alumni Interactions	4.51	33 (64.7)	51.6-77.8%
Face-to-Face Interaction with Faculty	4.49	33 (64.7)	51.6-77.8%
Perceived Positive Job Characteristics	4.63	31 (60.8)	47.4-74.2%
Current T&E Education Student in the program	2.94	16 (31.4)	18.6-44.1%
University Open House	2.49	11 (21.6)	10.3-32.9%
Technology Student Association (TSA)	2.18	10 (19.6)	8.7-30.5%
Family Members	3.10	8 (15.7)	5.7-25.7%
Friends/Peers	2.59	8 (15.7)	5.7-25.7%
University Website	2.55	5 (9.7)	1.6-17.9%
Brochures	2.14	4 (7.8)	0-15.2%
High School Counselors	2.20	3 (5.8)	0-12.3%
University Recruiter Visiting HS	1.47	2 (3.9)	0-9.2%
Social Media	1.29	2 (3.9)	0-9.2%

Note. M = Mean, representing Likert scores ranging from 1 (no influence) to 6 (main influence). VI represents the number (n) and percentage (%) of students who selected this recruitment factor as very influential. 95 CI represents the 95% confidence intervals.

Next, the recruitment factors which were rated as highly influential by more than half of the students were analyzed using one-proportion z-tests. Those factors and the results of the analyses are presented in Table 3.

Table 3

One-proportion Z-tests

Recruitment Factor	VI (%)	95 CI	Z	p value
Secondary Level T&E Teacher	86.2	76.8-95.7%	5.17039	<.000
Hands-on Hobbies	66.7	53.7-79.6%	2.38524	.017
Alumni Interactions	64.7	51.6-77.8%	2.09958	.036
Face-to-Face Interaction with Faculty	64.7	51.6-77.8%	2.09958	.036
Perceived Positive Job Characteristics	60.8	47.4-74.2%	1.54255	.123

Note. VI represents the percentage of students who selected this recruitment factor as very influential. 95 CI represents the 95% confidence intervals.

The one-proportion z-tests revealed that secondary level T&E teachers, students' interest in hands-on hobbies that they associated with T&E subject areas, interactions with program alumni, and in person interactions with program faculty members were all found to have a significant influence. Based on the theoretical proportion of 0.5, this indicates that the majority (more than 50%) of the population found these recruitment factors to be significantly influential. Most notably was the impact of secondary level T&E teachers encouraging students to pursue a degree in T&E education. More students rated this as very influential than any other recruitment factor. Although 60.8% of the students indicated they perceived teaching T&E to have positive characteristics which were highly influential in their decision, this was not found to be a statistically significant influencer.

Discussion

Overall, students found face-to-face interactions with a secondary level T&E teacher, T&E program alumni, or a program faculty member to be highly influential in their decision to enroll in the T&E teacher preparation program. The hands-on nature of the profession related to hands-on hobbies they enjoyed, and the perceived positive job characteristics associated with being a T&E educator also contributed highly to their enrollment decision. Statistically, it could not be concluded that there was one single dominant recruitment factor that influenced a student's decision to major in T&E education. Rather, it can be concluded that the aforementioned recruitment factors each played an important role in influencing an individual to enroll in a T&E education program.

One interesting finding from this study is that only 60.8% of the students currently enrolled in the T&E education major reported perceived positive job characteristics as influential in their decision to pursue a career as a T&E educator. Teaching as a profession in the US has been undervalued and underappreciated in recent years, leading to numerous state-wide teacher strikes and negative publicity (e.g. low salaries) that makes it challenging to encourage individuals to pursue a career in education (Ujifusa, 2018). Given that the survey participants were currently enrolled in a teacher preparation program, it begs to question why 39.2% did not find the perceived characteristics of their future career choice to be very influential. One characteristic of the profession that students found influential was its connection to hands-on hobbies that they enjoyed.

Safely maintaining a hands-on design and fabrication focus that differentiates T&E education from other content areas was a concern raised in previous recruitment studies (DATTA Australia, 2019; Reinsfield & Lee, 2021; Volk, 2019). Similar to Gray and Daugherty

(2004), this study supports those concerns, indicating that a highly influential characteristic attracting students to the profession is its resemblance to hands-on hobbies that they enjoy. This is a difficult challenge to address as it is fueled by the shortage of highly-qualified T&E teachers (DATTA Australia, 2019; Ernst & Williams, 2015; House of Commons Education Committee, 2017; Long & Danechi, 2021; Love, 2015; Reinsfield & Lee, 2021; Volk, 2019), resulting in unqualified instructors teaching T&E courses which poses serious health and safety risks, and has also been shown to shift courses toward more of a theory based focused as opposed to hands-on (Reinsfield & Lee, 2021; Volk, 2019). Recruitment and retention of students into T&E teacher preparation programs is critical to preparing highly qualified T&E educators to safely maintain the hands-on focus that attracts students to the profession. As numerous documents have suggested, reexamining professional development and training programs to better prepare those entering the profession from industry or a professional background is also warranted to safely maintain a hands-on focus that attracts students to T&E education (DATTA Australia, 2019; House of Commons Education Committee, 2017; Reinsfield & Lee, 2021; Volk, 2019).

Three of the four recruitment factors analyzed in the one-proportion z-tests (secondary level T&E education teacher, T&E program alumni, and face-to-face interaction with a program faculty member) were related to personal contact and interactions with people familiar with the program. However, personal interactions with secondary school counselors or an individual from the university's recruitment office were not found to have a significant influence on recruitment. This may have been due to their unfamiliarity with the program. School counselors are often viewed as influential in providing career advice to secondary level students, however in this study only 5.8% of the participants felt their school counselor was very influential in their decision to major in T&E education. This calls for the need to better educate school counselors

about T&E education as a profession and collaborate with them to identify students who enjoy hands-on hobbies or T&E topics that would be prime candidates for T&E teacher preparation programs. Interactions with current students in the program had a low influence with only 31.4% of students finding this highly influential. This recruitment factor may be more effective if combined with other influential factors such as current students attending recruitment events or secondary T&E classrooms with a program faculty member. Secondary level students may be able to connect better with a current T&E teacher education student closer to their age as opposed to an older faculty member. Additionally, Technology Student Association (TSA) which is often offered as an after-school club in US schools was only viewed as highly influential by 19.6% of the students. TSA is often facilitated by the T&E teacher, meaning the students get to spend additional time working with their teacher. This study did not investigate if TSA contributed to the influence of other recruitment factors, but it is plausible to conclude that while TSA may not have been influential by itself, it could have provided additional opportunities for T&E teacher interactions and introductions to hands-on T&E hobbies which were separate factors found to be influential.

More convenient recruitment methods such as the university's website, brochures, and social media were found to be among the least influential. This contradicts Edmunds's (1980) early findings that brochures had a significant influence. With many technological advancements since the previous studies were conducted, one may have hypothesized that social media or other electronic forms of communication and advertisement would be influential in lieu of brochures or personal letters. The findings from this study indicate that these more convenient technologically driven recruitment factors do not have as great of an impact as traditional face-to-face interactions with a T&E teacher, alumni, or program faculty member. This study was

unique in that it was one of the first to examine social media for recruitment within T&E education. The program utilized the university's Facebook, Twitter, and Instagram accounts to promote all of their programs through posts about awards, student success stories, and general announcements. Social media may have had a greater influence if the program was more aggressive in their recruitment efforts reliant on this factor.

Based on T&E teacher recruitment research trends, it should come as no surprise that influence from a secondary level T&E education teacher was again the highest rated recruitment factor. Numerous studies spanning almost forty years also found T&E teachers to be among the most influential recruitment factor (Craft, 1980; Devier, 1982; Edmunds, 1980; Gray and Daugherty, 2004; Izadi & Toosi, 1995; Ressler, 1966; Sanders, 1986). This reaffirms that despite advances in communication and electronic technologies, personal contact with a T&E teacher, program alumni, or program faculty member are still highly valued by students and are the most effective recruitment factors.

Conclusions and Recommendations

As a result of this study only surveying students from one program in the eastern US, the findings may not be generalizable to every T&E teacher preparation program across the US or outside of the country. Additionally, given this study only surveyed students who were enrolled in the program, the results may not be generalizable beyond the sample, especially regarding students who were recruited but decided not to enroll in the T&E teacher preparation program. Moreover, studies have questioned the comprehensiveness and accuracy of using the self-reported data from the CTETE directory to identify existing programs and current enrollments, however it remains one of the most common resources cited by studies examining this topic (Litowitz, 2014; Love & Maiseroulle, 2022; Moye, 2017; Volk, 2019). Recognizing this

limitation, Volk (2019) contacted current and missing programs from the directory as well as the California Educator Preparation Committee to report more accurate estimates. For that reason, Volk's findings were the most recently published data reported in the literature review. Another limitation pertains to the ratings reported for the university open house recruitment factor. This factor may have received a low rating by students because the T&E teacher preparation program's department did not fully participate in this opportunity for three years prior to this study due to facility renovations. Instead, smaller more personalized campus visit opportunities were offered. These events were for students who either already committed to the university or who were in their final decision stage of selecting which institution they would attend. Despite these limitations the study does provide valuable insight regarding recruitment factors that were found to be the most valuable for a T&E teacher preparation program. The following recommendations were derived from the findings of this study to help guide T&E teacher preparation programs in their recruitment efforts.

Given the strong influence that secondary level T&E teachers had, further research should be conducted examining what specific attributes of secondary level T&E teachers encouraged students to enter a T&E teacher preparation program. These traits should then be presented and modeled to in-service and pre-service T&E educators to encourage their pupils to pursue a career as a T&E educator. Qualitative methods such as interviews or focus groups are recommended to obtain more personal and detailed data to compliment the survey findings. Moreover, this study only collected data from one group of students at one university, providing a snapshot of the influence that various recruitment factors had over a short period of time. Further research investigating T&E teacher recruitment factors should be conducted with groups of students from various cohorts and universities over multiple years to analyze the longitudinal

effects of program recruitment efforts. Students who were recruited but decided to pursue other programs of study, and those who dropped out of T&E teacher preparation programs prior to graduation should be included in future studies if possible. This could further inform recruitment efforts and provide insight about the profession to attract students beyond ones who enrolled in T&E teacher preparation programs.

From the literature it is clear that the T&E teacher shortage crisis is not solely a US problem, but some other countries are experiencing similar challenges. Research examining and comparing recruitment efforts among these countries would provide valuable insight to address one of the greatest threats to the profession (Moye et al., 2020). Additionally, this study examined isolated recruitment factors. The influence of various factors implemented collaboratively or the effect that certain factors had on others was not investigated, but it should be examined in future studies to further refine recruitment efforts (e.g., does participation in TSA or after school T&E clubs increase the influence of T&E teachers). Factors beyond those directly related to recruitment efforts should also be investigated in future studies. The literature has suggested a number of factors (e.g., mismatch between secondary and higher education program curricula, teacher salaries) have an impact on one's decision to pursue a career in education (Ujifusa, 2018; Volk, 2019). However, there is limited data on this relative specifically to T&E education. Although recruiters may have no control over some of these factors, identifying them and the effect that specific recruitment efforts have on such factors could provide additional insight to help address the T&E teacher shortage.

Students' enjoyment of hands-on hobbies related to secondary level T&E education coursework was found to be one of the key influencers. This was something alluded to in recent publications (Reinsfield & Lee, 2021; Volk, 2019) and the data presented in this study supports

claims that the hands-on nature of T&E courses are a critical component attracting students to the profession. As the field of T&E education evolves, it should maintain this important and unique hands-on focus that students highly value. During T&E education recruitment events students should be safely immersed in examples of hands-on T&E education activities to better grasp their interest. Moreover, while this study focused on specific recruitment factors like enjoyment of hands-on hobbies, it is recommended that future studies investigate these factors and others in more detail. Although the survey instrument included the opportunity for open ended responses, further insight could be gained from examining what other factors students perceived as positive characteristics of teaching T&E. Additionally, questions examining non-technical related factors such as an interest in helping youth, fostering creativity, interest in coaching, or other broader education factors could be informative.

As discussed previously, the low influence of social media may have been due to the department's underutilization of this recruitment factor. Collaborating with university marketing and communications departments as well as students in teacher preparation programs may assist in advertising via this recruitment factor of which current students are more adept. This recruitment factor also allows programs to stay in contact with alumni and share information relatively quickly and often at no cost. It is important to remember that technological platforms such as social media and the university website were not found to be as influential as face-to-face interactions with alumni or secondary level T&E teachers. Teacher preparation programs are cautioned not to rely solely on these convenient technological recruitment sources, but use them in conjunction with face-to-face recruitment efforts. As T&E teacher preparation program enrollments across the U.S. and in some countries continue to project a declining trend, programs should utilize the survey instrument from this study (Appendix A) to determine the factors that

will be most influential in their recruitment efforts. The survey instrument should be modified to collect data unique to each program's recruitment methods and also examine the latest technological factors (emerging social media platforms, digital advertising, etc.).

It is important that the findings and recommendations from this study be presented not only to T&E teacher preparation programs and faculty members, but also to secondary level T&E education teachers, alumni, administrators, and school counselors. Face-to-face interactions with secondary level T&E educators and alumni were found to have a significant influence, therefore T&E teacher preparation programs would be wise to collaborate with their alumni (current T&E educators) to promote the profession to students. Working collaboratively, T&E teacher educator programs and alumni can better focus their recruitment efforts and increase secondary level students' interest in T&E teacher preparation programs, hopefully reversing decades of declining trends and salvaging the remaining T&E programs that are critical for preparing technologically and engineering literate citizens.

References

- Argyrous, G. (1997). The z-test for a single proportion. In *Statistics for Social Research*.
Palgrave. https://doi.org/10.1007/978-1-349-14777-9_11
- Bransberger, P., Falkenstern, C., & Lane, P. *Knocking at the college door: Projections of high school graduates* (10th ed.). Western Interstate Commission for Higher Education.
<https://knocking.wiche.edu/wp-content/uploads/sites/10/2020/12/Knocking-pdf-for-website.pdf>
- Craft, C. O. (1980). Recruitment of industrial arts education majors-A professional obligation of all industrial arts educators. *Man/Society/Technology*, 39(5), 21-23.
- Design and Technology Teachers' Association Australia (DATTA Australia). (2019).
Technologies teacher shortage survey: National overview 2019.
<https://www.datta.wa.edu.au/wp-content/uploads/2019/10/TECHNOLOGY-TEACHER-SHORTAGE-SURVEY-REPORT-2019-DATTA-AUSTRALIA.pdf>
- Daugherty, M. (1998). A recruitment crisis: Strategies for affecting change. *The Technology Teacher*, 57(7), 21-26.
- Devier, D. H. (1982). The recruitment of industrial arts teacher education students in Ohio with possible implications for the total profession. *Journal of Industrial Technology Education*, 19(3), 27-38.
- Edmunds, N. A. (1980). Effective recruiting - A tool to replenish, sustain, and improve the profession. *The Journal of Epsilon Pi Tau*, 6(1), 17-22.
- Ernst, J. V., & Williams, T. O. (2015). The "Who, what, and how conversation": Characteristics and responsibilities of current in-service technology and engineering educators. *The Journal of Technology Studies*, 41(1), 48-56.

Love, T. S., & Love, Z. J. (2022). The teacher recruitment crisis: Examining influential recruitment factors from a United States technology and engineering teacher preparation program. *International Journal of Technology and Design Education*. Pages in press.

Foley, D. J. (1967). Handbook on recruitment of potential industrial arts teachers. New York University, New York.

Gray, M., & Daugherty, M. (2004). Factors that influence students to enroll in technology education program. *Journal of Technology Education*, 15(1), 1-10.

House of Commons Education Committee. (2017). *Recruitment and retention of teachers*. HC 199. London.

<https://publications.parliament.uk/pa/cm201617/cmselect/cmeduc/199/199.pdf>

Isbell C. H., & Lovedahl, G. G. (1989). A survey of recruitment techniques used in industrial arts/technology education programs. *The Journal of Epsilon Pi Tau*, 15(1), 37-41.

Izadi, M., & Toosi, M. (1995). Effective recruitment techniques as identified by students majoring in industrial technology. *Journal of Industrial Technology*, 11(3), 13-16.

Litowitz, L. (2014). A curricular analysis of undergraduate technology & engineering teacher preparation programs in the United States. *Journal of Technology Education*, 25(2), 73–84.

Long, R., & Danechi, S. (2021). *Teacher recruitment and retention in England*. House of Commons Library Briefing Paper no. 07222. London: House of Commons Library.
<https://researchbriefings.files.parliament.uk/documents/CBP-7222/CBP-7222.pdf>

Love, T. S. (2015). Examining the demographics and preparation experiences of foundations of technology teachers. *The Journal of Technology Studies*, 41(1), 58-71.

Love, T. S., Love, Z. J., & Love, K. S. (2016). Better practices for recruiting T&E teachers. *Technology and Engineering Teacher*, 76(1), 10-15.

Love, T. S., & Love, Z. J. (2022). The teacher recruitment crisis: Examining influential recruitment factors from a United States technology and engineering teacher preparation program. *International Journal of Technology and Design Education*. Pages in press.

Love, T. S., & Maiserouille, T. (2022). Are technology and engineering educator programs really declining? Reexamining the status and characteristics of programs in the United States. *Journal of Technology Education*, 33(1), pages in press.

Moye, J. J. (2017). The supply and demand of technology and engineering teachers in the United States: Who knows? *Technology and Engineering Teacher*, 76(4), 32-37.

Moye, J. J., Reed, P. A., Wu-Rorrer, R., & Lecorchick, D. (2020). Current and future trends and issues facing technology and engineering education in the United States. *Journal of Technology Education*, 32(1), 35–49.

Nulty, D. D. (2008). The adequacy of response rates to online and paper surveys: What can be done? *Assessment and Evaluation in Higher Education*, 33(3), 301-314.

Reinsfield, E., & Lee, K. (2021). Exploring the technology teacher shortage in New Zealand: The implications for quality teaching and learning. *International Journal of Technology and Design Education*. <https://doi.org/10.1007/s10798-021-09668-4>

Ressler, R. (1966). *Recruitment of industrial arts teachers in the state of Ohio*. [Doctoral dissertation, The Ohio State University]. OhioLINK.

Sanders, M. (1986). Recruitment strategies for industrial arts teacher education. *The Journal of Epsilon Pi Tau*, 12(1), 59-65.

Sinn, J. W. (1989). The need for a defensible content base for industrial technology; An editorial. *Journal of Industrial Technology*, 6(1), 6-8 & 34-35.

Soboloski, M. (2003). *The current status of graduate and undergraduate programs in technology education*. Unpublished manuscript, Department of Technology, State University of New York at Oswego.

Starkweather, K. N. (1999). Teacher shortage. In M. R. Karnes (Ed.), *Technology education*

Love, T. S., & Love, Z. J. (2022). The teacher recruitment crisis: Examining influential recruitment factors from a United States technology and engineering teacher preparation program. *International Journal of Technology and Design Education*. Pages in press.

prospect: Perceptions, change, and the survival of the profession. Journal of Technology Studies, 25(1), 27-28.

Ujifusa, A. (2018, April 17). *Here's how the public views teachers, their salaries, and their impact*. Education Week. <https://www.edweek.org/leadership/heres-how-the-public-views-teachers-their-salaries-and-their-impact/2018/04>

United States Department of Education (USDOE). (2020). *Teacher shortage areas*. <https://tsa.ed.gov/#/reports>

Volk, K. S. (1993). Enrollment trends in industrial arts/technology education programs from 1970-1990. *Journal of Technology Education, 4(2), 46-59.*

Volk, K. S. (1997). Going, going, gone? Recent trends in technology teacher education programs. *Journal of Technology Education, 8(2), 67-71.*

Volk, K. S. (2000). Trends in U.S. technology teacher education programs: Home thoughts from abroad. *Journal of Industrial Teacher Education, 37(3).*
<https://scholar.lib.vt.edu/ejournals/JITE/v37n3/volk.html>

Volk, K. S. (2019). The demise of traditional technology and engineering education teacher preparation programs and a new direction for the profession. *Journal of Technology Education, 31(1), 2-18.*

Warner, S. A., Erli, L. M., Johnson C. W., & Greiner, S. S. (2007). Identifying the paradigm of design faculty in undergraduate technology education in the United States. *Journal of Technology Education, 18(2) 68-87.*

Wright, M. D. & Custer, R. L. (1998). Why they want to teach: Factors influencing students to become technology education teachers. *Journal of Technology Education, 10(1).*
<https://doi.org/10.21061/jte.v10i1.a.4>

Appendix A

Survey Items

Directions: Please rank the extent to which the following recruitment factors influenced your decision to pursue a career as a Technology and Engineering (T&E) educator. Responses range from 1-6, with 1 representing no influence, and 6 representing very influential.

1. University recruiter visited my high school
2. University social media account
3. University or program website
4. Program brochures
5. Face to face interaction with a faculty member from the program
6. Interaction(s) with alumni from the program
7. Positive T&E education job characteristics
8. Current student(s) in the T&E education program
9. University open house event
10. Involvement with Technology Student Association (TSA)
11. High school counselor(s)
12. Friends/peers
13. Family members
14. Middle or high school T&E teacher
15. Interest in hands-on T&E hobbies
16. Other (please describe)