Ohio Technology Education Status Study (Fundamental)

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Abstract

Currently, technology education continues to be considered an elective area in most states, with the process of writing and approving these state standards challenging. The inclusion of technology education into STEM education has made it even more critical now to assess the current status of technology and engineering education curriculum, implementation, and inclusion of minority populations. This quantitative research revisits a national 2001 status study describing technology education programs. Using stratified random sampling of high school technology programs in Ohio, the online survey reassesses enrollment numbers of instructors and students. Analysis of 93 participating teachers or program directors shows that 20% of the schools lack technology education related coursework. Current programs are identified as Technology Education, Technology and Engineering Education, Engineering Education, and Industrial Technology, with 35% of the programs having a different title. The number of female faculty for schools with technology programs remains low, with over 40% having no females, and over 25% having only one female member. Additional findings reveal patterns towards program content, overall purpose, and inclusion of minorities. This research will inform future studies focused on recruitment and retention of minority students and teachers in technology education.

Introduction

With the backdrop of reports such as *A Nation at Risk: The Imperative for Educational Reform* [1], *Tomorrow's Teachers* [2], and *A Nation Prepared* [3], the period of the eighties has been considered a "decade of educational reform" [4], [5]. This call for change initiated the serious introspection of industrial arts education programs and its transformation into technology education. With the vote to officially change the organizational name of the "American Industrial Arts Association" (AIAA) to the "International Technology Education Association (ITEA) in 1985, the movement towards "larger clusters of technological content" [6] ensued. With this reformation came the emergence of technology standards, introduced first by national professional organizations and then standards slowly developed and adopted by states [7]. This paper describes the movement towards technology education reform in the state of Ohio and the intertwining composition of gender and racial backgrounds of K-12 students and teachers in comparison to national studies over the past decades.

Literature Review

The Movement from Industrial Arts to Technology Education

Studies investigating the status of technology education programs across the United States can be traced to surveys conducted by Schmitt and Pelley [8] and the 1980 Standards for Industrial Arts (SfIAP) Project [9]. Also conducted over thirty years ago were the School Shop/ Tech

Directions studies of 1986 [10]. Technology teacher education during this period was similarly called to restructure its programs [11]. Jones [10] found in 1988 that of the technology teacher preparation program administrators surveyed, 63.3% reported recent changes in their program. Volk [12] attributed influences of philosophical changes from industrial arts to technology education and the expansion of non-teaching options such as industrial technology to the changes in teacher education programs.

Bame's 1980 [13] report on survey data from the SfIAP Project concluded that program content remained fairly consistent, with the enrollment of female students increasing. Bame [13] also found that most school shops were not equipped to accommodate handicapped students and that there existed a major shortage of industrial arts teachers. Assessing the supply and demand of industrial technology teachers from 1989-1992, Wright & Devier [14] distributed surveys to 616 public school districts, 59 nonpublic schools, and 7 Ohio teacher education programs. The study projected that by 1992, 1,023 additional industrial arts/technology teachers would be needed, hence deeming the situation an "impending crisis" [14]. The call for better efforts at recruitment and a national task force were some of the recommendations of the study [14].

Standards for Industrial Arts Programs, published in 1981, were later revised and retitled *Standards for Technology Education* in 1985 [6]. Developed by over four hundred industrial arts teachers, supervisors, educators, and consultants, the standards were the first set of comprehensive standards for technology education. The "comparative" statements were structured "to determine the strengths and weaknesses of industrial arts programs" and meant to "serve as models for schools, districts, and states that wish to develop, adopt, or refine standards for the improvement of their industrial arts programs" [15]. The four major documents produced for this project were the Standards for Industrial Arts Programs, AIASA Guide for Industrial Arts Programs, Sex Equity Guide for Industrial Arts Programs, and Special Needs Guide for Industrial Arts Programs [15].

National and State Technology Education Standards

Throughout the nineties, a number of lobbying efforts were pushed by technology educators [16]. These actions included the insertion of technology education language in the Education Reform Act of 1993 in Massachusetts and the approval of a Principles of Technology course as high school science credit in Virginia in 1998 [16]. The Connecticut State Board of Education approved the 1998 landmark "K-12 Standards for Technology Education" and other states such as Georgia and Texas continued to lay the groundwork for proposing bills to support technology education [16]. Written to specify "the knowledge (what students should know) and the process (what students should be able to do) in order to be literate," the ITEA/ITEEA commenced the national movement for adopting and implementing technology education standards [17].

In the state of Ohio, the Technology Education Standards was updated in 1984 [7]. During the nineties, the curriculum revision process was guided by William Spady's model of outcome-based education, but a different curriculum development model was passed by the Ohio Legislature [7]. An advisory committee of 36 members developed the framework and a writing team of 38 members developed the standards. The standards were further broken into benchmarks for which performance indicators were added to inform teachers, administrators, and parents about expectations [7]. The 2004 Ohio Technology academic content standards included: Nature of Technology, Technology and Society Interaction, Technology for Productivity Applications, Technology and Communications Applications, Technology and Information Literacy, Design, and Designed World [18]. The latest version, the Ohio Learning Standards in Technology (2017), was evolved from various phases as it was passed through an Advisory Committee, Working Group, and the Ohio Education Department. Using resources such as the International Society for Technology in Education Standards (ISTE), the International Technology and Engineering Educators Association (ITEEA) Standards, the Australian Curriculum Technologies Content Descriptions (ACARA), and Ohio's Learning Standards, the current Ohio standards seek to "instill in students a broad, rich understanding of technology and its effective use and role in their world -- an understanding they need to become technology-literate citizens" [19].

Contrasting the rise of technology education standards, however, is the increasing decline of the enrollment of teachers in technology education programs [14]. In 2003, Ndahi and Ritz confirmed teacher shortage projections on a national level as they conducted their study of lead technology education specialists (supervisor or director) covering all fifty states [20]. The report recognized the shortage was not only due to declining enrollments in teacher education, but other influences such as poor working conditions, lack of administrative and community support, as well as economic, political, and school reform efforts [21], [22]. The importance of not only recruiting, but also retaining technology education teachers [14], [20] is underscored in these studies.

Inclusion of Students from Diverse Backgrounds

Prior literature has pointed to the challenges Industrial Arts and Technology Education face in reaching out to three major groups - females, minorities, and students with special needs. A 1988 report showed that only 18 women out of 1,523 industrial arts/technology teachers in Ohio worked full-time, with only 1 woman out of 82 teachers working part-time [14]. The number of women enrolled in Ohio Industrial Arts or Technology teacher education programs was only 2.5% [14]. Addressing the important initiatives and work accomplished by women to promote industrial arts education, Zuga documented how their voices, with the pressure of cultural and societal norms, have been "shut out" [23]. In an effort to improve female enrollment in technology education, Flowers surveyed 154 female ITEA members who expressed the need to improve the enrollment and retention of female students by redefining the curriculum without sex bias, removing teachers who demonstrate gender bias, educating guidance counselors, changing school requirements, trying single-sex classes, and improving facilities to be more attractive and dynamic [24]. In addition, the ITEA members suggested the establishment of mentoring, promotion of active recruitment, and the dissemination of career information as a means to improve awareness of a field that includes female students [24].

In 1981, Dugger Jr. addressed the modification of industrial arts programs to serve special needs students by individualizing programs, modifying the physical environment, curriculum and instructional approaches [25]. Buffer and Scott's seminal work assisted technology educators in identifying, understanding, and adapting instructional practices to better respond to the needs of the special education population [26]. Though there are studies citing situated cognition, a form of contextualized learning, as a means of improving success for special needs technology education students [27] and the implementation of game design to assist special needs students in the classroom [28], a dearth of quantitative research remains in assessing the success of these methods.

Also limited are studies on ethnic minority students in technology education programs. Johnson cites perceptions accounting for the low enrollment of African-American students in technology education programs, including "(a) beginning salaries are too low, (b) lack of respect for teachers by students, (c) lack of respect for the profession in general, (d) uncertainty as to what technology is, and (e) a negative stigma attached to technology education due to the Booker T. Washington - W.E.B. DuBois debate" [29]. In a 2002 survey study, Akmal, Oaks, and Barker found that 29 of 39 reporting states (58% of all 50 states) do not offer programs for recruitment of minority teachers [30]. As part of a recruitment and retention strategy, Johnson asserts the importance for minority students to feel connected and have a "sense of belonging," and that "if the field of technology education is going to survive, members must be more innovative and motivated to attract and retain students of all races, including African-Americans" [29].

Following two decades of the warning of an "impending crisis," Moye's [31] 2009 study of technology education teacher supply and demand reports the dramatic decrease in technology education teachers, noting the nationwide shortage and "critical situation." Yu [32] emphasizes the importance of addressing the goals of technology education, which he finds to be "imperative to help clarify, modify, or develop appropriate approaches for technology education." National surveys conducted in the United States and Canada document the progress of the movement of industrial arts to technology education [33], [34]. A national survey in 2001 conducted by the ITEA revealed a trend towards pushing technology education for all students as an important pre-college subject [35].

Survey Studies on Technology Education

Noteworthy to this research investigation is Sanders' [36] study which sought to compare 2001 technology education programs to industrial arts programs of the 1960s and 1970s. Sanders developed the instrument "Technology Education Programs Survey" (TEPS) after reviewing previous surveys [8], [13] and the School Shop/ Tech Directions studies of 1986, 1989, 1990, and 1991 [36]. Sanders [36] found "technology education" programs outnumbered "industrial arts" programs by a ratio of six to one. Survey results showed that practitioners felt the purpose of technology education was to teach "problem-solving" as opposed to skill development, the emphasis found in earlier studies [8]. Sanders [36] identified "modular technology education" and "technological problem-solving" as the preferred method to instruction over the project-from-plans method. The demographic shifts reported in the survey [36] noted a 10 percent female faculty count, "ten times the percentage reported two decades ago" and "one third of technology education students enrolled are female, about fifteen times the percentage of the early 1960s." Minority ethnic enrollment, approximately one fourth of those in technology education, similarly showed growth, up 18% reported since 1979 and students with special needs numbered approximately 23% of the total enrolled [36]. A more recent national status study conducted by the International Technology and Engineering Educators Association (ITEEA) added engineering as a curriculum area [37] and found that 83% of the states responding did not require technology and engineering education. Frequent course titles that best described the technology and engineering education taught included engineering, technology education, “Project Lead the Way,” and “Engineering by Design” [37], [38].

Purpose of the Study

The main objective of this study is to investigate current middle and high school technology and engineering education programs in Ohio. By revisiting questions posed by Sanders two decades ago [36], it seeks to assess how industrial arts programs have transitioned to current technology and engineering programs. This study compares its findings with past status studies conducted in Ohio and nationally in order to describe the program title, content, and instructional methods employed in technology education [36], as well as how programs are aligning to ITEA’s case for providing technology education for all K-12 students [38], [39]. Most importantly, as a means to inform future research focused on the recruitment and retention of minority students and teachers in technology education, this study describes the inclusion of females, minorities, and students with special needs in Ohio technology education classrooms. With these objectives in mind, the following four research questions framed this study:

RQ #1: What are the characteristics of current technology and engineering education programs and how do they compare to those of previous industrial arts and technology education programs?
RQ #2: What courses are currently being taught in technology and engineering education programs?
RQ #3: What licensure and education backgrounds do teachers teaching technology and engineering education classes have? What is the racial and gender composition of technology education teachers?
RQ #4: What is the racial, gender, and ability composition of students in technology and education programs?

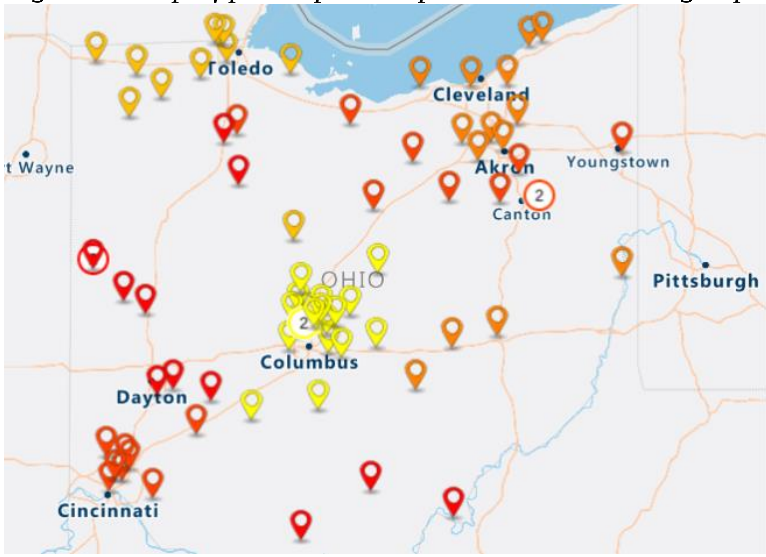
Method

The focal population for this study are middle schools and high schools identified through Ohio Department of Education public resources. With the growing emphasis of technology for all [38], [39], elementary schools were also included in the population sampling. Using the Qualtrics online survey software, thirty questions were adapted from Sanders’ [36] survey, placed into an online survey format, and emailed to a list of 2,341 schools with a greeting and introduction describing the study. The email was sent to the school principal and it was requested that the principal either pass it on to the appropriate teacher, fill out the survey him/herself, or reply to the email that there are no technology and engineering classes being taught at the school. Follow-up emails to administrators and teachers who did not respond were sent after 2 and 3 weeks.

As an incentive, participants who completed the survey elected to be entered into a random drawing for one of five $50 gift cards (winner’s choice of Amazon, iTunes, or Google Play). From the 2,341 emails, 101 administrators or teachers responded, with 93 completing the entire survey. Though the response rate, 3.97% was lower than guidelines suggesting higher sample sizes to yield a 95% confidence level [40], online surveys generally have an 11% lower response rate than other modes of survey delivery [41]. Our data collection, for example, did not include

Sanders' [36] method of mailing out up to three surveys with postage paid envelopes or encouraging non-respondents with follow-up phone calls. The use of the eSpatial mapping software (Figure 1) suggests a fairly even distribution of survey responses. A review of the respondents' zip codes shows that a variety of Ohio counties are represented and that responses were not generated from mainly urban areas.

Figure 1. Map of participant response locations using eSpatial software.



Instrumentation

The online survey used in this study was adapted from Sanders' [36] "Technology Education Programs Survey" (TEPS). TEPS was developed from a review of instruments of Industrial Art program survey studies from the sixties to the nineties [8], [13], [36], and from a panel of experts who provided feedback for revisions of the instrument. The Qualtrics survey for this study contained questions nearly identical to Sanders' [36] and the SfIAP Project survey [9] as displayed in Table 1.

Table 1. Survey Questions Nearly Identical to the Sanders' (2001) TEPS

Survey Questions Nearly Identical to Those Used by the SfIAP Project (1979)

Technology Education Programs Survey[1] (1999)		SfIAP Project[2] (1979)
Ques #	Approximate Wording of theTEPS Instrument Items Used in this Study	Ques #
3	With which of the following programs is your TE/IA program most closely associated? (Gen Ed ,Voc Tech Ed)	1
4	What is the average number of years faculty in your program have taught TE/IA (in any school)?	27
12	Over the past five years, funding for your TE/IA Program has…? (Decreased, Remained the Same, Increased)	17 & 18
17	What % of your TE/IA faculty are certified or licensed to teach TE/IA?	28
18	What % of your TE/IA faculty are members of the International Technology Education Association?	25
20	About what % of students in your TE/IA program are female?	5
21	About what % of students in your TE/IA program are minority (non-Caucasian) students?	23
22	About what % of students in your program are "gifted and talented" students?	21
23	About what % of students in your program are "special needs" students?	21
31	Does your TE/IA program have a student club (and if so, is it TECA affiliated)?	31
32	Do you have an Advisory Committee specifically for your TE/IA Program?	29
34	What one selection below best describes your TE/IA facilities? (Unit Lab, Systems Lab, General Lab, Modular Lab)	7
38	The most significant barrier to an outstanding TE/IA Program is____?	2
45-60	Rate the following purposes of TE/IA… (Develop problem-solving skills; Develop worthy leisure-time interests; Develop an understanding of the nature and characteristics of technology; and 13 other purpose statements)	4
Part Two	List the courses taught in your TE/IA Program (as well as grade levels, enrollments, % females enrolled, and # of sections)	5

[1]Sanders (1999b); [2]Dugger, et al. (1980)

In addition to these and other questions posed by Sanders [36], this study's online survey inquired about internet access and current technologies used in the classroom, such as Robots, 3D printers, Drones, Maker Space/ FabLab, Laser Engraver/Cutter, or CNC Devices. Prior to distributing the survey, two experts from the field, members of ITEEA and teacher educators, reviewed and tested out the online survey. Their feedback prompted additional refinements to the initial online survey. Numerous revisions were also made to adhere to required survey accessibility guidelines.

Findings

A report from the 101 responses was generated by the Qualtrics survey software. SPSS analysis of descriptive frequency distributions was conducted. The data were then compared to previous technology education status studies.

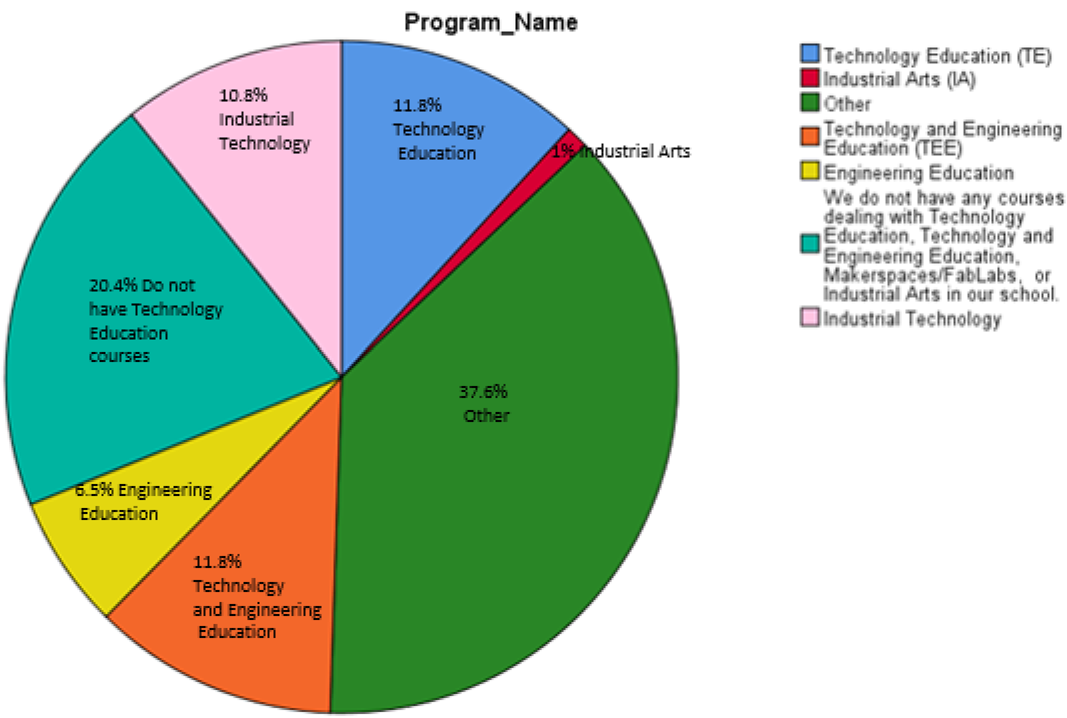
RQ #1: What are the characteristics of current technology and engineering education programs and how do they compare to those of previous industrial arts and technology education programs?
RQ #2: What courses are currently being taught in technology and engineering education programs?

Program Name and Content

Though nearly 38% of the respondents reported calling their program something other than the choices listed, 24% of the respondents called their program "Technology Education" or "Technology and Engineering Education"(Figure 2). The current use of the words technology education in the program name reflects a reduction from its popularity in 2001 where almost 59% of the programs included those terms [36]. Courses titled "Industrial Technology" (11%) differentiated from the less frequent program "Industrial Arts" (1%). This marked movement away from "Industrial Arts" was also captured in Sanders' [36] survey which reported 20% of the programs titled "Industrial Technology" and only 9% "Industrial Arts." Respondents also specified the name of their program in the "other" text box. These alternative program names included "RAMTEC," Industrial Technology/STEM,""STEAM," and "Construction Technologies." Currently, 6% of the Ohio programs refer to their program as "Engineering Education."

The TE/TEE/IA programs reported by the respondents were evenly split with associated school programs - General Education/ Technological Literacy ((32%), Career and Technical Education (30%), and Preparation for a College Education (30%), with the remainder of programs associated with Preparation for Post-secondary Career and Technical Education.

Figure 2. Program Names



Responses concerning the current methods of instruction include a decrease in Unit Labs 24% compared to Sanders' [36] study of finding 36% of the facilities with Woods, Electronics, Drafting, etc. Modular labs similarly declined, from 16% in Sanders' [36] study to 5% of the current survey's respondents. The employment of General Labs (a wide mix of equipment in each lab) is currently more prevalent (48%), compared to twenty years ago (30%) [36].

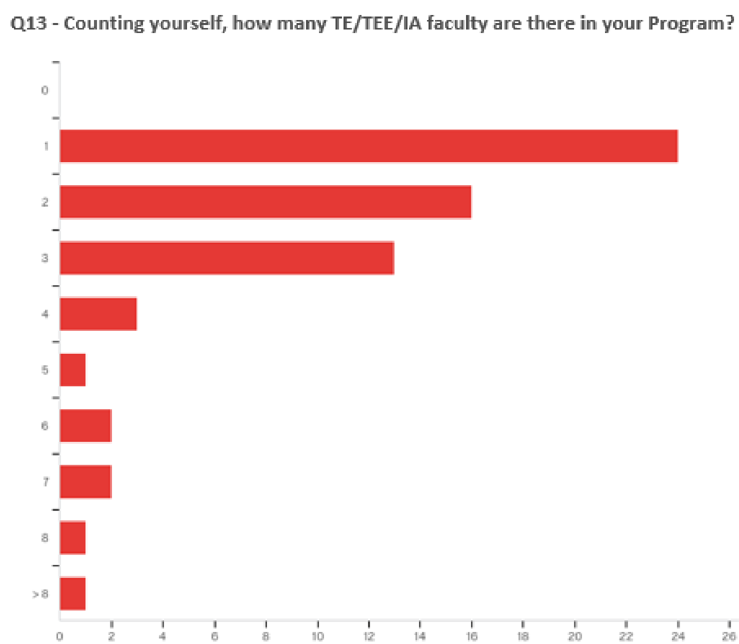
The course content has evolved from the "Most-Taught Course Categories" of the SfIAP Project [9] of General Woods (in 1979) and General Tech Ed (1999), Drafting/CAD, Wood Tech, Met Tech, and Architectural Drawing/Drafting to current course titles of Power/Energy/Transportation, Biotechnology, Production (including Makerspace), Communication, and Computer Science. A number of respondents typed in course names that were not listed on the survey but used in their schools, such as: "Unmanned Aircraft Systems - Drone Technology," "PLTW: Innovators and Makers," "Coding," "Lego Robotics," "TV Production," and "Wood Crafts I and II."

RQ #3: What licensure and education backgrounds do teachers teaching technology and engineering education classes have? What is the racial and gender composition of technology education teachers?

Faculty Demographics

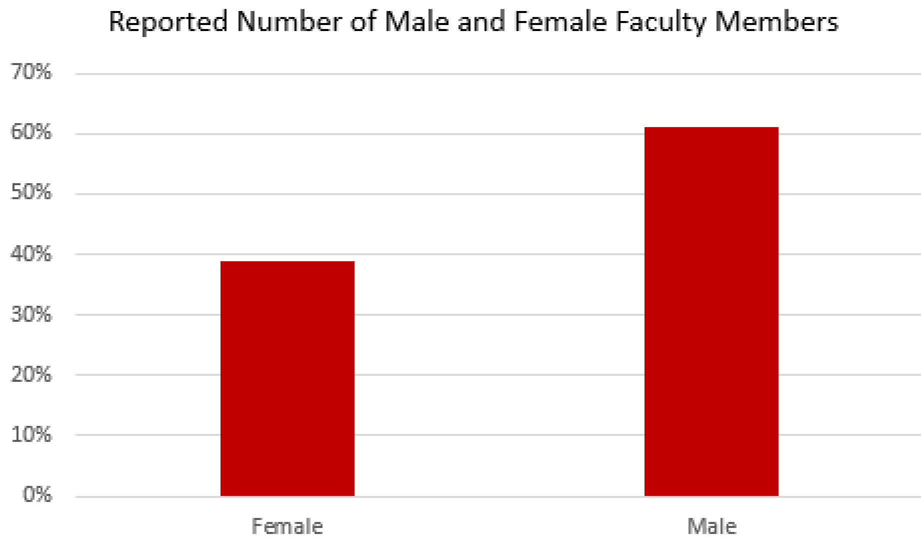
In the national 1979 SfIAP Project, an average of 2.8 faculty members were part of the programs surveyed [36]. Sanders' study twenty years later showed a slight decline of 2.5 faculty members [36]. Thirty eight percent of the respondents to this study reported that their school program had only one TE/TEE/IA faculty member, 25% with two, and 21% with three (Figure 3). These responses, when paralleled with survey question 11 which asks for TE/TEE/IA class sizes, show many current programs depend on faculty with a number lower than the average twenty years ago, despite class sizes remaining the same (60%) or increasing (34%) over the past five years.

Figure 3. Number of TE/TEE/IA Faculty Members



In 2001, the composition of white males in TE/TEE/IA faculty remained high, despite a ten-fold increase from prior reports decades earlier with the SfIAP Project [36]. Sanders [36] reflected that "the shortage of women throughout the profession remains one of the most pressing problems confronting our field." This current status study reveals an increasing number of female TE/TEE/IA faculty members in Ohio programs, with respondents reporting that 55 out of the 142 technology education faculty members were female and 87 were male (Figure 4). The majority of respondents (59%) noted that there was at least one female faculty member. This percentage shows a marked contrast to a 1988 Ohio status study identifying only 1% of the full-time Industrial Arts/Technology educators sample population as female [14]. Despite the more encouraging female numbers, 86.2% of the respondents overwhelmingly report male faculty members, with only 14% of the respondents stating there were no male faculty members, compared to 41% stating that there were no female faculty members.

Figure 4. Number of TE/TEE/IA Faculty Members

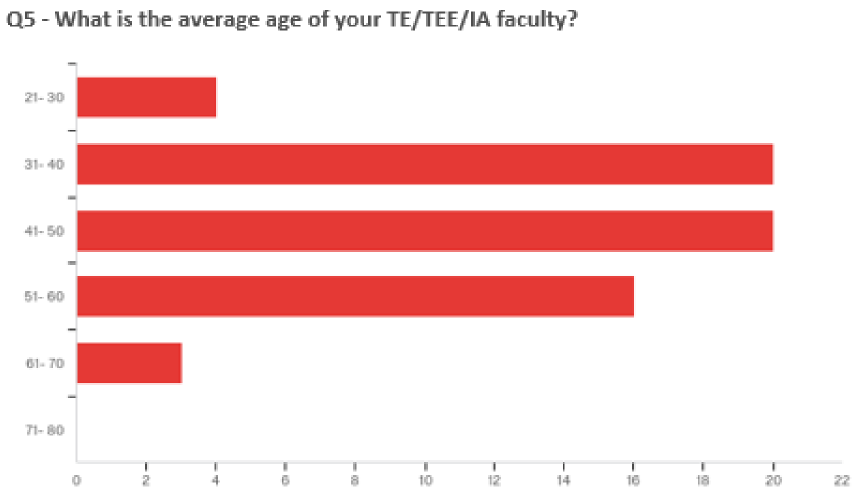


Concerning racial background, faculty members for the most part remain white. Ninety percent of the survey respondents reported having no African American instructors, 95% reported having no Asian instructors, 97% reported having no Hispanic instructors, and 100% reported having no Native American or Pacific Islander instructors. This lack of diversity in the faculty reflects Sanders' study finding white (94.1%) men (89.9%) [36].

Professional Activity

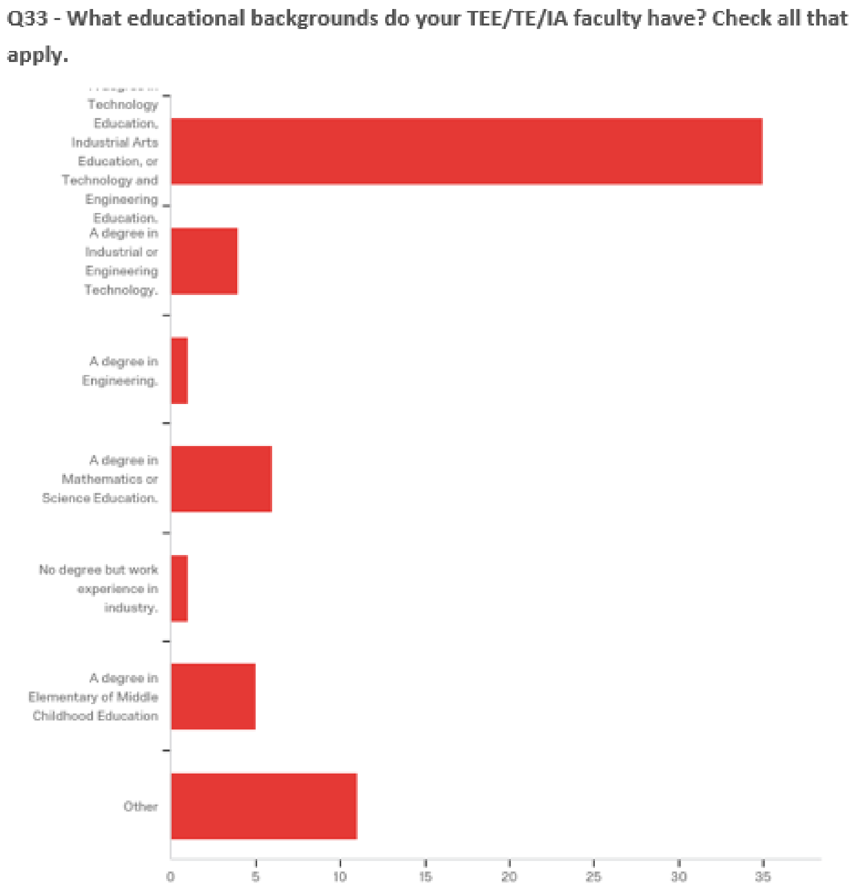
Previous studies reported an aging technology faculty [36], [14], with the alarming statistics propelling Wright and Devier [14] to address this problem by investigating efforts to recruit new and non-traditional students into technology teacher education programs in Ohio. This current status study shows that 38% of the teachers are forty years or younger (Figure 5), an increase from 29% in 2001 [36]. Respondents for this study reported that 32% of the teachers are between forty-one to fifty years old, an age range that was more prevalent (48%) twenty years ago for TE/TEE/IA faculty members, prompting Sanders to lightly note that "the field may more likely be ready for a mid-life crisis than a retirement party" [36].

Figure 5. Average Age of TE/TEE/IA Faculty Members



Licensure for technology teachers remained consistently high since the sixties [9], [36]. With the current survey, 86% of the respondents reported that there was at least one faculty member certified or licensed to teach Technology Education or Industrial Arts (Figure 6). The diversity of educational backgrounds includes TE/IA (55.6%), Engineering Technology (6%), Engineering (2%), Math/Science Education (10%), Elementary or Middle Childhood Education (8%), and other (17%). The inclusion of Math, Science, Elementary, and Middle Childhood Education teaching backgrounds may account for the report of increasing numbers of female faculty, since these fields are generally dominated by white women [42].

Figure 6. Certification and Licensure Backgrounds of TE/TEE/IA Faculty



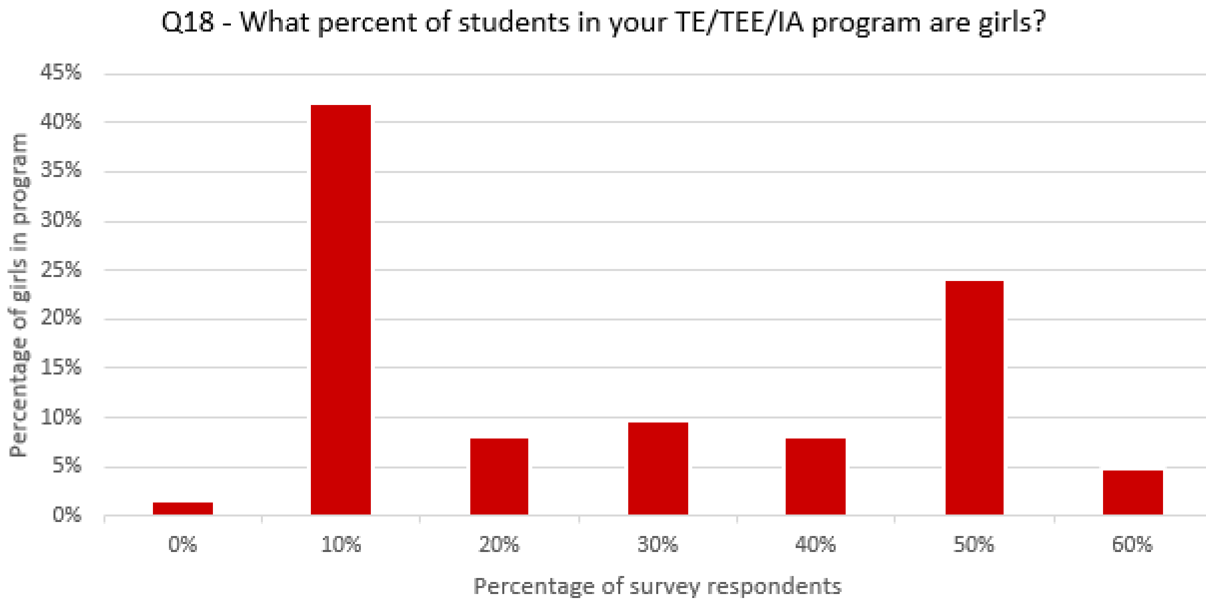
The majority of the respondents to the survey reported that there was at least one or two teachers in their program holding membership to ITEEA. Additionally, 100% of the respondents reported that there was at least one or two teachers holding membership to the Ohio Technology and Engineering Educators Association (OTEEA), Association of Career and Technical Educators (ACTE), and Ohio Association of Career and Technical Educators. This trend of organizational membership contrasts with Sanders' 2001 report [36] finding that only 24% of the faculty were organizational members. Despite the current high percentage of professional membership, very few teachers attend technology related conferences. Only 19% of the respondents reported to have at least one faculty member attend an ITEEA conference. Similarly, respondents reported low conference attendance to OTEEA (35%), Project Lead the Way (39%), and ACTE (12%).

RQ #4: What is the racial, gender, and ability composition of students in technology and education programs?

Student Demographics

A gender gap existed in earlier status studies [9], [36] where during the sixties only 2% of enrolled Industrial Arts students were female. This figure progressed to approximately 17% in 1979 [9], [36] and 33% in 2001, with almost 50% of middle school technology course students being female [36]. Despite the high female numbers, Sanders [36] found that female enrollments “drop off radically” (18%) during the high school years. For this current status study, almost half of the respondents (42%) reported that only 10% of the students enrolled in technology classes are girls (Figure 7). Sixty percent of the respondents reported that only 10-30% of their technology classes have female students. This staggering number may be due to the fact that for the majority of Ohio survey respondents, over 68% stated that technology education is not required in their schools.

Figure 7. Percent of girls in TE/TEE/IA programs.



Concerning racial backgrounds, 58% of the respondents to the current study reported that 80 to 90% of their students are white. Almost seventy percent of the respondents (67.2%) reported that only 10- 20% of the students in their TE/TEE/IA Program had an IEP, RTI, or 504 plan. Similarly, 64.4% of the respondents reported that only 10- 20% of the students were identified as “gifted and talented.”

Student Organizations and Advisory Committees

Sanders [36] found a rise in student participation in organizations, reporting 26% of the programs offering technology education student organizations, almost double from studies in the sixties and seventies. In the current online survey, 62% of the respondents reported that their program has an active student club (Figure 8) affiliated with the Technology Student Association (TSA) such as a Technology Club, Robotics, Gravity Racing Challenges, F1 in Schools, etc. An additional 6% of the programs have an after school club not affiliated with the TSA. An advisory committee specific to the school’s program was also reported by 34% of the respondents, showing an increase from Sanders’[36] survey where only 23% of the programs had an advisory committee (Figure 9).

Figure 8. Afterschool Technology Related Student Clubs

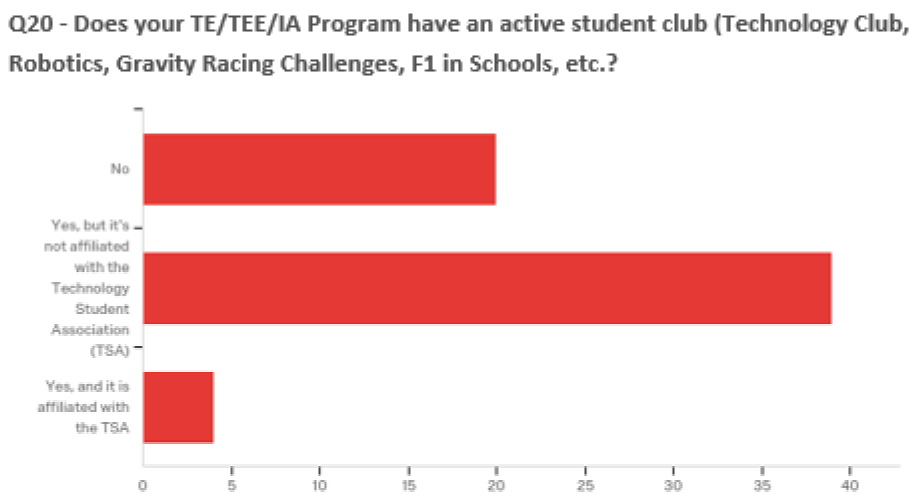
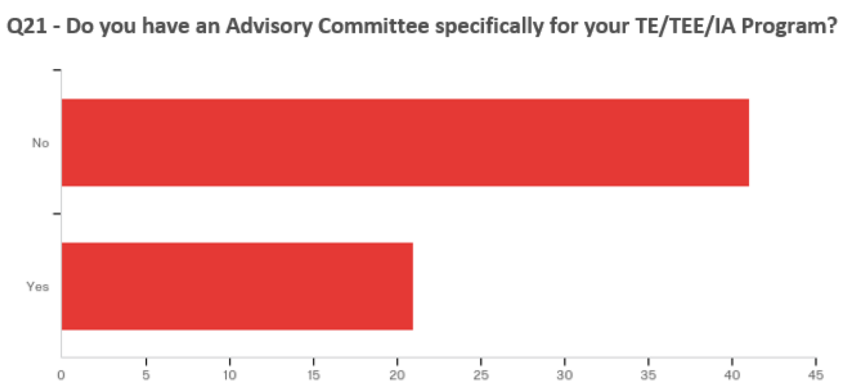


Figure 9. Advisory Committees



Limitations

Though the sample from this study is not completely representative or generalizable, it remains a fair approximation. A number of factors may have limited the number of responses generated for this study. The introductory email and online distribution of the survey, sent between the end of January and early February, may not have been an ideal time for the recipients. With the survey closing after a final reminder message of three weeks, potential respondents may not have had enough time to begin or complete the survey. The survey itself contained 30 questions, many of which were adopted from previous technology education status study instruments [36] which included a number of sub-questions. Question 14, for example, comprised of 9 specific sub-questions, and Question 18 was comprised of 11. Question 31 asked respondents to rank the importance of various purposes of technology education programs, listing 15 different items.

The detailed questionnaire, therefore, potentially presented a challenge for respondents to complete the survey. The online survey mode of delivery itself may have posed a limiting factor for the response rate [41]. Nevertheless, the survey responses recorded a fair spread throughout the state of Ohio, showing a diversity in the sample that mirrors the demographics.

Implications and Future Studies

Technology Access "For All"

This status study reveals that ITEA's endeavor for technology "for all" [38], [39] is slowly coming to fruition, with 9% of elementary school students and 39% of middle school students reportedly being part of technology education programs in the state. This emergence of technology education in the younger levels is encouraging for the field. The number of girls participating in technology education programs is similarly increasing. However, with the majority of the respondents being white reporting that 80% - 90% of their students are white, this status study reveals that members of the technology education field remain nondiverse. Additionally, the question remains whether students with disabilities are being offered the opportunities of technology education. With almost seventy percent of the respondents reporting that only 10- 20% of their technology education students have an IEP, RTI, or 504 plan, future studies need to investigate if shops and technology classrooms are equipped to accommodate handicapped students [13], modify the physical environment [25], and adapt instructional practices to better respond to the needs of the special education population [26].

Program Funding

Respondents to this survey showed that technology education in the form of afterschool clubs is increasingly prevalent, more than doubling since Sanders' study [36]. Such clubs help build a pipeline towards Technology and Engineering careers. As technology education in after-school programs continue to flourish, future studies should be conducted to investigate the benefit of corporate and community partnerships, especially from the perspective of the 30% of survey respondents who felt that a major barrier to having an outstanding technology education program in their school was due to a "lack of financial support." Studies should also assess the affordances of these afterschool informal settings in generating student, particularly female, interest, in the technology education field.

Recruitment and Retention

The retention of technology education teachers remains challenging in a period of a national teacher shortage. Prior studies have recognized that poor working conditions, lack of administrative and community support, as well as economic, political, and school reform efforts [21], [22] contribute to teacher attrition. The importance of not only recruiting, but also retaining technology education teachers [14], [20] has been underscored. This study reflects prior research finding that the vast majority of technology education teachers are white males [36]. Diversifying the field, therefore, is critical to the future of technology education [44].

New technology educators need to be supported by making them thoroughly aware of the national and state developed resources to assist them in their teaching [7], [20]. Full awareness of the state standards and professional development opportunities are particularly important since "the technology educator is the only person in many districts who really has a clear vision for what technology education needs to be" [7]. Steinke and Putnam [43] recommend employing a situational mentoring framework for new technology education teachers as a means to reduce "stressful duties" such as laboratory management. As a means to remedy the "supply and demand dilemma," Ndahi and Ritz [20] urge high school teachers to make a "commitment to send one member of this year's graduating class to pursue a teaching degree in technology education." By feeding a potential recruit into the technology teacher education system, Ndahi and Ritz suggest that "we could eradicate the technology education teacher shortage in a four-year time frame" [20].

As a means to improve working conditions, administrative and community support, and the retention of female teachers through mentoring [14], [24], schools need to provide incentives for their technology education faculty to become more aware of these issues, learn more about the state standards, community resources, and best practices for mentoring new as well as future teachers. Respondents to this study reported low percentages of professional conference attendance. Future studies should assess what the impact technology education conference attendance and participation in workshops focused on mentoring and minority recruitment might have on forwarding the field. With the inclusion of technology education in STEM education, it is even more critical now than ever to continue researching the current status of technology and engineering education curriculum, implementation, and inclusion of minority populations.

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