Perceptions of New Doctoral Graduates on the Future of the Profession

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Abstract

Advancement of a profession relies heavily on the participation of its members. Leadership roles must be filled at many levels. To effectively prepare future leaders, efforts must be undertaken to educate and mentor them both about their professions and how to lead within them. The authors sought to identify the perceptions of those who recently earned a doctoral degree with focus on technology and engineering education. In the past, this group developed and assumed major roles in leading their education professions. This study reports on new doctoral graduates' perceptions related to the focus of content taught in formalized K-12 technology and engineering education programs, methods used to prepare future technology and engineering teachers, characteristics of their planned professional involvement, and future forecasting for their school subject.

Keywords: New Ph.D. Perceptions, Profession, Technology and Engineering Education

Introduction

Public perceptions and economic circumstances often create disadvantages for the continued offering of K-12 school subjects that are classified as elective courses. In many cases, these elective courses are being eliminated from the school curriculum. This is no more evident than in the data revealed on the school subjects of technology and engineering education.

The number of teachers who teach in technology and engineering education programs has declined from 37,968 in 1995 to 28,310 in 2009, a loss of 9,658 teachers (35.4% decline) in just 14 years (Moye, 2009). The number of university programs that prepare these teachers also has declined from almost 300 in the 1970s to 27 (91% decline) identified in 2008 (Moye, 2009). These factors, plus the societal impacts associated with 9-11, the economic downturn of 2008, and the changing attitudes of the perceived value of belonging and participating in the sponsored activities of organizations, have caused a decline in the memberships of professional organizations (Martin, 2007). With fewer teachers entering the profession and fewer teachers joining professional organizations, how can the school subjects of technology and engineering education and their related professional education organizations keep the profession vibrant and provide the potential for change to meet the needs of their members and the students they serve?

The researchers of this study have been active participants in these school subjects for several decades and the professional organizations that are directly associated with them. They have provided guidance and teacher professional development to support these school subjects throughout their careers. They are very much aware that several universities, albeit a declining number, continue to prepare new professors who will train future teachers for these school subjects. They believe that the new technology and engineering teacher educators graduating from these doctoral programs have the challenge of continuing to prepare teachers for these school subjects to serve future generations of learners. Together, the researchers planned this study to determine the perceptions of new doctoral graduates on a number of issues related to technology and engineering education.

Consequently, this study was conducted for the purpose of determining directions that new graduates might pursue with their subject area's content, methods of future teacher preparation, planned professional involvement, and future forecasting of their school subject. The researchers' goal was to capture new graduates' perspectives about their profession in order to project what might be the future "health" of the profession by the year 2025. The anticipated beneficiaries of this study are individuals who closely identify themselves with mapping a course of action for the profession over the next 12 years. Professionals may use information reported in this study to initiate substantive discussions or even extend existing discussions on the future of the profession and the characteristics of individuals who will lead it.

Review of Literature

Organizations are formed by groups of people who bond together for a common purpose. K-12 schools are organizations, as are universities. Professional associations are organizations. To remain viable, organizations must adapt to changing environments (Senge, 1990). Adaptability is an important characteristic for the survival of any learning organization. Those who practice teaching, either in K-12 or at the university, have had to adapt their programs in order for their programs to remain viable. The associations that support teachers of technology and engineering also require continual change to better support their members.

Historically, professional associations provided a source of professional definition, a forum to increase public awareness, and a role in setting guidelines in preparing a person with appropriate credentials to practice that profession. The associations (a) provided professional development for their members, (b) set standards for educational practice, (c) organized and hosted forums on issues important to the members, and (d) attempted to unify political action campaigns to better position the profession (Phillips & Leahy, 2012). The major associations that represent the profession and technology and engineering education, including their state affiliates, practice many of the cited functions.

However, just as the number of technology and engineering teachers and their teacher preparation programs has been declining since the 1980s, similar reductions in professional memberships across various fields and disciplines have followed the same downward trend (Alotaibi, 2007; Bauman, 2008; Putnam, 2000; Yeager & Kline, 1983). These declines have caused professional organizations to cut services to members, just to survive economically (Martin, 2007). No longer can professional associations meet all the needs of their members. Consequently, this lack of help can cause further declines in memberships as people migrate to other associations they believe can provide the services to meet their individual needs.

Individuals join professional organizations because of the alignment of values they see between themselves, their profession, and the professional organization. The organizations they join often promote similar codes of ethics for professional conduct, work to preserve the subject's public image, and attempt to provide services to keep the professional current with the latest developments occurring within their field (Meltzer, 1996). As a result, people who join professional organizations care about their work within the profession (Rouch, 1999).

People who are perceived as leaders often lead professions and professional organizations. Some are hired as staff and others work as volunteers. Organization boards search for the best professionals to work in these positions to guide their associations in order to provide the best services and voice for their members. As their membership grows and develops professionally, it is most likely that they will improve the overall stature of their professions.

To become a professional leader usually takes years of professional development. A person must not only understand the knowledge base upon which the profession was established, but that person also must be willing to work for the betterment of the profession and its members. A leader must know how to work with others and direct them, get the tasks of the association accomplished, and plan for the future needs of the profession and its members. One function of leadership is thinking about the future (Gilberti, 1999).

When the technology and engineering teaching profession, particularly the Council on Technology and Engineering Teacher Educators (CTETE), began to vision its future, its members understood that new members would be needed to take over the leadership roles of the profession. Observations show that many talented leaders are good performers at their current jobs, leaders in their professions, and possible leaders of other organizations. Some leaders move on to other careers, causing voids in the leadership chain. High-performing members are not always there when associations need them to step into leadership roles as they move on to other career paths. These same observations show us that good leaders also retire, causing voids both at the workplace and in organizational leadership.

Colleges and universities have worked to develop models for the improved preparation of graduates who seek to become faculty members. In some fields, doctoral students take classes and work on research projects with faculty. These research projects sometime model what they will need to do in future faculty member positions. Many of these doctoral students prepare to become faculty, but they do not understand the teaching and service roles required in university positions. This creates problems for them when they transition into becoming teaching faculty members. In 1993, the Council of Graduate Schools and the Association of American Colleges and Universities designed a model labeled as “Preparing Future Faculty”; this program included three core components: “gaining teaching experience; learning about the academic triad of research, teaching, and service; and mentoring” (Richlin & Essington, 2004, p. 149). Its aim was to lessen the transition problems experienced by new doctoral graduates when they were hired to fill university faculty positions.

Most who seek to become professors of technology and engineering education have gained previous teaching experience and learned the best practices of teaching through degree work and on-the-job training. Many have student taught and operated their own classrooms/laboratories. These doctoral students could learn the research and service branches of the university triad by working closely with faculty and research mentors. However, reports indicate that not all new faculty are mentored well to become academic citizens (Gaff, 2002) or learn the other important qualifications needed for a faculty position.

Through the leadership of William Havice of Clemson University and Roger Hill of The University of Georgia, the Council on Technology and Engineering Teacher Education (CTETE) initiated the Twenty-first Century Leadership Academy (CLA) Program. Beginning in 2006, this program was developed “to facilitate a sense of community and provide activities and resources to support scholarly and professional development opportunities for groups of early career technology education faculty” (Havice & Hill, 2012, para. 1). One of the goals of the program was to “grow our own leaders.” The success of this program led it to become a part of the leadership program in the International Technology and Engineering Educators Association’s (ITEEA) strategic plan in 2010. “One of the purposes of this program is to provide initial experiences to potential leaders so that they can evolve to become the next generation of professional leaders” (Havice & Hill, 2012, para. 4).

The Twenty-first Century Leadership Academy Program

> This is a program designed to create tomorrow’s most successful and respected technology and engineering leaders, consultants, and strategic thinkers. As leaders, we need to create the future. This program incorporates knowledge and experiences from education leaders and other experts using practical and innovative advice on how leaders make a difference. Participants are involved in important dialogue using the best wisdom from experts and practitioners across sectors of the profession.
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> The aim of the program is to help technology and engineering educators gain additional skills to better deal with issues of performance, how systems and associations work, the role of finances in decision-making, and how to merge ideas and ambitions in a positive manner. The 21st CLA program provides a balance of practical and inspirational ideas to individuals who want to be leaders in the association and profession. (Havice & Hill, 2012, para. 2-3).

With the continued preparation of new doctoral graduates with focused study in the preparation of technology and engineering educators and the added benefits some of these graduates have gained through participation in the Twenty-first Century Leadership Academy Program, the researchers sought to determine the perspectives of these new professionals about the future of the school subjects technology and engineering education. (The researchers are not aware of any prior studies on this topic.) This study was designed during summer 2012 and administered in the fall of 2012. The researchers identified 59 new doctoral graduates who were prepared during the past five years in this teaching area. The researchers believe this population represents most (95-98%) graduates awarded doctoral degrees during the past five years in this field. This is based on: (a) information from program leaders at universities that offer doctoral degree programs with concentrated study in technology and engineering education, (b) a list of fellows who completed degree work through support of the National Center for Engineering and Technology Education, and (c) a list of participants who took part in ITEEA's Twenty-first Century Leadership Academy Program.

Research Design

The researchers selected the survey method, a nonexperimental quantitative research tool, as the research design for the study. Fraenkel, Wallen, and Hyun (2012) identified the survey as a method to "describe the characteristics of a population" (p. 393). These authors noted that in other types of research "the population as a whole is rarely studied" (p. 393), the survey method allows for a "carefully selected sample of respondents" (p. 394) to be surveyed, and a "description of the population is inferred from what is found out about the sample" (p. 394). For purposes of this study, a cross-sectional survey was administered to gather information from a predetermined population at a predetermined point in time. Gay, Mills, and Airasian (2012) noted that cross-sectional designs are "effective for providing a snapshot of the current behaviors, attitudes, and beliefs in a population" (p. 185). Creswell (2012) stated that a cross-sectional survey design has the "advantage of measuring current attitudes or practices" (p. 377).

Procedure

The researchers administered a structured 12-question survey (followed by 5 demographic-related questions) using SurveyMonkey™. Wiersma and Jurs (2009) underscored the importance of collecting demographic data in terms of classifying variables for further analysis. Gay et al. (2012) stated the importance of designing surveys that are brief, easy to respond to, and address a specific research topic. The survey for this study was administered in November 2012; two additional follow-up letters were sent to the invitees. In order to ensure anonymity of the participants, a URL to the survey was provided in the initial letter of invitation to participate and in follow-up letters. At no time during the conduct of the study did the researchers know which participants did or did not respond to the survey. In the final analysis, 34 of the 56 invitees or 60.7% selected to respond (correct email addresses could not be identified for three graduates). Although the response rate is not statistically significant (Patten, 2012), the information provided by the respondents was revealing because it provided clues about the health, vitality, and possibly the future of the technology and engineering education teaching profession as seen through the lens of recent doctoral graduates. No incentives were provided to the participants, and they were reminded in their letter of invitation to participate that there were no direct benefits to them by participating. Finally, invitees were informed that their responses would be aggregated with the responses from all other participants, so there would be minimal risk to them as a participant.

Prior to commencing the study, the researchers assumed that the participants were capable of identifying (a) the focus of content taught in a formalized K-12 technology and engineering education program, (b) methods of future teacher preparation, (c) characteristics of their professional involvement, and (d) future forecasting for their school subject. The researchers also assumed the participants understood the intent of each survey question and their responses to the questions would reflect their individual insights and perspectives about the profession. Finally, the researchers assumed that each survey question contained only one idea or question, used neutral (unambiguous) language so as not to lead a respondent to respond in a specific way, and contained response options that were simple, clear, and consistent.

Findings

The population for this study was a group of recent doctoral graduates ($N = 34$) who were nominated by lead professors at seven universities that offer the doctoral degree in technology and engineering education or the graduates were in a specialized sponsored program. For example, a qualified doctoral graduate was one who graduated (Ph.D. or Ed.D.) within the past five years from one of the following institutions: Colorado State University, North Carolina State University, Old Dominion University, The Ohio State University, The University of Georgia, Utah State University, and Virginia Polytechnic and State University. Some graduates may have completed their degrees under the auspices of the National Center for Engineering and Technology Education (NCETE) and may not be part of the seven purposely selected institutions. Finally, some graduates participated in the International Technology and Engineering Educators Association's (ITEEA) Twenty-first Century Leadership Academy Program and graduated from one of the purposely selected institutions and/or participated in the NCETE program. In a select few cases, a participant in the study may have been involved in more than one of the preceding categories. The researchers collected demographic data from the participants, and analyses of the data are provided in Table 1.

Data were gathered and analyzed from the participants' responses to the 12 survey questions. Part 1 of the survey focused on what is currently happening in the profession – the "here and now" – and the role the participants currently serve in their profession; Part 2 focused on the future of the profession from the participants' perspectives. A summary of the data for Part 1 of the study is first reported, followed by a summary of the data for Part 2.

Part 1

When asked to identify what should be the focus of content taught in a formalized K-12 technology and engineering education program, the participants were provided five choices to

Table 1. Population Demographics

Demographic	Selection	Number	Percent
Gender (*n* = 33)	Female	7	21.2
	Male	26	78.8
Age (*n* = 33)	20-30	1	3.0
	31-40	16	48.5
	41-50	8	24.2
	51-60	7	21.2
	61+	1	3.0
Area of Professional Interest (*n* = 33)	Post-Secondary	16	48.5
	High School	11	33.3
	Middle School	3	9.1
	Elementary School	3	9.1
Current Position (*n* = 26)	Teacher Educator	15	57.7
	Elementary Teacher	6	23.1
	Supervisor	2	7.7
	Private Sector	2	7.7
	Full-Time Student	1	3.8
CTETE 21st Century Leader Program Participant (*n* = 33)	Yes	18	54.5
	No	15	45.5

Note: *N* = 34. One respondent chose not to answer the demographic questions. It appears that eight participants work in the private sector by not selecting a response for current educational positions.

select from, and they were instructed to select "all that apply." Any participant could select one or more responses from the following choices: technological literacy, workforce education, engineering education, STEM integration, and "other." All 34 participants responded to the question. Twenty-five or 73.5% of the responses indicated the focus should be on technological literacy, 24 or 70.6% indicated the focus should be on STEM integration, 20 or 58.8% indicated the focus should be on engineering design, and 14 or 41.2% indicated the focus should be on workforce education. Three responses were recorded for the "other" category, and those written comments focused on content that might be included within the curriculum.

The second question focused on instructional strategies and what should be the focus of these strategies in a formalized K-12 technology and engineering education program. The researchers provided the participants four choices, and they were instructed to select "all that apply." The four choices were project-based, design-based, contextual, and "other." All 34 participants responded to the question. The project-based instructional strategy received the highest response at 85.3%, whereas designed-based was selected by 64.7% and contextual was selected by 61.8% of the participants. The "other" category was selected by five participants, and their responses included strategies such as inquiry-based, problem-based, hands-on (real world design and build), problem solving-based, and contest-based.

The researchers then focused on having the participants identify the primary audience for a formalized instructional program in technology

Table 2. Part 1, Current Activity within the Profession

Item	Selection	Number	Percent
1. Content for K-12 T/E Ed. (*n* = 34)	Technological Literacy	25	73.5
	Workforce Education	14	41.2
	Engineering Design	20	58.8
	STEM Integration	24	70.6
2. Focus of Instructional Strategies (*n* = 34)	Project-based	29	85.3
	Design-based	22	64.7
	Contextual	21	61.8
3. Primary Teaching Audience (*n* = 34)	Elementary School	1	02.9
	Middle School	2	05.9
	High School	3	08.8
	Secondary School	10	29.4
	Post-Secondary School	0	00.0
	All Levels	18	23.9
4. Journals Regularly Read (*n* = 29)	*Technology and Engineering Teacher*	23	79.3
	Children's Technology and Engineering	6	20.7
	Prism Magazine	6	20.7
	Journal of Technology Education	23	79.3
	Journal of Technology Studies	7	24.1

Note: *N* = 34. These numbers exceed the *N* value and 100%, since respondents could select more than one choice for these questions.

and engineering education. The participants were instructed to “select only one” from the following categories: elementary school students, middle school students, high school students, secondary students (middle and high school), post-secondary students, and all of the above identified populations. All 34 participants responded to the question. The participants believe that all elementary, middle, high school, and post-secondary students should be the primary audiences as this category was acknowledged by 53.9% of the participants. Only 29.4% of the participants selected secondary students (middle and high school) as the primary audience.

Professional publications provide members with a vehicle to share and gain new knowledge and to add to the knowledge base in their discipline. The researchers asked the participants which professional publications best described them as a regular reader of those publications. Interestingly, of the 34 individuals who participated in the study, five individuals chose to skip this question and not respond. Of those individuals who responded, two publications received the highest response. *The Technology and Engineering Teacher* and the *Journal of Technology Education* were each selected by 79.3% of the respondents. *The Journal of Technology Studies* was selected by 24.1% of the respondents and *Children’s Technology and Engineering* and *Prism Magazine* were each selected by 20.7% of the respondents. Participants were invited to identify other publications that were not part of the forced choices. *The Journal of Engineering Education, Journal of Learning Sciences, International Journal of Technology and Design Education*, and CTETE yearbooks were each identified. Table 2 summarizes data on the perceptions of recent doctoral graduates regarding current activities within the technology and engineering education professions.

Part 2

Part 2 of the survey instructed the participants to project to the year 2025 and then respond to a series of questions that focused on the future of the profession. For example, the researchers asked the participants to focus on teacher certification and how future technology and engineering educators will become certified (licensed) as classroom teachers. Thirty-two of the 34 participants responded to this question. The participants were instructed to select only one descriptor from the following statements and the response rate and n value follow each statement. Some chose to clarify their selection through the “other” category.

- A 4-year campus-based program, much like we have today in education; 40.6%, $n = 13$
- A 5-year campus-based program, with a major in industrial technology, engineering, or other similar major; 18.8%, $n = 6$
- Licensure add-ons to an existing degree program; 28.1%, $n = 9$
- Documenting academic qualifications through professional certification testing; 12.5%, $n = 4$
- Other; $n = 6$. Hybrids of the above options were mentioned, including combinations that entailed focus on STEM education.

Once the participants indicated how future teachers would be certified or licensed, they were then asked “where” they will receive their certification and teacher training. Thirty-three of the 34 participants responded to this question, and they could select “all that apply” from the following statements. The response rate and n value follow each statement.

- In brick and mortar university classroom/laboratories; 54.5%, $n = 18$
- Via distance learning technologies; 27.3%, $n = 9$
- Hybrid systems that involve blended methods of instructional delivery; 75.8%, $n = 25$
- Through an external testing organization; 0.0%, $n = 0$
- Other; 6%, $n = 2$. Both thought that online training was a poor option for the preparation of teachers.

Once teachers are certified, professional development becomes an important part of their tenure as a teacher. The researchers asked the participants to identify where technology and engineering practicing teachers will receive their professional development. Thirty-three of the 34 participants responded to this question, and they could select "all that apply" from the following statements. The response rate and n value follow each statement.

- State/district/city supervisors; 51.5%, *n* = 17
- Commercial vendors; 27.3%, n = 9
- National professional associations; 63.6%, *n* = 21
- State professional associations; 45.5%, *n* = 15
- Local professional associations; 33.3%, *n* = 11
- Teacher education institutions; 69.7%, *n* = 23
- Distance learning providers; 33.3%, *n* = 11
- Other; 0%

Historically, professional associations played a key role in serving the members they represent. Arguably, some associations are the lifeblood of their professions. The researchers sought to identify the professional associations that participants thought they would be members of in 2025. Thirty-two of the 34 participants responded to this question, and they could select "all that apply" from the following statements. The response rate and n value follow each statement.

- ASEE – American Society for Engineering Education; 68.8%, *n* = 22
- ITEEA – International Technology and Engineering Educators Association; 75%, *n* = 24
- CC of ITEEA – Children Council of ITEEA; 18.8%, *n* = 6
- CSL – Council for Supervision and Leadership of ITEEA; 12.5%, *n* = 4
- CTETE – Council on Technology and Engineering Teacher Educators of ITEEA; 50.0%, *n* = 16
- State-level Technology and Engineering Associations; 43.8%, *n* = 14
- STEM Associations (e.g., NSTA – National Science Teachers Association, NCTM – National Council of Teachers of Mathematics); 56.33%, *n* = 18
- Other; 21.8%, *n* = 7. Some of the respondents selected other associations that are related to technical professions but whose mission may not necessarily be directly supportive of education. This may show that not all who complete these specific degrees pursue employment within educational fields.

Being a member of a professional association does not necessarily imply that this person attends meetings of that association. The researchers sought to identify which association conferences the participants would be attending in 2025. Twenty-nine of the 34 participants responded to this question, and they could select "all that apply" from the following statements. The response rate and n value follow each statement.

- ASEE – American Society for Engineering Education; 62.1%, *n* = 18
- ITEEA – International Technology and Engineering Educators Association; 79.3%, *n* = 23
- PATT – Pupils Attitudes Towards Technology; 13.8%, *n* = 4
- State-level technology and engineering conferences; 58.6%, *n* = 17
- TERC – Technology Education Research Conference; 17.5%, *n* = 5
- Other; 31%, *n* = 9. Others included Mississippi Valley Conference, Southeastern Technology Education Conference, International Society for Technology Education, Association for Career and Technical Education, and others.

People join professional associations for a variety of reasons. For example, some may join to receive a publication, while others join because they want to attend meetings. Still others join so that they might publish in the journal of that association. The researchers inquired as to the publications the participants would be publishing in by 2025. Thirty of the 34 participants responded to this question, and they could select "all that apply" from the following statements. The response rate and n value follow each statement.

- *Technology and Engineering Teacher*; 73.3%, *n* = 22
- *Journal of Technology Education*; 86.7%, *n* = 26
- *Journal of Technology Studies*; 30%, *n* = 9
- *International Journal for Technology and Design Education*; 40%, *n* = 12

- *Australiasian Journal of Technology Education*; 3.3%, *n* = 1
- *Prism Magazine*; 10%, *n* = 3
- Other; 40%, *n* = 12. A number of participants listed many of the above journals plus others, including *Journal of Engineering Education* (3 responses), *Children's Engineering and Technology* (3 responses), and *Journal of STEM Education* (2 responses).

Table 3 provides a summary of perspectives of doctoral graduates related to the future of the profession.

The researchers inquired what the participants foresee as their role in the profession in the year 2025. They were provided some descriptive statements that represent different levels of activity. Thirty-two of the 34 participants responded to the question, and they could select "all that apply" from the following statements. The response rate and *n* value follow each statement.

- I believe I will hold or have held key leadership positions in ASEE – American Society for Engineering Education; 43.8%, *n* = 14
- I believe I will hold or have held key leadership positions in CC of ITEEA – Children Council of ITEEA; 25%, *n* = 8
- I believe I will hold or have held key leadership positions in CSL – Council for Supervision and Leadership; 12.5%, *n* = 4
- I believe I will hold or have held key leadership positions in CTETE – Council for Technology and Engineering Teacher Educators; 37.5%, *n* = 12
- I believe I will hold or have held key leadership positions in ITEEA – International Technology and Engineering Educators Association; 56.3%, *n* = 18
- I believe I will hold or have held key leadership positions in state-level technology and engineering education associations; 50%, *n* = 16
- I believe I will hold or have held key leadership positions in STEM Associations (e.g., NSTA – National Science Teachers Association, NCTM – National Council of Teachers of Mathematics); 34.4%, *n* = 11
- I do not envision myself serving in key leadership positions in professional associations; 6.3%, *n* = 2

Finally, the last question, but maybe the most important question: what did the participants project as the future of the technology and engineering education profession by the year 2025. Thirty-three of the 34 participants responded to the question, and they could select "only one" statement from the following choices.

- The profession will look very similar to what it looks like today; that is, it will be a vibrant profession with a core of members who are able to sustain it; 30.3%, *n* = 10
- The profession as we know it today will be replaced by STEM; 39.4%, *n* = 13
- The profession will be integrated into the science profession; 18.2%, *n* = 6
- Technology and engineering education will disappear as a school subject; 12.1%, *n* = 4

Discussion and Conclusions

What did we learn when we sought the informed opinions of what may be the next generation of individuals to lead this profession? Did these individuals identify some new directions for this profession? Did they reinforce the need to support the initiatives that the profession's leaders are currently pursuing? The researchers believe that data provided by the participants in this study provide much insight about current and future initiatives and it behooves the profession's leaders, current and future, to be apprised of what the next generation is suggesting.

As data from this study were reviewed, analyzed, and synthesized, the researchers reached several conclusions. First, there is general agreement among the participants that technological literacy, STEM integration, and engineering design are important foci for content taught in formalized K-12 technology and engineering education programs. Each one of these foci is identified by more than 50% of the participants in the study. This conclusion

Table 3. Part 2, Future of the Profession

Item	Responses	Number	Percent
5. Teacher Certification Pathways	4-year campus program	13	40.6
	5-year campus program with industry/engineering major	6	18.8
	License add-on	9	28.1
	Certification testing	4	12.5
6. Certification and Training Options	On university campus	18	54.5
	Via distance learning	9	27.3
	Hybrid delivery system	25	75.8
	Testing organization	0	00.0
7. Professional Development Providers	State/district supervisors	17	51.5
	Commercial vendors	9	27.3
	National professional associations	21	63.6
	State professional associations	15	45.5
	Local professional associations	11	33.3
	Teacher education institutions	23	69.7
	Distance learning providers	11	33.3
8. Member of which Professional Organization	ASEE	22	68.8
	ITEEA	24	75.0
	Children's Council (ITEEA)	6	18.8
	Council for Supervision and Leadership (ITEEA)	4	12.5
	Council for Teacher Educators (CTETE)	16	50.0
	State-level technology and engineering association	14	43.8
	STEM associations	18	56.3
9. Conference Attendance	ASEE	18	62.1
	ITEEA	23	79.3
	PATT	4	13.8
	State level	17	58.6
	TERC	5	17.2
10. Publications You Would Seek to Publish	*Technology and Engineering Teacher*	22	73.3
	Journal for Technology Education	26	86.7
	Journal of Technology Studies	9	30.0
	International Journal for Technology and Design Education	12	40.0
	Australasian Journal for Technology Education	1	03.3
	Prism Magazine	3	10.0

Note: *N* = 34. Respondents could have more than one response to questions posed.

is supported in the literature (Bybee, 2013; ITEA, 2000; Wicklein, 2006). Second, there is also general agreement on what should be the foci of instructional strategies offered in formalized K-12 technology and engineering education programs. Project-based, design-based, and contextual learning experiences were identified by more than 50% of the participants as important foci of instructional strategies. Third, the audience for engineering and technology education has been a topic of discussion since the subjects' inception. The participants' responses further underscored that the primary "audience" may continue to be a topic of discussion well into the future. The only descriptor selected by more than 50% of the participants was "all of the above," which simply extends the conversation on who these programs are designed to serve. This conclusion is also supported by the ITEA (2000) and Ritz (2011). Fourth, the researchers attempted to determine which publications the participants regularly read as part of their professional growth and development. It was clear that the only two publications were commonly identified in the current technology and engineering education environment: *Technology and Engineering Teacher* and *Journal of Technology Education*. Both publications were read regularly by 79.3% of the respondents.

Fifth, the researchers wanted to find out how future technology and engineering educators will become certified (licensed) as classroom teachers. There was no agreement among the participants. The 4-year campus-based program received the highest response rate (40.6%). Of those participants who chose the "other" category, there was no agreement in their written responses. Sixth, when asked where classroom teachers will receive their certification, hybrid systems involving blended methods of instructional delivery received the greatest response (75.8%), and 54.5% of the participants believed that certification and training would occur in brick and mortar university classroom/laboratories. Do the responses to this question reveal important information about the future of our delivery systems in technology and engineering education? Do institutions and professors need to get more aggressive in designing alternative delivery modes of instruction? Seventh, once we learned the participants' perspectives on how future teachers will be certified, future teachers must engage in continuous professional development. The participants believed that professional development would be provided by the national professional associations (63.6%). This is surprising because our national professional associations are experiencing a decline in membership and a decline in conference attendance. The participants (51.5%) thought that state/district/city supervisors would provide professional development, but once again, many states/districts/cities have either consolidated their supervisory positions or eliminated them to cut costs. Commercial vendors, state professional associations, and local professional associations did not meet the greater than 50% threshold established by the researchers to be considered as a viable alternative to providing professional development. These findings are also supported by those of Devier (1999), Karseth and Nerland (2007), and Leahy (2002). Eighth, the long-term viability of professional associations is always a concern of the leaders of these associations and to the associations' membership (Martin, 2007; Reeve, 1999). Strong membership levels are vitally important to our associations. Will the participants of this study be members of professional associations in 2025 that exist today? Three associations received greater than 50% responses from the participants: ITEEA (75%), ASEE (68.8%), and STEM associations (56.3%). The researchers did not find the selection of ITEEA, ASEE, and STEM associations surprising; however, CTETE did not meet the greater than 50% threshold. It was surprising that the association that has been historically associated with doctoral graduates was not to be viewed as a future association of the graduates. Ninth, it appears that participants in this study will be regular conference attendees of their professional associations' conferences: ITEEA (79.3%), ASEE (62.1%), and state-level technology and engineering conferences (58.6%). Not surprising to the researchers, the two association conferences (TERC and PATT) that are hosted outside the United States received only a small amount of attention from the participants. Tenth, the researchers asked the participants which professional publications they planned to publish in by 2025. Two publications, *Technology and Engineering Teacher* (73.3%) and *Journal of Technology Education* (86.7%)

exceeded the greater than 50% threshold established by the researchers. Surprisingly, even though 68.8% of the participants plan to be members of the ASEE, only 10% envisioned publishing in *Prism Magazine* by 2025.

Individuals who select to serve in leadership positions in their professional associations provide a valuable service to their members. Surprisingly, except for ITEEA, which received a response rate of 56.3%, participants in the study do not envision themselves serving in key leadership positions. Where will our professional associations find individuals to serve in key leadership positions? It appears these individuals may not come from the population represented in this study. Finally, and maybe the most important question asked in this study, what is the future of the technology and engineering education profession? Unfortunately, there is no clear agreement among the participants in this study. The participants were divided as to whether the profession as we know it today will (a) be replaced by STEM, (b) be very similar to what it looks like today, or (c) be integrated into the science school subjects. Will technology and engineering education disappear as school subjects? Of the participants, 12.1% believe they will disappear.

Recommendations for Further Research

The population for this study was a group of recent doctoral graduates (N = 34). It is clear they provided valuable information that may ultimately lead to substantive discussions about the core principles that guide the profession. Future researchers may wish to consider the findings of this study and develop a new and improved set of data. They may also wish to expand the size of the sample to include other populations to ascertain the professional judgments of a broader audience of practicing technology and engineering educators. Researchers may also wish to further dissect the findings of the study, delve more deeply into the current findings of one or more questions for deeper meanings and understandings, and/or simply pose the same questions via a different voice. Finally, researchers may wish to conduct a qualitative study that leads to in-depth interviews and a more in-depth analysis of the participants' initial responses.

Summary

The researchers selected the survey as the research design of choice to solicit specific information from a group of purposely selected graduates of doctoral degree granting institutions. The participants' responses to the survey questions provide quality information about the future of the technology and engineering education professions. In addition, information gleaned from this study may be helpful to professional leaders as they develop their strategic plans and make strategic decisions about the technology and engineering education subjects.

What was learned from this study? In some cases the participants were comfortable with the present direction of their profession. Their responses to other questions, however, left the researchers somewhat puzzled about this profession's future and their roles in that future. For example, they believe in the future of ITEEA and they feel comfortable with its two primary publications, but they do not necessarily feel comfortable with the teacher education affiliate (CTETE) of ITEEA. Participants plan to attend conferences of other professional associations, but they do not see themselves necessarily publishing in the literature of those same associations or leading those associations by holding key leadership positions. Finally, there was no consensus about the future of technology and engineering education in the year 2025. The larger message of the survey to all in this profession is the following uncertainty: Should we be alarmed by the message these graduates conveyed to us?

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