Research Needs for Technology Education: A U.S. Perspective

The research productivity of those in the technology education profession has been well documented in the literature over the past 50 years (Dyrenfurth & Householder, 1979; Householder & Suess, 1969; Johnson & Daugherty, 2008; McCrory, 1987; Reed, 2010; Streichler, 1966; Zuga, 1994). Some have suggested that the profession lacked research data to support the need for its subject matter (technology education, design and technology, technology and engineering education, etc.), while others have suggested that the field does not actively engage in research studies of both quality and quantity. All members appear to agree that performing quality research is a healthy and enriching experience and, when properly conducted and used, can lead to making better and more informed educational decisions about the subject matter.

This study was conducted for the purpose of identifying research needs for technology education by generating a rank-ordered list of research topics that the profession's members might wish to explore individually or in collaboration with colleagues and students. The researchers' goal was to provide a concise list of topics that could be used by the profession to better position itself within the greater educational community, not to provide a call for action. The anticipated beneficiaries of this study are researchers who identify themselves as furthering the development of the technology education school subject. Professionals may use the list found in this study to further cultivate scholarly research in technology education. They may also use the list as a guide and, where appropriate, make better and more informed educational decisions through the formal, systematic application of scholarship and disciplined inquiry.

The population for the study consisted of a purposeful sample of 17 individuals who had been named recipients of the Council on Technology and Engineering Teacher Education's (CTETE) Teacher Educator of the Year award. The CTETE *Constitution and ByLaws* (2011) indicates that recipients of this award are "selected on the basis of long and valued service to the Council, to technology teacher education, and to the field of education in general" and that "past and present contributions will be considered" (p. 10). These individuals were deemed qualified to serve as panelists for this study. This homogenous group met the criterion for expertise and competency, as they were nominated and selected for this award by their peers.

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Review of Related Literature

Since our teaching field began in the late 19th Century, much of the decision making has been guided by professional collaboration and/or individual philosophical reasoning. Group and individual philosophical work has helped the profession to decide what to teach (content) and how to teach it (method). As the profession began to mature in the middle of the 20th Century, research was utilized in decision making. During the 1960s, projects (e.g., Industrial Arts Curriculum Project, American Industry Project) were funded by the U.S. Office of Education so researchers could better explore the appropriate content to deliver through instruction in their laboratories (Cochran, 1970).

Individually and in groups, professionals in the field have sought to make this school subject better and enable it to become a core teaching area required for all students. To do this, they knew that teachers, graduate students, and professors must undertake research in order to demonstrate the value of technology in the curriculum and its project-based instructional techniques (Cajas, 2000; Foster, 1992; Garmire & Pearson, 2006; Johnson, 1993; Lewis, 1999; Passmore, 1987; Pearson & Young, 2002; Petrina, 1998; Reed, 2002; Sanders, 1987). However, many in the profession have not practiced research. Instead of conducting additional research, many have chosen to teach technology in their laboratories while emphasizing student development and subject content.

The call for research is not new to this profession. Five CTETE yearbooks have reiterated the importance of research for assisting with professional decision making and building support for our school subject (Israel & Wright, 1987; Porter, 1964; Reed & LaPorte, 2010; Rowlett, 1966; Van Tassel, 1960).

The Center on Education and Training for Employment has sponsored studies reporting on the research that had been conducted in technology education, with emphasis on what needs further research. These analyses were conducted by Dyrenfurth and Householder (1979), Householder and Suess (1969), McCrory (1987), Streichler (1966), and Zuga (1994).

Others have summarized the published works of technology educators and other professionals who have published their results in journals related to the study of technology education. Johnson and Daugherty (2008) reported that there were 199 scholarly research journal articles published from 1997-2007. Williams (2011) reviewed 472 manuscripts published since 2006 and organized them into categories (e.g., design, curriculum, technological literacy). His review included both journal and major conference manuscripts.

Several MS programs require a thesis or major research paper and all PhD/EdD programs require dissertations. Reed (2010) developed the Technology Education Graduate Research Database, which has posted approximately 5,500 entries (from 1892 to 2010) of graduate research in technology education. Santos (2005) conducted an analysis of dissertation topics reported by our doctoral granting institutions in the United States between the years 2000-2005.

To move our profession into the 21st Century, Waetjan (1992) recommended that technology educators establish a research consortium to better study critical issues found within the technology education school subject. Three areas he recommended that should be studied included the following:

- Students' competence in and attitudes toward technological studies and attitudes about themselves.
- Determining how political decisions are made.
- Outcomes of technology teacher education.

There is evidence that the challenge has been taken seriously by members of this teaching community. In 2004, faculty from nine universities established the National Center for Engineering and Technology Education (NCETE), with funding from the National Science Foundation. In July 2006, researchers working with NCETE proposed a research agenda for this teaching field. Major areas that NCETE proposed for continued research included:

- Questions Involving Learning
- Questions Involving Teaching
- Questions Involving Assessment (D. Householder, personal communication, December 8, 2011)

Although these topics are related to technology and engineering education, they are the agenda of NCETE and may not be applicable to the profession in general. Will NCETE topics ultimately be formally adopted by the entire profession? What should be the focus of research in the technology and engineering education school subject?

With this background information, the researchers believed that for technology education to become a *valued subject* (ITEA/ITEEA, 1996), it must identify a list of the most important issues to guide its research activity. But, what issues should be included on the list?

Research Design

The researchers selected the Delphi method as the research design for the study, as it is widely recognized as a structured communication process. This method allows researchers to collect, review, analyze, and synthesize information from a recognized group of experts. Within the communication process, the type and amount of feedback is controlled by the researchers, as there is no planned interaction among the participants by the researchers. In this study, the names of the participants were not identified, just their qualifications to be participants. The researchers assumed that the participants did not communicate with one another. Their individual responses were not shared with the other participants, only aggregated responses were shared. Participants were deemed to have the expertise and competency to be participants.

Procedure

The Delphi method followed in this study consisted of four rounds that were preceded by a letter of invitation to participate. All communications between the researchers and participants were administered electronically. The letter of invitation provided an overview of the research problem to be addressed, the goal of the study, and a rationale for their selection to be a participant. Invitees were requested to respond to the letter of invitation in order to confirm their commitment to participate. Seventeen of 19 invitees responded in the affirmative. No incentives were provided to the participants.

Prior to commencing the study, the researchers assumed that the participants were capable of identifying and describing the most important issues that need to be researched related to (a) K-12 technology (engineering) education and (b) preparation for teaching this school subject. We assumed that the participants were capable of reaching consensus and creating a list of the most relevant issues that need to be researched by the profession's members. Furthermore, once identified, the list could be rank-ordered by applying statistics and using a structured communication process called the Delphi method. The Delphi method proved to be an acceptable research method to meet the goal of the study.

Prior to commencing the study, the researchers determined that an issue had to reach a mean score higher than a 3.50 on a 5-point scale in order to be considered a significant issue that should be researched by the profession. A mean score higher than a 3.50 is equivalent to a rating of *significant relevant issue* or *most relevant issue* on the 5-point Likert-type scale as used in this study.

Round 1

In Round 1, the researchers posed two fundamental but open-ended questions for the participants to consider:

- Research Question 1: What is the most important issue that needs to be researched related to K-12 technology (and engineering) education?
- Research Question 2: What is the most important issue that needs to be researched related to preparation for teaching this school subject?

The participants were instructed to (a) identify the most important issue related to each of the two questions and (b) provide a brief description of each issue so that other panelists would be able to properly reflect on all the issues generated in Round 2. A recommended format for receiving their response was also provided. Each participant could submit only one response to each question. Finally, the researchers provided the participants definitions of key terms to assist them in meeting the purpose of Round 1.

In order to control for researcher bias, the researchers utilized Survey Monkey™ (i.e., the researchers did not know the names of each participant or their specific responses to the two questions in Round 1). In addition, an external panel of three individuals was formed to review the participants' Round 1 responses. The researchers deemed these individuals qualified to serve as panelists, as they are active participants in the profession's mission. They are not, however, past recipients of the CTETE Teacher Educator of the Year award.

The external panel met and reviewed the participants' responses to the two research questions. They created categories to group responses and, when necessary, they placed similar responses into similar categories in order to reduce or eliminate response duplication. The names of the categories were not shared with the participants as the researchers did not want to positively or negatively influence the participants in subsequent rounds. The net result was the identification of issues and descriptions of those issues. Once the external panel's recommendations were received, the researchers further edited some of the issue statements or descriptions within categories in order to place the issues and descriptions in a similar format for Round 2. The editing process by the external panel and researchers produced 17 issues with descriptions to Research Question 1 and 11 issues with descriptions to Research Question 2. A listing of the issues are provided in Table 1-A and Table 2-A.

Round 2

The purpose of Round 2 was to initiate the process of drawing consensus on the issues the participants believed were important to establish a better knowledge base for the technology education school subject. The content of the instrument in Round 2 was based on participants' responses to Round 1. There was no attrition among the participants in this round, as all participants responded to the instrument. Using a 5-point Likert-type scale (i.e., *most relevant issue* = 5 points, *significant relevant issue* = 4 points, *moderate relevant issue* = 3 points, *limited relevant issue* = 2 points, *not relevant issue* = 1 point), participants were instructed to rate the importance of each issue identified in the instrument.

Participants' ratings for each of the 17 issues from Research Question 1 and 11 issues from Research Question 2 were recorded and the mean score, median, standard deviation, and interquartile range (IQR) for each issue were computed. An IQR above 2.0 would indicate disagreement among the panelists on their rating of an item. (See Tables 1-A and 2-A for the results of Round 2 for each research question.)

Table 1-A (continued on next page)
Research Question 1

	Round 1	Round 2			
	Item	*M*	*Md*	*SD*	*IQR*
1	K-12 Technology Education and Engineering Curriculum	3.29	3	1.05	1
2	Engineering Content and Curriculum	4.12	4	0.70	1
3	Perception of Technology and Engineering Education	3.41	3	0.94	1
4	Impact on Basic Education	3.30	3	0.99	1
5	Influence on Career Selection	2.71	3	0.85	1
6	Impact on Academic Achievement	4.00	4	1.00	1.5
7	Contributions of Technology Education	3.18	3	1.24	2
8	Content that Is Valued	3.47	4	0.94	1
9	Social Confusion between Technology and Science	3.53	4	1.18	2.5
10	Value of Research	3.12	3	1.41	2.5
11	Verification of Content	4.12	4	0.93	1.5
12	Benefit of K-12 Technology and Engineering Education	4.12	4	0.86	1
13	Shortage of Critical Research Important to K-12 Learning Outcomes	3.65	4	1.06	1
14	Student Learning	3.53	4	1.18	1.5

15	Serving All Learners	2.94	3	0.99	2
16	Preparing Students for Technological (and Engineering) Literacy	2.88	3	0.99	2
17	Identify a Unique Focus for This School Subject	2.71	2	1.16	2

Round 3

The purpose of Round 3 was to draw further consensus on the issues the participants believed were important to establish a better knowledge base for our school subject. The list of issues in Round 3 was the same list and was presented in the same order as the list in Round 2. The 5-point Likert-type scale used in Round 2 was also used in Round 3. The median and standard deviation for each of the issues were provided to participants, along with their individual responses to these issues from Round 2. They were instructed to either reaffirm the original response they provided in Round 2 or change their response. A review of the data from Round 3 indicates that two participants chose not to change any of their responses and seven participants chose to change eight or more of their responses with the greatest number of changed responses being 12. The standard deviation, mean score, median, IQR, and coefficient of variation (CV) were computed for each issue (see Tables 1-B and 2-B).

There is a strong consensus when the CV is between 0.00 and 0.50. In Round 3, the strong CV substantiates the presence of a consensus among the participants for each of the issues to the two research questions. As a group of professionals, they appeared willing to compromise and reach consensus.

Table 2-A
Research Question 2

	Round 1 Item	Round 2 *M*	*Md*	*SD*	*IQR*
1	Need for Refined Content and Process Standards	3.94	4	1.03	2
2	What Is the Content for the Study of Technology	3.24	3	0.90	1
3	Strategies to Teach Engineering Design	3.71	4	0.92	1
4	Appropriate Teacher Preparation Model	3.35	3	0.87	1
5	Preparation Needed to Effectively Teach Technology (and engineering) Education	3.41	3	1.06	1.5
6	Content Pedagogy	3.29	3	0.92	1
7	Cognitive Science Connections	3.71	4	1.11	1.5
8	How Do Students and Teachers Learn Technology and Engineering	3.24	3	1.30	2.5
9	Technology and Engineering's Influences on Student Achievement	3.41	3	1.33	3
10	Determining Skill Sets that Make for the Best Secondary Technology Education Teachers	3.12	3	1.22	2
11	Effective Teaching-Learning Strategies for Technology and Engineering Education	3.41	3	1.12	1

Table 1-B
Research Question 1

	Round 1 Item	Round 3 *M*	*Md*	*SD*	*IQR*	*CV*
1	K-12 Technology Education and Engineering Curriculum	3.24	3	1.03	1	0.32
2	Engineering Content and Curriculum	4.18	4	0.60	1	0.15
3	Perception of Technology and Engineering Education	3.30	3	0.92	1	0.28
4	Impact on Basic Education	3.18	3	0.64	1	0.20
5	Influence on Career Selection	2.71	3	0.99	1	0.36
6	Impact on Academic Achievement	4.29	4	0.77	1	0.18
7	Contributions of Technology Education	3.06	3	1.09	2	0.36
8	Content that Is Valued	3.53	4	0.87	1	0.25
9	Social Confusion between Technology and Science	3.47	4	1.12	2	0.32
10	Value of Research	2.94	4	1.25	2	0.42
11	Verification of Content	4.06	4	0.75	.5	0.18
12	Benefit of K-12 Technology and Engineering Education	4.24	4	0.67	1	0.16
13	Shortage of Critical Research Important to K-12 Learning Outcomes	3.82	4	0.95	.5	0.25
14	Student Learning	3.65	4	1.11	1.5	0.31
15	Serving All Learners	2.94	3	1.09	1.5	0.37
16	Preparing Students for Technological (and Engineering) Literacy	2.77	3	0.97	1	0.35
17	Identify a Unique Focus for This School Subject	2.41	2	0.71	1	0.30

Table 2-B
Research Question 2

	Round 1	Round 3				
	Item	*M*	*Md*	*SD*	*IQR*	*CV*
1	Need for Refined Content and Process Standards	3.94	4	0.97	.5	0.25
2	What Is the Content for the Study of Technology	3.29	3	0.59	1	0.18
3	Strategies to Teach Engineering Design	3.77	4	0.83	1	0.22
4	Appropriate Teacher Preparation Model	3.18	3	1.02	1	0.32
5	Preparation Needed to Effectively Teach Technology (and engineering) Education	3.29	3	0.92	1.5	0.28
6	Content Pedagogy	3.24	3	0.90	1	0.28
7	Cognitive Science Connections	3.82	4	0.95	.5	0.25
8	How Do Students and Teachers Learn Technology and Engineering	3.06	3	1.03	2	0.34
9	Technology and Engineering's Influences on Student Achievement	3.29	3	1.11	1.5	0.34
10	Determining Skill Sets that Make for the Best Secondary Technology Education Teachers	3.00	3	1.23	2	0.41
11	Effective Teaching-Learning Strategies for Technology and Engineering Education	3.24	3	0.83	1	0.26

Round 4

As a result of input received from the participants, Round 4 was administered to determine whether the issues in the previous rounds were truly research initiatives that needed to be undertaken by the profession's members or were issues that should be undertaken by the profession to fulfill some other purpose. In other words, while the previous rounds "forced" the participants to indicate the level of relevancy of each issue, they were now being provided a final opportunity to verify whether they thought the issues were truly research initiatives.

The researchers requested that participants reflect on the Delphi process and then consider whether the issues could best be addressed in a Research Activity or Development Activity. For purposes of this study, the following two definitions were provided in the instructions to Round 4:

> **Research Activity**. Research is the formal, systematic application of scholarship and disciplined inquiry to the study of problems that have been identified by the profession's members. Individuals who conduct research are commonly referred to as researchers. Researchers identify their research question(s) and then follow a research design (e.g., quantitative and/or qualitative) or plan to answer their research question(s). Researchers formally engage in a Research Activity to address their specific research question(s). The end product is an analysis of the data collected or the results of their study that is prepared into a formal document.
>
> **Development Activity**. Sometimes what is initially thought to be a research activity is not really one at all. Instead, it is a Development Activity where individuals work together to address a specific problem in the profession. For example, a development activity may be associated with reaching consensus on (a) curricular issues, (b) marketing strategies, (c) political strategies, (d) professional development programs, or (e) recruitment strategies. As used in the context of this study, the goal of a Development Activity is to reach consensus among the participants. It may or may not result in a tangible product such as a formal document.

Data collected from Round 4 appeared to generate the greatest amount of informal discussions between the participants and the researchers and underscored the importance of whether some of the issues originally identified as research issues may best be addressed as a development activity. Other discussions centered on whether some of the issues were neither research nor developmental but actually something else. One out of the 17 original participants chose not to participate in Round 4 (see Tables 1-C and 2-C).

Table 1-C
Research Question 1

	Round 1	Round 4	
	Item	*R/D*	*%*
1	K-12 Technology Education and Engineering Curriculum	R	75
2	Engineering Content and Curriculum	R	56
3	Perception of Technology and Engineering Education	D	88
4	Impact on Basic Education	R	63
5	Influence on Career Selection	R	75
6	Impact on Academic Achievement	R	88
7	Contributions of Technology Education	D	69
8	Content that Is Valued	D	56
9	Social Confusion between Technology and Science	D	69
10	Value of Research	D	75
11	Verification of Content	R	81
12	Benefit of K-12 Technology and Engineering Education	R	75
13	Shortage of Critical Research Important to K-12 Learning Outcomes	R	75
14	Student Learning	R	94
15	Serving All Learners	D	81
16	Preparing Students for Technological (and Engineering) Literacy	R	56
17	Identify a Unique Focus for This School Subject	D	69

Table 2-C
Research Question 2

	Round 1 Item	Round 4 *R/D*	 *%*
1	Need for Refined Content and Process Standards	D	69
2	What Is the Content for the Study of Technology	R	56
3	Strategies to Teach Engineering Design	D	56
4	Appropriate Teacher Preparation Model	D	56
5	Preparation Needed to Effectively Teach Technology (and engineering) Education	R	81
6	Content Pedagogy	R	75
7	Cognitive Science Connections	R	62
8	How Do Students and Teachers Learn Technology and Engineering	D	56
9	Technology and Engineering's Influences on Student Achievement	R	94
10	Determining Skill Sets that Make for the Best Secondary Technology Education Teachers	R	69
11	Effective Teaching-Learning Strategies for Technology and Engineering Education	R	81

Findings

Data were gathered and analyzed through the four rounds of this study. An analysis of the data derived from Rounds 3 and 4 and relating to Research Question 1 revealed there were seven issues above the mean score of 3.50 threshold level indicating they were either *significant relevant* or *most relevant* issues. (One of these seven issues, Issue No. 8, was recommended as a Development Activity, not a Research Activity, in Round 4 and was withdrawn from further consideration.) The remaining six issues are as follows:

- **Issue No. 2: Engineering Content and Curriculum** (M = 4.18, 56% selected as a Research Activity issue).
- **Issue No. 6: Impact on Academic Achievement** (M = 4.29, 88% selected as a Research Activity issue)

- **Issue No. 11: Verification of Content** (M = 4.06, 81% selected as a Research Activity issue)
- **Issue No. 12: Benefit of K-12 Technology and Engineering Education** (M = 4.24, 75% selected as a Research Activity issue)
- **Issue No. 13**: **Shortage of Critical Research** [Important to K-12 Learning Outcomes] (M = 3.82, 75% selected as a Research Activity issue)
- **Issue No. 14: Student Learning** (M = 3.65, 94% selected as a Research Activity issue)

An analysis of the data derived from Rounds 3 and 4 and relating to Research Question 2 revealed there were three issues above the mean score of 3.50 threshold level indicating it was either a *significant relevant* or *most relevant* issue. (Two of these issues, Issues No. 1 and 3, were recommended as a Development Activity, not a Research Activity, in Round 4 and were withdrawn from further consideration.) The remaining issue, Issue No. 7 is as follows:

- **Issue No. 7: Cognitive Science Connection** (M = 3.82, 62% selected as Research Activity issue)

All other issues for Research Question 2 that were originally identified by the participants in Round 1 and responded to in Rounds 2 and 3 did not meet the minimum threshold of having a mean score greater than 3.50.

Discussion and Conclusions

Buzz words or substance? What do we learn when we seek expert opinions? Researchers always fear their work may result in a ho-hum response from the profession. Do the results of this study reinforce the status quo or do they extend the profession into new arenas? The researchers believe the issues identified in this study are important and timely for technology education. If the profession's members decide to address these issues, they will have capitalized on an opportunity to advance the profession well into the next decade, while advancing the position of technology education as a school subject.

As data were further reviewed, analyzed, and synthesized, the researchers reached several conclusions. First, there was relative stability between Rounds 2 and 3 on the issues the participants rated for Research Question 1 that met the criterion of a mean score greater than 3.50. For example, in Round 2, Issues No. 2, 6, 9, 11, 12, 13, and 14 met the criterion (see Table 1-A). In addition, all seven issues reported a median of 4. These same issues, except for Issue No. 9, had an IQR less than 2.0. In Round 3 (see Table 1-B), only Issue No. 9 had a mean score less than 3.51. In addition, Issue No. 8 reported a mean score of 3.53 in Round 3. These seven issues (2, 6, 8, 11, 12, 13, & 14) had a median of 4, an IQR less than 2.0, and a CV less than 0.50. At the end of Round 3, these seven issues for Research Question 1 were deemed significant by the researchers.

Second, Round 4 instructed the participants to reflect on all the statistical data provided in Rounds 2 and 3 and then recommend whether each of the 17 issues for Research Question 1 was a Research Activity or a Development Activity. The researchers arbitrarily decided that for an activity to be considered a Research Activity or a Development Activity, 51% of the participants had to recommend it in their responses. The data indicated that participants believe Issues No. 1, 2, 4, 5, 6, 11, 12, 13, 14, and 16 are Research Activity issues (see Table 1-C).

Third, when data for the issues in Rounds 2, 3, and 4 were further analyzed, it was readily apparent that only Issues No. 2, 6, 11, 12, 13, and 14 had met the minimum criteria for a mean score greater than 3.50, an IQR of 2.0 or less, and a CV of 0.50 or less. Each issue also had a median of 4. These six issues had been identified by the participants as Research Activity issues. The researchers recommend the following rank-ordered list of Research Activity issues that should be addressed by the profession:

- Rank #1: Issue No. 6 – Impact on Academic Achievement; M = 4.29
- Rank #2: Issue No. 12 – Benefit of K-12 Technology and Engineering Education; M = 4.24
- Rank #3: Issue No. 2 – Engineering Content and Curriculum; M = 4.18
- Rank #4: Issue No. 11 – Verification of Content for Technology and Engineering Education; M = 4.06
- Rank #5: Issue No. 13 – Shortage of Critical Research [Important to K-12 Learning Outcomes]; M = 3.82
- Rank #6: Issue No. 14 – Student Learning; M = 3.65

The researchers followed the same procedure used in analyzing data for Research Question 1 when analyzing data for Research Question 2. For example, in Round 2, issues No. 1, 3, and 7 had mean scores greater than 3.50 and an IQR of 2.0 or less. They also had a median of 4 (see Tables 2-A through 2-C). In Round 3, these same issues were the only issues with mean scores greater than 3.50, an IQR of 2.0 or less, a CV less than 0.50, and a median of 4. Just as with the procedure used in Research Question 1, Round 4 directed participants to reflect on all the statistical data provided them in previous rounds and then recommend whether each of the 11 issues was a Research Activity or a Development Activity. As before, the researchers arbitrarily decided that for an activity to be considered as either a Research Activity or a Development Activity, 51% of the participants had to recommend it in their responses. The data indicated that the participants believe that issues No. 2, 5, 6, 7, 9, 10, and 11 are Research Activity issues. When data for the issues in Rounds 2, 3, and 4 were further analyzed, it was apparent that only Issue No. 7 had met the minimum criteria for a mean score (greater than 3.50), an IQR of 2.0 or less, and CV of 0.50 or less with a median of 4. Therefore, only one issue is being recommended as a significant issue that should be researched to meet Research Question 2.

- Rank #1: Issue No. 7 – Cognitive Science Connections; M = 3.82

When provided an opportunity in Round 4 to reconsider their original recommendations for issues to address the two research questions, several issues that had been previously recommended as research activities were changed by the participants to development activities. In fact, seven (41%) of the original 17 issues identified in Research Question 1 became development activity issues and four (36%) of the original 11 issues for Research Question 2 became development activity issues.

Finally, the researchers of this study take the prerogative to identify what might first appear to be glaring omissions in the recommendations of the participants. First, as the number of educators in technology education continues to dwindle, our research attention needs to be directed to best practices in recruitment, specifically, identifying and implementing strategies to recruit new members into the teaching profession and retain those that are already serving as teachers. Second, attention also needs to be directed to attracting and serving the needs of females and minorities. The changing demographics in the United States require that we focus more of our time and energies on these populations. Third, the role that student organizations may serve to reinvigorate our profession needs to be researched. Student organizations are one vehicle to attract new students into our subject matter courses and our profession. Fourth, there is a growing void in the number of people who seek to serve in leadership roles. Research that focuses on successful strategies to lead others towards common goals needs to be undertaken. Finally, there is an important role for our professional organizations. The Council on Technology and Engineering Teacher Education and/or the International Technology and Engineering Educators Association should consider hosting a forum to further discuss the profession's research activity priorities and development activity priorities.

Recommendations for Further Research

The population for this study was a purposeful sample of past recipients of the CTETE Teacher Educator of the Year award. Future researchers may wish to include other panelists who may have different academic and professional credentials. It is clear that when the panelists participated in Round 4 and were given time to reflect on the previous three rounds, some issues they had originally identified in Round 1 were rated as Development Activities, not Research Activities. For example, future researchers may wish to review and consider moving Round 4 to the position of Round 2, and then following Round 4 with the processes followed in Rounds 2 and 3 as described in this study. Future researchers may also wish to take the findings from this study and develop a new and improved set of data. Finally, a considerable amount of work remains to be completed by the profession and it is the desire of the authors that future researchers will take from this study what they find of value and leave the rest behind.

In the spirit of openness and a supporting nature for a positive future of the profession, the authors are making available to the profession data collected in this study. Data may be retrieved from the following URL: http://www.ctete.org/#!resources. This posting also provides a description for each research issue identified through this study.

Summary

The authors selected the Delphi method to develop a rank-ordered list of topics that would be of substance and which researchers might wish to further explore individually or in collaboration with their colleagues and students. The participants who served as panelists are recognized as leading professionals within the technology education school subject area (technology education, technology and engineering education, etc.). Specifically, these professionals are all past recipients of the CTETE Teacher Educator of the Year award. The authors posed two questions to the panelists and charged each of them with (a) identifying the most important issue related to each question and (b) providing brief descriptions of each issue. In the end, six issues were identified and rank-ordered for Research Question 1 and one issue for Research Question 2. Obviously, it is unknown whether a different set of panelists would have generated a different list of issues. The final rank-ordered list, however, does provide a foundation of information to build upon for future researchers and advisors of aspiring graduate research students who have as one of their goals to establish a better knowledge base for the technology education school subject.

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