It is important for us to continue to study the health of our profession.

STATUS OF T&E IN THE U.S.

by Johnny J. Moye, DTE, Virginia R. Jones, and William E. Dugger, Jr., DTE

A FIFTH REPORT OF THE FINDINGS FROM THE STATES (2014-15)

The International Technology and Engineering Educators Association (ITEEA [formerly ITEA]) has tracked the status of technology (and engineering) education in four previous studies (Newberry, 2001; Meade & Dugger, 2004; Dugger, 2007; Moye, Dugger, & Starkweather, 2012). The purpose of this continuing study has been to determine the health of the technology and engineering education profession in the United States.

Study Methodology

On May 22, 2014, ITEEA disseminated an email to state technology and engineering education supervisors announcing that the 2014-2015 study would commence on June 2, 2014. The email discussed the importance of the study and requested participation. The results of the last status study (2011-2012) were attached to that email in PDF format. On June 3, 2014, supervisors were sent an email containing the cover letter that provided the background and the importance of the study. The letter also contained a link to the instrument prepared with the SurveyMonkey® online survey application. On July 2, 2014, ITEEA sent a follow-up email to the supervisors who had not yet responded. From July 15 until the survey closed on August 29, the researchers made numerous telephone calls and sent emails to state supervisors requesting additional participation.

This study contains 14 questions. Following are the questions, state supervisor responses, and previous study information.

Question 1: Please provide the following contact information: name, state, telephone number, and email address.

Thirty-nine of the 50 (78%) state technology and engineering education supervisors responded. The nonresponding states were: CT, FL, IN, LA, MA, MI, MS, MT, NH, NM, and OH. For detailed state-by-state information, please refer to the following URL: www.iteea.org/Resources/Press-Room/2015/Jan/StatusSurvey2014.Article.pdf.

Question 2: Is technology and engineering education in your state framework? Check all that apply:
- technology education
- engineering education
- technology and engineering education
Thirty-seven of the 39 participating supervisors responded to this question. Sixteen (41%) of those supervisors reported that their programs included one or more of the following items in their state framework: STEM education that includes technology and engineering (21; 56.7%), technology and engineering education (20; 54%), technology education (14; 37.8%), and engineering education (14; 37.8%). There were four “other” responses. Three of those responses included the word “science” in the response, and one identified Career Pathways. In 2012, Moye, Dugger, and Starkweather reported that technology education was the item most selected (25 of the 42 (60%)). In the 2007 study, 40 of the 46 (87%) state supervisors reported that technology education was in their states’ framework (Dugger, 2007). Meade and Dugger (2004) identified that 38 of the 50 supervisors (76%) reported that technology education was in their framework, and in 2001 Newberry found that 30 of the 50 states (60%) included technology education in their state framework.

Question 3: Is technology and engineering education required in your state?
- Yes
- No

All 39 of the participating supervisors answered this question. Seven of the 39 (17.9%) responded “yes” and 32 (82.1%) “no.” In 2012, seven of the 42 (17%) responding supervisors responded “yes” and 35 (83%) “no.” The 2007 Dugger study found that 12 (no percentage available), and the Meade and Dugger 2004 study also found that 12 (no percentage available) states required technology education. In 2001, Newberry found that 14 states required technology education in their states.

Question 4: If you answered “Yes” to question #3, indicate the geographic level of requirement. Select all that apply:
- Required in selected local school districts
- Required statewide
- Other (please specify)

Seven supervisors responded to this question. One selected two of the three possible options. Five supervisors indicated that technology and engineering education was required statewide. Supervisors provided three comments, two of which indicate that technology and engineering education was required via Next Generation Science Standards (NGSS), and one stated that a “few charter schools” have this requirement. No supervisors indicated that technology and engineering education was required in selected local school districts. The 2011-2012 study revealed, “Eight states responded to this question: four indicated that technology and engineering education was required statewide” (Moye, Dugger, & Starkweather, 2012, p. 27).

Question 5: If you answered “Yes” to question #3, indicate the grade level required. Select all that apply:
- Elementary school
- Middle/junior high school
- High school

Seven state supervisors responded to this question. Four states require technology at the elementary level, and six require it at both the middle/junior and high school levels. In the 2011-2012 study, three of the seven responding supervisors indicated that technology and engineering education was required in their states. Three supervisors reported that it was required at the elementary level, “five at the middle/junior high level, and five at the high school level” (Moye, Dugger, & Starkweather, 2012, p. 27).

Question 6: Please estimate the number of technology and engineering teachers in your state during the 2013-2014 school year at the following levels:
- Grades PK-5
- Grades 6-8
- Grades 9-12
- Total

Twenty-three supervisors entered PK-5 (elementary) data. Five of them indicated that the number of elementary level technology and engineering teachers was unknown. Nine stated that there were zero PK-5 technology and engineering teachers in their states. The remaining nine supervisors indicated that there were 322 elementary technology and engineering teachers in their states. Of the thirty-four supervisors that provided Grades 9-12 (high school) information, four indicated that the number was unknown and 30 stated that there were 9,683 high school technology and engineering teachers in their states. With 34 supervisors reporting, there were approximately 15,510 elementary, middle, and high school technology and engineering teachers in those 34 states.
The 2011-2012 Moye, Dugger, and Starkweather study found that, with 32 supervisors reporting, there were approximately 
6,200 middle school and 9,666 high school, for an approximate 
number of 15,866 technology and engineering teachers in the 
United States. That report also stated,
In previous studies, Moye (2009) found that with all 50 
states reporting, there were approximately 12,146 middle 
and 16,164 high school (total: 28,310) technology education 
teachers in the U.S. The Dugger (2007) study did not break 
out the specific number of middle and high school teach-
chers, but with 40 states reporting there were approximately 
25,258 total middle and high school technology teach-
ers. The Meade/Dugger (2004) study found that 49 states 
reported an approximation of 35,909 technology education 
teachers. Ndahi and Ritz (2003), reported that in 49 states, 
there were approximately 36,261 technology teachers in 
2001. Newberry (2001) reported that 48 states indicated 
that there were approximately 38,537 in 2001, and Weston 
(1997) found that there were approximately 37,968 technol-
28).

**Question 7:** If possible, please estimate the number of male 
and female technology and engineering teachers in your state:
This question is new to this year’s study. Feedback from 
members of the profession revealed that there is an interest in 
determining the number of male and female technology and 
engineering teachers. Twenty-five supervisors responded; four 
of whom were unable to provide the number of male and female 
teachers. With 21 supervisors reporting, there were approxi-
ately 6,029 male and 1,376 female technology and engineer-
ing teachers in those 21 states.

Questions 8, 9, and 10 asked supervisors to answer the follow-
ing:

**Question 8:** Have you used *Standards for Technological Lit-
eracy: Content for the Study of Technology (STL)*? 
**Question 9:** Have you used *Advancing Excellence in Technological Literacy 
Student Assessment, Professional Development, and Program Standards (AETL)*? 
**Question 10:** Have you used *Next Generation Science Standards (NGSS)*?

Supervisors were given specific responses to choose from and asked to select all that 
applied to their state. Those specific responses were: (1) Ad-
opted as is in state standards, (2) Placed in state standards with modifications, (3) Conducted workshops using the standards, (4) Used in curriculum resources, and (5) Not used at all.

Thirty-seven supervisors responded to the questions. However 
not all answered every question; therefore it would be very cum-
bbersome to include the percentage for all responses.

Eight of the responding supervisors indicated that their states 
have adopted *Standards for Technological Literacy: Content for 
the Study of Technology (STL)* (ITEA/ITEEA, 2000/2002/2007) 
“as is.” Fifteen supervisors indicated that their states have 
placed *STL* in their state standards. Twenty use *STL* in their cur-
riculum guides, and fourteen states have conducted workshops 
using *STL*. Six supervisors indicated that their states do not use 
*STL* at all. The 2012 report identified that 33 of the 40 respond-
ing supervisors indicated that their states were using *STL* in 
some manner, 16 used *STL* in their curriculum guides, 14 had 
placed *STL* in their state standards, 7 did not use *STL* at all, 6 
had adopted *STL* “as is;” and 12 states had conducted work-
shops using *STL* (Moye, Dugger, & Starkweather, 2012).

When answering the questions concerning *Advancing Excel-
lence in Technological Literacy Student Assessment, Profes-
sional Development, and Program Standards (AETL)* (ITEA/ 
ITEEA, 2003), one supervisor indicated that his or her state has 
adopted *AETL* “as is” and four have placed that information into 
their state standards. Six states have conducted workshops 
using *AETL*, and four use *AETL* in their state curriculum guides. 
Ten of the supervisors indicated that their states do not use 
*AETL* at all. The 2012 report found that one state had adopted 
*AETL* “as is” but 20 had not used *AETL* at all. Three states had 
placed *AETL* in their state standards, six states had conducted 
workshops using *AETL*, and 13 used the *AETL* as a curriculum 
resource (Moye, Dugger, & Starkweather, 2012).

Ten supervisors indicated that their states have adopted *Next 
Generation Science Standards (NGSS)* (NGSS Lead States, 
2013) “as is” and have placed them in their state standards. 
Fourteen states have conducted NGSS workshops. Twelve 
states use NGSS in their curriculum guides, and five do not use 
NGSS at all. This marks the first Status of Technology and En-
gineering Education in the U.S. study asking about NGSS, and 
therefore no previous information is available to report. Figure 1 
contains the supervisor responses to the specific questions.

**Question 11:** Does your state have statewide assessments to 
measure what every student should know and be able to do in 
technology and engineering education?
- Yes
- No
- If yes, please share how it is used
Two of the 30 supervisor responses indicate that they have statewide assessments; 28 reported that they do not. Supervisors provided eight written comments; three states gave some form of end-of-course technology and engineering assessment, and two use industry credentialing tests as a means of assessment. One state supervisor indicated that 4th and 8th grade technology and engineering students are assessed using the science state system of school assessment.

**Question 12:** What course title(s) best describe the secondary school (MS & HS) level technology and engineering education being taught in your state?

Thirty-five state supervisors responded, providing numerous course titles. The researchers performed a “search” using the most commonly occurring keywords in those titles. Being mentioned 56 times, engineering was the most common word, followed by technology (49). Table 1 contains the list of the 12 most commonly occurring keywords used in secondary school technology and engineering courses.

The 2012 report identified that Engineering occurred most frequently, followed by Technology, and then Project Lead The Way™.

**Question 13:** Do you have a technology and engineering education state curriculum guide(s)?

- Yes
- No

Thirty-eight supervisors responded; 16 (42%) said that they have and 22 (58%) said that they do not have technology and engineering education curriculum guides. The 2012 study revealed similar findings: of the 41 responding supervisors, “nine-teen (46%) indicated that they had technology education state curriculum guides. Twenty two (54%) said that they did not” (Moye, Dugger, and Starkweather, 2012, p. 29). In the Dugger (2007) study, 27 states (59% of those reporting) indicated that they had technology education curriculum guides, and 19 (41%) reported that they did not have the guides.

**Question 14:** Please submit any additional comments that you would like to make concerning technology and engineering education in your state.

Twenty-seven supervisors provided additional comments. Of course those comments crossed many topics and issues. The researchers reviewed and categorized the inputs. In eight

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**Table 1: Most Common Course Title Keywords**

<table>
<thead>
<tr>
<th>Keywords</th>
<th>Number of Occurrences</th>
<th>Keywords</th>
<th>Number of Occurrences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>56</td>
<td>STEM</td>
<td>7</td>
</tr>
<tr>
<td>Technology</td>
<td>49</td>
<td>Construction</td>
<td>5</td>
</tr>
<tr>
<td>Design</td>
<td>28</td>
<td>Robotics</td>
<td>5</td>
</tr>
<tr>
<td>Project Lead the Way™ (PLTW)™</td>
<td>13</td>
<td>Communications/Audiovisual</td>
<td>5</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>12</td>
<td>Drafting/CADD</td>
<td>4</td>
</tr>
<tr>
<td>Engineering by Design™ (EbD™)</td>
<td>9</td>
<td>Electronics</td>
<td>4</td>
</tr>
</tbody>
</table>
incidences, supervisors identified that their states used Project Lead the Way™ and Engineering byDesign™ programs. The second most frequently mentioned category (occurring five times) was collaboration and integration of academics into technology and engineering programs. Supporting the idea of integration, the acronym STEM was mentioned three times. Four supervisors mentioned that they were unable to determine the number of technology and engineering teachers in their states. Some supervisors mentioned that specific technology and engineering program information would have to be gathered from local divisions. One supervisor indicated that his state technology and engineering student population was growing, but “there is a huge discrepancy between student growth and the need for [more] Tech/Eng teachers.” Four additional supervisors made statements indicating that the number of technology and engineering teachers was declining in their states; one was concerned about University teacher preparation program closures. Another supervisor stated, “We have not been able to hire as many people who have a Technology and Engineering Education teaching certificate, so many of our new teachers are certified in math or science and add the Tech. Ed. Endorsement.” One supervisor stated: because of the lack of funding, “Some schools have tried to drop the program but have been able to keep them, while some schools are starting to increase offering if they have a STEM focus.”

**DISCUSSION**

In the 2001 Newberry study, 49 state supervisors responded; in the 2004 Meade and Dugger study, all 50 supervisors responded. Dugger had 46 responses for the 2007 study, and for the 2012 Moye, Dugger, and Starkweather study, there were 42 supervisor inputs. There were only 37 state supervisors that responded to this study. The lack of responses is discouraging. There could be many different reasons why a state technology and engineering education supervisor would not respond, e.g., lack of time, unable to gather the data, etc. However, the fact remains that if we are unable to determine (accurately) the status of technology and engineering education in each state, it is impossible to determine the status of the profession in the United States. If the status is unobtainable, then discussing the needs and developing a future strategy is impossible.

Seven of the 39 reporting states require technology and engineering education. A similar number has been reported in the past (2012, 7 states; 2007, 12 states; 2004, 12 states; and 2001, 14 states). Without all 50 states reporting during each triennial study, it is difficult to determine if there is an increase or decrease of states requiring technology and engineering education in the United States.

Thirty-seven of the responding 39 state supervisors indicated that their state used some form of technology and engineering education in their state framework. Sixteen selected more than one of the available options (technology education, engineering education, technology and engineering education, STEM education that includes that includes technology and engineering, and other). For the first time in the study of technology and engineering education in the U.S., supervisors indicated STEM education was included in their state framework more frequently than technology education. Four supervisors selected “other” and entered a comment. Three of the four comments contained the word “science” in the description. This information could mean that technology and engineering education is being identified with STEM and science more often than in years past.

Supervisors were asked if technology and engineering education was required in their states. Thirty-nine responded, seven said yes, and 32 no. Again, because of the inconsistent responses over the past five studies, the researchers were unable to draw any conclusive correlation between the studies.

Those supervisors who stated that technology and engineering education was required in their states were asked to indicate the geographic level of the requirement. Five supervisors indicated that technology and engineering education was required statewide. Three of them included a comment, two of which indicated that technology and engineering education was presented with the Next Generation Science Standards (NGSS), and one in a charter school. It is difficult to determine any sort of geographic-level trends over the past studies because it cannot be determined if the same supervisors provided a comment during the past years of this study. What can be determined is that technology and engineering education is required in several states and that NGSS is beginning to be used in the delivery of that content.

Of the seven supervisors who stated that technology and engineering education was required in their states, four stated that it was required at the elementary school level, and six said it was required at the middle/junior high and high school levels. The 2011-12 report identified that technology and engineering education was required at the elementary level in three states, and five at the middle/junior high and high school levels. Again, due to the lack of data, the researchers are unable to conclude if there is an increase or decrease of technology and engineering requirement at the elementary, middle, or high school levels.

Determining the number of technology and engineering education teachers in the United States is one of the best indicators
of the health of the profession. Based on the 18 supervisors who could provide a number, there were approximately 322 elementary technology and engineering education teachers in their states. Twenty-seven stated that there were approximately 5,551 middle school technology and engineering education teachers in their states. Thirty stated that there were approximately 9,683 high school technology and engineering education teachers in their states. Based on the responding supervisor inputs, there were approximately 15,555 elementary, middle/junior high, and high school technology and engineering education teachers in the 30 reporting states. The researchers were unable to conclude if there has been an increase or decrease of technology and engineering teachers. The number of teachers in the U.S. is a frequent topic of discussion. However, if the profession is unable to even determine the approximate number of teachers, it will be unable to properly ascertain the extent of the problem or if a problem even exists.

Twenty-one supervisors provided an approximate number of male and female technology and engineering education teachers in their states. Those supervisors report that there were approximately 6,029 (77.2%) male and 1,376 (22.8%) female technology and engineering education teachers in their states. Data show female teachers comprise fewer than one quarter of the technology and engineering teacher population. This data is important because it is a well-accepted theory that female students are attracted to technology and engineering education programs led by female teachers. One quarter of the population is not the number of female technology and engineering education teachers that the profession desires. This data does not include all of the 50 states, but it does provide a benchmark concerning the inequitable distribution of male and female teachers within the profession.

As in past studies, the data shows that the states use Standards for Technological Literacy: Content for the Study of Technology (STL) more frequently than the Advancing Excellence in Technological Literacy Student Assessment, Professional Development, and Program Standards (AETL). Eight states reported that they have adopted STL “as is,” 15 have placed the STL standards in their state standards, 20 use STL in their curriculum guides, and 14 have conducted workshops using STL. Six of the state supervisors reported that their states do not use STL at all. One state supervisor reported that his or her state has adopted AETL “as is,” four have placed it into their state standards, and six conducted workshops using AETL. Four states have placed AETL information in their state curriculum guides, and ten states do not use AETL at all. Again, it is not possible to draw conclusive trends concerning the use of STL or AETL over the years because of the lack of inputs from each state.

This was the first year the researchers asked if states use Next Generation Science Standards (NGSS). NGSS was published in 2013 and the document contains science and engineering education standards that could potentially have a significant impact on how (and by whom) engineering education is delivered to United States students. Ten of the responding supervisors indicated that their states have adopted the NGSS “as is” and have placed them in their state standards. Fourteen states have conducted workshops using NGSS. Twelve use NGSS in their curriculum guides, and five states do not use NGSS at all.

Only two supervisors indicated that their states had a statewide assessment to measure what every student should know and be able to do in technology and engineering. Supervisors provided written comments stating that four states gave students some form of end-of-course assessment, and two states use industry-credentialing exams as assessments.

Supervisors were asked to provide the course titles that best describe the secondary school level technology and engineering education being taught in their states. When searching for the most commonly used keywords, the word “engineering” occurred 56 times; technology, 49; design, 28; Project Lead The Way™, 12; manufacturing, 12; and Engineering by Design™, 9. STEM was mentioned 7 times. The 2012 status study revealed that “engineering” occurred most frequently, then “technology” and “Project Lead The Way.” The data show that “engineering” and “technology” remain the most frequently occurring focus of technology and engineering education courses.

When asked if states have technology and engineering education state curriculum guides, 16 state supervisors said “yes” and 22 said “no.” It appears that the findings are consistent with previous studies. In 2012, 19 of the 41 reporting supervisors and in 2007, 27 of the 46 reporting supervisors indicated that their states had technology and engineering education curriculum guides.

Supervisors were asked to submit any additional comments that they would like to make concerning technology and engineering education in their state; twenty-seven supervisors provided a comment. The most frequently mentioned comments concerned Project Lead The Way (PLTW™) and Engineering by Design™, which could imply that supervisors recognize that these are two commonly used programs in their states. Teacher collaboration, integration of academics into technology and engineering education programs, and STEM were also frequently mentioned. Some supervisors mentioned that they were unable to gather all of the information that the researchers requested and that infor-
information would have to be gathered from local school divisions. In four incidences supervisors were concerned about the decline of technology and engineering education teachers in their states; declining teacher preparation programs was also mentioned.

This is the fifth study of Technology and Engineering Education in the United States. The first two studies in 2001 and 2004 were conducted as part of the Technology for All Americans Project (funded by the National Science Foundation [NSF] and the National Aeronautics and Space Administration [NASA] to ITEA from 1994 to 2005). This study continued in 2007 and 2012 under ITEA/ITEEA’s support. The rate at which supervisors have participated has waned over the years.

It is important for us to continue to study the health of the profession; however, with so many issues and trends (e.g., changing the focus from technology to technology and engineering and the advent of NGSS) that have changed over the past 15 years, it may be time to modify how the researchers perform this study. Prior to the next round of this study in 2018, the researchers will reevaluate how to prepare and conduct the study. State supervisors are welcome to submit their recommendations concerning the future direction of this study.

RECOMMENDATIONS

Supervisors should provide feedback concerning the improvement of this study. Researchers should conduct a study to determine the number and gender of technology and engineering education teachers in the United States.

REFERENCES


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