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Technology Education Teacher Supply and Demand in the United States

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TECHNOLOGY EDUCATION TEACHER SUPPLY AND DEMAND IN THE UNITED STATES

by

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ABSTRACT

TECHNOLOGY EDUCATION TEACHER SUPPLY AND DEMAND IN THE UNITED STATES

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This research investigated the supply and demand of technology education teachers in each of the United States. The research goals guiding this study were to determine (1) the number of technology education teachers produced in the United States, (2) the number of technology education teachers employed in the United States public schools during the spring of 2009, (3) the number of vacant technology education teacher positions in United States public schools during the spring of 2009, and (4) the projected number of technology education teacher vacancies for the fall semesters of 2009, 2012, and 2014. The 2004-2005, 2005-2006, 2006-2007, and 2007-2008 *Industrial Teacher Education (ITE) Directories* were reviewed to determine the number of teachers (supply) produced during those years. In 2004-2005, 34 institutions produced 338 technology teachers, in 2005-2006, 32 institutions produced 315 teachers, in 2006-2007, 29 institutions produced 311 teachers, and in 2007-2008, 27 institutions produced 258 technology teachers.

State technology education supervisors were surveyed to answer the remaining three goals. Their responses indicated that there were 12,146 middle school and 16,164

high school (a total of 28,310) teachers employed in the United States during the spring of 2009. Supervisors also reported that there were 367 middle school and 549 high school vacancies. Supervisors expected that there will be 823 vacancies during the fall of 2009, 1,152 in 2012, and 1,435 in 2014, for a total of 3,410 vacancies.

The survey also asked supervisors questions concerning alternative technology education teacher processes. Forty-three of the 50 states offered alternative technology education teacher licensure processes. Of those 43 states, 34 modified existing state teacher licensure processes.

Supervisors were asked if their state had incorporated or were planning to incorporate pre-engineering curriculum into their technology education programs. Forty-nine of the 50 state supervisors responded with a "yes." Data indicated that there were a total of 1,969 Project Lead The Way®, 939 Engineering byDesign™, and 368 other types of pre-engineering programs in the United States. Forty-seven state supervisors also indicated that their state had or were planning to integrate Science, Technology, Engineering, and Mathematics (STEM) components into their technology education programs.

This dissertation is dedicated to my wife, Debra. Without her unswerving support for the past 25 years, I could not have accomplished so many things in my life. This is also dedicated to all my students whom have made my teaching experience one that keeps me young and convinced that our Nation's youth can accomplish anything if they receive sufficient direction.

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CHAPTER I

INTRODUCTION

"How will technology education survive in the future" (Weston, 1997, p. 6)? Weston used these words to describe the dire need for the technology education profession to produce more technology education teachers. Ndahi and Ritz (2003) reiterated the fact that "the technology education teaching profession is concerned about teacher supply and demand" (p. 27). Eleven years after the Weston report, the shortage of technology education teachers (and teachers in general) persists. States are trying innovative ways to recruit and retain technology education teachers. For example, Florida has initiated a "Critical Teacher Shortage Student Loan Forgiveness Program" (Florida Department of Education, n.d.). The program aims to recruit and retain teachers (including technology education teachers).

Annually the United States Department of Education (USDOE) publishes a list of teacher shortage areas for each state. States provide critical teacher shortage information to the USDOE. In the most recent analysis (March, 2008), USDOE reported that only 24 states indicated a shortage of technology education teachers, 22 did not indicate a shortage. Data were not available for four states (USDOE, 2008). These data could indicate one of two points. The major shortfall of technology education teachers reported in Weston (1997) and Ndahi and Ritz (2003) have been resolved, or some states did not provide accurate data to the USDOE indicating the critical need for technology education teachers.

An accurate assessment of each state's current and expected technology education teacher shortage was necessary. Once determined, states may develop strategic plans to rectify existing shortages and to address expected future shortages. This study was designed to query the technology education supervisors (directors, lead technology specialist, etc.) in each state concerning the technology education teacher supply and demand in their state.

STATEMENT OF THE PROBLEM

The purpose of this study was to determine the technology education teacher supply and demand in the United States.

RESEARCH GOALS

There were four research goals for this study. They were to determine:

1. The number of technology education teachers produced in the United States.
2. The number of technology education teachers employed in United States public schools during the spring of 2009.
3. The number of vacant technology education teacher positions in United States public schools during the spring of 2009.
4. The projected number of technology education teacher vacancies for the fall semesters of 2009, 2012, and 2014.

BACKGROUND AND SIGNIFICANCE

Over the past several decades technology education has evolved. Its programs have prepared students for highly sophisticated fields of study that also "reinforces and complements the material that students learn in other classes" (ITEA, 2000, p. 6). Technology education teaches understanding and problem solving skills in medical, agricultural and related biotechnologies, energy and power, information and communication, transportation, manufacturing, and construction technologies (ITEA, 2007). However, the benefits of technology education are still generally "misunderstood by the public" (Sanders, 2000, p. 16). Johnson (1992) identified that technology education programs reinforce "academic content, higher order thinking skills, and promote active involvement with technology" (p. 26).

Technology education is an excellent format that integrates Science, Technology, Engineering, and Mathematics (STEM) studies by employing problem-based learning activities (Berentsen, 2006; Moye, 2008; Ritz, 2006; Zinser & Poldink, 2005). Berry and Ritz (2004) illustrated how middle school technology education courses are a practical means of teaching geometry and measurement by solving "real world problems" (p. 23). The effects of technology education on increased student mathematics abilities have been identified in several studies (Dyer, Reed, & Berry, 2006; Frazier, 2009; Setter, 2006; Scarborough & White, 1994). Identification of increased success is critical given that the Elementary and Secondary Education (No Child Left Behind (NCLB)) Act requires each state to demonstrate student achievement gains in mathematics and science by 2008 (NCLB, 2001).

It is evident that technology education is beneficial in raising student technological literacy and core academic success. However the supply of technology education teachers produced in the United States has not met the increased demand (Gray & Daugherty, 2004; Ndahi & Ritz, 2003; Weston, 1997; Wright & Custer, 1998; Wright & Devier, 1989). Wright and Devier (1989) reported that in 1987, there was an approximate surplus of 70 industrial arts/technology education teachers in the United States "compared to a surplus of 100 the year before" (p. 3). Even though there was a surplus of teachers, the number of students enrolled in industrial arts/technology teacher education programs declined significantly during the 1980s (Wright, 1989). Much of this reduction was blamed on high stakes testing in the core academic subjects (J. M. Ritz, personal communication, February 13, 2009).

Weston (1997) reported that an Old Dominion University survey revealed that in four states "256 technology education positions went unfilled in 1996 and several [states] reported they had to fill positions with teachers from other disciplines or used alternative certification programs to meet their needs" (p. 7). Ndahi and Ritz (2003) identified that there were 1,707 less technology education teachers employed in the United States in 2001 than in 1997. Also in 2001, "the technology education teaching profession was short 1,665 licensed teachers" (Ndahi & Ritz, 2003, p. 28). Gray and Daugherty (2004) reported the United States was experiencing a "nationwide shortage of technology teachers" because of increased secondary student enrollment, teacher attrition, and the "decreasing number of universities offering technology education degrees" (p. 5).

The technology education teacher shortage was realized decades ago and appears to be increasing each year. Technology education teachers are instrumental in raising student technological literacy during a challenging time in our nation's history. However the profession is experiencing a critical shortage of teachers that threatens the very existence of the profession. Daugherty (1998) stated: "The greatest problem facing the technology education profession in the next decade will be the acute shortage of entering technology education teachers" (p. 24). Ten years have passed since Daugherty's statement and more than 20 years have passed since Wright's (1989) observation of the industrial arts/technology education teacher education decline. This study was designed to determine the current supply and demand of technology education teachers in the United States.

The information revealed from this study will be critical when determining the future of the technology education profession. For the profession to continue to exist, it must provide the supply of teachers to meet the demands of the profession (Ritz, 1999; Volk, 1993, 1997, 2000; Weston, 1997). Literature has identified that the supply of technology teachers have not met the demand. This study is very important because it continues to track the "critical problem.... [of] insufficient quantities of qualified technology education teachers" (Wicklein, 2005, p. 7), also, because "assessment works best when it is ongoing and continuous, not episodic" (Day & Schwaller, 2007, p. 254).

LIMITATIONS

This study was limited to:

- Technology education teacher education programs in each of the 50 United States.
- Input of state technology education supervisors accurately reflecting the supply/demand in their state.
- Public middle and high school technology education teachers employed during the spring of 2009.
- Public middle and high school technology education teacher shortages during the spring of 2009.
- Institutions accuracy in reporting the number of licensed technology education teachers produced in 2004-2005, 2005-2006, 2006-2007, and 2007-2008.

ASSUMPTIONS

The following assumptions were made during this study:

- States will continue to provide middle and high school technology education programs within their states.
- Student enrollment in middle and high school programs are increasing across the United States.
- An emphasis on Science, Technology, Engineering, and Mathematics (STEM) will increase the need for technology education teachers.
- Future technology education teacher preparation programs must change in order to met future Science, Technology, Engineering, and Mathematics (STEM) initiatives.
- There are not enough students in technology education teacher preparation programs to meet the current U.S. demand.
- State supervisors will accurately gather and report data.

PROCEDURES

The researcher surveyed state technology education supervisors to determine the number of middle and high school technology education teachers employed and the number of vacant middle and high school technology education teacher positions in their states during the spring of 2009. Supervisors were also asked to provide the expected number of middle and high school technology education teacher vacancies in their states in fall 2009, 2012, and 2014. A document review was also conducted to determine how many institutions offered technology teacher education licensure programs in 2004-2005, 2005-2006, 2006-2007, and 2007-2008, as well as how many technology education teachers those institutions produced in those years. The researcher then compared the supply to determine if institutions were producing enough technology education teachers to meet current and projected future demands of the profession.

DEFINITION OF TERMS

The following terms are defined to ensure the reader does not misinterpret their meanings:

- Alternative licensure programs – Nontraditional training/preparation programs designed to reduce the time and expense of obtaining teacher credentials through a streamlining of curriculum and intensive on-the-job supervision (Sandlin, 1993).
- Engineering byDesign™ (EbD™) – A national model program that incorporates mathematics, science, and design concepts to help K – 12 students learn and understand common everyday problems (ITEA, 2006).
- Project Lead The Way® (PLTW®) – A middle and high school pre-engineering curriculum that challenges students with real-world hands-on project based learning that help students understand how to solve problems in everyday life (PLTW, n.d.).
- State supervisor – The lead technology education person in the state. This position could also be identified as program director, state specialist, etc.
- STEM – Science, Technology, Engineering, and Mathematics. Evidence suggests that increasing STEM literacy "is an urgent national concern for the health and well-being of citizens, the environment, and the economy" (Rose, 2007, p. 46).
- Supply and demand – Supply refers to the amount of technology education teachers being produced by teacher educator institutions. Demand refers to the

number of technology education teachers required to fill all public middle and high school technology education positions in the United States.

- Technology education – Dedicated courses designed to help students develop technological literacy (ITEA, 2000).
- Technology teacher education – College and university programs designed to prepare students to become technology education teachers.

OVERVIEW OF CHAPTERS

The literature clearly indicates that the United States has experienced a shortage of technology education teachers for the past 30 years. This shortage has a direct impact on the ability to produce technologically literate students prepared to meet the expectations of a society demanding such literacy. The lack of technological literacy not only effects our youth but also presents an unfavorable national security situation. The focus of this study was to determine the number of middle and high school technology education teachers in each state and how many vacancies each state experienced in the spring of 2009. This study was also designed to determine the expected technology education teacher shortage in each state in the upcoming years of 2009, 2012, and 2014.

Chapter II identifies current literature that supports the need for this study. The chapter describes technology education teacher shortages and how these shortages adversely affect the technological literacy of United States students. Chapter III explains the methods and procedures used to conduct the research and how the data were analyzed. Chapter IV reveals and describes the researcher's findings. Chapter V includes a summary, conclusions, and recommendations for future research concerning this study.

CHAPTER II

REVIEW OF LITERATURE

As the old American proverb goes "A stitch in time saves nine" (Russell, 2007). The proverb could be applied to the current situation surrounding technology education teacher supply and demand. The problem is to identify if a stitch is actually needed. Determining the supply and demand of technology education teachers in the United States is critical to ensure the health of the profession. Realizing and understanding the supply and demand of teachers will aid policy makers in determining the future of the profession (Wayne, 2000). Hanushek, Kain, and Rivikin (2001) stated that "without a full understanding of the factors influencing the teacher supply, effective policies and strategies to address the teacher shortage will not be developed" (as cited in Steinke & Putnam, 2007, p. 73).

Experts have identified industrial arts/technology education teacher shortages for many years (AAEE, 2007; Dunlap, 1986; Ndahi & Ritz, 2003; Weston, 1997; Wright & Devier, 1989), while others indicate that the shortage is a myth (NTSA, 2007; Rothstein, 2002). The purpose of this study was to determine technology education teacher supply and demand in the United States. This chapter provides a review of literature concerning technology education teacher supply in the United States, the technology education teacher demand, alternative technology education licensure, why this study is important, and a summary.

TECHNOLOGY EDUCATION TEACHER SUPPLY

Technology education teachers are produced by institutions possessing technology education teacher programs. These programs exist because of the demand for technology education teachers at the secondary education level of instruction. Hicks (2005) described technology education programs as:

> Technology education programs strive to achieve technological literacy and to prepare students to teach technology to students in a school setting. Depending on the program and university, the faculty positions may be related to course content. Communication Technology, Transportation Technology, Production Technology, and Technology Education....The inability of a school system to enhance and maintain their Technology Education program will dramatically change the demand of Technology Education teachers (p. 12).

While discussing declining technology education student enrollments, Hill (1999) stated: "When the number of students in a program, especially those majoring in it, greatly decreases, the program's existence is threatened" (p. 21).

Volk (1997) predicted the demise of the technology teacher education preparation profession by 2005 due to decreased enrollment trends. Certainly the profession continues to exist, however it is necessary to research and discuss the health of the profession. One measure of health is the supply of technology education teachers being produced in the United States. In 1998, Wright and Custer stated that technology education teacher recruitment has been a concern for "more than two decades" (p. 58). Technology education teacher recruitment and enrollments continue to be an issue of concern (Gray & Daugherty, 2004).

In 1992, "research conducted on technology teacher education programs revealed an estimate of 706 technology teacher education graduates...a decline of approximately 27.4 percent in one year" (Young-Hawkins, 1996). The researcher did not specify exact numbers of graduates, however it was evident that the downward trend of technology education teacher graduates had begun.

Annually, the National Association of Industrial and Technical Teacher Educators (NAITTE) and Council on Technology Teacher Education (CTTE) produce the *Industrial Teacher Education (ITE) Directory: Institutions, Degree Data, and Personnel.* The *ITE Directory* includes "program listings for technology education, industrial education, occupational education, trade & industrial education, vocational education, vocational-technical education, industrial technology, engineering technology, and other specialty programs" (Schmidt & Custer, 2007, p. 1). In short, the *ITE Directory* compiles information concerning technology, industrial, and occupational degrees awarded by institutions on an annual basis.

Using *ITE Directories*, Volk conducted research focusing on the *Enrollment Trends in Industrial Arts/Technology Teacher Education from 1970-1990* (Volk, 1993). To examine industrial arts/technology teacher education (IA/TE) program enrollments, Volk studied "the number of degrees granted (by type) within technology teacher preparation programs" (Volk, 1993, p. 44). The number of degrees produced by each program was studied in five year increments. The increments were 1970, 1975, 1980, 1985, and 1990. Volk found that a "rate of decline for all IA/TE majors was 69.7%" (Volk, 1993, p. 48). He also found that during the same timeframe, there was a 14.7% decrease of universities providing IA/TE programs (Volk, 1993). Many of the programs moved from preparing technology teachers to preparing industrial technology graduates to work as business and industry supervisors/managers (J. M. Ritz, personal communication, January 8, 2009). Table 1 identifies Volk's (1993) research, identifying the total number of IA/TE programs, and graduates by degree type, from 1970 to 1990.

Table 1

Industrial Arts/Technology Education Degrees Awarded From 1970 to 1990

	Industrial Arts/Technology Education Degrees				
Year	University Programs	BA/BS	MS/MEd	EdD/PhD	Total
1970	203	6368	1767	83	8218
1975	204	6371	1918	75	8364
1980	205	5048	1353	73	6474
1985	198	2668	931	51	3650
1990	174	1790	650	50	2490

Adapted from "Enrollment Trends in Industrial Arts/Technology Teacher Education from 1970-1990," by K. S. Volk, 1993, *Journal of Technology Education*, *4*(2), p. 48.

Volk acknowledged that information contained in *ITE Directories* was not infallible. He noted that the meaning of information contained in the documents could be misinterpreted and that there was also an issue of trustworthiness. "Meaning refers to the way the document was interpreted; trustworthiness deals with the accuracy of the information provided" (Volk, 1993, p. 46). When considering Volk's statement, a reader would conclude that differences in interpretation of data could occur when the reporter misinterprets what the editor of the *ITE Directories* was seeking when asking for licensed graduates. Also, differences could occur when a researcher interprets information from another researcher.

Newberry (2001), using the 2000-2001 *ITE Directory* "listed possible majors for technology education, technology education certification, or industrial arts education" (p. 5). Like Volk's 1993 study, Newberry's 2001 study occurred during the period when industrial arts programs were transitioning to technology education, therefore the studies could have included a number of industrial arts and industrial technology graduates as well as the number of technology education teacher graduates. During the 1990's it was obvious that a transition from industrial arts education to technology education was occurring (Foster, 1994). Colleges and universities had to make changes to their teacher education programs to accommodate the new philosophical view of technology education. Addressing these changes, Volk (1993) stated:

> The field of industrial arts/technology education (IA/TE) has gone through considerable introspection and revision over the past twenty years. This process has taken place at both the public school and post-secondary level. College and university programs which prepare industrial arts/technology education teachers have instituted changes in curriculum, program requirements, and facilities. Universities which prepare IA/TE teachers have also witnessed a change in emphasis and program support to non-teaching options such as industrial technology (p. 44).

Although the Volk (1993) and Newberry (2001) studies identified industrial arts, industrial technology, and technology education graduates, the data received were beneficial in determining historical teacher preparation trends. Newberry (2001) found that "approximately 1077 graduates were prepared to teach technology education" (p. 5) during the 1999-2000 school year and that there were "approximately 105 teacher education programs for technology education" (p. 5). Figure 1 illustrates the decline of industrial arts/technology education teacher graduates during the period of 1970 to 2000.

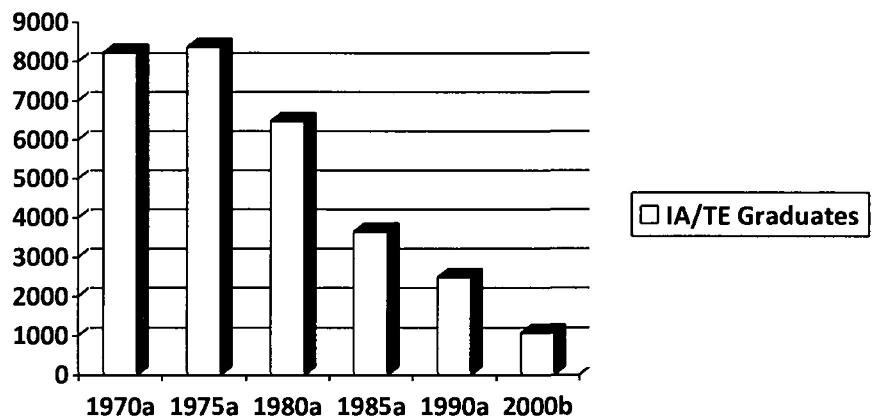

Figure 1. Number of industrial arts/technology education graduates during the years between 1970 and 2000.

[a] From "Enrollment Trends in Industrial Arts/Technology Teacher Education From 1970-1990," by K. S. Volk, 1993, *Journal of Technology Education, 4*(2), p. 48. [b] From "Technology Education in the U.S.: A Status Report" by P. B. Newberry, 2001, *The Technology Teacher, 61*(1), p. 12.

Weston's (1997) research also found data concerning the dwindling number of technology education graduates. The study established the exact criteria to gauge teachers solely produced as technology education teachers. Weston used the terms *Technology Education Certification* and *Technology Education Licensure* as criteria to identify technology education teachers (J. M. Ritz, personal communication, December 1, 2008). The Weston study did not provide a specific number of graduates; however it reported that the information in the 1996-1997 *ITE Directory* indicated "a 22 percent decrease in the number of graduates in technology teacher education programs from the previous year" (Weston, 1997, p. 7).

Ritz's 1999 study researched the 1995-1996, 1996-1997, and 1997-1998 *ITE Directories* to determine the number of technology education teachers produced during that period. Ritz found that the 1995-1996 *ITE Directory* reported 815 technology education teacher graduates, the 1996-1997 *Directory* reported 635, and 732 were reported in the 1997-1998 *ITE Directory.* Ndahi and Ritz (2003) found that the 2001-2002 *ITE Directory* "shows that 71 U.S. universities produced 672 technology education teachers in 2001" (p. 28). There were 143 less technology education teachers produced in 2001 as was in 1995, a 17.55 percent decrease. This decrease was in addition to the 22 percent that Weston (1997) reported. Table 2 illustrates the downward trend of technology education teachers produced during the years of 1995, 1996, 1997, and 2001.

Table 2

Downward Trend of Technology Education Teachers from 1995 to 2001.

ITE Directory Year	Number of TE Teachers
1995/1996[a]	815
1996/1997[a]	635
1997/1998[a]	732
2001/2002[b]	672

[a] From Ritz, 1999. [b] From Ndahi and Ritz, 2003.

As with previous studies (Ndahi & Ritz, 2003; Newberry, 2001; Ritz, 1999; Volk, 1993; Weston, 1997), this study reviewed *ITE Directories* to determine the number of technology education graduates produced by institutions. A document review of the 2004-2005, 2005-2006, 2006-2007, and 2007-2008 *ITE Directories* was performed to identify which institutions produced technology education teachers during the years following the Ndahi and Ritz (2003) study. The *ITE Directories* listed dozens of different degrees, licenses, and certifications offered by institutions. This study used the same criteria as the Weston (1997) and Ndahi and Ritz (2003) studies and was limited to the number of students receiving technology education teacher certifications or licenses produced by these institutions.

The 2004-2005 *ITE Directory* identified 34 colleges and universities that produced 338 technology education teachers (Schmidt & Custer, 2005). The 2005-2006 *ITE Directory* identified 32 colleges and universities that produced 315 technology education teachers (Schmidt & Custer, 2006). The 2006-2007 *ITE Directory* identified 29 colleges and universities that produced 311 technology education teachers (Schmidt & Custer, 2007). The 2007-2008 *ITE Directory* identified 27 colleges and universities that produced 258 technology education teachers (Waugh, 2008). The data indicated that both the numbers of colleges and universities as well as the number of technology education teachers being produced have decreased each year since 2004. Table 3 identifies the institutions that reported technology education graduates and number of graduates per year.

Table 3

Institutions that Reported Technology Education Graduates and Number of Graduates per Year in 2004-2005, 2005-2006, 2006-2007, and 2007-2008

Institution/Location	Number of Technology Education Teachers Produced			
	2004/05[a]	2005/06[b]	2006/07[c]	2007/08[d]
Abilene Christian University (TX)	TE Cert-2	-	-	-
Appalachian State University(NC)	TE Cert-6	TE Cert-6	TE Cert-6	TE Cert-6
Bemidji State University (MN)	TE Cert-13	TE Cert-13	TE Cert-13	TE Cert-13
Bowling Green State University (OH)	TE Lic-11	TE Lic-11	TE Lic-7	TE Lic-11
California University of Pennsylvania (PA)	TE Cert-2	TE Cert-8	TE Cert-4	-
Central Connecticut State University (CT)	TE Cert-0	-	-	TE Cert-2
Eastern Kentucky University (KY)	-	-	TE Cert-23	TE Cert-10
Fitchburg State University (MA)	BS TE Lic-2	BS TE Lic-3	BS TE Lic-11	BS TE Lic-11
Fort Hays State University (KS)	TE Cert-10	TE Cert-5	TE Cert-6	TE Cert-8
Georgia Southern University (GA)	TE Cert-10	TE Cert-5	TE Cert-4	TE Cert-3
Illinois State University (IL)	TE Cert-11	TE Cert-14	TE Cert-21	TE Cert-24
Millersville University (PA)	TE Cert-29	TE Cert-33	TE Cert-35	TE Cert-39
Montana State University (MT)	TE Cert-2	TE Cert-2	TE Cert-0	TE Cert-0
Murray State University (KY)	TE Cert-3	TE Cert-3	TE Cert-3	TE Cert-3
New York City College of Technology (NY)	TE Cert-3	TE Cert-7	TE Cert-7	TE Cert-9
Northeastern State University (OK)	TE Cert-4	TE Cert-4	-	-
North Carolina State University (NC)	TE Cert-7	TE Cert-9	TE Cert-12	TE Cert-12
Ohio Northern University (OH)	TE Lic-4	TE Lic-4	TE Lic-3	TE Lic-0
Ohio State University (OH)	BS TE Lic-5 MEd TE Lic-9	BS TE Lic-8 MEd TE Lic-8	BS TE Lic-8 MEd TE Lic-3	BS TE Lic-8 MEd TE Lic-2
Old Dominion University (VA)	TE Cert-13	TE Cert-10	TE Cert-16	TE Cert-9
Oregon State University (OR)	-	TE Cert-5	TE Cert-1	TE Cert-1
Purdue University (IN)	TE Cert-2	TE Cert-1	-	-

Table 3 (Continued).

Institution/Location	Number of Technology Education Teachers Produced 2004/05[a]	2005/06[b]	2006/07[c]	2007/08[d]
Southwestern Oklahoma State University (OK)	MEd Lic-0	BS Lic-4 MEd Lic-1	TE Lic-0	-
Southern Utah University (UT)	TE Cert-7	TE Cert-7	TE Cert-7	-
St. Cloud State University (MN)	BS TE Lic-3	BS TE Lic-3	BS TE Lic-9	BS TE Lic-12
State University College at Buffalo (NY)	TE Cert-0	TE Cert-0	TE Cert-0	TE Cert-0
State University of New York – Oswego (NY)	TE Cert-4	TE Cert-4	TE Cert-4	TE Cert-4
Sul Ross State University (TX)	-	-	-	BS TE Lic-1
Tarleton State University (TX)	TE Cert-2	TE Cert-0	TE Cert-1	TE Cert-1
University of Idaho (ID)	TE Cert-18	TE Cert-18	TE Cert-18	TE Cert-10
University of Maryland Eastern Shore (MD)	-	-	-	TE Lic-3
University of Minnesota (MN)	TE Lic-6	-	-	-
University of North Dakota (ND)	TE Cert-1	TE Cert-1	TE Cert-4	TE Cert-0
University of South Florida (FL)	TE Cert-15	-	-	-
University of Southern Maine (ME)	TE Cert-5	TE Cert-1	TE Cert-4	TE Cert-1
University of Southern Mississippi (MS)	TE Cert-48	TE Cert-33	TE Cert-9	-
University of Wisconsin-Stout (WI)	TE Cert-66[e]	TE Cert-53[e]	TE Cert-51[e]	TE Cert-38[e]
University of Wisconsin-Platteville (WI)	TE Cert-3	TE Cert-11	TE Cert-15	-
Utah State University (UT)	-	-	-	TE Cert-6
Valley City State University (ND)	TE Cert-1	TE Cert-4	TE Cert-5	TE Cert-5
Virginia Polytechnic Institute and State University (VA)	TE Cert-10	BSEd Lic-11 MA Lic-4	-	-
Western Washington University (WA)	TE Cert-1	TE Cert-1	TE Cert-1	-
Total Technology Education Teachers Produced	338	315	311	258

Note. There were colleges and universities that did not report during particular years. If a cell within this matrix contains an "-" there were no data available. However, a program could have existed but did not produce any graduates. This situation is indicated by the following example: "TE Cert-0." [a] From Schmidt and Custer, 2005. [b] From Schmidt and Custer, 2006. [c] From Schmidt and Custer, 2007. [d] From Waugh, 2008. [e] From K. Welty, personal communication, January 14, 2009.

In 2001/2002, "71 U.S. universities produced 672 technology education teachers" (Ndahi & Ritz, 2003, p. 28). In 2007/2008, 32 institutions produced 258 teachers (Waugh, 2008). These data represented a 45 percent decrease of institutions producing technology education teachers and 38 percent fewer technology education teachers between the years of 2001/2002 and 2007/2008.

The 2007-2008 *ITE Directory* also indicated that the number of institutions that produced technology education teachers and the number of graduates have declined significantly since Weston's 1997 study. Although the Weston study did not specify an exact number of graduates, it stated that the 1996-1997 *ITE Directory* (Dennis, 1996) indicated a "22 percent decrease in the number of graduates in technology teacher education programs from the previous year" (Weston, 1997, p. 7). Addressing this trend, Volk (1997) stated that the programs lost during this downward spiral will not return and that, "we must therefore give serious attention to the issues influencing the downward trend, for the survival of the technology teacher profession is at stake" (p. 69).

It is important to compare historical data to gather a fair perspective of past and current trends. When comparing the number of technology education programs and graduates in the United States, it is apparent that Weston's (1997) description of the profession as being in a "downward spiral" (p. 6) was accurate. As Ritz (1999) stated "The supply/demand issue is critical today" (p. 9). The data indicate that the lack of technology teachers being produced continues to be a critical issue in 2009.

TECHNOLOGY EDUCATION TEACHER DEMAND

Is there an actual shortage of technology education teachers in the United States? There is conflicting data concerning the current demand for technology education teachers. "Whispers of a dire nationwide technology teacher shortage began to surface throughout technology education in the early 1990s" (Litowitz & Sanders, 1999, p. 5). In 1993, Daugherty stated that "there are numerous openings for technology education teachers in almost every state" (p. 22). Data from the American Association for Employment in Education (AAEE) indicated that there was a "shortage" of technology education teachers in the United States (AAEE, 2007, p. 6).

The Purdue University (Indiana) website advertized that "Currently there is an extreme shortage of technology education teachers in the school districts across the nation" (Purdue, n.d.) and boasts of a "100% job placement rate within 6 months of graduation" (Purdue, n.d.). Also, the Fairmont State University (West Virginia) technology education web site indicated that "In the field of Technology Education there is 600 graduates in the nation for 2400 or more teaching positions each year which means that there [are] at least 4 jobs for every technology education graduate nationally" (FSU, n.d.).

In a study of state technology education supervisors conducted by Akmal, Oaks, and Barker (2001), they indicated that:

The demand for technology education teachers increased, yet almost all states reported a shortage in the preparation of new technology education teachers. That shortage ranged from as low as two teachers in states that reported an adequate supply (but projected to soon become inadequate) to as high as 200 in those states that reported a current shortage" (Teacher Supply/Demand & Teacher Education Programs section, para. 4).

Conflicting information indicate that the shortage of technology education teachers is inconclusive. The United States Department of Education (USDOE) *Teacher shortage areas nationwide listing 1991-92 through 2007-08* document indicated that only 24 states reported a shortage of technology education teachers; 22 did not indicate a shortage. Data were not available for four states (USDOE, 2008). Technology education may not be deemed important enough in some districts/states to be reported as being in need of teachers. In Hoepfl's (2001) study, a state technology education supervisor observed:

> If you have four math teachers and lose one, the fraction becomes ¾ and the administration moves quickly to fill the position. If you have four technology teachers and one leaves, the administration simply adjusts the fraction from 4/4 to 3/3 to fit (p. 37).

This type of conflicting data illustrates the need to determine specific technology education teacher demand within each state. The review of literature indicated that there has been and continues to be a shortage of technology education teachers in the United States (Gray & Daugherty, 2000; Hoepfl, 2001; Householder, 1993; Ndahi & Ritz, 2003;

Ritz, 1999; Volk, 1993; Weston, 1997; Wicklein, 2005; Wright & Custer, 1989; Wright & Devier, 1989).

Wright and Devier (1989) reported that in 1987, there was an approximate surplus of 70 industrial arts/technology education teachers in the United States "compared to a surplus of 100 the year before" (p. 3). Also, the number of college students enrolled in industrial arts/technology teacher education programs declined significantly during the 1980s (Wright & Devier, 1989). The study surmised that by 1997, 50% of industrial arts and technology education teachers would "be retiring or eligible to retire" (Wright & Devier, p. 4). An "Impending Crisis" is how Wright and Devier (1989, p. 18) concluded their report. Although the study focused on the state of Ohio, it identified national statistics and provided recommendations that still apply and could be utilized to resolve a technology education teacher shortage. Three of Wright and Devier's five recommendations were:

1. Teacher education programs will have to make much greater efforts in the area of recruitment....In addition, recruitment efforts should also be directed toward non-traditional students; including women, minorities, and students with a keen interest in applied science, in addition to the (previously) typical "craftsman" type of individual.
2. There appears to be sufficient evidence to suggest that a crisis is pending. However, the situation is not hopeless IF WE TAKE ACTION NOW. Specific activities need to be identified to attract qualified teachers for technology education. A task force should be developed at the national level to formulate a strategic plan....If we have not prepared qualified teachers for technology

education, and more states begin to mandate required courses, some other discipline will step in to fill the void….

5. Teacher education institutions may need to develop special programs to "re-train" teachers from other disciplines, or individuals with degrees in related areas if a severe shortage should occur (Wright & Devier, 1989, pp. 18-19).

Wright and Devier (1989) also identified that the teaching force was "growing steadily older" (p. 3). Their observation was made even before the majority of the "baby boomers" were beginning to retire in mass. Dugger, French, Peckham, and Starkweather (1991) identified that more then 50% of technology education teachers were over the age of 50 and that they would soon retire. Abbott (2007) indicated that by 2008, hundreds of thousands of baby boomers would begin to retire creating the largest exodus of the workforce in history. Being that the teaching profession "represents 4 percent of the entire civilian workforce" (Ingersoll, 2003), this *exodus* will only exacerbate an existing shortage of technology education teachers in the United States.

Weston (1997) reported that nine state supervisors that responded to a survey indicated that a total of "256 technology education teaching positions went unfilled in 1996 and several reported they had to fill positions with teachers from other disciplines or used alternative certification programs to meet their needs" (p. 7). Ndahi and Ritz (2003) identified that in 2001, the "technology education teaching profession was short 1665 licensed teachers" (p. 28). Hoepfl's (2001) study indicated of the 36 states that responded to her study, seventy-four percent stated they had "program closings as a result of districts not being able to fill a position" (p. 38). "The maximum reported was 30 programs closed; however, one state indicated that 15 to 20 programs were being closed per year due to teacher shortages" (Hoepfl, 2001, p. 38).

Gray and Daugherty (2004) performed a study to determine the *Factors that Influence Students to Enroll in Technology Education Programs*. Their reason for conducting the study was "a nationwide shortage of technology education teachers" (p. 5) due to "increased primary and secondary enrollment, recent expansion of secondary technology education programs, teacher attrition, and the decreasing number of universities offering technology education degrees" (Gray & Daugherty, 2004, p. 5). Summing up the general feeling of the status of technology education teacher production in the latter 1990s, Gonzales (1998) stated:

> We have done a good job of promoting technology education as a curriculum, but we will lose everything if we are unable to perpetuate our programs....The technology teacher shortage needs to be addressed immediately to produce results in the next few years....Make no mistake, our efforts need to be focused on technology teacher education (p. 52).

The number of technology education teachers employed in public schools may also be declining. Westin (1997) indicated that there were 37,968 public school technology education teachers employed in 1995. Newberry (2001) reported that "A total of 38,537 teachers are reported to be teaching technology education in the middle grades and high school" (Newberry, 2001, p. 11). Ndahi and Ritz (2003) reported that "there were 16,775 middle school technology teachers and 19,487 high school technology teachers for a total of 36,261 technology education teachers employed during the 2001 school year" (p. 28). The Weston (1997) and Ndahi and Ritz (2003) studies provided an approximate number of middle school and high school technology education teachers employed, per state, in United States public schools during the years of 1995 and 2001. Table 4 identifies that there were 778 fewer middle school and 929 fewer high school technology education teachers in 2001 than there were in 1995. The data indicate that there were a total of 1,707 fewer technology education teachers in United States public schools in 2001 than there were in 1995. Twenty-three states reported a decline in the number of middle school technology education teachers. Twenty reported a decline in the number of high school technology teachers. Eighteen states indicated that they experienced an increase in the number of middle school technology education teachers. Twenty-four states reported that they had an increase of high school technology education teachers. There were three states whose number of middle school technology education teachers remained the same. The number of high school technology teachers remained the same in two states. Eight states indicated that they had experienced a decrease in middle school technology education teachers but an increase in the number of high school technology education teachers. Seven states indicated that there was a decrease of middle school but an increase of high school technology education teachers. There were insufficient data available to determine trends for five states (Ndahi & Ritz, 2003; Weston, 1997).

Meade and Dugger (2004) researched *The Status of Technology Education in the United Stated in 2003-2004*. With 49 of the 50 states reporting, they found that there were 35,909 technology education teachers employed in the United States. In 2007, Dugger performed the same research.

Table 4

Total Number of Middle and High School Technology Teachers in 1995 and 2001

States	Middle School 1995[a]	High School 1995[a]	Middle School 2001[b]	High School 2001[b]
Alabama	99	64	120	85
Alaska	201	266	--	300
Arizona	700	925	250	435
Arkansas	70	0	65	10
California	2000	3000	1224	1224
Colorado	150	135	138	287
Connecticut	500	345	450	290
Delaware	75	100	36	62
Florida	950	450	1064	760
Georgia	225	225	230	350
Hawaii	48	117	10	5
Idaho	74	95	40	168
Illinois	1100	1100	900	900
Indiana	700	400	650	650
Iowa	100	750	280	550
Kansas	30	45	210	430
Kentucky	135	290	125	225
Louisiana	100	350	100	350
Maine	80	198	230	110
Maryland	300	300	510	511
Massachusetts	375	275	375	275
Michigan	422	1014	425	425
Minnesota	300	400	380	500
Mississippi	69	242	0	395
Missouri	350	575	343	580
Montana	122	130	75	175
Nebraska	285	286	256	256
Nevada	65	11	70	10
New Hampshire	83	64	80	110
New Jersey	145	145	700	800
New Mexico	97	196	150	150
New York	1700	1100	1700	1750
North Carolina	355	325	360	350

Table 4 (Continued).

States	Middle School 1995[a]	High School 1995[a]	Middle School 2001[b]	High School 2001[b]
North Dakota	31	120	30	81
Ohio	950	1250	1000	1000
Oklahoma	127	93	175	100
Oregon	150	30	--	--
Pennsylvania	1650	1650	1200	900
Rhode Island	70	132	30	50
South Carolina	250	110	125	75
South Dakota	60	42	42	32
Tennessee	110	221	209	140
Texas	600	950	706	1498
Utah	240	95	200	250
Vermont	100	41	--	--
Virginia	389	570	571	468
Washington	--	520	--	300
West Virginia	145	100	95	120
Wisconsin	675	575	600	750
Wyoming	--	--	245	245
Totals	17,552	20,416	16,774	19,487
Total MS/HS	37,968		36,261	

Note. The "--" indicates that there were no data available. [a] From Weston, 1997, pp. 8-9. [b] From Ndahi and Ritz, 2003, p. 29.

Table 5 identifies the number of middle school and high school technology education teachers employed during the years of 1995, 2001, and 2004. With 40 states reporting, the study revealed that there were 25,258 technology education teachers employed in the United States (Dugger, 2007). Data indicate that there were at least a 5.42 percent decrease in the number of middle and high school technology education teachers employed in the United States between the years of 1995 and 2004.

Table 5

Number of Technology Education Teachers Employed in 1995, 2001, and 2004

Year	Technology Education Teachers
1995[a]	37,968
2001[b]	36,261
2004[c]	35,909

[a] From Weston, 1997, pp. 8-9, [b] Ndahi and Ritz, 2003, p. 28, and [c] from Meade and Dugger, 2004, p. 38.

The National Center for Education Statistics (NCES) periodically conducts *Schools and Staffing Surveys.* The NCES is considered the most authoritative source of information concerning national teacher supply and demand (Wayne, 2000).

The 2003-2004 survey indicated that there was a 33.3% shortage of "vocational or technical education" teachers in the United States (Strizek, Pittsonberger, Riordan, Lyter, & Orlofsky, 2006, p. 41). The survey may be another indicator that there was a shortage of technology education teachers. The majority of literature indicated that there has been a shortage of technology education teachers.

The American Association for Employment in Education (AAEE) conducts annual research concerning the supply and demand of teachers in the United States. The organization surveys school districts and colleges to determine current supply and demand of educators in 64 educational fields. To illustrate the supply and demand, the AAEE uses a scale of one to five. A one on the scale indicates a considerable oversupply of educators in a field and five represents a considerable shortage. Figures falling between 5.00 – 4.21 on the scale are measured as a considerable shortage; 4.20 – 3.41

means some shortage; 3.40 – 2.61 indicates a balanced supply and demand; 2.60 – 1.81 means some surplus; and 1.80 – 1.00 measures a considerable surplus.

These scales are applied to regions of the United States rather than specific states. There are 11 regions. Region 1 (Northwest) is comprised of Washington, Oregon, and Idaho. Region 2 (West) is California, Nevada, Utah, and Arizona. Region 3 (Rocky Mountain) is Montana, Wyoming, Colorado, and New Mexico. Region 4 (Great Plains/Midwest) is North Dakota, Minnesota, South Dakota, Nebraska, Iowa, Kansas, and Missouri. Region 5 (South Central) is Oklahoma, Arkansas, and Texas. Region 6 (Southeast) is Kentucky, West Virginia, Virginia, Tennessee, North Carolina, South Carolina, Mississippi, Alabama, Georgia, and Florida. Region 7 (Great Lakes) is Wisconsin, Michigan, Illinois, Indiana, and Ohio. Region 8 (Middle Atlantic) is Pennsylvania, New York, New Jersey, Delaware, Maryland, and the District of Columbia. Region 9 (Northeast) is Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut. Region 10 is Alaska, and Region 11 is Hawaii.

Ndahi and Ritz (2003) used the AAEE *Educator Supply and Demand in the United States* report and identified that the need for technology education teachers in 2000 was 4.17 (some shortage) on the scale which represented a 0.14 increase in demand from 1999 to 2000 (Ndahi & Ritz, 2003). In 2000, four of the 11 regions experienced considerable shortages, Region 4 – Great Plains/Midwest (4.44), Region 6 – Southeast (4.31), Region 8 – Middle Atlantic (4.54), and Region 9 – Northeast (4.29) (Ndahi & Ritz, 2003). Table 6 identifies regions that experienced considerable shortages in 2000.

The AAEE 2003 *Educator Supply and Demand in the United States* report indicated 3.57 (some shortage) for technology education teachers.

Table 6

Regions that Experienced Considerable Technology Education Teacher Shortages in 2000

Region	Severity of Need
4 – Great Plains/Midwest	4.44
6 – Southeast	4.31
8 – Middle Atlantic	4.54
9 – Northeast	4.29

From Ndahi and Ritz, 2003, p. 27.

The number represented a 0.45 decrease from the 2002 figure of 4.02. While no region reported considerable shortages, seven of the 11 reported some shortage in their region. Those regions were: Region 3 – Rocky Mountain (3.50), Region 4 – Great Plains/Midwest (3.60), Region 6 – Southeast (3.43), Region 7 – Great Lakes (3.76), Region 8 – Middle Atlantic (4.15), Region 9 – Northeast (3.83), and Region 10 – Alaska (4.00). Three regions reported a balance of technology education teachers; they were: Region 1 – Northwest (2.60), Region 2 – West (2.83), and Region 5 – South Central (3.38). A report for Hawaii was not available (AAEE, 2004). Table 7 contains supply and demand figures by region for the years of 2003 through 2007.

The AAEE 2004 *Educator Supply and Demand in the United States* report indicated a 3.74 (some shortage) of technology education teachers. The number represented a 0.17 increase from the 2003 figure of 3.57. While no region reported considerable shortages, eight of the 11 reported some shortage of technology education teachers in their region. Those regions were: Region 1 – Northwest (3.60),

Table 7

Regional Supply and Demand 2003 – 2007

Region	2003[a]	2004[b]	2005[c]	2006[d]	2007[e]
1 – Northwest	2.60	3.60	3.33	3.50	3.67
2 – West	2.83	3.60	3.50	3.29	3.67
3 – Rocky Mountain	3.50	3.14	3.75	3.40	3.80
4 – Great Plains/Midwest	3.60	4.17	3.52	3.50	4.12
5 – South Central	3.38	3.50	3.22	2.77	3.31
6 – Southeast	3.43	3.64	3.60	3.69	3.73
7 – Great Lakes	3.76	3.73	3.60	3.40	3.32
8 – Middle Atlantic	4.15	3.91	3.88	3.89	3.56
9 – Northeast	3.83	4.00	3.50	4.50	4.33
10 – Alaska	4.00	-	-	-	-
11 – Hawaii	-	-	-	5.00	-

Note. An "-" indicates that no data were available. [a] From AAEE, 2004. [b] From AAEE, 2005. [c] From AAEE, 2006. [d] From AAEE, 2007. [e] From AAEE, 2008. Note that Regions 3 and 7 were .01 from being considered in the some shortage category. A report for Alaska was not available (AAEE, 2007).

Region 2 – West (3.60), Region 4 – Great Plains/Midwest (4.17), Region 5 – South Central (3.50), Region 6 – Southeast (3.64), Region 7 – Great Lakes (3.73), Region 8 – Middle Atlantic (3.91), and Region 9 – Northeast (4.00). Region 3 – Rocky Mountain reported a balance (3.14). Reports for Hawaii and Alaska were not available (AAEE, 2005).

The AAEE 2005 *Educator Supply and Demand in the United States* report indicated 3.54 (some shortage) for technology education teachers in 2005. The number represented a 0.20 decrease from the 2004 figure of 3.74. While no region reported considerable shortages, seven of the nine regions that supplied data reported some shortage of technology education teachers in their region. Those regions were: Region 2 – West (3.50), Region 3 – Rocky Mountain (3.75), Region 4 – Great Plains/Midwest (3.52), Region 6 – Southeast (3.60), Region 7 – Great Lakes (3.60), Region 8 – Middle Atlantic (3.88), and Region 9 – Northeast (3.50). Regions 1 (Northwest) and 2 (South Central) reported a balance of technology education teachers. Reports for Hawaii and Alaska were not available (AAEE, 2006).

The AAEE 2006 *Educator Supply and Demand in the United States* report indicated 3.44 (some shortage). The number represented a 0.10 decrease from the 2005 figure of 3.54. Two of the 11 regions reported considerable shortages. Those two regions were Region 9 – Northeast (4.50) and Region 11 – Hawaii (5.00). Four regions reported some shortage of technology education teachers. Those regions were: Region 1 – Northwest (3.50), Region 4 – Great Plains/Midwest (3.50), Region 6 – Southeast (3.69), and Region 8 – Middle Atlantic (3.89). Four regions reported a balance; they were: Region 2 – West (3.29), Region 3 – Rocky Mountain (3.40), Region five – South Central (2.77), and Region 7 – Great Lakes (3.40).

The AAEE 2007 *Educator Supply and Demand in the United States* report indicated 3.64 (some shortage). The number represented a 0.20 increase from the 2006 figure of 3.44. Region 9 – Northeast reported a considerable shortage of technology education teachers (4.33). Seven regions reported some shortage of technology education teachers. Those regions were: Region 1 – Northwest (3.67), Region 2 – West (3.67), Region 3 – Rocky Mountain (3.80), Region 4 – Great Plains/Midwest (4.12), Region 5 – South Central (3.31), Region 6 – Southeast (3.73), and Region 8 – Middle Atlantic (3.56). Region 7 – Great Lakes reported a balance (3.32) of technology education teachers. Reports for Hawaii and Alaska were not available (AAEE, 2008). Data indicated that a shortage of technology education teachers in the United States existed. If this was the case, the profession must continue to examine its exact status and formulate a plan in order to, as Wicklein (2005) stated, "undertake significant efforts aimed at recruiting and preparing new technology education educators at all levels" (p. 9).

Over the five year period and out of 55 possible reports from *Educator Supply and Demand in the United States*, of the 11 regions, three reported that they had experienced *considerable shortages*, 32 reported that they experienced *some shortages*, and 12 of the regions reported as having a *balanced supply and demand* of technology education teachers. During the five year period, no region indicated that they had *some surplus* or *considerable surplus*. Data for eight reports were not available, four from Alaska and four from Hawaii. When compiling the available data (47 regional reports), the 11 United States regions experienced some or considerable technology education teacher shortages, 74.46 percent of the time. Overall, the 11 regions reported *some shortage* every year from 2003 to 2007. Table 8 shows the overall level of technology education teacher shortages in the United States during the years of 2002, 2003, 2004, 2005, 2006, and 2007.

Table 8

Overall Shortages of Technology Education Teachers in the United States from 2002 through 2007

Year	Severity of Need	Meaning
2002[a]	4.02	Some Shortage
2003[a]	3.57	Some Shortage
2004[b]	3.74	Some Shortage
2005[c]	3.54	Some Shortage
2006[d]	3.44	Some Shortage
2007[e]	3.64	Some Shortage

Note: [a] From AAEE, 2004, [b] from AAEE, 2005, [c] from AAEE, 2006, [d] from AAEE, 2007, [e] from AAEE, 2008.

The United States Bureau of Labor and Statistics estimates that the demand for teachers will increase 12% between 2008 and 2016 (BLS, n.d.). Between the years of 2005 and 2017, the number of "high school graduates is projected to increase nationally by 6 percent" (Hussar & Bailey, 2008, p. 11). The number of elementary and secondary education teachers "increased 27 percent between 1992 and 2005....[and] is projected to increase an additional 18 percent between 2005 and 2017" (Hussar & Bailey, 2008, p. 16). Based on these data, one could infer that if the number of high school graduates and the need for more teachers increased , so also should the number of technology education teachers. Literature indicated that as requirements (students and teachers) increase, the assets (technology education teachers) have and will potentially continue to decrease. With the severe economic crises experienced in 2008 and 2009 (Credit Crisis, 2008), as Volk (1997) suggested, it is reasonable to believe that school systems did not fill and may not fill vacated technology education teacher positions lost during the last two decades of declining numbers.

ALTERNATIVE TECHNOLOGY EDUCATION TEACHER LICENSURE

Alternative teacher licensing is an avenue that states have implemented in order to resolve the technology education teacher shortage (Hoepfl, 2001). In fact, "the alternative licensure "movement" cuts across most school subject areas" (Litowitz & Sanders, 1999, p. i) and "hold considerable promise" (Podgursky, 2006, p. 32). Alternative licensure is controversial (Hoepfl, 2001; Litowitz, 1998; Volk, 1997), "However, given the current status of Technology Education teacher supply and demand, a number of states have had little choice other than to explore alternative route licensure measures" (Litowitz, 1998, p. 28). Litowitz further explains that: "Many states are already faced with the undesirable choice between allowing technology education positions to be staffed with candidates that may be minimally qualified via emergency licensure measures, or allowing positions to remain vacant altogether" (p. 23). Litowitz and Sanders (1999) indicated that "virtually all but a few states have initiated alternative teacher licensure programs" (p. 2). Volk (1997) indicated that there are programs such as the Military Career Transition Program (MCTP) at Old Dominion University but did not identify to what extent those programs were "meeting the needs of schools to have qualified technology teachers" (p. 67). Litowitz's 1997 study found, with 35 states reporting, there were approximately 1,200 alternatively licensed technology education teachers in the United States. The most frequent population of teachers receiving alternative technology education teacher certification were teachers “from another teaching field” (Hoepfl, 2001, p. 41).

WHY THIS STUDY IS IMPORTANT

Technology education is designed to produce technologically literate students. “Technological literacy encompasses three interdependent dimensions – knowledge, ways of thinking and acting, and capabilities” (Pearson & Young, 2002, p. 3). Technologically literate citizens have the ability to make “well-informed decisions on matters that affect, or are affected by, technology” (Pearson & Young, 2002, p. 3). “A technologically literate person understands…what technology is, how it is created, and how it shapes society, and in turn is shaped by society” (International Technology Education Association (ITEA), 2000, p. 9).

Technology education is a mainstay for the *States' Career Cluster* initiative. These career clusters present students with 16 different areas of study. Technology education course content provides students with information in at least seven of the 16 different clusters (States Career Clusters Initiative, n.d.).

Technology education is an excellent vehicle to integrate STEM and social science information into lesson planning (Berry & Ritz, 2004; Clark & Ernst, 2007; Moye, 2008). In 2002, the United States Congress passed the Elementary and Secondary Education (No Child Left Behind) Act. The law required each state to demonstrate student achievement gains in mathematics and science by 2008 (NCLB, 2001). Studies have shown that technology education students' in many cases performed better in mathematics and science than students whom did not take technology education courses

(Dugger & Johnson, 1992; Dyer, Reed, & Berry, 2006; Frazier, 2009; Setter, 2006; Scarborough & White, 1994).

Some feel that the content of technology education curricula should become more engineering design focused (Custer & Erekson, 2008; Daugherty & Mentzer, 2008; Lewis, 2004, 2005; Wicklein, 2006). The change to an engineering focus may be an effort to avert the demise of technology education as Volk (1993, 1997) has suggested. Whatever view is taken, it is apparent that "The urgent need to recruit, prepare and retain significantly more teachers in technology education is clear....The low number of individuals entering technology education preparation institutions threatens not only post-secondary programs, but the very fabric of the profession" (Daugherty, 1998, p. 22).

There may be many ideas concerning how to resolve the shortage of technology education teachers but it basically comes down to recruiting, teacher preparation, and retention of technology education teachers. These actions are very important to ensure the survival of the technology education profession. Wicklein (2005) stated that the profession must strategically approach problems facing technology education and "to preserve the future of the profession is to gather empirical data that accurately identifies the critical issues and problems facing technology education" (p. 7). The foremost critical issue facing the technology education profession is the "recruitment of students/teachers into teacher education programs" and the number one critical problem facing the profession is "insufficient quantities of qualified technology education teachers" (Wicklein, 2005, p. 7).

Today, it appears that the technology education profession is facing a teacher supply and demand crisis, even after 20 years since Wright and Devier (1989) stated that "there is ample evidence to suggest that a crisis is pending. If we desire qualified teachers and sound educational programs, we, as professionals, need to plan and take action now" (p. 19).

Data indicated that the technology education teacher profession is in a "downward spiral" (Westin, 1997, p. 6) due to decreased technology education teacher enrollment trends. During the past two decades, institutions have not produced enough technology education teachers needed to fill vacancies (Dugger, 2007; Newberry, 2001; Ndahi & Ritz, 2003; Ritz, 1999; Volk, 1993; Weston, 1997). Although the demise of the technology teacher preparation profession did not occur in 2005 as Volk (1997) had predicted, the profession may be experiencing a "slow death" as Ritz (1999, p. 9) suggested may occur.

SUMMARY

This chapter provided an overview of technology education teacher supply in the United States, the technology education teacher demand, alternative technology education licensure, and why this study is important. Previous studies and four *Industrial Teacher Education Directories* were used to determine the number of United States institutions that produced technology education teachers and the number of teachers those institutions produced. Data indicated that the number of institutions and the number of technology education teachers have been in decline during the past three decades.

Previous studies and five *American Association for the Employment in Education in the United States* studies indicated that there has been a shortage of technology education teachers in the United States. States across the nation have employed alternative licensure of technology education teachers in attempts to alleviate shortages.

Studies conducted on technology education teachers receiving their licenses through alternative means have indicated safety and pedagogical concerns, however it has been realized that this process is necessary in order to meet the technology education teacher demand.

Technology education is as an excellent venue to present students with cross curricular information using hands-on project-based learning to teach science, technology, engineering, and mathematics (STEM) as well as social science information. Literature indicated that there has been a shortage of technology education teachers for many years. For the health of the profession, it was important to determine the status of technology education teacher supply and demand.

Chapter III describes the methods and procedures used to conduct this study. The chapter identifies the population, instrument design, methods of data collection, analysis of data, and summary. Chapter III also introduces the survey instrument used to conduct this study.

CHAPTER III

METHODS AND PROCEDURES

This chapter describes the methods and procedures used to conduct this study. The purpose of this study was to determine the supply and demand of technology education teachers in the United States. This will be a descriptive study limited to state technology education supervisor's inputs. The study will identify the number of technology education teachers employed and vacant teaching positions in the United States during the spring of 2009, as well as the number of expected technology education teacher vacancies each state may experience in fall 2009, 2012, and 2014. This study will also determine the number of institutions that offered technology education teacher certification programs and the number of technology education teachers those institutions produced in 2004-2005, 2005-2006, 2006-2007, and 2007-2008. This chapter identifies the population of this study, instrument design, methods of data collection, analysis of data, and summary.

POPULATION

The population of this study consisted of the 50 state technology education supervisors. A state technology education supervisor is the lead technology educator in their state. Supervisors are responsible for the development and approval of technology education curriculum, management of state and federal funding, management of the Technology Student Association (TSA) state chapter, and professional development of teachers. State technology education supervisors are employed by each state Department of Education. Appendix A contains a list of states and state technology education supervisors. *Industrial Teacher Education (ITE) Directories* were also reviewed to determine how many institutions offered technology education teacher programs and how many teachers those institutions produced in 2004-2005, 2005-2006, 2006-2007, and 2007-2008.

INSTRUMENT DESIGN

The instrument used in this study was a survey. The survey consisted of eight open-form and three closed-form questions. The survey was modeled after Weston (1997) and Ndahi and Ritz (2003) studies. The survey contained questions that answered the research problem and goals of this study. The survey was designed to determine the number of technology education teachers employed and number of vacancies each of the 50 states experienced during the spring of 2009. The survey also asked supervisors the number of middle and high school technology education vacancies that they expect to face during the 2009, 2012, and 2014 school years. They were asked if their states provided alternative technology education teacher licensure programs and if those programs modified the existing licensure process. The survey also asked if state supervisors were planning to adopt pre-engineering curriculum into their technology education programs and if so, the number of Project Lead The Way®, Engineering byDesign™, or other engineering-based programs they anticipated. Lastly, supervisors were asked if their state was integrating STEM components into their technology education program structure. A copy of the survey is included in Appendix B.

METHODS OF DATA COLLECTION

On February 17, 2009, the researcher mailed a letter of introduction (via the United States Postal Service) to all 50 state technology education supervisors. Supervisors' names and contact information were obtained from the International

Technology Education Association (ITEA) Council for Supervisors list of Department of Education Personnel for Technology Education. The letter introduced the researcher and stated his affiliation with Old Dominion University as a Ph.D. candidate and that this study served as that candidate's dissertation topic. The letter also noted that this study will continue to build upon the database containing the status of technology education teacher supply and demand in the United States. The letter discussed the importance of each state supervisor's response in order to gather an accurate status of current and future United States technology education teacher demands. Appendix C contains a copy of the letter of introduction.

On March 2, 2009, state supervisors were advised of the start of the study. The researcher mailed the survey (Appendix B) and a cover letter (Appendix D) to supervisors via the United States Postal Service. Supervisors were asked to return the survey to the researcher in an enclosed self-addressed stamped envelope by March 20, 2009. On March 24, 2009, the researcher mailed a follow-up letter (Appendix E) with an enclosed survey to those supervisors who had not yet responded. Supervisors were asked to provide the researcher with their information no later than April 10, 2009. Between March 24 and May 9, 2009, the researcher also telephoned state supervisors offering survey completion assistance.

The researcher devised a system to identify the origin of each survey response. A number was applied to each survey mailed to supervisors. The researcher developed a key that identified which numbered survey was sent to each supervisor. This system was necessary to ensure the researcher could identify the specific response of each supervisor. The researcher ensured confidentiality and protection of human subjects during the study.

ANALYSIS OF DATA

State technology education supervisor responses were collected. The information was tabulated and analyzed ensuring the objectives of this study were met. Supervisors identified the number of middle and high school technology education teachers employed as well as the number of vacancies that they experienced during the spring of 2009. Supervisors provided their projected middle and high school technology education teacher vacancies for the years 2009, 2012, and 2014. Supervisors responded to several questions; they were: Does your state provide alternative technology education teacher certification programs? If so, do those programs modify the existing state teacher licensure process? Is your state planning to adopt pre-engineering curriculum into technology education programs? If the answer was yes, state supervisors were asked to indicate the number of Project Lead The Way®, Engineering byDesign™, or other engineering-based programs that they intended to adopt. Lastly, supervisors were asked if their state was working toward integrating STEM components into their technology education program structure.

The researcher conducted a review of 2004-2005, 2005-2006, 2006-2007, and 2007-2008 *Industrial Teacher Education (ITE) Directories* to determine how many institutions offered technology education teacher certification programs and how many technology education teachers were produced during those years. A matrix of nominal data was created to determine what institutions produced technology education teachers and the number of teachers that those institutions produced between the years of 2004-2005 and 2007-2008.

SUMMARY

This chapter identified the methods and procedures used to collect the information necessary to answer the problem statement and research goals of this descriptive study. The population of this study consisted of technology education supervisors from each of the 50 United States. An 11 question survey was mailed to state supervisors. The survey was designed to find the total number of middle and high school technology education teachers employed and the number of teacher vacancies in each state during the spring of 2009. The survey also asked state supervisors to indicate their projected vacancies for the 2009, 2012, and 2014 school years. Supervisors were also asked if their states offered alternative technology teacher certification programs and if those programs modify the existing licensure process. Questions were also offered to determine if supervisors were planning to adopt pre-engineering technology education programs and if they were working to integrate STEM components into their technology education program structure. This information was tabulated and analyzed to determine the current and projected technology education teacher demand in each state and if states offered alternative teacher licensure opportunities in their states. The researcher also reviewed the 2004-2005, 2005-2006, 2006-2007, and 2007-2008 *Industrial Teacher Education (ITE) Directories* to determine how many institutions offered technology education teacher licensure programs and how many technology education teachers were produced during those years. Results of the information received from state supervisors are presented in Chapter IV (Findings).

CHAPTER IV

FINDINGS

The problem of this study was to determine the technology education teacher supply and demand in the United States. Four goals were developed to guide this study; they were to determine:

1. The number of technology education teachers produced in the United States.
2. The number of technology education teachers employed in United States public schools during the spring of 2009.
3. The number of vacant technology education teacher positions in United States public schools during the spring of 2009.
4. The projected number of technology education teacher vacancies for the fall semesters of 2009, 2012, and 2014.

A document review of the 2004-2005, 2005-2006, 2006-2007, and 2007-2008 *Industrial Teacher Education (ITE) Directories* was performed to answer the first goal. An 11 question survey was developed to collect data necessary to answer the remaining three research goals. This chapter provides the findings derived from that document review and survey.

REPORT OF FINDINGS

On March 2, 2009, a survey (Appendix B) and cover letter (Appendix C) were mailed to each of the 50 state technology education supervisors. Supervisors were asked to respond by March 20, 2009. Three of the 50 supervisors (6%) responded by March 20. On March 24, 2009, the researcher mailed a follow-up letter (Appendix E) to each of the remaining 47 supervisors asking for their participation in this study. Another survey was enclosed with the letter. Supervisors were asked to provide the information to the researcher no later than April 10, 2009. An additional seven supervisors (14%) responded to the second mailing of surveys for a total of 20% of total supervisors. The researcher made telephone calls to remaining supervisors asking for their participation and offered assistance if needed. Table 9 identifies by what media supervisors and the percentage of supervisors that responded.

Table 9

Media and Percentages of Supervisor Responses

Medium of Response	Response Rate
Supervisors Responded to Written Survey	20%
Supervisors Responded by Telephone	80%
Total Supervisor Response	100%

The survey and telephone calls revealed that all supervisors felt there was a shortage of available technology education teachers. During telephone calls many of the supervisors indicated that they had not responded to the survey due to the amount of work that they had to perform. Because of a decrease of staffing, some supervisors had recently taken on extra responsibilities and positions that had recently been vacated.

SUPPLY OF TECHNOLOGY EDUCATION TEACHERS

Research Goal 1 was to determine the supply of technology education teachers in the United States. To determine the supply, the researcher reviewed the 2004-2005, 2005-2006, 2006-2007, and 2007-2008 *Industrial Teacher Education (ITE) Directories*. The *Directories* compile information concerning technology, industrial, and occupational degrees awarded by institutions annually. The *Directories* listed dozens of different degrees, licenses, and certifications offered by institutions. This study was limited to the number of students receiving technology education teacher certifications or licenses produced by these institutions. The 2004-2005 *ITE Directory* identified 34 colleges and universities that produced 338 technology education teachers (Schmidt & Custer, 2005). The 2005-2006 *ITE Directory* identified 32 colleges and universities that produced 315 technology education teachers (Schmidt & Custer, 2006). The 2006-2007 *ITE Directory* identified 29 colleges and universities that produced 311 technology education teachers (Schmidt & Custer, 2007). The 2007-2008 *ITE Directory* identified 27 colleges and universities that produced 258 technology education teachers (Waugh, 2008). Table 10 identifies the number of institutions that produced technology education teachers during 2004-2005, 2005-2006, 2006-2007, and 2007-2008, and the number of teachers those institutions produced during those years.

NUMBER OF TECHNOLOGY EDUCATION TEACHERS EMPLOYED

Research Goal 2 was to determine the number of technology education teachers employed in United States public schools during the spring of 2009. Two open-form questions were developed to collect the information. Question 1 was: What is the number of public middle school technology education teachers employed in your state during the spring of 2009? Fifty of the 50 (100%) supervisors responded to the question. The Louisiana, Massachusetts, and Montana supervisors stated that their state did not track the number of middle school technology education teachers employed in their state. The Massachusetts supervisor stated that there were still technology education programs in the state but they may have "evolved into programs that are now being taught in

Table 10

Number of Institutions that Produced Technology Education Teachers and the Number of Teachers Those Institutions Produced in 2004-2005, 2005-2006, 2006-2007, and 2007-2008

	2004-2005[a]	2005-2006[b]	2006-2007[c]	2007-2008[d]
Number of Institutions	34	32	29	27
Number of Technology Education Teachers	338	315	311	258

[a] From Schmidt and Custer, 2005. [b] From Schmidt and Custer, 2006. [c] From Schmidt and Custer, 2007. [d] From Waugh, 2008.

mathematics and science departments. Therefore it is difficult to determine the number of programs, teachers, and teacher shortages in the state" (J. Foster, personal communication, April 22, 2009). The 47 states and the number of middle school technology education teachers those states reported were: Alabama: 73; Alaska: 15; Arizona: 0; Arkansas: 65; California: 900; Colorado: 129; Connecticut: 350; Delaware: 30; Florida: 525; Georgia: 201; Hawaii: 0; Idaho: 20; Illinois: 240; Indiana: 620; Iowa: 450; Kansas: 215; Kentucky: 30; Maine: 165; Maryland: 500; Michigan: 30; Minnesota: 400; Mississippi: 40; Missouri: 218; Nebraska: 50; Nevada: 30; New Hampshire: 68; New Jersey: 750; New Mexico: 130; New York: 1755; North Carolina: 236; North Dakota: 35; Ohio: 960; Oklahoma: 200; Oregon: 208; Pennsylvania: 633; Rhode Island: 55; South Carolina: 75; South Dakota: 20; Tennessee: 144; Texas: 588; Utah: 141; Vermont: 0; Virginia: 345; Washington: 32; West Virginia: 90; Wisconsin: 450; and

Wyoming: 0. Based on state supervisor inputs, there were approximately 12,146 public middle school technology education teachers employed in the United States during the spring of 2009.

Question 2 was: What is the number of public high school technology education teachers employed in your state during the spring of 2009? Fifty of 50 (100%) supervisors responded to the question. The Massachusetts supervisor stated that his state did not collect data on the number of high school technology teachers in his state. The states that did collect the data and the number of high school technology teachers in each state were: Alabama: 26; Alaska: 130; Arizona: 1; Arkansas: 15; California: 918; Colorado: 263; Connecticut: 400; Delaware: 60; Florida: 175; Georgia: 300; Hawaii: 59; Idaho: 62; Illinois: 1500; Indiana: 640; Iowa: 619; Kansas: 445; Kentucky: 125; Louisiana: 154; Maine: 80; Maryland: 560; Michigan: 44; Minnesota: 328; Mississippi: 450; Missouri: 467; Montana: 170; Nebraska: 10; Nevada: 10; New Hampshire: 118; New Jersey: 850; New Mexico: 135; New York: 945; North Carolina: 224; North Dakota: 65; Ohio: 950; Oklahoma: 170; Oregon: 52; Pennsylvania: 1267; Rhode Island: 80; South Carolina: 45; South Dakota: 20; Tennessee: 115; Texas: 1032; Utah: 112; Vermont: 200; Virginia: 610; Washington: 255; West Virginia: 115; Wisconsin: 838; and Wyoming: 0. Based on state supervisor inputs, there were approximately 16,164 public high school technology education teachers employed in the United States during the spring of 2009.

When summed, there were approximately 28,310 middle and high school technology teachers employed during the spring of 2009. Table 11 provides the approximate number of technology education teachers employed in each state and the total approximate number employed in the United States during the spring of 2009.

VACANT TECHNOLOGY EDUCATION TEACHER POSITIONS

Research Goal 3 was to determine the number of vacant technology education teacher positions in United States public schools during the spring of 2009. Two open-form questions were developed to answer the third goal. Question 3 was: What is the estimated number of vacant public middle school technology education positions in your state during the spring of 2009? Fifty of 50 (100%) supervisors responded to this question. Sixteen supervisors (32%) from Alaska, Connecticut, Georgia, Hawaii, Iowa, Kansas, Louisiana, Massachusetts, Michigan, Mississippi, Montana, New York, North Carolina, Oregon, Rhode Island, and West Virginia stated that they did not track the number of middle school technology education teacher vacancies and were unable to estimate. The states that reported the estimated number of vacant middle school technology education teachers were: Alabama: 12; Arizona: 0; Arkansas: 5; California: 0; Colorado: 0; Delaware: 10; Florida: 12; Idaho: 0; Illinois: 20; Indiana: 25; Kentucky: 2; Maine: 0; Maryland: 15; Minnesota: 10; Missouri: 179; Nebraska: 0; Nevada: 2; New Hampshire: 8; New Jersey: 5; New Mexico: 4; North Dakota: 1; Ohio: 2; Oklahoma: 10; Pennsylvania: 13; South Carolina: 2; South Dakota: 4; Tennessee: 5; Texas: 0; Utah: 14; Vermont: 0; Virginia: 2; Washington: 0; Wisconsin: 5; and Wyoming: 0. Based on state supervisor inputs, there were approximately 367 middle school technology education teacher vacancies in the United States during the spring of 2009.

Question 4 also addressed the third goal of this study: What is the estimated

Table 11

Total Number of Middle School and High School Technology Education Teachers Employed Per State During the Spring of 2009

State	Middle	High	State	Middle	High
Alabama	73	26	Montana	-	170
Alaska	15	130	Nebraska	50	10
Arizona	0	1	Nevada	30	10
Arkansas	65	15	New Hampshire	68	118
California	900	918	New Jersey	750	850
Colorado	129	263	New Mexico	130	135
Connecticut	350	400	New York	1755	945
Delaware	30	60	North Carolina	236	224
Florida	525	175	North Dakota	35	65
Georgia	201	300	Ohio	960	950
Hawaii	0	59	Oklahoma	200	170
Idaho	20	62	Oregon	208	52
Illinois	240	1500	Pennsylvania	633	1267
Indiana	620	640	Rhode Island	55	80
Iowa	450	619	South Carolina	75	45
Kansas	215	445	South Dakota	20	20
Kentucky	30	125	Tennessee	144	115
Louisiana	-	154	Texas	588	1032
Maine	165	80	Utah	141	112
Maryland	500	560	Vermont	0	200
Massachusetts	-	-	Virginia	345	610
Michigan	30	44	Washington	32	255
Minnesota	400	328	West Virginia	90	115
Mississippi	40	450	Wisconsin	450	838
Missouri	218	467	Wyoming	0	0

Table 11 (Continued).

Total Employed	Middle	High	Combined Total
	12,146	16,164	28,310

Note. A "-" indicates that a supervisor responded but did not have the information.

number of vacant public high school technology education positions in your state during the spring of 2009? Fifty of 50 (100%) supervisors responded to the question. Sixteen supervisors (32%) from Alaska, Connecticut, Georgia, Hawaii, Iowa, Kansas, Louisiana, Massachusetts, Michigan, Mississippi, Montana, New York, North Carolina, Oregon, Rhode Island, and West Virginia stated that they did not track the number of high school technology education teacher vacancies and were unable to estimate. The states that reported the information and the estimated number of vacant high school technology education teachers were: Alabama: 2; Arizona: 0; Arkansas: 5; California: 0; Colorado: 0; Delaware: 15; Florida: 10; Idaho: 3; Illinois: 60; Indiana: 25; Kentucky: 4; Maine: 0; Maryland: 20; Minnesota: 10; Missouri: 262; Nebraska: 0; Nevada: 1; New Hampshire: 5; New Jersey: 26; New Mexico: 6; North Dakota: 3; Ohio: 2; Oklahoma: 10; Pennsylvania: 15; South Carolina: 2; South Dakota: 5; Tennessee: 5; Texas: 0; Utah: 15; Vermont: 20; Virginia: 3; Washington: 0; Wisconsin: 15; and Wyoming: 0. Based on state supervisor inputs, there were approximately 549 high school technology education teacher vacancies in the United States during the spring of 2009.

When summed, the approximate number of vacant middle and high school technology education teacher positions during the spring of 2009 was 916. Table 12 lists the approximate number of middle school and high school technology education vacancies by state and the total estimated number of vacancies during the spring of 2009.

PROJECTED TECHNOLOGY EDUCATION TEACHER VACANCIES

Research Goal 4 of this study was to determine the projected number of technology education teacher vacancies during the fall of 2009, 2012, and 2014. Two open-form questions were developed to collect this information. Question 5 was: What is the expected number of public middle school technology education teacher vacancies in your state for the fall of 2009, 2012, and 2014? Fifty of the 50 (100%) supervisors responded to this question. The 17 supervisors (34%) from Colorado, Connecticut, Hawaii, Iowa, Kansas, Louisiana, Maine, Massachusetts, Michigan, Montana, New York, Oregon, Rhode Island, Tennessee, Texas, Virginia, and West Virginia stated that they could not determine future vacancies and declined from providing any estimates. The following is a list of states and projected estimates of vacant middle school technology education teacher positions for the fall of 2009, 2012, and 2014, respectively. Alabama: 12, 12, 12; Alaska: 2, 2, 2; Arizona: 0, 0, 0; Arkansas: 2, 2, 2; California: 0, 0, 0; Delaware: 10, 10, 10; Florida: 12, 12, 12; Georgia: 20, 20, 20; Idaho: 2, 2, 2; Illinois: 5, 5, 7; Indiana: 50, 75, 100; Kentucky: 10, 20, 20; Maryland: 10, 10, 15; Minnesota: 5, 8, 10; Mississippi: 2, 4, 6; Missouri only indicated an estimated shortage of 15 in 2014; Nebraska: 2, 10, 20; Nevada: 2, 2, 2; New Hampshire: 5, 8, 5; New Jersey: 75, 75, 75; New Mexico: 5, 5, 10; North Carolina: 5, 5, 5; North Dakota: 3, 6, 9; Ohio: 0, 0, 0; Oklahoma: 30, 70, 100; Pennsylvania: 63, 96, 116; South Carolina: 4, 4, 4; South Dakota: 4, 8, 16; Utah: 7, 10, 12; Vermont: 0, 0, 0; Washington: 0, 0, 0; Wisconsin: 6, 6, 6; and Wyoming, 0, 0, 0. When all state projected estimates were summed, data indicated that

Table 12

Approximate Number of Vacant Middle and High School Technology Education Teacher Positions During the Spring of 2009

State	Middle	High	State	Middle	High
Alabama	12	2	Montana	-	-
Alaska	-	-	Nebraska	0	0
Arizona	0	0	Nevada	2	1
Arkansas	5	5	New Hampshire	8	5
California	0	0	New Jersey	5	26
Colorado	0	0	New Mexico	4	6
Connecticut	-	-	New York	-	-
Delaware	10	15	North Carolina	-	-
Florida	12	10	North Dakota	1	3
Georgia	-	-	Ohio	2	2
Hawaii	-	-	Oklahoma	10	10
Idaho	0	3	Oregon	-	-
Illinois	20	60	Pennsylvania	13	15
Indiana	25	25	Rhode Island	-	-
Iowa	-	-	South Carolina	2	2
Kansas	-	-	South Dakota	4	5
Kentucky	2	4	Tennessee	5	5
Louisiana	-	-	Texas	0	0
Maine	0	0	Utah	14	15
Maryland	15	20	Vermont	0	20
Massachusetts	-	-	Virginia	2	3
Michigan	-	-	Washington	0	0
Minnesota	10	10	West Virginia	-	-
Mississippi	-	-	Wisconsin	5	15
Missouri	179	262	Wyoming	0	0

Table 12 (Continued).

Est. Vacancies	Middle	High	Combined
	367	549	916

Note. A "-" indicates that a supervisor responded but did not have the information.

there will be an estimated 353 middle school vacancies during the fall of 2009, 487 in 2012, and 598 in 2014. Table 13 lists the expected number of vacant middle school technology education teacher positions during the fall of 2009, 2012, and 2014.

Question 6 was designed to answer the fourth goal: What is the expected number of public high school technology education teacher vacancies in your state for the fall of 2009, 2012, and 2014? Fifty of the 50 (100%) supervisors responded to the question. The 17 supervisors (34%) from Colorado, Connecticut, Hawaii, Iowa, Kansas, Louisiana, Maine, Massachusetts, Michigan, Montana, New York, Oregon, Rhode Island, Tennessee, Texas, Virginia, and West Virginia stated that they could not determine future vacancies and declined from providing any estimates.

The following is a list of states and projected high school technology education teacher vacancies for the fall of 2009, 2012, and 2014, respectively. Alabama: 2, 2, 2; Alaska: 2, 4, 8; Arizona: 0, 0, 0; Arkansas: 2, 2, 2; California: 0, 0, 0; Delaware: 10, 10, 10; Florida: 12, 12, 12; Georgia: 25, 25, 25; Idaho: 3, 5, 9; Illinois: 5, 5, 7; Indiana: 50, 75, 100; Kentucky: 15, 30, 30; Maryland: 10, 10, 15; Minnesota: 5, 8, 10; Mississippi: 2, 4, 6; Missouri: 20, 47, 123; Nebraska: 1, 3, 5; Nevada: 2, 2, 2; New Hampshire: 5, 8, 5; New Jersey: 75, 75, 75; New Mexico: 5, 5, 10; North Carolina: 5, 5, 5; North Dakota: 3, 6, 9; Ohio: 0, 0, 0; Oklahoma: 15, 40, 75; Pennsylvania: 127, 194, 234; South Carolina: 2,

Table 13

Expected Number of Vacant Middle School Technology Education Teacher Positions During the Fall of 2009, 2012, and 2014

State	2009	2012	2014	State	2009	2012	2014
Alabama	12	12	12	Montana	-	-	-
Alaska	2	2	2	Nebraska	2	10	20
Arizona	0	0	0	Nevada	2	2	2
Arkansas	2	2	2	New Hampshire	5	8	5
California	0	0	0	New Jersey	75	75	75
Colorado	-	-	-	New Mexico	5	5	10
Connecticut	-	-	-	New York	-	-	-
Delaware	10	10	10	North Carolina	5	5	5
Florida	12	12	12	North Dakota	3	6	9
Georgia	20	20	20	Ohio	0	0	0
Hawaii	-	-	-	Oklahoma	30	70	100
Idaho	2	2	2	Oregon	-	-	-
Illinois	5	5	7	Pennsylvania	63	96	116
Indiana	50	75	100	Rhode Island	-	-	-
Iowa	-	-	-	South Carolina	4	4	4
Kansas	-	-	-	South Dakota	4	8	16
Kentucky	10	20	20	Tennessee	-	-	-
Louisiana	-	-	-	Texas	-	-	-
Maine	-	-	-	Utah	7	10	12
Maryland	10	10	15	Vermont	0	0	0
Massachusetts	-	-	-	Virginia	-	-	-
Michigan	-	-	-	Washington	a	a	a
Minnesota	5	8	10	West Virginia	-	-	-
Mississippi	2	4	6	Wisconsin	6	6	6
Missouri	-	-	15	Wyoming	0	0	0

Table 13 (Continued).

	2009	2012	2014
Est. Vacancies	353	487	598

Note. A "-" indicates that a supervisor responded but did not provide information.

2, 2; South Dakota: 4, 8, 16; Utah: 7, 10, 12; Vermont: 20, 20, 20; Washington: 28, 40, no estimate for 2014; Wisconsin: 8, 8, 8; and Wyoming: 0, 0, 0. When all state inputs were summed, data indicate that there will be an estimated 470 high school vacancies during the fall of 2009, 665 in 2012, and 837 in 2014. Table 14 lists the number of expected high school vacancies for the fall of 2009, 2012, and 2014.

ALTERNATIVE TEACHER LICENSURE PROGRAMS

In addition to the research goals, two questions were posed to supervisors to ascertain the status of alternative licensure programs in each state. Question 7 was: Does your state offer alternative licensure programs? Fifty of 50 (100%) supervisors responded to the question. Seven states (14%) did not offer alternative programs; they were: Arizona, Idaho, Maine, Nebraska, New York, South Carolina, and Utah. The remainder of the states did offer alternative programs; they were: Alabama, Alaska, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Georgia, Hawaii, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nevada, New Hampshire, New Jersey, New Mexico, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Dakota, Tennessee, Texas, Vermont, Virginia, Washington, West Virginia, Wisconsin, and Wyoming. Table 15 identifies which

Table 14

Expected Number of Vacant High School Technology Education Teacher Positions During the Fall of 2009, 2012, and 2014

State	2009	2012	2014	State	2009	2012	2014
Alabama	2	2	2	Montana	-	-	-
Alaska	2	4	8	Nebraska	1	3	5
Arizona	0	0	0	Nevada	2	2	2
Arkansas	2	2	2	New Hampshire	5	8	5
California	0	0	0	New Jersey	75	75	75
Colorado	-	-	-	New Mexico	5	5	10
Connecticut	-	-	-	New York	-	-	-
Delaware	10	10	10	North Carolina	5	5	5
Florida	12	12	12	North Dakota	3	6	9
Georgia	25	25	25	Ohio	0	0	0
Hawaii	-	-	-	Oklahoma	15	40	75
Idaho	3	5	9	Oregon	-	-	-
Illinois	5	5	7	Pennsylvania	127	194	234
Indiana	50	75	100	Rhode Island	-	-	-
Iowa	-	-	-	South Carolina	2	2	2
Kansas	-	-	-	South Dakota	4	8	16
Kentucky	15	30	30	Tennessee	-	-	-
Louisiana	-	-	-	Texas	-	-	-
Maine	-	-	-	Utah	7	10	12
Maryland	10	10	15	Vermont	20	20	20
Massachusetts	-	-	-	Virginia	-	-	-
Michigan	-	-	-	Washington	28	40	-
Minnesota	5	8	10	West Virginia	-	-	-

Table 14 (Continued).

State	2009	2012	2014	State	2009	2012	2014
Mississippi	2	4	6	Wisconsin	8	8	8
Missouri	20	47	123	Wyoming	0	0	0
Est. Vacancies	470	665	837				

Note. A "-" indicates that a supervisor responded but did not provide information.

states did and did not offer alternative technology education teacher licensure program in their state.

If supervisors answered yes to the first alternative licensure question, they were asked to respond to a second question. Question 8 was: Do programs modify the existing state teacher licensure process? Fifty of 50 (100%) supervisors responded to the question. Data indicated that 34 of the 43 states (72%) that offer alternative licensure programs modify existing state teacher licensure processes. The states that do modify the existing state teacher licensure processes are: Alabama, Alaska, California, Colorado, Delaware, Florida, Georgia, Hawaii, Illinois, Indiana, Iowa, Kansas, Louisiana, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nevada, New Hampshire, New Jersey, New Mexico, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Dakota, Tennessee, Virginia, Washington, and Wyoming. Table 16 identifies which states' alternative licensure programs do or do not modify existing teacher licensure processes.

Supervisors were also asked to explain the modification(s). Nineteen of the 34

Table 15

States that Did or Did Not Offer Alternative Technology Education Teacher Licensure Programs

	State Offers Alternative Licensure Programs			State Offers Alternative Licensure Programs	
States	Yes	No	States	Yes	No
Alabama	X		Montana	X	
Alaska	X		Nebraska		X
Arizona		X	Nevada	X	
Arkansas	X		New Hampshire	X	
California	X		New Jersey	X	
Colorado	X		New Mexico	X	
Connecticut	X		New York		X
Delaware	X		North Carolina	X	
Florida	X		North Dakota	X	
Georgia	X		Ohio	X	
Hawaii	X		Oklahoma	X	
Idaho		X	Oregon	X	
Illinois	X		Pennsylvania	X	
Indiana	X		Rhode Island	X	
Iowa	X		South Carolina		X
Kansas	X		South Dakota	X	
Kentucky	X		Tennessee	X	
Louisiana	X		Texas	X	
Maine		X	Utah		X
Maryland	X		Vermont	X	
Massachusetts	X		Virginia	X	
Michigan	X		Washington	X	

Table 15 (Continued).

	State Offers Alternative Licensure Programs			State Offers Alternative Licensure Programs	
States	Yes	No	States	Yes	No
Minnesota	X		West Virginia	X	
Mississippi	X		Wisconsin	X	
Missouri	X		Wyoming	X	

supervisors (56%) who indicated that the alternative licensure program(s) in their state modified the existing state teacher licensure process provided a comment. Those comments were:

- Alabama, a person attempting to receive an alternative technology education teacher license would have to earn an alternate baccalaureate certification and pass the PRAXIS II (B. Scheirman, personal communication, April 17, 2009).
- Alaska, one alternative means to fill vacancies was if a teacher taught less than 100 students during a semester, that teacher did not have to possess a technology education teaching endorsement. Alaska also targeted trades people for potential technology education teachers (H. Mehrkens, personal communication, April 15, 2009).
- Georgia has prepared a certification exam that focuses on the five traditional areas of technology education (R. Barker, personal communication, April 13, 2009).

Hawaii's supervisor indicated that the technology education teacher alternative certification was in the "process of being reworked" (S. Kow, personal communication, April 17, 2009).

Table 16

States Alternative Technology Education Teacher Licensure Programs that Modify Existing State Licensure Process

States	State Programs Modify Existing Teacher Licensure Process Yes	No	States	State Programs Modify Existing Teacher Licensure Process Yes	No
Alabama	X		Montana	X	
Alaska	X		Nebraska		N/A
Arizona	N/A		Nevada	X	
Arkansas		X	New Hampshire	X	
California	X		New Jersey	X	
Colorado	X		New Mexico	X	
Connecticut		X	New York		N/A
Delaware	X		North Carolina	X	
Florida	X		North Dakota	X	
Georgia	X		Ohio	X	
Hawaii	X		Oklahoma	X	
Idaho		X	Oregon	X	
Illinois	X		Pennsylvania	X	
Indiana	X		Rhode Island	X	
Iowa	X		South Carolina		N/A
Kansas	X		South Dakota	X	
Kentucky		X	Tennessee	X	
Louisiana	X		Texas		X
Maine		N/A	Utah		N/A
Maryland		X	Vermont		X
Massachusetts	X		Virginia	X	

Table 16 (Continued).

States	State Programs Modify Existing Teacher Licensure Process		States	State Programs Modify Existing Teacher Licensure Process	
	Yes	No		Yes	No
Michigan	X		Washington	X	
Minnesota	X		West Virginia		N/A
Mississippi	X		Wisconsin		X
Missouri	X		Wyoming	X	

Note. N/A indicates that the question is not applicable because the state does not offer alternative licensure programs.

- Illinois, a person can acquire a provisional "vocational" license by obtaining 60 hours of post secondary coursework and 2,000 hours of work related experience. A person can also acquire a temporary provisional "vocational" license by obtaining less then 60 hours of coursework but have 8,000 hours of related work experience (S. Parrott, personal communication, April 29, 2009).
- Louisiana created an alternative licensure process that they call the "Career, Technical, Trade, and Industrial Education" process. The process targets business and industry individuals, encouraging them to become teachers in the different areas of Career and Technical Education (J. Birchman, personal communication, April 17, 2009).
- Massachusetts offers an alternate technology education teacher licensure process which involves the creation and review of a candidate portfolio of experience, credentials, and course work. The license all technology education teachers strive for is no longer a "technology education license", it is now called a

"Technology and Engineering" license (J. Foster, personal communication, April 22, 2009).

- Minnesota, a school district can waive a technology education licensure for three years while a person works for their certification (J. Rapheal, personal communication, April 29, 2009).
- North Carolina has three different technology education alternative licensure programs. The first – a licensed teacher may take the PRAXIS II exam and become a technology education teacher, the second – a non-licensed person must attend one of three NC Universities and take their alternative licensure plan of study. With the third program, an individual must have a bachelor's degree (or higher) in either mathematics, science, trade & industry, or from an engineering field and then complete 18-21 hours of course work, and an 80-hour technology education teacher instruction program (B. Moye, personal communication, April 29, 2009).
- Nevada allows retired teachers to return to work full time to fill vacant positions. Also, persons entering the teaching profession from industry must have five years experience in the area in which he/she will teach. They are not required to pass the PRAXIS II certification test (M. Raponi, personal communication, April 13, 2009).
- New Hampshire allows for a one year provisional license. At the end of the year, the teacher has to pass a state-developed certification board (E. Taylor, personal communication, April 17, 2009).

- North Dakota has targeted elementary school teachers to fill vacant technology education teacher positions. A program through Valley State University allows for a two year provisional license which could be extended to five years based on performance (M. Strinden, personal communication, April 17, 2009).
- Oklahoma supervisor stated that "The career tech system has the requirement for their teachers to maintain career tech certificates" (K. Terronez, personal communication, April 10, 2009).
- The Oregon supervisor said that "A license can be obtained through a regional instructor appraisal process provided the individual has appropriate education and industry experience (T. Thompson, personal communication, April 17, 2009).
- Tennessee, teachers attempting to achieve an alternative license must complete 18 hours of coursework, pass the PRAXIS I and II, receive safety training, and must learn and teach the ITEA *Standards for Technological Literacy* (T. D'Apolito, personal communication, April 17, 2009).

PRE-ENGINEERING CURRICULUM

Supervisors were also asked Question 9, which was: Is your state planning to adopt pre-engineering curriculum into technology education programs? Fifty of 50 (100%) supervisors responded to the question. Forty-nine states (98%) indicated that their state was planning to adopt pre-engineering curriculum into their technology education programs. Oregon was the exception.

If supervisors indicated that their state currently had or were planning to adopt pre-engineering curriculum into their technology education programs, they were asked to respond to Question 10, which was: If yes, please indicate the approximate number of

Project Lead The Way®, Engineering byDesign™, or "Other" pre-engineering programs in their state.

In Maine, there were technology education teachers that had "morphed" their programs to include pre-engineering, but there are no state formalized programs (S. Rookard, personal communication, May 8, 2009). The New York supervisor did not want to discuss (or "promote") the types of pre-engineering programs in the state, therefore did not provide specifics (P. Dettelis, personal communication, April 17, 2009). Wyoming indicated that there were two Project Lead The Way® programs within the state, but they also indicated that there were zero technology education teachers in the state. Eight of the 49 (16%) supervisors that stated pre-engineering curricula were offered in technology education programs indicated that they were unsure of the number of those programs. Those states were: Arkansas, California, Maine, Massachusetts, Michigan, Mississippi, Montana, and Vermont. Forty of the 49 (82%) supervisors with pre-engineering curriculum in their state provided the number of pre-engineering programs offered in their state. Table 17 shows the approximate number of Project Lead The Way®, Engineering byDesign™, and "other" pre-engineering curricula that states had or were planning to adopt. Based on supervisor inputs, there were approximately 1,969 PLTW®, 929 EbD™, and 368 other pre-engineering curriculum in technology education programs in the United States during the spring of 2009. In addition to the number of pre-engineering programs within their state, eighteen supervisors provided additional comments. Those comments are listed in Appendix F.

STEM INTEGRATION

Question 11 was the last question asked of supervisors; it was: Is your state working toward integrating STEM components into the technology education program structure? Fifty supervisors (100%) responded to this question. Forty-seven of the 50 (94%) indicated that their state was working toward integrating STEM components into their technology education program structure. The Montana, Oregon, and Wyoming supervisors indicated that there was no movement to integrate STEM components into technology education courses within their states. Six supervisors included comments to this question. Those comments are listed in Appendix F.

During telephone calls, some supervisors provided additional relevant comments concerning the supply and demand of technology education teachers. Where these comments did not directly apply to any one particular research goal or question, they provided relevant and interesting information. Appendix F contains those comments.

SUMMARY

The purpose of this study was to determine the technology education teacher supply and demand in the United States. This chapter provided the findings of this study. A document review of 2004-2005, 2005-2006, 2006-2007, and 2007-2008 *Industrial Teacher Education (ITE) Directories* identified a decrease of institutions offering technology education teacher preparation programs and the amount of technology teachers being produced during those years. Those *Directories* indicated that in 2004-2005, 34 institutions produced 338 technology teachers, in 2005-2006, 32 institutions produced 315 teachers, in 2006-2007, 29 institutions produced 311 teachers, and in 2007-2008, 27 institutions produced 258 technology teachers.

Table 17

The Number of Project Lead The Way® (PLTW), Engineering byDesign™ (EbD), and Other Pre-Engineering Programs States Currently Had or Planned to Adopt

States	PLTW	EbD	Other	States	PLTW	EbD	Other
Alabama	5	0	26	Montana	-	-	-
Alaska	5	0	0	Nebraska	9	0	-
Arizona	15	15	2	Nevada	2	0	0
Arkansas	-	-	-	New Hampshire	20	4	1
California	-	-	-	New Jersey	31	0	-
Colorado	6	-	-	New Mexico	3	0	0
Connecticut	70	15	0	New York	[a]	[a]	[a]
Delaware	0	0	-	North Carolina	55	0	0
Florida	55	4	0	North Dakota	3	40	1
Georgia	18	18	1	Ohio	-	2	1
Hawaii	0	0	15	Oklahoma	35	200	200
Idaho	10	0	2	Oregon	-	0	0
Illinois	90	-	10	Pennsylvania	50	190	-
Indiana	336	0	-	Rhode Island	3	0	-
Iowa	90	0	-	South Carolina	15	0	0
Kansas	37	10	-	South Dakota	1	-	-
Kentucky	70	105	-	Tennessee	4	264	47
Louisiana	19	0	-	Texas	161	0	0
Maine	-	-	-	Utah	33	0	0
Maryland	73	50	-	Vermont	-	-	-
Massachusetts	-	-	-	Virginia	44	-	42
Michigan	-	-	-	Washington	130	4	-
Minnesota	181	0	[b]	West Virginia	14	0	-

Table 17 (Continued).

States	PLTW	EbD	Other	States	PLTW	EbD	Other
Mississippi	-	-	-	Wisconsin	156	0	20
Missouri	118	8	0	Wyoming	2	-	-
Totals	1969	929	326				

Note. A "-" indicates that a state supervisor responded to the question but did not know the specific number of programs within the state. [a] The New York state supervisor did not want to endorse any pre-engineering program therefore did not wish to discuss the different programs within the state. [b] The Minnesota supervisor stated that there were several proprietary programs that teachers were using to teach pre-engineering design but was unsure of the number of those programs.

This research acquired information concerning the demand for technology education teachers by surveying state level technology education supervisors from each of the 50 states. Supervisors were asked the number of middle and high school technology education teachers their state employed during the spring of 2009 as well as the number of vacancies during the same period. Resulting data indicated that there were 12,146 middle school and 16,164 high school teachers employed in the United States during the spring of 2009. Also, data showed that there were 367 middle school and 549 high school (a total of 916) vacancies.

Supervisors were also asked to estimate the number of vacancies their state expected to experience during the fall of 2009, 2012, and 2014. In United States middle schools, there are expected to be 353 vacancies during the fall of 2009, 487 in 2012, and 598 in 2014. Concerning high school vacancies, state supervisors estimated there will be 470 during the fall of 2009, 665 in 2012, and 837 in 2014.

Supervisors were asked if their state offered alternative licensure programs and if those programs modified existing teacher licensing processes. Forty-three of the 50 states offered alternative technology education teacher licensure programs. Of those 43 states, 34 have alternative licensure programs that modify existing state teacher licensure processes.

Supervisors were also asked if their state incorporated or were planning to incorporate pre-engineering curriculum into their technology education programs. Forty-nine of the 50 states had or were planning to adopt pre-engineering programs. Supervisors were asked for the number of Project Lead The Way®, Engineering byDesign™, and if there were any other pre-engineering programs offered in their state. Data indicated that there were a total of 1,969 Project Lead The Way®, 939 Engineering byDesign™, and 368 other types of pre-engineering programs in the United States.

Lastly, supervisors were asked if their state was working toward integrating Science, Technology, Engineering, and Mathematics (STEM) components into their technology education program structure. Forty-seven state supervisors indicated that their state was or were planning to integrate STEM components into their technology education programs. The results of this study will be presented in Chapter V, Summary, Conclusions and Recommendations.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This study examined the supply and demand of technology education teachers in the United States. To determine the supply, the number of institutions offering technology education teacher programs and the number of teachers those programs produced during the years of 2004-2005, 2005-2006, 2006-2007, and 2007-2008 was researched. Technology education supervisors from the 50 United States were surveyed to find the number of middle and high school technology education teachers employed and the number of vacancies in their states during the spring of 2009. Supervisors were asked what they estimated would be the number of technology education vacancies during the fall semesters of 2009, 2012, and 2014. Alternative technology licensure programs have been used in the past to fill vacant positions (Litowitz, 1998; Litowitz & Saunders, 1999). Supervisors were asked if their state offered alternative licensure programs and if those programs modified the normal teacher licensure process. Supervisors were also asked if their state was planning to incorporate pre-engineering curricula into their state technology education programs, specifically asking for the number of Project Lead The Way®, Engineering byDesign™, or "other" pre-engineering curricula. Lastly, supervisors were asked if their state was planning to incorporate Science, Technology, Engineering, and Mathematics (STEM) curricula into their state technology education programs. A summary, conclusions, as well as recommendations for future studies are included in this chapter.

SUMMARY

The purpose of this study was to determine the technology education teacher supply and demand in the United States. There were four research goals for this study. They were to determine 1) the number of technology education teachers produced in the United States, 2) the number of technology education teachers employed in United States public schools during the spring of 2009, 3) the number of vacant technology education teacher positions in United States public schools during the spring of 2009, and 4) the projected number of technology education teacher vacancies for the fall semesters of 2009, 2012, and 2014.

To meet current demands, technology education has evolved over the past several decades. Technology education programs have prepared students for highly sophisticated fields of study that "reinforces and complements the material that students learn in other classes" (ITEA, 2000, p. 6). Technology education teaches understanding and problem solving skills in medical, agricultural and related biotechnologies, energy and power, information and communication, transportation, manufacturing, and construction technologies (ITEA, 2007). However, the benefits of technology education are still generally "misunderstood by the public" (Sanders, 2000, p. 16). Johnson (1992) identified that technology education programs reinforce "academic content, higher order thinking skills, and promote active involvement with technology" (p. 26).

Technology education is an excellent format to integrate Science, Technology, Engineering, and Mathematics (STEM) studies by employing problem-based learning activities (Berentsen, 2006; Frazier, 2009; Moye, 2008; Ritz, 2006; Zinser & Poldink, 2005). Berry and Ritz (2004) illustrated how middle school technology education courses are a practical means of teaching geometry and measurement by solving "real world problems" (p. 23). The effects of technology education on increased student mathematics abilities have been identified in several studies (Dyer, Reed, & Berry, 2006; Frazier, 2009; Setter, 2006; Scarborough & White, 1994). Identification of increased success is critical given that the Elementary and Secondary Education (No Child Left Behind (NCLB)) Act requires each state to demonstrate student achievement gains in mathematics and science by 2008 (NCLB, 2001).

It is evident that technology education is beneficial in raising student technological literacy and core academic success. However the supply of technology education teachers produced in the United States has not met the increased demand (Gray & Daugherty, 2004; Ndahi & Ritz, 2003; Weston, 1997; Wright & Custer, 1998; Wright & Devier, 1989). Wright and Devier (1989) reported that in 1987, there was an approximate surplus of 70 industrial arts/technology education teachers in the United States "compared to a surplus of 100 the year before" (p. 3). Also, the number of students enrolled in industrial arts/technology teacher education programs declined significantly during the 1980s (Wright, 1989). Much of this reduction was blamed on high stakes testing in the core academic subjects (J. Ritz, personal communication, February 13, 2009).

Volk (1997) predicted the demise of the technology teacher education preparation profession by 2005 due to decreased technology education teacher enrollment trends. Certainly the profession continues to exist, however the profession's health is in question. One measure of health is to determine the supply of technology education teachers being produced in the United States. Wright and Custer (1998) stated that technology education teacher recruitment has been a concern for "more than two decades" (p. 58). Daugherty (1998) stated: "The greatest problem facing the technology education profession in the next decade will be the acute shortage of entering technology education teachers" (p. 24). Ten years have passed since Daugherty's statement and more than 20 since Wright's (1989) observation of the industrial arts/technology education teacher education decline. Still, the shortage continues. If the past downward trend continues, the outlook for the technology education profession looks very bleak!

In 1992, research conducted on technology teacher education programs revealed an "estimate of 706 technology teacher education graduates...a decline of approximately 27.4 percent in one year" (Young-Hawkins, 1996). The researcher did not specify an exact number of graduates; however it was evident that the downward trend of technology education teacher graduates had begun. Gray and Daugherty (2004) reported the United States was experiencing a "nationwide shortage of technology teachers" because of increased secondary student enrollment, teacher attrition, and the "decreasing number of universities offering technology education degrees" (p. 5).

Annually, the American Association for Employment in Education (AAEE) produces the *Educator Supply and Demand in the United States* document. The AAEE surveys school districts and colleges to determine current supply and demand of educators in 64 educational fields, including technology education. Between 2003 and 2007, and out of 55 possible reports from 11 United States regions, three regions reported that they had experienced *considerable shortages*, 32 reported that they experienced *some shortages*, and 12 of the regions reported as having a *balanced supply and demand* of technology education teachers. During the five year period, no region indicated that they had *some surplus* or a *considerable surplus* of technology education teachers. Data indicated that the 11 United States regions experienced some or considerable technology education teacher shortages, 74.5 percent of the time (AAEE, 2004; AAEE, 2005; AAEE, 2006; AAEE, 2007; AAEE, 2008). The AAEE reports are yet another indicator of a technology education teacher shortage.

Many researchers have performed studies focusing on supply and demand, alternative teacher licensure processes, teacher recruitment, etc., to determine the health of the technology education profession (Akmal, Oaks, & Barker, 2002; Daugherty, 1998; Dugger, French, Peckham, & Starkweather, 1991; Hill, 1999; Hoepfl, 2001; Householder, 1993; Litowitz, 1998; Meade & Dugger, 2004; Ndahi & Ritz, 2003; Newburry, 2001; Ritz, 1999; Steinke & Putnam, 2007; Volk, 1993, 1997, 2000; Weston, 1997; Wicklein, 2005; Wright & Custer, 1998; Wright & Devier, 1989; Young-Hawkins, 1996). While there continues to be many issues of concern, this study was limited to: 1) technology education teacher education programs in each of the 50 United States, 2) input of state technology education supervisors reflecting the demand in their state, 3) public middle and high school technology education teachers employed during the spring of 2009, 4) public middle and high school technology education teacher vacancies during the spring of 2009, and 5) institutions that produced and the number of licensed technology education teachers produced in 2004-2005, 2005-2006, 2006-2007, and 2007-2008.

The population of this study consisted of the 50 state technology education supervisors. A state technology education supervisor is the lead technology educator in their state. Supervisors are responsible for the development and approval of technology education curriculum, management of state and federal funding, management of the Technology Student Association (TSA) state chapter, and professional development of teachers. State technology education supervisors are employed by each state Department of Education.

A survey was the instrument used to collect information from state supervisors. The survey consisted of eight open-form and three closed-form questions. The survey was modeled after Weston (1997) and Ndahi and Ritz (2003) studies. The survey contained questions that answered the research problem and goals of this study.

A letter introducing the researcher and study was mailed to all 50 state technology education supervisors. The letter noted that this study will continue to build upon the database containing the status of technology education teacher supply and demand in the United States. Two weeks after the letter of introduction was mailed, surveys and cover letters were mailed to all supervisors. Three supervisors (6%) responded to the first mailing. A follow-up letter, with a survey included, was mailed to the 47 supervisors who had not responded. An additional seven (14%) supervisors responded to that mailing. Twenty percent of supervisors responded to the written survey. The researcher conducted telephone calls and was successful in gathering information from the remaining 80% of the supervisors who had not returned the survey. Using the survey and telephone communications methods, the researcher collected responses from all 50 (100%) of state technology education supervisors. The responses were collected, aggregated, and will be revealed in this chapter.

Industrial Teacher Education (ITE) Directories were reviewed to determine the number of institutions that offered technology education teacher programs and how many teachers those institutions produced in 2004-2005, 2005-2006, 2006-2007, and 2007-2008. Matrixes of nominal data were created to provide an illustration of the teachers produced.

The information revealed from this study will be critical when determining the future of the technology education profession. For the profession to continue to exist, it must provide the supply of teachers to meet the demands of the profession (Ritz, 1999; Volk, 1993, 1997, 2000; Weston, 1997). Literature written prior to this study has identified that the supply of technology teachers has not met the demand. The technology education teacher shortage realized decades ago continues and appears to becoming more extensive each year. The shortage threatens the very existence of the profession. This study is very important because it continues to track the "critical problem…. [of] insufficient quantities of qualified technology education teachers" (Wicklein, 2005, p. 7), also, because "assessment works best when it is ongoing and continuous, not episodic" (Day & Schwaller, 2007, p. 254).

CONCLUSIONS

Research Goal 1 was to determine the number of technology education teachers produced in the United States. To gain an answer for this goal, the 2004-2005, 2005-2006, 2006-2007, and 2007-2008 *Industrial Teacher Education (ITE) Directories* were reviewed. The document review found that in 2004-2005, there were 34 institutions that produced 338 technology education teachers (Schmidt & Custer, 2005). In 2005-2006, 32 institutions produced 315 technology education teachers (Schmidt & Custer, 2006). Twenty-nine institutions produced 311 technology education teachers in 2006-2007

(Schmidt & Custer, 2007). Finally, in 2007-2008, 27 institutions produced 258 technology teachers (Waugh, 2008).

Data obtained from *ITE Directories* identified a downward trend of institutions that produced technology education teachers as well as the number of teachers produced during the years of 2004 to 2008. This trend follows a similar downward pattern identified by Ritz (1999) and Ndahi and Ritz (2003). In 1995-1996, institutions produced 815 technology education teachers (Ritz, 1999). In 1996-1997 there were 635 technology teachers produced and in 1997-1998 there were 732 (Ritz, 1999). In 2001-2002, institutions produced 672 technology education teachers (Ndahi & Ritz, 2003). Figure 2 provides a graphic illustration of the downward trend of technology education teachers produced in the United States during the years of 1995/96, 1996/97, 1997/1998, 2001/02, 2004/05, 2005/06, 2006/07, and 2007/08.

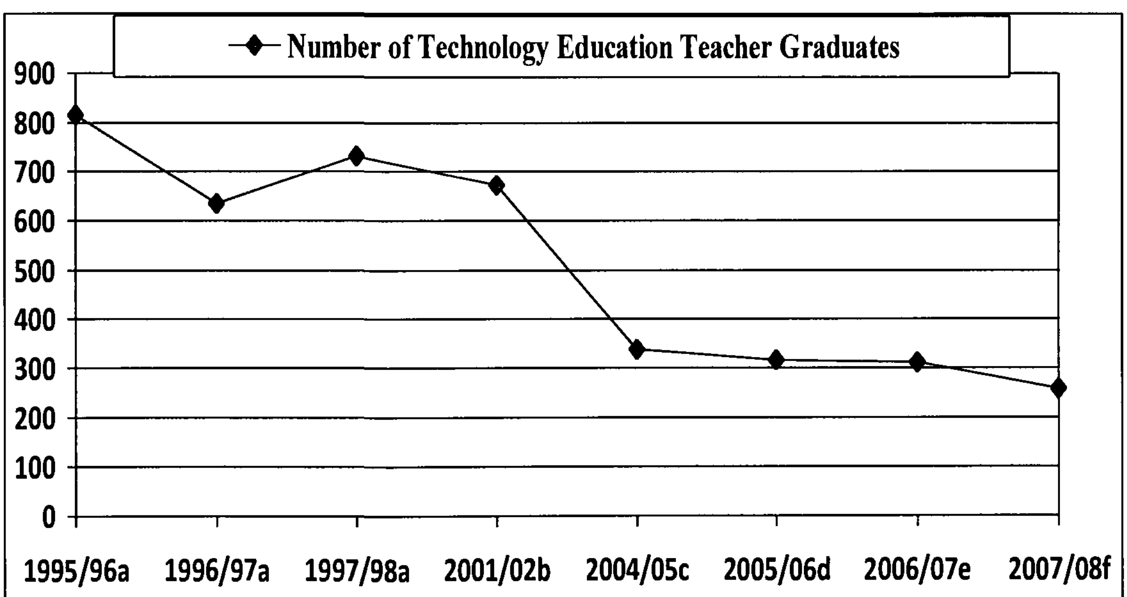

Figure 2. Downward Trend of Technology Education Teacher Graduates in 1995-1996, 1996-1997, 1997-1998, 2001-2002, 2004-2005, 2005-2006, 2006-2007, and 2007-2008.

[a] From Ritz, 1999. [b] Ndahi and Ritz, 2003. [c] Schmidt and Custer, 2005. [d] Schmidt and Custer, 2006. [e] Schmidt and Custer, 2007. [f] Waugh, 2008.

Research Goal 2 was to determine the number of technology education teachers employed in United States public schools during the spring of 2009. To find this information, state supervisors were asked two questions. Question 1 was: "What is the number of public middle school technology education teachers employed in your state during the spring of 2009?" Fifty supervisors (100%) responded. Data indicated that there were approximately 12,146 middle school technology education teachers employed in the United States during the spring of 2009.

Question 2 was: "What is the number of public high school technology education teachers employed in your state during the spring of 2009?" Fifty supervisors (100%) responded. Data indicated that there were approximately 16,164 high school technology education teachers employed in the United States during the spring of 2009. When summed, the approximate total number of middle and high school technology education teachers in the United States during the spring of 2009 was 28,310.

The Weston (1997) study reported that there were 17,552 middle school and 20,416 high school teachers (a total of 37,968 technology education teachers) employed in the United States in 1995. In 2001, Ndahi and Ritz (2003) found that there were 16,774 middle school and 19,487 high school, for a total of 36,261 technology teachers employed. This study found that there were approximately 12,146 middle school (not including Louisiana, Massachusetts, and Montana) and 16,164 high school (not including Massachusetts), for a total of 28,310 technology teachers employed in the United States during the spring of 2009. Based on the results of this study, there were approximately 5,406 fewer middle school technology teachers in 2009 than there were in 1995, a decrease of 30.8%. There were also 4,252 less high school technology teachers, a 20.9% decrease from the number found in the 1995 Weston (1997) study.

When comparing the number of teachers found in this study to the number of teachers employed in 2001 (Ndahi & Ritz, 2003) or compared to the 1995 number reported by Weston (1997), 35 (70%) states reported to have had fewer middle school teachers employed in 2009. Thirty-one (62%) of state supervisors indicated that they had fewer high school technology teachers employed in their state in 2009. Ten (20%) states indicated an increase in the number of middle school teachers. Seventeen states (34%) indicated that they had experienced an increase in the number of high school technology teachers employed. Table 18 provides the number of middle and high school technology teachers employed in the United States during the years of 1995, 2001, and 2009. Figure 3 provides a graphic illustration of the downward trend.

Research Goal 3 was to determine the number of vacant technology education teacher positions in United States public schools during the spring of 2009. To find this information, supervisors were asked Question 3, which was: What is the estimated number of vacant public middle school technology education positions in your state during the spring of 2009? Fifty supervisors (100%) responded. Data indicated that there were approximately 367 middle school technology education teacher vacancies in the United States during the spring of 2009. Question 4 asked: What is the estimated number of vacant public high school technology education positions in your state during the spring of 2009? Fifty supervisors (100%) responded. Data indicated that there

Table 18

Approximate Number of Middle and High School Technology Education Teachers Employed in the United States in 1995, 2001, and 2009

States	Middle School 1995	High School 1995	Middle School 2001	High School 2001	Middle School 2009	High School 2009
Alabama	99	64	120	85	73	26
Alaska	201	266	-	300	15	130
Arizona	700	925	250	435	0	1
Arkansas	70	0	65	10	65	15
California	2000	3000	1224	1224	900	918
Colorado	150	135	138	287	129	263
Connecticut	500	345	450	290	350	400
Delaware	75	100	36	62	30	60
Florida	950	450	1064	760	525	175
Georgia	225	225	230	350	201	300
Hawaii	48	117	10	5	0	59
Idaho	74	95	40	168	20	62
Illinois	1100	1100	900	900	240	1500
Indiana	700	400	650	650	620	640
Iowa	100	750	280	550	450	619
Kansas	30	45	210	430	215	445
Kentucky	135	290	125	225	30	125
Louisiana	100	350	100	350	-	154
Maine	80	198	230	110	165	80
Maryland	300	300	510	511	500	560
Massachusetts	375	275	375	275	-	-
Michigan	422	1014	425	425	30	44
Minnesota	300	400	380	500	400	328
Mississippi	69	242	0	395	40	450
Missouri	350	575	343	580	218	467
Montana	122	130	75	175	-	170
Nebraska	285	286	256	256	50	10
Nevada	65	11	70	10	30	10
New Hampshire	83	64	80	110	68	118
New Jersey	145	145	700	800	750	850

Table 18 (Continued).

States	Middle School 1995	High School 1995	Middle School 2001	High School 2001	Middle School 2009	High School 2009
New Mexico	97	196	150	150	130	135
New York	1700	1100	1700	1750	1755	945
North Carolina	355	325	360	350	236	224
North Dakota	31	120	30	81	35	65
Ohio	950	1250	1000	1000	960	950
Oklahoma	127	93	175	100	210	170
Oregon	150	30	-	-	208	52
Pennsylvania	1650	1650	1200	900	633	1267
Rhode Island	70	132	30	50	55	80
South Carolina	250	110	125	75	0	0
South Dakota	60	42	42	32	20	20
Tennessee	110	221	209	140	144	115
Texas	600	950	706	1498	588	1032
Utah	240	95	200	250	141	112
Vermont	100	41	-	-	0	200
Virginia	389	570	571	468	345	610
Washington	-	520	-	300	32	255
West Virginia	145	100	95	120	90	115
Wisconsin	675	575	600	750	450	838
Wyoming	-	-	245	245	0	0
Totals	17,552	20,416	16,774	19,487	12,146	16,164
	37,968		36,261		28,310	

Note: A "-" indicates that there were no data available.

were approximately 549 high school technology education teacher vacancies in the United States during the spring of 2009. When the two numbers were summed, data indicated that there were approximately 916 vacant middle and high school technology education teacher positions in the United States during the spring of 2009.

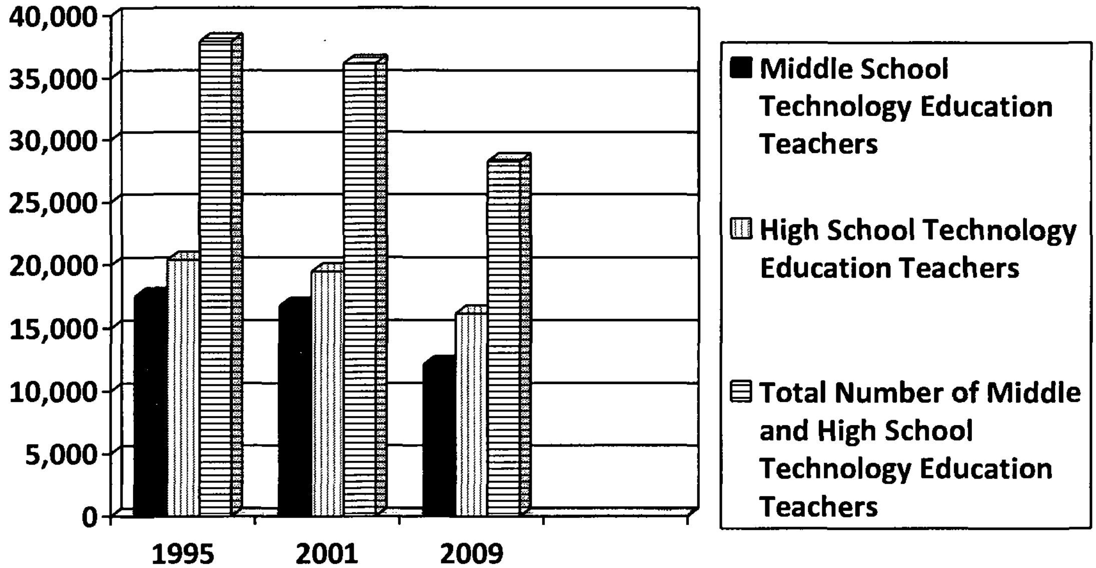

Figure 3. Downward Trend of Public Middle and High School Technology Education Teachers Employed in the United States, 1995, 2001, and 2009.

Weston (1997) reported that in nine states "256 technology education positions went unfilled in 1996 and several [states] reported they had to fill positions with teachers from other disciplines or used alternative certification programs to meet their needs" (p. 7). Whereas the data from only nine states were not sufficient to establish an overall status of technology education vacancies in the United States, it does illustrate that a significant number of vacancies did exist in 1996. Ndahi and Ritz (2003) reported that the "technology education profession was short 1665 licensed teachers" in 2001 (p. 28).

Similar to the Weston (1997) and Ndahi and Ritz (2003) studies, this study also found that a shortage of technology education teachers continued to exist – 916. However, there appeared to be an additional variable to consider - program closures. Supervisors from California, Georgia, Massachusetts, Oregon, Maine, and North Dakota indicated that their state had a limited number of vacancies because when technology education teachers have left positions, those positions were not filled and would probably not be filled in the future. Other states also may be experiencing the same situation. This new variable is similar to what Volk (1997) predicted would happen (and is happening) to technology education teacher preparation programs. He wrote: "It is very doubtful technology teacher preparation programs lost will ever return, and that very few new programs will have the opportunity to start, given the retrenchment efforts and budget cuts in higher education" (p. 69). Ndahi and Ritz (2003) stated that "the shortages will continue to increase" (p. 28). Unfortunately, it appears that program closures have and will continue to minimize the concern for vacated technology education positions in some states.

Research Goal 4 was to determine the projected number of technology education teacher vacancies for the fall semesters of 2009, 2012, and 2014. Question 5 was: What is the expected number of public middle school technology education teacher vacancies in your state for the fall of 2009, 2012, and 2014? Fifty of the 50 supervisors (100%) responded. The estimated number of middle school vacancies is projected to be 353 in 2009, 487 in 2012, and 598 in 2014.

Question 6 was: What is the expected number of public high school technology education teacher vacancies in your state for the fall of 2009, 2012, and 2014? Supervisors predicted 470 in 2009, 665 in 2012, and 837 in 2014.

Between 2004 and 2008, colleges and universities produced an average of 306 technology education teachers per year. During that time, the annual average number of new teachers declined by 3.5 percent each year. If that trend continues, there will be approximately 242 technology teachers produced in 2009, 196 in 2012, and 173 in 2014.

Supervisors reported that there will be approximately 823 middle and high school technology teacher vacancies in the fall of 2009, 1,152 in 2012, and 1,435 in 2014. Using the estimated number of technology teacher graduates and comparing them to the estimated number of vacancies, there will be a shortfall of 581 middle and high school technology teachers in the fall of 2009, 956 in 2012, and 1,262 in 2014. When estimating the supply and demand of technology education teachers in the United States, there will be an estimated shortfall of 2,799 teachers between the fall of 2009 and 2014. Figure 4 provides a graphic illustration of the estimated supply and demand of technology education teachers during the fall of 2009, 2012, and 2014.

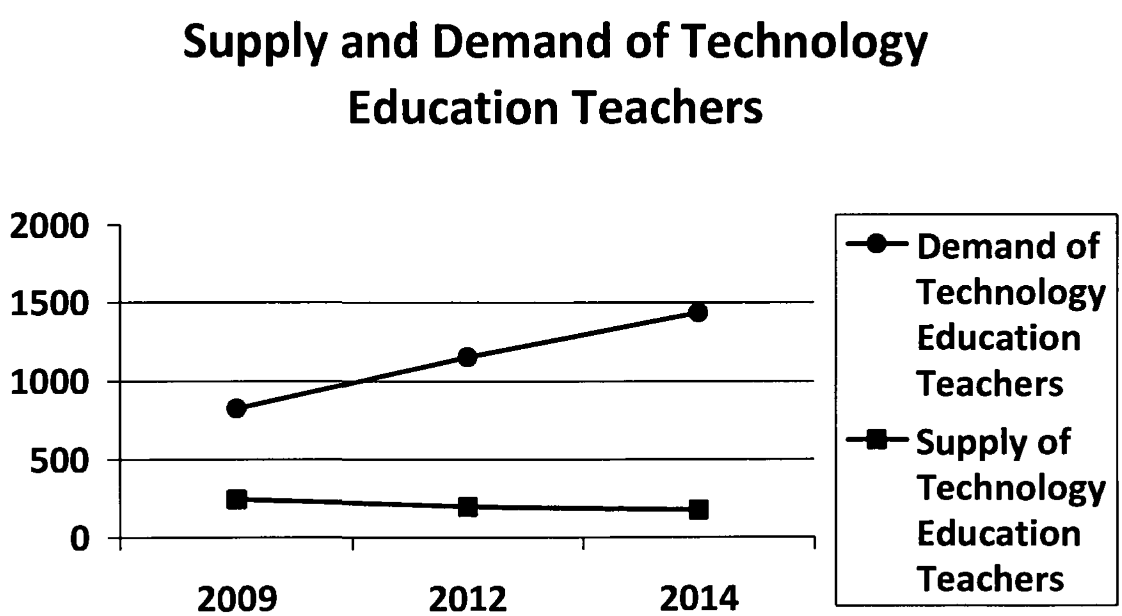

Figure 4. Estimated Supply and Demand of Technology Education Teachers 2009, 2012 and 2014.

One commonality between supervisors was the effect that the current "credit crisis" had on the economy and teacher retirement plans. With recent loss of retirement funds, some teachers that were planning to retire have opted to continue teaching until the economy rebounds.

Westin (1997) reported that some states "had to fill positions with teachers from other disciplines or used alternative certification programs to meet their needs" (p. 7). Ndahi and Ritz (2003) reported that 39 states used alternative technology education teacher licensure paths in order to meet the technology education teacher demand. This study found that 43 states used alternative technology education licensure programs. Thirty-four of the 43 state programs modified the normal teacher licensure process. Many of these modifications accommodated business and industry personnel, enticing them to become career switchers. States also encouraged current mathematics and science teachers to obtain their technology education teacher licensure.

Some technology education leaders felt that technology education should take on an engineering design focus (Custer & Erekson, 2008; Daugherty & Mentzer, 2008; Lewis, 2004, 2005; Wicklein, 2006). The change to an engineering focus may be an effort to avert the demise of technology education as Volk (1993, 1997, 2000) had suggested would occur. State supervisors were asked if their states were planning to incorporate pre-engineering principles into their technology education programs. Fifty supervisors responded, 49 (98%) of which stated that there were school districts that were incorporating pre-engineering principles into their programs. Supervisors were further asked to report the number of Project Lead The Way®, Engineering byDesign™, or if there were "other" pre-engineering programs that were being taught within their state.

Eight (16%) of the 49 supervisors indicated that they were unsure of the number of pre-engineering programs in their state. Thirty-seven supervisors (74%) reported that Project Lead The Way® programs were being taught in their state. When the number of those programs were summed, there was a total of 1,969 Project Lead The Way® programs. Fifteen supervisors stated that there were a total 929 Engineering byDesign™ programs, and 13 supervisors stated that there were 368 "other" types of pre-engineering curricula offered in their states.

Science, Technology, Engineering, and Mathematics (STEM) is a term representing an integration of these content areas into technology education programs. By employing problem-based learning activities, technology education is an excellent format to perform this integration (Berentsen, 2006; Moye, 2008; Ritz, 2006; Zinser & Poldink, 2005). Supervisors were asked if their state was working toward integrating STEM components into the technology education program structure. Fifty supervisors responded; 47 (94%) stated that their state was planning to integrate STEM into their technology education programs.

The purpose of this study was to determine the technology education teacher supply and demand in the United States. Based upon data collected to answer the research goals, this study found that on an annual basis, fewer institutions were offering technology education teacher licensure programs and fewer teachers were being produced. There were also fewer technology education teachers employed and there was a significant amount of vacancies during the spring of 2009. It also appears that the decreasing number of new technology education teachers will not meet the estimated demand between the fall of 2009 and 2014. Based on trends identified in previous studies (Weston, 1997; Ndahi & Ritz, 2003) and this study, the supply and demand of technology education teachers continues to be on a downward spiral as Weston (1997) suggested.

RECOMMENDATIONS

Weston (1997) said "The time to take action is now, but just how or if the technology education teacher shortage is solved can only be answered in the years to come" (p. 9). Data indicated that institutions were producing fewer technology education teachers each year. The question must be asked, what has the profession done differently since Weston's study to ensure the survival of the profession? To effect change, recommendations should be reviewed and acted upon. If the technology education profession is to survive, the time for action to ensure that survival is NOW! The following recommendations are offered to eliminate the shortage of technology education teachers in the United States.

1. Technology education teachers are in contact with their students each day. These students are prospective technology education teachers. This researcher reiterates and recommends one of Ndahi and Ritz's (2003) recommendations, which was: "If all high school teachers made a commitment to send one member of this year's graduating class to pursue a teaching degree in technology education, we could eradicate the technology education teacher shortage" (p. 30).
2. Volk (1997) posed several questions to technology education leaders, one of which was: "why are students not considering a career in technology education" (p. 69)? The second, "What is being done right in those few technology education teacher programs that are succeeding" (p. 69)? These two questions should be

reiterated in a study designed to determine the reasons why students do or do not choose a career as a technology education teacher.

3. Old Dominion University has taken the challenge to monitor the status of the technology education profession (Moye, 2009; Ndahi & Ritz, 2003; Weston, 1997). Old Dominion University should conduct a follow-up technology education supply and demand study in 2014, and every five years thereafter. The studies should establish current status and future needs of the technology education profession.
4. This study found that the definitions of technology education, industrial technology, and trade and industry courses were not well defined. A study should be performed to determine how states differentiate between these three areas of study and what the implications would be if the lack of clear definitions continues to exist.
5. This study identified that between 2004 and 2008, an average of 2.3 technology education teacher preparation programs have closed each year. Program declines may be resultant of the lack of students entering the technology education profession. A study should be performed asking high school technology education teachers why they feel their students are not entering into the profession. The study should also ask teachers of their recommendations. Teachers that have had students enter into the profession should be asked why they felt their students chose to pursue the profession.
6. Alternative licensure programs have helped alleviate teacher shortages (Hoepfl, 2001; Litowitz, 1998; Volk, 1997). This study found that 43 states had alternative

technology education teacher licensure programs in 2009. A study should be performed to find the different types of programs and which programs have experienced the most success in placing qualified technology education teachers in the classroom.

7. Pre-engineering curricula is becoming more common in technology education courses (Custer & Erekson, 2008; Lewis, 2004, 2005; Ritz, 2006; Wicklein, 2006). This study found that 49 states currently had or were planning to adopt pre-engineering courses into their technology education programs. A study should be performed to determine the advantages and/or disadvantages of integrating pre-engineering content into technology education. The study should also survey the attitudes of teachers, students, and parents concerning this integration.
8. Technology Student Association (TSA) fully supports the technology education profession. Technology students should be given the opportunity to participate in TSA events. A study should be performed to determine if students who are active in TSA are more apt to become technology education teachers.
9. Technology education teachers should advertise their success stories. They should attend parent/student organizational meetings to discuss what technology education can do for students. Teachers should publish success stories in local newspapers and general education professional publications.
10. Standardized tests are considered tools that gauge student success. In 2008 – 2009, the National Assessment Governing Board/National Assessment of Educational Progress (NAGB/NAEP) developed an assessment tool designed to

gauge student technological literacy (NAGB, n.d.). State technology education leaders should provide state teachers with the tools such as the NAEP technological literacy assessment to determine if their programs are preparing technologically literate students that are ready for future education and workplace experiences.

11. "Enrollment in, and graduation from, technology education teacher education programs are on a downward spiral [and] the demand for teachers is on an upward trend greatly accelerating the gap between supply and demand" (Weston, 1997, p. 6). To determine and maintain the status of technology education teachers and programs within each state, state technology education leaders should improve their mechanisms to collect and evaluate current supply and demand of technology education teachers within their state.
12. The United States Department of Education publishes a list of teacher shortage areas for each state annually (USDOE, 2008). Also, the American Association for Employment in Education (AAEE) creates a teacher supply and demand document annually. These organizations gather and disseminate this information for "state department and education agency officials... [to make] decisions about funding, education policy, and legislative mandates" (AAEE, 2008, p. 2). It is critical that states accurately report the severity of need for technology education teachers in their state. It is recommended that state technology education leaders gather data concerning the supply and demand of technology education teachers within their state and make sure that the information is accurately reported to the USDOE and AAEE and to provide data for studies such as this study.

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LIST OF APPENDICES

APPENDIX A

LIST OF STATES AND STATE TECHNOLOGY EDUCATION SUPERVISORS

State	Supervisor	State	Supervisor
Alabama	Ben Schelerman	Montana	Don Michalsky
Alaska	Helen Mehrkens	Nevada	Michael Raponi
Arizona	Tracy Rexroat	Nebraska	Tony Glenn
Arkansas	Dick Burchett	New Hampshire	Ed Taylor
California	Dennis Guido	New Jersey	Susan Sullivan
Colorado	Ben Nesbitt	New Mexico	Tony Korwin
Connecticut	Greg Kane	New York	Phil Dettelis
Delaware	Sharon Rookard	North Carolina	Brian Moye
Florida	Duane Hume	North Dakota	Matt Strindon
Georgia	Ron Barker	Ohio	Richard Dieffenderfer
Hawaii	Steven Kow	Oklahoma	Kevin Terronez
Idaho	Monti Pittman	Oregon	Tom Thompson
Illinois	Steve Parrott	Pennsylvania	William Bertrand
Indiana	Mike Fitzgerald	Rhode Island	Vanessa Cooley
Iowa	Ken Maguire	South Carolina	Benjamin T. Martin
Kansas	R. J. Dake	South Dakota	Ray Tracy
Kentucky	Henry Lacy	Tennessee	Thomas D'Apolito
Louisiana	John Birchman	Texas	John Ellis
Maine	Lora Downing	Utah	Darrell Andelin
Maryland	Luke Rhrine	Vermont	John Fischer
Massachusetts	Jake Foster	Virginia	Lynn Basham
Michigan	Bruce Umpstead	Washington	Moe Broom
Minnesota	John Rapheal	West Virginia	Kathy Gillman
Mississippi	Valerie Taylor	Wisconsin	Brent Kindred
Missouri	Doug Miller	Wyoming	Joe Baker

APPENDIX B

SURVEY

The purpose of this survey is to determine current and projected technology education teacher demand within your state, if your state is moving toward including pre-engineering programs, and if your state offers alternative technology education licensure programs. The information from each state will be compiled to determine the overall technology education teacher demand in the United States.

This survey will use an open and closed-form format. Please write in each of your responses or circle the correct answer.

1. What is the number of public middle school technology education teachers employed in your state during the spring of 2009? ________________

2. What is the number of public high school technology education teachers employed in your state during the spring of 2009? ________________

3. What is the estimated number of vacant public middle school technology education positions in your state during the spring of 2009? ________________

4. What is the estimated number of vacant public high school technology education positions in your state during the spring of 2009? ________________

5. What is the expected number of public middle school technology education teacher vacancies in your state for the fall of: 2009____________, 2012 ____________, 2014 ____________

6. What is the expected number of public high school technology education teacher vacancies in your state for the fall of: 2009 ____________, 2012 ____________, 2014 ____________

7. Does your state offer alternative licensure programs? Yes or No

8. If yes, do programs modify the existing state teacher licensure process? Yes or No
   If yes, please explain the modification(s) or attach a copy of the regulation(s): -

____

____

9. Is your state planning to adopt pre-engineering curriculum into technology education programs? Yes or No

10. If yes, please indicate the approximate number of:
Project Lead The Way: _______ Engineering byDesign: _______ Other: _______

11. Is your state working toward integrating STEM components into the technology education program structure? Yes or No

Thank you for your participation!

APPENDIX C
LETTER OF INTRODUCTION

February 17, 2009

[address of recipient]

Dear ____:

We are working to determine the supply and demand of technology education teachers in the United States. In approximately two weeks we will ask you to complete a survey that will determine the following information:

- The number of public middle and high school technology education teachers employed in your state.
- The number of public middle and high school technology education vacancies you anticipate in the upcoming years of 2009, 2012, and 2014.

Your input will help technology education leaders understand the extent of the technology education teacher shortage in the U.S. The information you provide could help determine future recruitment needs. The survey will be voluntary.

We anticipate your help in determining the supply and demand of technology education teachers in your state so we may determine the status at the national level. Thank you!

Sincerely,

Johnny J. Moye
Old Dominion University, Ph.D. Candidate
Telephone: 757-546-0151
email: jmoye003@odu.edu

John M. Ritz
Professor and Chair
Old Dominion University

APPENDIX D

SURVEY COVER LETTER

March 2, 2009

[address of recipient]

Dear ____:

Two weeks ago we sent you a letter indicating that we would be asking you to complete a survey. The information sought in the enclosed questionnaire is critical in determining the status of technology education teachers in your state and the nation. The data you gather concerning your state will help you address current and future technology education teacher shortages. Your input will also allow us to compile the information from each state to determine the status of technology education in the United States. This study will continue to build upon the database containing the status of technology education teacher supply and demand in the United States.

Your input as the state technology education specialist is very valuable. We respectfully ask that you complete the enclosed survey and return it to in the enclosed self-addressed stamped envelope no later than March 20, 2009.

Your participation is totally voluntary. At any time you may withdraw from participation in this study. Each survey is serialized to identify who responded. During data collection all returned surveys will be maintained in a locked storage cabinet and destroyed by shredding once the data have been compiled.

Thank you in advance for your time and cooperation.

Sincerely,

Johnny J. Moye
Old Dominion University, Ph.D. Candidate
Telephone: 757-546-0151
email: jmoye003@odu.edu

John M. Ritz
Professor and Chair
Old Dominion University

APPENDIX E

FOLLOW-UP LETTER

March 24, 2009

<<Address of Recipient>>

Dear :

Approximately three weeks ago I sent you a survey requesting your participation in research concerning the supply and demand of technology education teachers in the United States. I am sure that you have a very busy schedule and find it difficult to complete everything that you already have to do. I am asking again that you complete the enclosed survey and return it to me by April 10, 2009. Your input as the state technology specialist is critical to the success of this study.

If you have already mailed your response, I thank you for your support. If you have any questions regarding the survey or the research in general, please email or telephone me.

Thank you for your assistance.

Sincerely,

Johnny J. Moye
Old Dominion University, Ph.D. Candidate
Telephone: 757-546-0151
email: jmoye003@odu.edu

John M. Ritz
Professor and Chair
Old Dominion University

Enclosure: Technology Education Demand Survey

APPENDIX F

STATE SUPERVISOR COMMENTS

State supervisors made several comments that amplified the data they submitted for this study. Below are comments: they have been categorized by the survey questions: Concerning the number of public middle and high school teachers in each state, supervisors also stated:

- The Georgia supervisor indicated that the number of technology education programs in the "metro areas" were growing but the programs in the "county areas" were declining. He stated that when a sole technology education teacher leaves a county, that program would close rather than hire a new teacher. He also stated that there are some technology education teachers that teach both high and middle school (R. Barker, personal communication, April 13,2009).
- The Illinois supervisor stated that some of the trade and industry teachers could also be counted at technology education teachers (S. Parrott, personal communication April 29,2009).
- The Massachusetts supervisor stated that there were still technology education programs in the state but many have "evolved into programs that are now being taught in mathematics and science departments. Therefore, it is difficult to determine the number of programs, teachers, and teacher shortages in the state" (J. Foster, personal communication, April 22, 2009).
- The Oregon supervisor stated the state's middle school programs "are disappearing" (T. Thompson, personal communication, April 17, 2009).

- The North Dakota supervisor stated that there were approximately 10 teachers that taught both middle and high school technology education and that some of the teachers were even shared between school districts. He also stated that there were many middle schools programs that have closed (R. Tracy, personal communication, April 17, 2009).
- The California supervisor stated that the state would not experience any technology education shortages in the upcoming years because the lack of funding will dictate the closure of any programs when a teacher vacates that position (D. Guido, personal communication, April 22, 2009).
- The South Dakota supervisor indicated that up to 80% of the state's current technology education teachers will be eligible to retire within the next five years (R. Tracy, personal communication, April 17, 2009).

Eighteen state supervisors provided additional comments concerning pre-engineering curricula in technology education courses. Those comments were:

- The Alaska supervisor said that there are five Project Lead The Way® programs in the state. She also stated that they have no Engineering byDesign™ programs but they are interested in investigating that curricula (H. Mehrkens, personal communication, April 15, 2009).
- The Georgia supervisor stated that the state had "18 or 19 Project Lead The Way® Programs" and that about 18 schools used the EbD™ curriculum as a resource. There was also one school that used the Boston Museum Engineering the Future program (R. Barker, personal communication, April 13, 2009).

- Hawaii adopted the Dr. Willard Daggett Application (pre-engineering) Model in 15 of their schools (S. Kow, personal communication, April 17, 2009).
- The Indiana supervisor indicated that the state would like to add Engineering byDesign™ courses into their state technology education program curriculum (M. Fitzgerald, personal communication, April 17, 2009).
- The Kansas supervisor stated that the number of schools offering Project Lead The Way was increasing at a very fast pace. He stated that on January 7, 2009, there were 21 high schools and seven middle schools offering PTLW®. By April 13, 2009, the numbers had increased to 25 (or 26) high schools and 11 middle schools offering PLTW®. He also stated that there were less than 10 schools offering Engineering byDesign™ courses but many of the schools were using that curricula as resource material (R. Dake, personal communication, April 13, 2009).
- The Montana supervisor indicated that curriculum is controlled by local school districts. He knows that there are some schools that have Project Lead The Way® courses but was unable to specifically identify which ones (D. Michalsky, personal communication, April 13, 2009).
- The Nebraska supervisor said that nine schools within the state offered Project Lead The Way® programs and that there are some other "hybrid" pre-engineering courses within the state. There were no EbD™ courses being taught in Nebraska (T. Glenn, personal communication, April 13, 2009).
- New Mexico has three PLTW® programs in the state. The state supervisor stated that much of his state was rural and expressed concerns about the cost of the

program. He indicated that they were planning to incorporate EbD™ courses in the state (T. Korwin, personal communication, April 29, 2009).

- All North Dakota middle and high schools offer EbD™ courses. Some teachers follow the curriculum very closely and some incorporate the information into the courses that they are teaching (M. Strinden, personal communication, April 17, 2009).
- The Oklahoma supervisor indicated that the state has made 200 EbD™ resources available and that there are currently 200 "other" types of pre-engineering modules available to Oklahoma schools (K. Terronez, personal communication, April 17, 2009).
- The Oregon supervisor indicated that "Oregon does not adopt curriculum in this area" (T. Thompson, personal communication, April 17, 2009).
- The Pennsylvania supervisor indicated the number of PLTW (50)® and EbD™ (190) but indicated that the "other" category was "unknown" (W. Bertrand, personal communication, March 23, 2009).
- South Dakota currently has one PLTW® program being taught. Some schools are evaluating the EbD™ curriculum with intentions to start offering some of those courses (R. Tracy, personal communication, April 17, 2009).
- In Tennessee, the four PLTW® programs were divided between technology education and Trade and Industry programs. Engineering byDesign™ must be taught in each middle and high school. There are also 47 schools that use the Boston Museum Engineering the Future program (T. D'Apolito, personal communication, April 17, 2009).

- The Utah supervisor stated that there were 33 PLTW® programs in the state. Utah did not have any EbD™ courses but they were "looking at bringing them into our rural schools" (D. Andelin, personal communication, April 15, 2009).
- Virginia has state developed pre-engineering courses which were being offered at 42 different high schools. There were 44 PLTW® programs in the state. Virginia renewed its CATTS Consortium State status again in 2008. The supervisor stated that several schools were evaluating EbD™ courses (L. Basham, personal communication, April 17, 2009).
- The Wisconsin supervisor stated: "We already have pre-engineering curriculum in about 123 H.S." and concerning the other category, "most of these were self developed by teachers" (B. Kindred, personal communication, April 13, 2009).
- The Wyoming supervisor stated that "Wyoming is a local control state. The state cannot impose curricula." The supervisor also stated "The Department of Education advocates STEM and Project Lead The Way®" (J. Baker, personal communication, March 20, 2009).

Six supervisors provided additional comments concerning the integration of STEM components into state technology education programs. Those comments were:

- In Alaska, for the past eight or nine years there has been a movement to incorporate science and mathematics into all of their academic coursework, including technology education (H. Mehrkens, personal communication, April 15, 2009).

- The Montana supervisor indicated that the state would encourage the integration of STEM into technology education courses but local school districts would make that determination (D. Michalsky, personal communication, April 13, 2009).
- The Oklahoma supervisor stated that state technology education programs are in "a continuous alignment with all cluster areas" (K. Terronez, personal communication, April 17, 2009).
- The Oregon supervisor stated that "All curriculum decisions are made locally" (T. Thompson, personal communication, April 17, 2009).
- The Pennsylvania supervisor stated: "We are starting to see an increase in elementary technology education" (W. Bertrand, personal communication, March 23, 2009).
- The Utah supervisor said that during the last 10 years "there has been a tremendous movement to integrate math, science, and other academics into our technology education programs" (D. Andelin, personal communication, April 15, 2009).

Additional comments made by supervisors:

- The California supervisor indicated that the state received a 20% cut to their Career and Technical Education programs. A proposition was before the state to cut an additional nine billion dollars to public education "which would definitely effect technology education" (D. Guido, personal communication, April 22, 2009).
- The Delaware supervisor stated that there were no technology education teacher preparation programs in the state and that she had to "go outside of the state to get

my technology teachers." Delaware targets industry professionals to become technology teachers. (S. Rookard, personal communication, May 8, 2009).

- The Iowa supervisor stated that high schools must have programs that support workforce development of students. Many of their technology education courses (and teachers) would be considered trade and industry in other states (K. Maguire, personal communication, April 22, 2009).
- In Maryland, career switchers populate a large number of the technology education teacher positions. Alternative programs target career switchers (L. Rine, personal communication, April 17, 2009).
- The Massachusetts supervisor stated that there were still technology education programs in the state but many had "evolved into programs that are now being taught in mathematics and science departments. Therefore, it is difficult to determine the number of programs, teachers, and teacher shortages in the state" (J. Foster, personal communication, April 22, 2009).
- The Mississippi supervisor (supervisor position was actually vacant and was being filled by a person from a different content area) indicated that some technology education teacher positions are filled with teachers that were not licensed technology education teachers (V. Taylor, personal communication, April 17, 2009).
- Ohio has an alternative licensure program for technology education teachers however; the supervisor said that it is rarely used because Ohio is experiencing an "even supply and demand flow of teachers" This "even flow" is due to the

number of technology education teacher graduates being produced by state universities (R. Dieffenderfer, personal communication, April 23, 2009).

- The Oregon supervisor stated that there was not a strong emphasis on technology education in his state. Oregon does not use the International Technology Education Association's *Standards for Technological Literacy*; they use the International Society for Technology in Education (ISTE) standards. He further stated that, in Oregon, Perkins funding drives what is being offered in the state (T. Thompson, personal communication, April 17, 2009).
- Washington has one middle school program. The program was temporary and "once the grant supporting the program sunsets, there will no longer be a middle school technology education program in Washington" (M. Broom, personal communication, April 17, 2009).

VITA

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Education:

- Master of Science, Occupational and Technical Studies, concentration in middle and secondary teaching, technology education, Old Dominion University, May 2003
- Bachelor of Science (Cum Laude), Regents College of New York, April 2000
- Associate in Science (Magna Cum Laude), Tidewater Community College, May 1999

Presentations:

Moye, J. J. (2009, March). *Integrating Core Academic Information into Your Geospatial Technology Course.* Presented at the International Technology Education Conference, Louisville, KY.

Moye, J. J. (2008, February). *Foundations of technology effect upon increased success on standardized mathematic and science examinations; research introduction and requirements.* Presented at the International Technology Education Conference, Salt Lake City, UT.

Reed, P., Harrison, H., Moye, J., Opare, P., Ritz, J., & Skophammer, R. (2008, February). *Yes, there is research support for technology education!* Presented at the International Technology Education Conference, Salt Lake City, UT.

Ritz, J., Carper, S., & Moye, J. (2007, September). *Engineering byDesign™ assessments.* Presented at the Center to Advance the Teaching of Technology and Science State Advisor Leadership Forum, Herndon, VA.

Publications:

Moye, J. J. (2007). Teaching technology – It couldn't get any better. *The Technology Teacher, 67*(4), 22-26.

Moye, J.J. (2008). How I define success. *The Virginia Journal of Education, 101*(6), 15-17.

Reed, P. A., Harrison, H. L., Moye, J. J., Opare, P. B., Ritz, J. M., & Skophammer, R. A. (2008, February, 22). *Research supporting technological literacy.* Paper presented at the 2008 ITEA National Conference. Abstract retrieved September 10, 2008, from http://www.iteaconnect.org/mbrsonly/Library/Research/Research%20Task%20Force%2Final_b.pdf

Moye, J. J. (2008). Technical and socio-cultural contexts of technological literacy. *ITEA Online Library-Scholarly Articles,* Retrieved September 10, 2008 from: http://www.iteaconnect.org/mbrsonly/Library/TechnologySA/Moye%20Graduate%20Papers%2031708.pdf

Moye, J. J. (2008). Starting a new technology course? An opportunity to develop student technological literacy. *The Technology Teacher, 68*(2), 27-31.

Moye, J. J. (2009). The foundations of technology course: Teachers like it! *The Technology Teacher, 68*(6), 30-33.
Moye, J. J. (2009). Making your mark. *The Virginia Journal of Education, 102(6),* 15-17.

Grants and Fellowships:
- February 2008: Pitsco/Hearlihy/FTE Grant
- Spring 2009: Old Dominion University Fellowship

Professional Organization Membership:
- International Technology Education Association (since 2002)
- Virginia Technology Education Association (since, 2003) (Elections Committee Chair since 2007)
- Council on Technology Teacher Education (since 2006) (Marketing committee since 2006)
- Council of Supervisors (since 2009)
- National Education Association (since 2003)
- Virginia Education Association (since 2003)
- Chesapeake Education Association (since 2003)
- Association of Career and Technical Education (since 2008)
- Virginia Association of Career and Technical Education (since 2008)

Awards and Honors:
- May 2009, Old Dominion University 2008-2009 Outstanding Technology Education Graduate Student Award
- March 2009, International Technology Education Teacher Excellence Award
- March 2009, Donald Maley Spirit of Excellence – Outstanding Graduate Student Citation
- August 2008, Virginia Technology Education Association, Virginia High School Technology Teacher of the Year.
- August 2008, Virginia Technology Education Association, Achievement Award

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