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Industrial Technology Education Teachers Perceptions of National Standards for Technological Literacy in the State of Arizona

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INDUSTRIAL TECHNOLOGY EDUCATION TEACHERS PERCEPTIONS OF NATIONAL STANDARDS FOR TECHNOLOGICAL LITERACY IN THE STATE OF ARIZONA

by

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I have read the thesis of Allan R. McRae in its final form and have found that (1) its format, citations, and bibliographical style are consistent and acceptable and fulfill university and department style requirements; (2) its illustrative materials including figures, tables, and charts are in place; and (3) the final manuscript is satisfactory to the graduate committee and is ready for submission to the university library.

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ABSTRACT

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Today, it is becoming increasingly clear that there is a growing interest, concern, and need for technological literacy. To this end, the International Technology Education Association (ITEA) through the Technology for All Americans Project, has developed and promulgated the *Standards for Technological Literacy: Content for the Study of Technology*. This effort is part of the ongoing initiative to develop technology standards on a national level, and to focus on what every student in grades K-12 should know and be able to do in order to achieve technological literacy (ITEA, 2000).

The purpose of this study was to investigate the perceived knowledge, use, and acceptance of national content standards by industrial technology education teachers in the state of Arizona.

This study used a descriptive survey design in which self-reported perceptional and demographic data were obtained from industrial technology education teachers in Arizona. The survey was delivered via the web for expediency and reduced cost in collecting the data. Due to the relatively small size of the population and historically low response rate from teachers in the field, a census study was conducted (Creswell, 2002). The instrument was adapted from a survey questionnaire developed through Utah State University after a review of the literature failed to reveal any validated instrument that could be used to collect the requisite data.

In addition to investigating the perceived level of knowledge, use, and acceptance of national content standards, the study also investigated the perceptions of industrial technology teachers as to the importance of the content standards with regard to their students and to classroom instruction. Frequencies, percentages, means, standard deviations, and correlational analyses were performed on the data.

Results of the study showed that in spite of a low percentage of membership in either the state or international governing organizations, the majority of industrial technology education teachers in Arizona endorsed all of the national content standards presented in the *Standards for Technological Literacy*. This is in contrast to an historic lack of acceptance of technology education by industrial arts teachers. The study also revealed that the majority of technology education teachers in Arizona perceived they would benefit from additional training on all of the standards.

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CHAPTER I

INTRODUCTION

Technology education teachers around the country have been given the charge by local, state, and national representatives to teach their students to become technologically literate (Bybee, 2002). Technological literacy can be defined as "the ability to use, manage, understand, and assess technology" (ITEA, 2000a, p. 9). These teachers are uniquely positioned as the educators in K-12 schools dedicated to teaching a technological literacy curriculum. To help teachers accomplish this objective, national *Standards for Technological Literacy* (STL) have been developed by the International Technology Education Association to identify the technological content that should be taught. Specifically, STL lists 20 standards that can be used to develop curricula in grades K-12. The standards detail the technological facts, concepts, and capabilities that students should master at each level of schooling in order to obtain technological literacy (ITEA, 2000).

Technological literacy is particularly important in a rapidly evolving technological world. Citizens should understand and be comfortable with the concepts and workings of modern technology. From a personal standpoint, virtually everyone benefits both at work and at home by being able to choose the best products for their purposes, to operate the products properly, and to troubleshoot them when something goes wrong. From a societal standpoint, an informed citizenry improves the chances that decisions about the use of technology will be made rationally and responsibly. For these reasons and others, a growing number of voices worldwide have called for the study of technology to be included as a core subject in elementary, middle, and secondary schools (Dugger, 2001). Among the experts who have addressed this issue, the value and importance of teaching about technology is widely accepted. Two recent Gallup polls indicate the American public is virtually unanimous in regarding the development of technological literacy as an important goal for people at all levels and near total consensus was found in the public sampled that schools should include the study of technology in the curriculum (Rose, 2004).

A major constraint in developing technological literacy in the United States is that technology education is not taught as a core subject. Knowing that technology education is more than a class that uses and learns about computers, today only 14 states require some form of technology education for K-12 students (Rose, 2004), and this instruction is usually affiliated with technician-preparation or school-to-work programs. Massachusetts became the first state (in 2000) to add a combined engineering/technology component to its K-12 curriculum. Elsewhere, a few schools offer stand-alone courses at all grade levels; however, the majority of school districts devote little attention to technology. "This is in stark contrast to the situation in some other countries, such as the Czech Republic, France, Italy, Japan, the Netherlands, Taiwan, and the United Kingdom, where technology education courses are required in middle school or high school" (Young et al., 2003, p. 141)

One factor that is holding back the development of technological literacy is inadequate preparation of other K-12 teachers to teach about technology. Today, there are approximately 40,000 technology education teachers nationwide, mostly at the middle-school and high-school levels. By comparison, there are some 1.7 million teachers in grades K-12 responsible for teaching science. The integration of technology content into other subject areas--such as science, mathematics, history, social studies, the arts, and language arts--could greatly boost technological literacy (Young et al., 2003).

Another factor that could broaden the acceptance of technology education in the curriculum is strengthening the research base related to technological literacy. There is a lack of reliable information about what teachers know and believe about technology, as well as the cognitive steps they use in gathering this knowledge (Henderson, 2003). These gaps have made it difficult for curriculum developers to design teaching strategies and for policymakers to enact programs fostering technological literacy. Building this scientific base will require creating cadres of competent researchers, developing and periodically revising a research agenda, and allocating adequate funding for research (Young et al., 2003).

Even with the importance of technology in our lives today, the fact is that the disciplined study of technology education remains unimportant to many teachers and administrators. As a field of study that has evolved over the past 15 to 20 years, technology education is just beginning to establish a new identity that is recognized and understood by people outside the field (Dugger, 2001).

Although philosophically different approaches to technological literacy are taken by vocational and technology education teachers, it is common that in many schools across the country vocationally trained teachers have been given the assignment to teach technology education to their students (Ballou, 1996). This transition has been difficult for vocational teachers who are accustomed to teaching trade-specific skills to prepare students for the workplace. In contrast, technology education is thought of in terms of "general education" or what every student should be taught. This is of particular concern in the state of Arizona where vocationally trained teachers struggle to develop their own technology education curriculum. In the state of Arizona vocational and technology education teachers are grouped together and given the title of industrial technology education (ITE) teachers. The majority of technology education courses in Arizona are offered in middle and junior high schools with high school ITE teachers finding it especially difficult to develop curriculum for their technology education classes. Even though they have access to the *Standards for Technological Literacy*, the standards do not prescribe a curriculum to follow. This is a challenge because many teachers wonder what a standards-based curriculum "looks like" and how do they teach it? (Valesey, 2003). The research indicates there is a growing interest, concern, and need for technological literacy, but it is unclear how industrial technology education teachers in the state of Arizona are making decisions on classroom practice based on the standards.

Problem Statement

In the state of Arizona vocationally trained teachers are struggling to develop a technology education curriculum for their students. It is undetermined to what extent teachers have accepted and are using the recently developed content standards found in the *Standards for Technological Literacy*. Do they know what the content standards are? Do they feel they are important? How comfortable are they with implementing them? By investigating the perceived knowledge, use, and acceptance of the content standards presented in the *Standards for Technological Literacy*, industrial technology education teachers can consider the need for implementing the standards into their programs.

Purpose of Study

The purpose of this study was to investigate the perceived knowledge, use, and acceptance of national content standards by industrial technology education teachers in the state of Arizona.

Need for Research

As noted previously, in 2000, the ITEA, through its Technology for All Americans Project (TfAAP), released the *Standards for Technological Literacy: Content for the Study of Technology*. However, while the ITEA initiative is laudable, some claim the standards alone are insufficient to make the reform of technology education happen in American classrooms (Delaney, Dugger, Meade & Nichols, 2003). Exposing students to relevant concepts and hands-on, design-related activities is one of the most valuable ways teachers help students acquire the kinds of knowledge, ways of thinking and acting, and capabilities consistent with technological literacy (Young, Cole & Denton, 2003). Teachers can provide these opportunities for their students on a daily basis and it is directly through these teachers that technological literacy will occur. One of the challenges in finding studies relating to the *Standards for Technological Literacy* is the Standards have only been in circulation since 2000 and little research has been conducted on their acceptance and use (Donan, 2003). Therefore this study is important in documenting Arizona industrial technology education teachers' perceived knowledge, use, and acceptance of the content standards. By doing so, this study will provide a baseline for further research to be conducted on the acceptance and use of the *Standards for Technological Literacy* in the field of technology education.

Research Questions

This study was guided by the following research questions:

1. To what extent do industrial technology education teachers' in Arizona believe there is a need for technology education content standards and how familiar are they with the content standards presented in the *Standards for Technological Literacy*?
2. Are the content standards perceived as being important and to what extent are industrial technology teachers in Arizona addressing them during instruction?
3. To what extent do industrial technology teachers in Arizona endorse the content standards presented in the *Standards for Technological Literacy*?
4. To what extent do industrial technology education teachers in Arizona feel they are prepared to address the content standards presented in the *Standards for Technological Literacy*?

Significance

This study was undertaken because high school industrial technology education teachers in Arizona have been asked to teach technology education to their students and many are finding it difficult to develop technology education curriculum. The *Standards for Technological Literacy* allows teachers to identify the content that should be taught in order for students to become technologically literate but teachers need help implementing the standards into their curriculum. There is also a lack of sufficient information regarding technology education teachers' perceptions of the content standards presented in the *Standards for Technological Literacy* and the possible impact their perceptions would have on standards implementation.

Limitations of the Study

The following were determined by the researcher to be limitations to this study:

1. The accuracy of the listings of industrial technology education teachers, provided by the Arizona Department of Education.
2. The differential in time between receiving the email address listings from the Arizona Department of Education (Summer 2003) and the request to participate (Spring 2005) may have affected the accuracy of the listings and subsequent response rate.
3. The first request to participate was emailed four weeks prior to the end of the spring semester 2005 due to the late development of the web-based survey, thus limiting the effectiveness of three follow up requests to participate that were made at the beginning of each week the online survey was available.
4. The validity of the researcher designed instrument (custom survey) to accurately depict the perceptions of industrial technology education teachers.

CHAPTER II

REVIEW OF LITERATURE

Introduction

In an effort to investigate Arizona industrial technology education teachers' knowledge, use, and acceptance of the content standards presented in the *Standards for Technological Literacy*, the following review of literature was conducted. First, a review of papers concerning research priorities for technology education was completed in order to justify the objectives of this study. Then a review of studies available on the Standards for Technological Literacy and their impact on technology education was performed. This proved to be valuable in redefining ideas and needs within this study.

This chapter is divided into four sections. Section one is a synopsis of the review of literature procedures followed in this study. In the second section, a background and overview of the national standards movement and development of the *Standards for Technological Literacy* is presented. The third section describes current and future trends relating to the standards. In the last section, information is presented to understand and frame the complexity of innovation acceptance and teachers perceptions in the field of technology education pertaining to the *Standards of Technological Literacy*. This includes reviews of related articles and studies specific to the knowledge, use, and acceptance of the content presented in the *Standards of Technological Literacy*.

Review Procedures

Selecting studies for review was accomplished through various research tools. Internet Explorer was used in searching the ERIC databases from 1965-2004 using descriptors of "Technological Education" and "Standards for Technological Literacy" along with other key words such as "training," "in-service," "acceptance," and "needs." Articles found in ITEA's *The Technology Teacher* were reviewed and yielded additional research pertaining to the *Standards for Technological Literacy*. The resulting articles were read and evaluated for appropriateness, and selected studies were located and photocopied for further analysis.

A review of CTTE Monographs was used to provide a database of technology education graduate research studies from 1964-2000. Several unpublished dissertations were located and reviewed for relative content. One of the challenges in finding studies relating to the *Standards for Technological Literacy* is the Standards have only been in circulation since 2000 and little research has been conducted on their acceptance and use (Donan 2003). This reinforces the need for further research to be developed. By searching the Dissertations Abstracts Online database another study was located dealing specifically with the subject of "acceptance of national standards for technological literacy." Finally, two more theses were obtained from Brigham Young University (BYU) Technology Education's Learning Resource Center published in 1999 and 2005 respectively.

Background and Overview

National Standards Movement

For the last two decades the United States has been immersed in a major educational reform movement, one based on standards in most school subjects. These standards serve to identify what every discipline-literate pupil, kindergarten through high school, should know and be able to do (Dugger, 2002). Over 16 sets of nationally developed standards have been generated since 1989, and 49 of the 50 states have been using state standards in developing curriculum and assessment for pupils in public schools (Henderson, 2003).

The first set of standards in this movement, released in 1989 by the National Council of Teachers of Mathematics (NCTM), were titled Curriculum and Evaluation Standards for School Mathematics. Following the NCTM effort, almost every subject area has developed standards, including science education, which has created two different documents: Benchmarks for Science Literacy (1993), by the American Association for the Advancement of Science (AAAS), and the National Science Education Standards (1995) produced by the National Research Council. Nationally developed standards exemplify for many states and local school districts what to adopt or adapt in their efforts to reform education at their level.

Across the United States the standards movement in education is strengthening. Standards are written statements about what is valued and they can be used to judge the quality of education. Standards can potentially provide higher expectations and consistency in subject matter for student learning. They also help provide continuity and articulation of the content taught and learned among grade levels, from K-12 (Henderson, 2003).

Development of Literacy Standards

Information literacy is defined as the ability to know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand (Henderson & Scheffler, 2003). In this dynamic environment, teacher education programs must develop strategies for ensuring that teacher candidates comprehend the wide range of information literacies, demonstrate skills related to those literacies, and integrate literacies into instructional activities. “The school, college, department of education (SCDE) must now address state, regional, and national standards, including NCATE 2000, that specify information, media, and technology competencies” (Henderson & Scheffler, 2003, p. 391). However, the concept of information literacy is not new; nevertheless, the impact of the Information Age exacerbated its importance and expanded the types of literacies. A broad focus on library skills and information literacy has now become a complex concept incorporating multiple literacies. Likewise, Shapiro and Hughes (1996) recommended that we conceive of information literacy as a "new liberal arts," one as essential as the basic liberal arts were to educated persons in medieval society (p. 2). Breivik (1998) maintained that the recent and ongoing explosion of information has entirely and forever changed the landscape and described the bottom line as: "When will this campus embrace information literacy programs?" (p. 6). Dorr and Besser (2002) wrote that, “In addition to information literacy--and traditional reading and writing or print literacy -- other literacies have been important or are emerging now as important" (p. 6). The California State University

System (CSUS, 1995) defined "information competence" as "the fusing or the integration of library literacy, computer literacy, media literacy, technological literacy, ethics, critical thinking, and communication skills" (p. 2). Focusing on teacher education's role in relation to these new literacies, Metcalfe (in Dorr & Besser, 2002) stated:

> With the proliferation of technology in public and private arenas, it is important for teacher education programs to develop strategies for ensuring that teacher candidates are able to understand the complexity of information literacy. Teachers must be prepared to use technology for their professional growth and learning. In addition, teachers need to be able to teach in ways that connect to students' lives and expand their students' understandings, knowledge and use of technology (p. 4).

The National Forum on Information Literacy was tasked to work with teacher education programs to ensure that new teachers could integrate information literacy into instruction. However, in its Progress Report on Information Literacy, the Forum reported that no progress had been realized toward modification of teacher education and performance expectations to include information literacy concerns (Henderson & Scheffler, 2003).

Without a national model for literacy standards, many departments of education and school districts began as early as 1989 to develop their own information literacy competency standards. Some of these were very detailed and complex, such as those developed in Texas, California, and Louisiana. In response to renewed interest in the development of performance or outcomes based standards, professional organizations (including NCTE, NCSS, IRA, ECE, and CEC), incorporated information literacy competencies into new program standards. As the National Council for the Accreditation of Teacher Education planned for NCATE 2000, revised accreditation standards for the school, college, department of education (SCDE) and focused on outcomes, constituent organizations were required to develop new standards. The majority of professional organizations and state departments have revised standards, developed new curricular emphases, and issued new content standards. All of these new or revised standards include components related to information literacy, technological literacy, and/or other literacies (Henderson & Scheffler, 2003).

Technological Literacy

Technology has become so user-friendly that it is largely invisible. We drive high-tech cars but know little more than how to operate the steering wheel, gas pedal, and brakes. We fill shopping carts with highly processed foods but are largely ignorant of the composition of those products or how they are developed, produced, packaged, and delivered. We click on a mouse and transmit data over thousands of miles without understanding how this is possible or who might have access to the information. Therefore, even as technology has become increasingly important in our lives, it has receded from obvious view.

In order to take and maximize the benefits of technology, as well as to recognize, address, or even avoid some of its pitfalls, we must become better stewards of technological change. Unfortunately, society is ill prepared to meet this goal and the mismatch is growing. Neither the nation's educational system nor its policymaking apparatus has recognized the importance of technological literacy. Furthermore, few people have hands-on experience with technology, except as finished consumer goods. Consequently, technological literacy depends largely on what we learn in the classroom. However, for the most part, technology is not treated seriously as a subject in any grade, kindergarten through twelfth (K-12). An exception is the employment of computers and the Internet; however, even in this case, efforts have focused on using them to improve education rather than to teach about technology. "As a result, many K-12 educators identify technology almost exclusively with computers and related devices and so believe, erroneously, that their institutions already teach about technology" (Young et al., 2003, p. 141).

Standards for Technological Literacy

To overcome misperceptions and strengthen the field of technology education the International Technology Education Association (ITEA) and its Technology for All Americans Project developed and promulgated the *Standards for Technological Literacy: Content for the Study of Technology*. To date, thousands of technology, science and mathematics teachers, and other educators and experts from around the country have collaborated in an effort to identify precisely what students in kindergarten through 12th grade should be learning about technology. This group, together with content specialists and representatives from the National Research Council (NRC) and the National Academy of Engineering (NAE), reviewed *Standards for Technological Literacy* and recommended modifications and additions. The resulting document, supported by both NRC and NAE, defined the study of technology as a discipline and provided a framework for individual teachers, schools, school districts, and states or provinces to develop technological literacy in all students.

The *Standards for Technological Literacy* initiative goes beyond merely providing a "cookbook" or checklist for the technological facts, concepts, and capabilities that students should master at each level. The document describes how and why technological literacy fits with the broader mission of schools and describes the benefits of the study of technology for students. In short, the document makes the case for why the study of technology should be an integral part of the curriculum of our elementary and secondary schools today and in the future (Dugger, 2001).

William A. Wulf (2000), President of the National Academy of Engineering and an ardent supporter of technological literacy and ITEA's standards stated:

> The release of the Standards for Technological Literacy presents a wonderful opportunity for technology education teachers. The standards should bring increased-and deserved-visibility to the work of technology educators around the country. The standards will provide a much-needed reference point for developers of curriculum and instructional materials. Most important, the standards lay the foundation for building a technologically literate citizenry" (p. 13).

Vocational Education Considerations

In many states across the country including Arizona, schools are depending on vocationally trained teachers to make the transition towards teaching a technology education curriculum. This has not been an easy transition for many teachers. During the last decades of the 20th century, educators in the field of occupational education witnessed numerous debates over the "new vocationalism"; this is the concept of integrating occupational and academic courses (Prentice, 2001). While such calls for educational reform have been made for decades, this new emphasis assumed new urgency and was based on the 1983 report, *A Nation at Risk*, a study that severely criticized occupational education for focusing students too narrowly on low-skill, entry-level jobs (Prentice, 2001). In response to those criticisms, the National Commission on Secondary Vocational Education (NCSVE) in 1984 supported vocational education, but also pointed out that, "What is really required today are programs and experiences that bridge the gap between the so-called `academic' and `vocational' courses. The theoretical and empirical aspects of academic courses and vocational courses must be made explicit and meaningful" (Prentice, 2001, p. 80). A few years following the publication of *A Nation at Risk,* research by the William T. Grant Foundation Commission on Work, Family, and Citizenship (1988), *The Forgotten Half*, cautioned that fully half of the students graduating from American high schools would not complete college; therefore, these students would clearly require some type of advanced training in order for them to succeed in their jobs (Prentice, 2001).

Political Legislation

To help make the transition from vocational to technology education the Carl D. Perkins Vocational Education Act of 1984 and its subsequent reauthorizations called specifically for the integration of academic and occupational education, as did the School-to-Work Opportunities Act of 1994. The SCANS Report (Secretary's [of Labor] Commission on Achieving Necessary Skill), *What Work Requires Of Schools: A SCANS*

Report For America 2000 (1991), asserted that what employers require of schools is to teach the students thinking, decision-making, and problem-solving skills to succeed in the workplace. In addition, the legislation for TechPrep also focused on the integration of academic and occupational education to prepare the kinds of thinking, decision-making, problem-solving technicians that the advanced U.S. industry would demand in the future (Prentice, 2001).

Based on these initiatives in the recent past, the North Carolina State University, Department of Adult & Community College Education conducted the Eric Review: Integrating Academic and Occupational Instruction (2001) to determine whether occupational programs in the community colleges have actually integrated academic and occupational education. The ERIC review examined the progress made, focusing particularly on literature since 1995 (Prentice, 2001).

The academic and occupational integration concept is not new; in fact, as early as 1916, John Dewey argued for educating through the occupations (Prentice, 2001). According to Prentice, in the 1920s, Leonard Koos (1924) proposed that occupational efficiency and civic and social responsibility should become the guideposts for the curriculum in the newly formed junior colleges. Walter Eells (1931) and Jesse Bogue (1950) proposed similar ideas.

Unfortunately, vocational courses are frequently viewed as being a type of remedial education in disguise. A continuing but erroneous belief exists that occupational students are somehow not as academically capable as their baccalaureate-bound counterparts. In fact, in spite of the glowing reports from teachers who have actually implemented academic and occupational integration in their classrooms, the perception continues that academic and occupational integration is fundamentally remedial, a technique for getting vocational students to swallow larger doses of general education that they somehow missed earlier.

Current and Future Trends

To help negate the perception that academic and occupational integration is remedial, the *Standards for Technological Literacy* may provide a framework that enables teachers to develop curriculum that will help their students become technologically literate. The standards do not represent an end to a process but rather a beginning. In other fields of study, the development of standards has often proven to be the easiest step in a long and arduous process of educational reform. "Getting STL and the three standards on assessment, professional development, and programs currently being developed accepted and implemented in grades K-12 in every school will certainly be far more difficult than developing them" (Dugger, 2002, p. 28). These documents — which together provide a starting point for action within schools and districts, states and provinces — aim to make technology an essential field of study for all students. "Improving technological literacy in the United States is the long-term vision of ITEA" (Dugger, 2002, p. 29).

Now that the Standards for Technological Literacy have been in the hands of educators, administrators, and state supervisors for a little over five years, what impact have they had on technology teachers and their programs? Studies must be conducted to investigate the knowledge, use, and acceptance of the *Standards for Technological Literacy*. If technology teachers do not understand the technology concepts they are trying to teach, one cannot expect their students to learn them (Bybee, 2000).

Technology teachers around the country have been asking, “Now that we have content standards for technological literacy, what does a curriculum based on the standards look like? What should we be teaching? How do we begin to transform our programs and our teaching to deliver the content specified in the standards to our students?” (Valesey 2002). With the 2003 release of *Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards* (AETL), it is advocated that standards-based training is an essential component of classroom and student success—something which also requires further investigation.

Standards Implementation

Many articles (Lindsrom, 2002; Valesey, 2002; Reeve, 2002; Barnette, 2003;) reveal what technology teachers are doing to implement the standards into their curriculum and the affect it is having in their classrooms and professional development. These articles are a helpful resource for teachers who subscribe to technology education journals but more needs to be done. To be effective, a technology education curriculum must be developed by a curriculum team, a group of experts (technology teachers, educational specialists, and curriculum developers) who know and understand the curriculum development process and are well acquainted with STL (Reeve 2002). State supervisors and administrators should also be involved with the process to help technology education teachers within their districts.

John R. Wright from the University of Southern Maine also believes that teachers need help. In a dynamic discipline such as technology, the pressure to keep pace provides stress that can burn technology education teachers out at a faster rate than other colleagues with more stable subject matter areas. Add to this dilemma the new challenge of implementing STL and the "world begins to tilt" for the average public school technology education teacher. This issue is so critical to the technology education profession that major efforts have been planned by national and state associations to provide regular workshops to implement STL at conferences and in-service seminars (Wright 2002).

State and District Training

Typically, public school in-service consists of a few days throughout the school year when teachers gather to discuss common issues that relate to their disciplines. These meetings fall drastically short in providing enough material or experience to change a teacher's behavior. In-service education for implementing STL will be much more successful if there is a component that deals with hands-on activities for teachers. Most technology education teachers will be motivated to implement STL if they:

1. Feel comfortable with the new content and teaching strategies.
2. Can convince their colleagues and administrators that all students need this type of education.
3. Believe that enrollment increases will occur with the new curriculum offerings.
4. Can secure some assistance in the change process (Wright, 2002).

In-service programs must be developed to teach technology educators how to implement STL. Rodger Bybee explains how STL will be an important tool in educational reform and reviews the advantages of having standards but stresses the importance of STL being "understandable, useable, and achievable." The degree to which standards meet these criteria will determine the success of establishing technology education in school programs (Bybee, 2002).

Innovation Acceptance and Teacher Impact

Now that technology teachers' have access to the standards how will they be accepted? A review of the literature related to educational change and school reform, specifically related to the acceptance of innovations in educational curricula, revealed an historic reluctance on the part of teachers to both endorse change and adopt national standards. Numerous studies on educational change strongly support the notion that innovations such as the *Standards for Technological Literacy* will not be implemented in schools merely because they make sense and/or meet specific needs; rather, the acceptance of those innovations will be most successful when support is geared to the specific needs of individual teachers (Linnell, 1992).

Acceptance of Change

This became apparent when studies were conducted on acceptance of technology education teachers toward the curriculum change from industrial arts to technology education. Teacher concerns were primarily in the ways that the change would affect them personally, their knowledge of the subjects, and their ability to manage their educational and administrative responsibilities. Many similar studies reveal a variety of resistance towards the implementation of technology education from industrial arts. (Berrett, 1999; Oaks, 1991; Rogers, 1989; Smallwood, 1989). It is therefore essential to properly investigate technology education teachers' concerns regarding the content standards presented in the *Standards for Technological Literacy* to make sure they are not being forced upon those who may not agree or accept the Standards.

It is also important to note the impact teachers' perceptions have on student achievement as it relates to innovation acceptance. Grossman, Wilson, and Shulman

(1989) described a component of the teachers' belief system they called "beliefs about subject matter." They claimed that a teacher's beliefs about the subject matter combined with their beliefs about students, schools, learning, and the nature of teaching, "powerfully affected their teaching" (p.31). According to Gudmundsdottir (1990), these beliefs or values shape the content of the subject matter that teachers feel is important for students to know. Therefore, investigating teachers perceptions of the importance of the content standards in relation to their students may influence standards implementation.

Another important factor is the impact of teachers' content knowledge on student achievement. In order to increase student achievement and technological literacy, teachers must become familiar with the Standards. According to the American Federation of Teachers (AFT) (1995), teachers who do not know content cannot teach it. This position has been supported by a number of recent studies investigating the impact of teacher quality on student learning (e.g., Ferguson, 1991; Hanushek, 1992; Lieberman & Miller, 1991; and Sanders, 1999). Theses studies revealed that out of all the school level variables related to student achievement, the one with the greatest impact was teacher quality because what teachers' know and do makes the most difference in what students learn (Ferguson, 1991).

Primary Research Studies

In reviewing the literature related to the standards for technological literacy it became apparent that very limited research has been conducted with regard to the knowledge, use, and acceptance of the *Standards for Technological Literacy*. The following three studies were found that specifically addressed the acceptance of the standards.

In a recent article by Reeve, Nielsen, & Meade (2003), results of a survey conducted by Utah State University revealed that while a majority of junior high school technology education teachers in Utah had a copy of the standards and that they are supportive of the standards, teachers wanted help implementing standards-based technology education in their classrooms. The survey was sent to 107 junior high school technology teachers in the state of Utah with 51 teachers responding. According to the researcher, these figures may have been influenced by Utah's decision in 2002 to adopt the Standards for Technological Literacy as well as the possibility that some of the teachers may have attended the 2000 ITEA Conference, which was held in Salt Lake City, where the standards were initially released.

In Reeve's study, he found that teachers in Utah are largely supportive (78%) of the decision to adopt the standards, indicating that the standards have been positively received by teachers in the state of Utah. An overwhelming 93% of respondents felt that standards needed to be developed with only 6% regarding the standards as only being applicable to technology education. Reeve suggests this may indicate the need for the development of interdisciplinary curricula to reflect the scope of the new program standards released in ITEA's AETL (Reeve, 2003). While most junior high school technology teachers in Utah felt qualified to teach the categories of content identified by the standards, survey results reveal a strong desire for more in-service professional development on STL. Only 19% of the teachers in the survey had been in-serviced, and 85% of those who had not received in-service training would take it if it were offered to them. It was suggested that some of the uncertainty experienced by teachers could very well be eliminated through adequate in-service training (Reeve, 2003).

In another similar study Jill Russell, executive assistant to the president at Springfield College, Massachusetts sent an email survey to 410 ITEA members who were teachers, department chairs, or state supervisors and asked them about their knowledge and use of the standards. Although, only sixty individuals completed and returned the survey, 75% were teachers. When asked the extent to which they were familiar with the *Standards for Technological Literacy*, 72% reported that they had looked through the standards. Over half had compared the standards to their own curriculum, and a third had participated in training. She found that 93% of respondents who completed the survey thought the standards were important. These respondents are concerned that much remains to be done in spreading the word, in implementation of the standards, and in professional development that includes standards-based training (Russell, 2003).

In the last study, Robert Donan of the University of Tennessee stated that after a review of literature, no documentation was found to suggest that any studies had been conducted that examined the current status of adoption of the content standards presented in the *Standards for Technological Literacy* by technology education practitioners (Donan 2003). The primary purpose of Donan's study was to determine the level of endorsement of national content standards by technology education teachers in Tennessee. Though much of his study was dedicated towards the creation and validation of his instrument, results of the study showed that the majority (82%) of technology education teachers in Tennessee were willing to endorse all of the content standards presented in the *Standards for Technological Literacy.* For the purpose of determining the minimum level of endorsement for each of the 20 content standards to warrant further analysis, a cut-point of 10% or greater non-endorsement was determined to be a significantly large percentage of the population to warrant further investigation. Content standards four, seven, fourteen, and fifteen met the established criteria. Only a few reasons were cited by practitioners for non-endorsement. Those most cited were (a) that the standard was more suited to the social sciences and therefore should be taught in either social studies or history rather than in technology education (as was the case with content standards four and seven); (b) that Content Standard fourteen was "beyond the scope of the middle school technology education program" and was "inappropriate for inclusion in technology education;" and (c) the content explicit in Content Standard fifteen was "more appropriate to high school vocational agriculture curricula."

Conclusion

The purpose of this review of literature has been to present scholarly information needed to understand and frame the complexity of innovation acceptance in the field of technology education as it relates the *Standards for Technological Literacy* (ITEA, 2000). The background and overview section revealed that a major educational reform movement has been in progress to promote and develop national literacy standards. The *Standards for Technological Literacy* were developed to help technology education teachers develop curriculum for students to become technologically literate. Current and future trends show acceptance and implementation of the standards to be a difficult but important process. Teachers need more in-service and training in order to implement the standards into their curriculum. Studies show there has been an historic reluctance to endorse change and school reform. It was revealed that teacher perceptions and content knowledge play a major factor in innovation acceptance and therefore play an important role in research on acceptance of the standards. By reviewing recent studies, it is clear there is a need for technological literacy. Research indicates that the standards are being accepted, used, and implemented to some degree by technology education teachers. Because the *Standards for Technological Literacy* is still a relatively new document additional research must be conducted to determine the knowledge, use, and acceptance of the standards in other areas of the country.

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CHAPTER III

METHODOLOGY

There is a need to investigate teachers' perceptions toward acceptance of, or level of concern about an innovation prior to its mandate (Rogers, 1983). At the time this study was initiated, two surveys had been conducted within the field of technology education to investigate if teachers in the field endorsed the content standards contained in the *Standards for Technological literacy* (ITEA, 2000). No studies were found that investigated Arizona industrial technology education teachers' acceptance of the content standards or concerns with respect to implementing the content standards into existing curriculum.

Research Design

Based on other studies in the field of industrial arts/technology education in which perceptual data were analyzed it was determined that a self-reported web-based questionnaire would be incorporated into this study to gather the required data from industrial technology education teachers within the state of Arizona. A non-experimental, cross-sectional survey design was developed and used to gather perceptions of industrial technology education teachers' knowledge, use, and acceptance of the content standards contained in the *Standards for Technological Literacy* (ITEA, 2000). This design has the advantage of measuring current attitudes and practices. It also provides information in a short amount of time, such as the time required for administering the survey and collecting the information (Creswell, 2002). Data were analyzed using percentages, means, frequencies, and standards deviations to describe the obtained characteristics and in order to answer the research questions presented in chapter one. A recent survey conducted by Utah State University (Reeve, 2002) provided the framework in the development of the Arizona survey.

Population and Sample

In the State of Arizona, Industrial Technology Education is separated into four comprehensive program levels (Figure 1). Level I courses provide students with basic career exploration and workplace skills common to all occupations. Level II courses provide students with knowledge and basic skills for the cluster of occupations in industrial and technological areas. Level III courses provide students with specific vocational skills, while Level IV courses are geared towards community college articulation or Tech Prep programs.

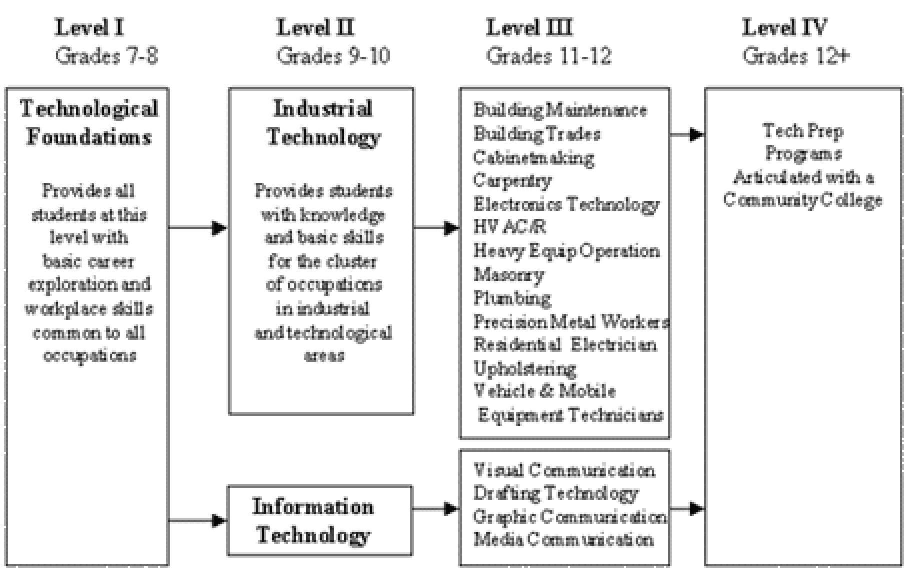

Figure 1. Industrial technology education comprehensive programs

Since the *Standards for Technological Literacy* were created primarily from a non-vocational perspective, the target population for this study is all industrial technology education teachers who teach at least one Level I and/or Level II course in school districts within the state of Arizona. A list of the entire population of certified industrial technology education teachers was obtained from the Arizona Department of Education. The list had over 850 industrial technology education teachers' names on it, including the school where they taught and what specific subjects they taught. Email addresses were also provided. In order to identify teachers who taught Level I and/or Level II courses an analysis of class content titles or descriptors was conducted. All teachers who taught only Level III and/or Level IV courses were then excluded. In order to increase accuracy, local CTE directors were contacted to provide a current list of ITE teachers within their school districts who taught Level I and/or Level II courses (Appendix A). Any additional information obtained from CTE directors was used to finalize the list. Through this process a total of 279 teachers were identified as the target population of all teachers who taught Level I and/or Level II courses in the state of Arizona.

Pilot Study

A feasibility/pilot survey (Appendix B) involving technology education teachers from the Glendale Union High School District (GUHSD) was conducted during the 2004 spring semester. Nine high school industrial technology education teachers (who taught at least one Level II course) from seven high schools within the district participated in the survey. Seventy two percent of GUHSD industrial technology education teachers have a copy of the standards and are familiar with them to some extent. Comments made by those surveyed indicate a need for standards-based training and professional development opportunities regarding the standards. Free comments reflected a positive reaction to the standards with the majority in favor of using standards to enhance their programs. Participants' recommendations were analyzed and implemented where appropriate. The results from the pilot study prompted discussions with other ITE teachers, administrators, and committee members which led to revisions of the survey instrument. Detailed questions regarding each content standard and respondents professional and educational background were added to provide additional data for the study.

Survey Instrument

The final, four-page survey instrument (Appendix C) was developed using web-based software for convenience in the collection of data. A request to participate (Appendix D) was emailed to the entire population of 279 industrial technology education teachers along with a copy of the *Standards for Technological Literacy* executive summary in PDF format on May 2nd 2005. Follow-up requests to participate were emailed at the beginning of each new week the online survey was available. This allowed a total of 4-6 weeks to collect the necessary data for this study.

The first page of the instrument was designed as the demographic gathering section. Information was collected about respondents (a) gender, (b) years of teaching, (c) educational background, (d) membership in ITEA, (e) school district, (f) grade level of students taught, and (g) courses taught. These data were necessary to form the basis for a comparative analysis of the respondents' perceptions. One open-ended question was used to gather free response data and information about technology education teachers' school and program characteristics. On the second page respondents were asked questions about their knowledge and perceptions about the ITEA content standards.

A four-point and six-point, Likert-type scale was used to collect perceptual data from respondents related to research question one. The third page contained questions used to collect perceptual data related to research questions two and three. Questions were designed to measure the level of perceived importance, use, and acceptance of the content standards with respect to respondents' students and the extent to which teachers address the standards during instruction. Questions were presented using four-point and five-point Likert-type scales. The final page was used to collect data regarding respondents' educational and professional background in relation to the standards and to what extent they could benefit from additional training.

Design Considerations

Likert-scales were chosen based on their ability to measure attitudes, their relative ease of completion by respondents, and the relative ease of scoring and analyzing results when compared to other scales (Mueller, 1986). Likert (1932) originally stated that there are a variety of possible response scales (1-to-7, 1-to-9, 0-to-4, etc.) and that the use of odd-numbered scales allows a middle value which is often labeled Neutral or Undecided. Additionally, the larger the number of available responses, the higher the level of discrimination, and along with it a higher level of variability. However, Nunnally (1967) and Kerlinger (1986) stated that it is possible to use a forced-choice response scale with an even number of responses and no middle neutral or undecided choice without jeopardizing statistical validity of the results. They concur that when a forced-choice response scale is used, respondents are encouraged to think through their decisions and to avoid the tendency to select a middle-of –the-road response as they are forced to decide whether they lean more towards the agree or disagree end of the scale for each item.

Varying scales were used for this study based on the researcher's need for a forced-choice or neutral response to specific questions presented in the survey instrument.

Analysis

The results and findings were analyzed according to response rates, demographic data of respondents, and research questions. Frequency counts and percentages were calculated and used to determine the attitude of respondents concerning questions one, three, and four. Descriptive statistics were calculated for research question two to determine statistical significance of respondent's perceptions of the content standards. Findings are reported in tables showing the most relevant information in chapter four. Summary's of these tables are included to elaborate on the results. Discussion about the findings are included in chapter five. SPSS Version 11.0 (Student Version) was used for the statistical analyses.

While caution should be exercised in extrapolating the reactions of the respondents of this survey to the general population, data obtained from a sizeable number of respondents reflect a significant body of information that should not be ignored. Face validity requires that your measure appears relevant to your construct to an innocent bystander, or more specifically, to those you wish to measure. This was established through discussions with advisors and the industrial technology educators who participated in the pilot study who felt the survey could adequately assess industrial technology education teachers' perceptions of the content presented in the *Standards for Technological Literacy*.

CHAPTER IV

RESULTS & FINDINGS

Response Rate

Because of the size of the population, the expanse of the geographic area over which it was spread, and limited budget for conducting the study, an online survey was determined to be the most efficient and cost effective method for data acquisition. In an effort to gain maximum participation from teachers, pre-notification of data collection was given to industrial technology education teachers throughout Arizona via personal contact at state conferences and in-service training sessions during the summer and fall of 2004. The survey was originally scheduled to go online at the beginning of the 2005 spring semester but due to several revisions of the survey instrument, scheduling conflicts, teaching duties, and other time constraints, the survey was not available online until the last four weeks of the spring semester. Thirty six surveys were completed by the end of the first week. An email request to participate was sent out at the beginning of each week the survey was available thereafter which accounted for an additional 12 returned surveys for a total of 48 respondents. The calculated response rate was 17.2%. Although a low response rate challenges the statistical significance of the results, since the sample is a consensus the results have a high practical significance. Even still, the findings are representative only of the respondents, not necessarily the entire population of industrial technology education level I and II teachers in the state.

Demographic and Background Characteristics

The demographic and background characteristics of the respondents are presented in Table 1. The majority (83.3%) of the sample was male. Most (70.8%) of the sample had been teaching for more than nine years, and only one individual had taught for less than four years, indicating that the sample had a high level of teaching experience. Exactly half of the sample had obtained a master's degree, with bachelor's degrees (37.5%) being the second most common level of educational attainment. Most (62.5%) of the sample had received a bachelor's degree in either technology or industrial arts education. Four respondents had received a high school or associates degree, indicating a traditional teaching degree may not be required to obtain a technology education teaching position in certain school districts. While 22.9% of the respondents were currently members of the ITEA, 29.2% of them had a copy of the ITEA standards.

The respondents tended to teach in large school districts, with 83.3% teaching in districts with one thousand or more students. Almost three-quarters (72.9%) of the sample taught high school students, with the remaining 27.1% teaching junior high (6^{th} through 8^{th} grades). Not surprisingly, it was found that 78% of industrial technology education teachers in the state of Arizona teach multiple levels of industrial technology education.

Regarding the extent to which technology content standards are currently established by grade level in the instructors schools, over one-third (35.4%) indicated that this was done to a great extent, while another 29.2% indicated that this was done to some extent. Only 12.5% indicated that technology content standards were not at all established by grade level.

Table 1

Demographic and Background Characteristics of the Respondents

	F	%
Gender		
Male	40	83.3
Female	8	16.7
Years Teaching		
1-3 Years	1	2.1
4-6 Years	6	12.5
6-9 Years	7	14.6
>9 Years	34	70.8
Highest Degree Earned		
High School	2	4.2
Associate's Degree	2	4.2
Bachelor's Degree	18	37.5
Master's Degree	24	50.0
Doctorate	2	4.2
Technology or Industrial Arts Education Major		
No	18	37.5
Yes	30	62.5
ITEA Member		
No	37	77.1
Yes	11	22.9
Have a Copy of ITEA Standards		
No	34	70.8
Yes	14	29.2
Number of Students in District		
< 1000	8	16.7
1000-5000	40	83.3
Grade Level of Students Taught		
6-8	13	27.1
9-12	35	72.9

Findings

Research Question #1

The first research question investigated the extent to which industrial technology education teachers in Arizona are familiar with the content standards presented in the *Standards for Technological Literacy* and whether they believe technology content standards are needed. To answer this question, data were collected from industrial technology education teachers in Arizona in response to the question "How familiar are you with the International Technology Education Association's *Standards for Technological Literacy*?" on the survey. A six-point, Likert-style, forced-selection, fixed rank order-scale with the range: 6 = *very familiar*, 1 = *very unfamiliar* was used to gather the response data. Analyses were conducted by performing frequency counts with percentages using SPSS and the results entered in Table 2.

There was a high degree of variability in terms of the respondents' familiarity with the ITEA's *Standards for Technological Literacy (STL)*. The majority (58.3%) were unfamiliar with *STL*. The most common response was 'very unfamiliar' (25.0%) and an additional 20.8% reported that they were 'unfamiliar.' Of the remaining (41.7%) respondents who were familiar with *STL*, 14.6% reported being 'familiar' and only 4.2% reported being 'very familiar.' The respondents who reported being 'very familiar' with *STL* typically taught level I (7^{th}-8^{th} grades) technology education classes whereas the respondents who are 'very unfamiliar' with *STL* taught level II (9^{th} -10^{th} grade) and level III (11^{th} -12^{th} grade) classes.

Data were also collected in response to the question "To what extent do you believe there is a need for technology education content standards?" A four-point, Likert-style, forced-selection, fixed rank order-scale with the range: 4 = *great extent*, 1 = *no extent* was used to gather the response data. Approximately two-thirds of the sample (64.6%) indicated that technology content standards were needed to a great extent, while only 6.3% indicated that they were not needed at all (2.1%) or to a little extent (4.2%).

Table 2

Knowledge and Perceptions of Technology Content Standards

	F	%
Familiarity with ITEA's *Standards for Technological Literacy*		
Very Unfamiliar	12	25.0
Unfamiliar	10	20.8
Somewhat Unfamiliar	6	12.5
Somewhat Familiar	11	22.9
Familiar	7	14.6
Very Familiar	2	4.2
To What Extent Are Technology Content Standards Needed		
No Extent	1	2.1
Little Extent	2	4.2
Some Extent	14	29.2
Great Extent	31	64.6
Don't Know	0	0.0

Research Question #2

The second research question examined respondents' perceptions of the importance of the content standards presented in the *Standards for Technological Literacy* and the extent to which industrial technology teachers in Arizona address them during instruction. Ordinal data were collected from industrial technology education teachers in Arizona in response to the following questions, "For your students, how important are the following ITEA content standards?" and "To what extent do you address the following ITEA content standards during instruction?" These questions were posed for each of the 20 individual content standards presented in the *Standards for Technological Literacy*. A five-point, Likert-style, forced-selection, fixed rank order-scale with the range: 5 = *very important*, 1 = *unimportant* was used on the survey in order to answer the first question. For the second question a four-point, Likert-style, forced-selection, fixed rank order-scale with the range: 4 = *great extent*, 1 = *no extent* was used.

The 20 individual content standards presented in the *Standards for Technological Literacy* are organized into five major categories as shown in figure 2 below. These categories were used as organizers for questions 14-23 in the survey.

THE NATURE OF TECHNOLOGY

STANDARDS

1 Students will develop an understanding of the characteristics and scope of technology.

2 Students will develop an understanding of the core concepts of technology.

3 Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.

TECHNOLOGY AND SOCIETY

4 Students will develop an understanding of the cultural, social, economic, and political effects of technology.

5 Students will develop an understanding of the effects of technology on the environment.

6 Students will develop an understanding of the role of society in the development and use of technology.

7 Students will develop an understanding of the influence of technology on history.

DESIGN

8 Students will develop an understanding of the attributes of design.

9 Students will develop an understanding of engineering design.

10 Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

ABILITIES FOR A TECHNOLOGICAL WORLD

STANDARDS

11 Students will develop the abilities to apply the design process.

12 Students will develop the abilities to use and maintain technological products and systems.

13 Students will develop the abilities to assess the impact of products and systems.

THE DESIGNED WORLD

14 Students will develop an understanding of and be able to select and use medical technologies.

15 Students will develop an understanding of and be able to select and use agricultural and related biotechnologies.

16 Students will develop an understanding of and be able to select and use energy and power technologies.

17 Students will develop an understanding of and be able to select and use information and communication technologies.

18 Students will develop an understanding of and be able to select and use transportation technologies.

19 Students will develop an understanding of and be able to select and use manufacturing technologies.

20 Students will develop an understanding of and be able to select and use construction technologies.

Figure 2 The 20 content standards from *Standards for Technological Literacy*

Nature of Technology. Content standards 1 through 3 are combined to define the Nature of Technology. Table 3 lists these standards and contains the mean and standard deviation for responses relating to the importance of the Nature of Technology content standards with respect to their students and the extent to which they are currently being addressed in the respondents' classrooms. The mean importance ratings for content standards 1 through 3 range from 3.98 (for content standard 1) to 4.04 (for content standard 3), indicating that these three standards were rated as important. The 'extent addressed' items ranged from 1 (no extent) to 4 (great extent). The mean degree to which content standards 1 through 3 are currently being addressed ranged from 2.87 (for content standard 1) to 3.02 (for both content standard 2 and content standard 3), indicating that these content standards are being addressed to some extent.

Table 3

Descriptive Statistics for the Nature of Technology Content Standard Items

#	Content Standard	Importance			Extent Addressed		
		N	M	SD	N	M	SD
1	The Characteristics and Scope of Technology	47	3.98	.99	46	2.87	.89
2	The Core Concepts of Technology	47	4.02	.92	46	3.02	.88
3	Relationships Among Technologies and the Connections Between Technology and Other Fields	47	4.04	.96	46	3.02	.88

Note. The scale for the 'importance' items ranged from 1 to 5, while the scale for the 'extent addressed' items ranged from 1 to 4.

Technology and Society. Content standards 4 through 7 are combined to define Technology and Society. These content standards are listed in Table 4 along with means and standard deviations for each standard. The mean importance ratings were slightly lower than they were for the Nature of Technology category, ranging from 3.62 (for content standard 4) to 3.80 (for content standard 7). However, the extent to which these content standards are currently being taught was approximately the same as those for the Nature of Technology, ranging from 2.80 (for content standard 6) to 3.04 (for content standard 5).

Table 4

Descriptive Statistics for Technology and Society Content Standard Items

#	Content Standard	Importance			Extent Addressed		
		N	M	SD	N	M	SD
4	The Cultural, Social, Economic, an Political Effects of Technology	45	3.62	1.07	46	2.98	1.83
5	The Effects of Technology on the Environment	45	3.69	1.16	46	3.04	1.59
6	The Role of Society in the Development and Use of Technology	45	3.73	1.10	45	2.80	1.27
7	The Influence of Technology on History	44	3.80	1.13	45	3.00	1.60

Note. The scale for the 'importance' items ranged from 1 to 5, while the scale for the 'extent addressed' items ranged from 1 to 4.

Design. The means and standard deviations for the importance and use of the content standards relating to Design are shown in Table 5. The mean importance rating for the Design content standards were again lower than those for the Nature of Technology but comparable with content standards from the Technology and Society category. The mean importance ratings ranged from 3.56 (for content standard 9) to 3.84 (for content standard 10). The extent to which these standards are currently being addressed ranged from 3.00 (for content standard 9) to 3.33 (for content standard 10).

Table 5

Descriptive Statistics for Design Content Standard Items

#	Content Standard	Importance			Extent Addressed		
		N	M	SD	N	M	SD
8	The Attributes of Design	45	3.67	1.11	46	3.30	1.98
9	Engineering Design	45	3.56	1.08	46	3.00	1.84
10	The Role of Troubleshooting, Research and Development, Invention, and Innovation, and Experimentation in Problem Solving	45	3.84	1.21	46	3.33	1.79

Note. The scale for the 'importance' items ranged from 1 to 5, while the scale for the 'extent addressed' items ranged from 1 to 4.

Abilities for a Technological World. Table 6 contains the means and standard deviations for the importance and use of the content standards listed in the Abilities for a Technological World category. Again, the mean importance ratings were lower than those for the Nature of Technology content standards but comparable to content standards from the Technology and Society, and Design categories. These importance ratings ranged from 3.58 (for content standard 13) to 3.82 (for content standard 12). The extent to which these content standards are currently being taught ranged from 3.11 (for content standard 13) to 3.40 (for content standard 11), which indicates slightly more application than the content standards for the Nature of Technology, Technology and Society, or Design categories.

Table 6

Descriptive Statistics for the Abilities for a Technological World Content Standard Items

#	Content Standard	Importance			Extent Addressed		
		N	M	SD	N	M	SD
11	Apply Design Processes	45	3.78	1.04	45	3.40	1.95
12	Use and Maintain Technological Products and Systems	45	3.82	1.01	46	3.28	1.75
13	Assess the Impact of Products and Systems	45	3.58	1.08	46	3.11	1.82

Note. The scale for the 'importance' items ranged from 1 to 5, while the scale for the 'extent addressed' items ranged from 1 to 4.

The Designed World. The means and standard deviations for the importance and use of the content standards related to the Designed World are shown in Table 7. The importance ratings ranged from 3.40 (for content standard 14) to 3.82 (for content standard 17). These values indicate that the content standards subsumed under the Designed World category are comparable to those of the Nature of Technology, Technology and Society, Design, and Abilities for a Technological World categories.

In terms of the extent to which the content standards are currently being addressed, the ratings ranged from 2.67 (for content standards 14 and 15) to 3.22 (for content standard 17), which is a lower range than for any of the other four categories.

Table 7

Descriptive Statistics for The Designed World Content Standard Items

#	Content Standard	Importance			Extent Addressed		
		N	M	SD	N	M	SD
14	Medical Technologies	45	3.40	1.07	46	2.67	1.90
15	Agricultural and Related Biotechnologies	45	3.42	1.16	46	2.67	1.98
16	Energy and Power Technologies	45	3.80	1.10	46	2.85	1.62
17	Information and Communication	44	3.82	1.04	46	3.22	1.56
18	Transportation Technologies	45	3.69	1.02	46	3.04	1.59
19	Manufacturing Technologies	45	3.78	1.11	46	2.98	1.67
20	Construction Technologies	44	3.73	1.07	46	2.96	1.66

Note. The scale for the 'importance' items ranged from 1 to 5, while the scale for the 'extent addressed' items ranged from 1 to 4.

Research Question #3

The third research question was to investigate the extent to which industrial technology teachers in Arizona endorse the content standards presented in the *Standards for Technological Literacy* (ITEA, 2000)? To answer this question, data were collected from industrial technology education teachers in Arizona in response to five questions that dealt with teachers' perceptions of the value of the content standards presented in the

Standards for Technological Literacy. A four-point, Likert-style, forced-selection, fixed rank order-scale with the range: 4 = *great extent*, 1 = *no extent* was used. Analyses were conducted by performing frequency counts with percentages using SPSS and the results entered in Table 8.

First, respondents were asked the extent to which the standards represented what students should know and be able to do in order to be technologically literate. A total of 84.5% of respondents feel that the content standards represent what students should know. Only two respondents feel that the standards do not represent what students should know. Second, respondents were asked about the extent to which the standards represented the current curriculum. This time 77.3% of respondents indicted that this was true to ‘some’ or a ‘great extent.’ The remainder indicated that this was true to ‘no extent’ or to a ‘little extent.’ Respondents were asked how useful the standards would be in designing the curriculum and the extent to which standards could be implemented into their teaching area. In both cases all but one respondent felt that the standards would be useful and could be implemented into their teaching area. This indicates an extremely positive response towards the content standards. Finally, respondents were asked about the extent to which the standards should be adopted in the state of Arizona. Again, the majority (77.3%) indicated that they should be adopted to ‘some’ or a ‘great extent.’ Much smaller percentages indicated that the standards should be adopted to little (11.4%) or no (11.4%) extent.

Table 8

Standards Endorsement by Industrial Technology Education Teachers in Arizona

	F	%
Standards represent what students should know to (N=45)		
No Extent	2	4.4
Little Extent	5	11.1
Some Extent	26	57.8
Great Extent	12	26.7
Standards represent current curriculum to (N=44)		
No Extent	2	4.5
Little Extent	8	18.2
Some Extent	25	56.8
Great Extent	9	20.5
Standards would be useful in designing curriculum to (N=44)		
No Extent	1	2.3
Little Extent	7	15.9
Some Extent	21	47.7
Great Extent	15	34.1
Standards could be implemented in teaching area to (N=44)		
No Extent	1	2.3
Little Extent	5	11.4
Some Extent	25	56.8
Great Extent	13	29.5
Standards should be adopted in Arizona to (N=44)		
No Extent	5	11.4
Little Extent	5	11.4
Some Extent	22	50.0
Great Extent	12	27.3

Research Question #4

The last research question was to discover the extent to which industrial technology education teachers' in Arizona feel they are prepared to address the content standards presented in the *Standards for Technological Literacy*. Respondents were asked the extent to which their education and professional experience had prepared them to address the content standards in the classroom and whether they would benefit from additional training on the standards. A four-point, Likert-style, forced-selection, fixed rank order-scale with the range: 4 = *great extent*, 1 = *no extent* was used.

Preparation to Address Content Standards. In Table 9 the frequency and percentage of each response is presented for the extent to which education prepared the respondents to address the standards. Respondents felt most prepared to address the content standards included in the category of Abilities for a Technological World. A total of 81.4% felt their education prepared them to either 'some' or a 'great extent.' Surprisingly, the respondents felt least prepared to address the content standards included in the category of The Designed World with 72.1% of respondents who felt their education prepared them to 'some' or a 'great extent.' For each category the majority of respondents (ranging from 44.2% to 53.5%) felt that their education prepared them to address all of the content standards to 'some extent' with only 7% to 9.3% of respondents indicating that their education did not prepare them to address the content standards at all.

Table 9

Degree to which Education Prepared Instructors to Address Content Standards

	F	%
Nature of Technology (N=43)		
No Extent	3	7.0
Little Extent	6	14.0
Some Extent	23	53.5
Great Extent	11	25.6
Technology and Society (N=43)		
No Extent	3	7.0
Little Extent	7	16.3
Some Extent	19	44.2
Great Extent	14	32.6

Table 9, cont'd.

	F	%
Design (N=43)		
No Extent	4	9.3
Little Extent	7	16.3
Some Extent	22	51.2
Great Extent	10	23.3
Abilities for a Technological World (N=43)		
No Extent	3	7.0
Little Extent	5	11.6
Some Extent	23	53.5
Great Extent	12	27.9
The Designed World (N=43)		
No Extent	3	7.0
Little Extent	9	20.9
Some Extent	21	48.8
Great Extent	10	23.3

In Table 10 the same information is presented in terms of the extent to which professional experience had prepared the respondents to address the content standards. Respondents felt most prepared to address the content standards included in the category of the Nature of Technology. A total of 88.4% indicated that their professional experience prepared them to 'some' or a 'great extent.' Again, respondents felt least prepared to address the content standards included in the category for The Designed World with 77.3% of respondents who felt their professional experience prepared them to 'some' or a 'great extent.' For each category the majority of respondents (ranging from 45.5% to 60.5%) felt that their professional experience prepared them to address all of the content standards to 'some extent' with only 4.5% to 6.8% of respondents indicating that their education did not prepare them to address the content standards at all.

In comparing respondents' educational background with their professional experience, it appears respondents feel their professional experience has prepared them to address the content standards more than their educational background. The results also indicate that although the majority of respondents are unfamiliar with the content standards found in the *Standards for Technological Literacy*, they feel that their educational and professional background has prepared them to address the standards in the classroom.

Table 10

Degree to which Professional Experience Prepared Instructors to Address Content Standards

	F	%
Nature of Technology (N=43)		
No Extent	2	4.7
Little Extent	3	7.0
Some Extent	26	60.5
Great Extent	12	27.9
Technology and Society (N=44)		
No Extent	2	4.5
Little Extent	6	13.6
Some Extent	20	45.5
Great Extent	16	36.4
Design (N=44)		
No Extent	3	6.8
Little Extent	4	9.1
Some Extent	25	56.8
Great Extent	12	27.3
Abilities for a Technological World (N=43)		
No Extent	2	4.7
Little Extent	6	14.0
Some Extent	23	53.5
Great Extent	12	27.9
The Designed World (N=44)		
No Extent	2	4.5
Little Extent	8	18.2
Some Extent	23	52.3
Great Extent	11	25.0

Benefits of Additional Training. The final question on the survey inquired about the extent to which additional training would benefit the respondents, and the results are presented in Table 11. Respondents felt they could benefit the most from additional training relating to the content standards included in The Designed World category. A total of 90.9% of respondents felt they could benefit to 'some' or a 'great extent.' Respondents felt they would also benefit from additional training to 'some' or a 'great extent' on the other categories. Those responses ranged from 84.1% for additional training on content standards included in Technology and Society to 88.6% for content standards included in Design. Only one or two respondents indicated they would not benefit at all from additional training with respect to the standards. The results indicate a high level of perceived benefit from additional training.

Table 11

Degree to which Instructors Would Benefit from Additional Training Related to Content Standards

	F	%
Nature of Technology (N=44)		
No Extent	2	4.5
Little Extent	4	9.1
Some Extent	28	63.6
Great Extent	10	22.7
Technology and Society (N=44)		
No Extent	1	2.3
Little Extent	6	13.6
Some Extent	27	61.4
Great Extent	10	22.7

Table 11, cont'd.

	F	%
Design (N=44)		
No Extent	2	4.5
Little Extent	3	6.8
Some Extent	25	56.8
Great Extent	14	31.8
Abilities for a Technological World (N=43)		
No Extent	1	2.3
Little Extent	5	11.6
Some Extent	26	60.5
Great Extent	11	25.6
The Designed World (N=44)		
No Extent	2	4.5
Little Extent	2	4.5
Some Extent	26	59.1
Great Extent	14	31.8

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Summary

To improve technological literacy, one of the most important places to begin is in schools. Providing all students with early and regular contact with technology, exposing them to relevant concepts and hands-on, design-related activities is one of the potentially most valuable ways to help them acquire the kinds of knowledge, ways of thinking and acting, and capabilities consistent with technological literacy (Young, Cole & Denton, 2003). National *Standards for Technological Literacy* were developed by the International Technology Education Association to identify the technological content that should be taught by teachers to help students to become technologically literate. The purpose of this study was to investigate the perceived knowledge, use, and acceptance of national content standards by industrial technology education teachers in Arizona. Four research questions were posited by this investigator to address the purpose of the study: Each is stated below, followed by a summary of the findings related to that particular question.

Research Question #1

The first research question was to investigate the extent to which industrial technology education teachers in Arizona believe there is a need for technology education content standards and how familiar are they with the content standards presented in the

Standards for Technological Literacy. From the data analysis it was found that a small majority (58.3%) were unfamiliar with the ITEA *Standards for Technological Literacy*. It was not surprising to find that respondents who were the most familiar with the *Standards for Technological Literacy* taught only Level I (grades 7-8) technology education classes whereas the respondents who were very unfamiliar with the standards taught Level II (grades 9-10) and Level III (grades 11-12) classes. In addition, it was of interest to find that only one-third of the sample population of Arizona teachers actually possessed a copy of the ITEA standards. This represents a challenge for ITEA as they look for ways to disseminate information regarding the standards. If the ITEA is promoting wider acceptance of the *Standards for Technological Literacy* they need to promote ways of getting the standards into the hands of technology educators throughout the country.

A large majority (93.8%) agreed, however, that content within the standards were needed to some or a great extent indicating that industrial technology education teachers in Arizona feel comfortable with the material in the STL document. This indicates the standards are accepted by a broad readership, which includes not only pure technology teachers, but industrial technology education teachers as well. The discrepancy of these findings between acceptance and need further indicates that these same teachers need help making the connection of the standards to their current curriculum.

Research Question #2

In terms of the extent to which the content standards are perceived as important and currently being addressed in the classroom, for the category Nature of Technology respondents feel content standards 2 & 3 are more important for their students to learn and are addressed more during instruction than content standard 1. For Technology and Society, respondents perceive content standard 7 as being the most important for their students to learn although content standard 5 is addressed the most during instruction. Reasons for this may include the amount of exposure given to the effects of technology on the environment that is generated through various media and institutional reports. As pertaining to Design, respondents feel content standards 8 & 10 are more important for their students to learn and addressed more during instruction than content standard 9. The same was true for Abilities for a Technological World– that is, respondents believed that content standards 11 & 12 were more important for their students to learn and addressed during instruction more than content standard 13. For the extent to which respondents address the content standards related to The Designed World, content standards 14 and 15 indicated a lower range of importance and extent addressed than content standards 16-20.

In taking all 20 content standards into consideration, respondents perceive the ability to problem solve (content standard 10) and use & maintain technological products (content standard 12) as being the most important for their students to learn and are addressed most during instruction. This is interesting because free response comments collected during the pilot study indicated that many teachers feel students lack valuable problem solving skills required to succeed in the workplace. This also correlates with comments made by employers who have described high school and college graduates as lacking the applicable technical and problem solving skills for their given industry (Prentice 2001).

Research Question #3

It is first important to mention that the majority (84.5%) of respondents indicated that the content standards did represent what their students should know and be able to do in order to be technologically literate. Thus, the standards were perceived by teachers to be useful, meaningful, and accepted. The majority also perceived the standards as useful in designing the course curriculum. A total of 77.3% indicated that the standards did represent their current curriculum with responses ranging from some to a large extent. The same was found to be true with respect to using the standards in teaching as 86.3% of the respondents felt that the standards could be implemented into their teaching areas. However, teachers did not indicate specifically in which ways they were developing curriculum in their programs. Understanding this was out of the scope of this research project.

Exactly half of the respondents indicated that the standards should be adopted within the state of Arizona to some extent, with an additional third indicating that they should be adopted to a great extent. Thus, a clear majority supported the subsequent adoption of the standards. This finding is significant because traditionally teachers are reluctant to accept new innovations as referenced in the review of literature. The conclusion was reached from the responses of the teachers that the content standards are perceived as meaningful, that they could be used in designing the curriculum, and that many of the standards were already being addressed. This is a clear indication of an acceptance towards the content standards presented in the *Standards for Technological Literacy*.

Research Question #4

When asked the extent to which their education had prepared them to address the content standards in the classroom, the majority of the teacher respondents felt that they were prepared with relation to all of the categories. These included the Nature of Technology, Technology and Society, Design, Abilities for a Technological World, and the Designed World (over three quarters of the respondents felt that their education prepared them in each of these categories to some or to a great extent).

Similar research findings emerged when respondents were asked the extent to which their professional experience had prepared them to address the content standards in the classroom. In fact, percentages were even higher. For Nature of Technology, 88.4% of the sample indicated they were either somewhat or greatly prepared; 81.9% indicated the same for the Technology and Society content standards and 84.1% for Design. A total of 81.4% agreed that their professional experience had prepared them to address the content standards associated with Abilities for a Technological World. A little over three-fourths of the sample stated they were somewhat or greatly prepared as related to the Designed World. These results seem a little strange since the majority of the respondents are prepared through the vocational or skills based paths, and not through a general technology education degree program. These results came as a surprise to the researcher who expected the opposite response. It would appear vocationally trained teachers in the state of Arizona do feel prepared to teach the content standards found within the *Standards for Technological Literacy* which makes one wonder whether there is a need for general technology education. Perhaps vocational education teachers can adequately teach the necessary content standards for their students to become technologically literate. Further research would be required to address this issue.

When asked the extent to which additional training on the content standards would be beneficial, 86.3% of respondents believe they could benefit from additional training on the content standards related to The Nature of Technology to some or a great extent. The response was similar (84.1%) for content standards related to Technology, Design (88.6%), Abilities for a Technological World (86.1%), and The Designed World (90.9%). These findings strongly suggest an overall interest and acceptance of the content presented in the *Standards for technological Literacy* and a willingness to pursue additional in-service or training based on the standards.

Conclusions

The Arizona survey results were largely consistent with surveys conducted by Utah State University and Jill Russell, external evaluator for ITEA's Technology for All Americans Project. Results of the surveys "indicate these respondents are highly supportive of the K-12 content standards for the study of technology" (Russell, 2003, p. 29). The purpose of this study was to investigate the perceived knowledge, use, and acceptance of STL by industrial technology education teachers in the state of Arizona. The overall results of the study should be very encouraging to those who develop and deliver technology education curricula, administer technology education programs, and provide pre-service and in-service training for technology education teachers. Almost all teachers (93.8%) felt that there was a need for standards for technology education. Furthermore, almost all teachers (95.4%) would benefit from additional training related to the standards, and most teachers (90.8%) felt that their own educational background and experience had adequately prepared them to teach any of the five major categories (e.g., Design) identified in STL. On the basis of the data collection and subsequent analysis, the present research study supports the researcher in making the following conclusions:

1. A small majority of industrial technology education teachers in the state of Arizona are unfamiliar with the content standards presented in the Standards for Technological Literacy.

2. Respondents feel the content standards are important for their students and are addressing them during instruction to some extent.

3. Industrial technology education teachers within the state of Arizona are accepting of the content standards presented in the *Standards for Technological Literacy*.

4. The majority of the respondents feel that the standards represented their current curriculum.

5. Respondents also felt that the standards would be useful in revising or developing curriculum for technology education and could be implemented into their teaching area.

6. It was also concluded that the majority of respondents feel the state of Arizona should adopt the standards to some or a great extent.

7. The educational and professional background of industrial technology teachers in Arizona has prepared them to some extent to address the content standards that are related to all five major categories (Nature of Technology,

Technology and Society, Design, Abilities for a Technological World, and The Designed World);

8. Most respondents believed that they could benefit from additional training and professional development opportunities as related to the standards to some or a great extent.

Recommendations

In an effort to apply the findings of the present investigative research, specific recommendations have been formulated, as based on the analysis and conclusions of the study. These recommendations are as follows:

1. The study recommends that future research, in an effort to support the findings of the present investigation, conduct follow-up studies, but on a broader scale as regards sample size, diversity of sample group, and number of states included in the population. A study of significantly more teacher respondents in different states and employed in various types of school districts would almost certainly yield greater insight and perhaps an even closer convergence with the findings of the present research. An investigation that would assess the use and understanding of the standards in a wider context would serve to validate the findings of this study. Such a study would also provide additional and substantial support to the growing body of evidence supporting the adoption of the *Standards for Technological Literacy*.
2. The study also recommends that replication of the present investigation should logically be made at intervals in the future in an effort to detect changing or similar trends with respect to the Standards for Technological literacy. Such

continuing support for the standards would assist school management boards in taking positive steps forward toward such an adoption.

3. This researcher also sees the need to conduct future studies using more than one method for collecting data. Triangulation of information could take place from interviews, observations, and focus groups to supplement survey information and add to the validity of the findings. Underlying most uses of triangulation is the goal of seeking convergence of meaning from more than one direction. If the data from two or more methods seem to converge on a common explanation, the biases of the individual methods are thought to "cancel out" and validation of the claim is enhanced. This particular recommendation is substantially supported in the statistical and methodological literature.
4. Lastly, the researcher sees the need for an investigative study of level II industrial technology education teachers in the state of Arizona to determine their perceptions and needs relative to technology education curriculum development.
5. Further research needs to be conducted among those industrial technology education teachers in Arizona who are using the standards in curriculum development to determine how they are doing it.

Implications

For a society deeply dependent on technology, we are largely ignorant about technological concepts and processes and we mostly ignore this discrepancy in our educational system. The need to achieve technological literacy is a national imperative. School programs *must* include technology education. Professional development is needed for the technological literacy standards to move outside the very documents that contain them and eventually into the practice of every teacher and the learning of every student. The field of technology education is an ever evolving phenomena. It is important to investigate teachers' perceptions within the field in order to determine how to face the future direction and needs of the profession. It is critical that we continue to research these items of concern and come to terms with them. It is exciting to be part of such a great profession at such a dynamic period of time. As industrial technology education teachers in Arizona and around the country continue to challenge themselves and their students to become technologically literate, we must accept and use the tools we have been given so great things can be accomplished.

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APPENDICES

APPENDIX A

Letter to CTE Directors and Administrators

Dear CTE Director/Administrator:

My name is Allan McRae. I teach technology education and CAD drafting at Greenway High School. As part of a master's thesis I am preparing a survey to be sent to other technology education teachers in the Phoenix metropolitan area. In order for the survey to be successful I am compiling a list of high school teachers who teach a Level I and/or Level II (generally grades 7-10) technology education class. Part of the research is to survey these teachers to determine their knowledge, use, and acceptance of the national *Standards for Technological Literacy*.

The Arizona Department of Education emailed a list of Industrial Technology Education teachers within the state; however, I need your help in narrowing the list to those who teach a level I and/or Level II technology class i.e. Introduction to Technology, Principles of Technology, Foundations of Technology, or any other general technology education class your district may have adopted.

Please respond to this email with a current list of level I and/or level II technology education classes that are taught in your district along with teacher contact information so I can get in touch with them regarding the survey. I will be glad to share the results along with any other information you request. Your assistance is greatly appreciated.

Sincerely

Allan R. McRae

APPENDIX B

Pilot Study Survey

Arizona Teachers= Perceptions of the ITEA *Standards for Technological Literacy: Content for the Study of Technology*

Introduction: In the Spring of 2000, the International Technology Education Association (ITEA) released the *Standards for Technological Literacy: Content for the Study of Technology*. The *Standards* contain 20 technology content standards that specify what every student should know and be able to do in order to be technologically literate in grades K-12. The purpose of this survey is to explore and determine the knowledge, use, and acceptance of the standards in Arizona high schools.

Directions: Please answer the following questions by checking the appropriate box. A copy of the **Executive Summary** of the *Standards for Technological Literacy: Content for the Study of Technology* is provided for your reference. For more information about the *Standards*, visit the International Technology Education Association home page at www.iteawww.org

ITEA Standards for Technological Literacy

1. Do you have a copy of the *Standards?* ☐YES ☐NO

   (If you do not have a copy of the *Standards* or have not previously reviewed the *Standards* in some form SKIP TO QUESTION #6)

2. To what extent are you familiar with the *Standards*?

To a great extent	To some extent	To little extent	To no extent
☐	☐	☐	☐

3. To what extent do you feel that the *Standards* adequately describe what students need to know to be technologically literate?

To a great extent	To some extent	To little extent	To no extent
☐	☐	☐	☐

4. To what extent have you modified your curriculum in any way to reflect the *Standards?*

To a great extent	To some extent	To little extent	To no extent
☐	☐	☐	☐

5. To what extent do you feel the lessons and activities that you now do in class are meeting the *Standards*?

To a great extent	To some extent	To little extent	To no extent
☐	☐	☐	☐

(Please use the Executive Summary of the STL to answer the following questions if you skipped here from question #1)

6. To what extent do you feel that there was a need to develop *Standards* for Technology Education?

To a great extent	To some extent	To little extent	To no extent
☐	☐	☐	☐

7. Have you taken any in-service training on the new *Standards*? ☐YES ☐NO
   If you have not taken training on the new *Standards*, to what extent would you attend training if it was offered?

To a great extent	To some extent	To little extent	To no extent
☐	☐	☐	☐

8. If available, to what extent would you implement *Standards-Based* curriculum into your teaching area?

To a great extent	To some extent	To little extent	To no extent
☐	☐	☐	☐

9. If the State of Arizona were to adopt the new *Standards*, to what extent would you support the decision?

To a great extent	To some extent	To little extent	To no extent
☐	☐	☐	☐

Background & Training

10. To what extent do you feel that your own background and training has prepared you to teach each of the following categories identified in the *Standards*? (If needed, please review the Executive Summary of the *Standards*.)

Category #1: *Nature of Technology*

To a great extent	To some extent	To little extent	To no extent
☐	☐	☐	☐

Category #2: *Technology and Society*

To a great extent	To some extent	To little extent	To no extent
☐	☐	☐	☐

Category #3: *Design*

To a great extent	To some extent	To little extent	To no extent
☐	☐	☐	☐

Category #4: *Abilities for a Technological World*

To a great extent	To some extent	To little extent	To no extent
☐	☐	☐	☐

Category #5: *The Designed World*

To a great extent	To some extent	To little extent	To no extent
☐	☐	☐	☐

Teacher Information

11. Are you a member of ITEA? ☐YES ☐NO

12. Number of years teaching: _______________ years

13. Highest level of schooling:
    _______ Less than Associate Degree _____ Associate Degree
    _______ BS _____ MA/MS _____ PhD/ EdD

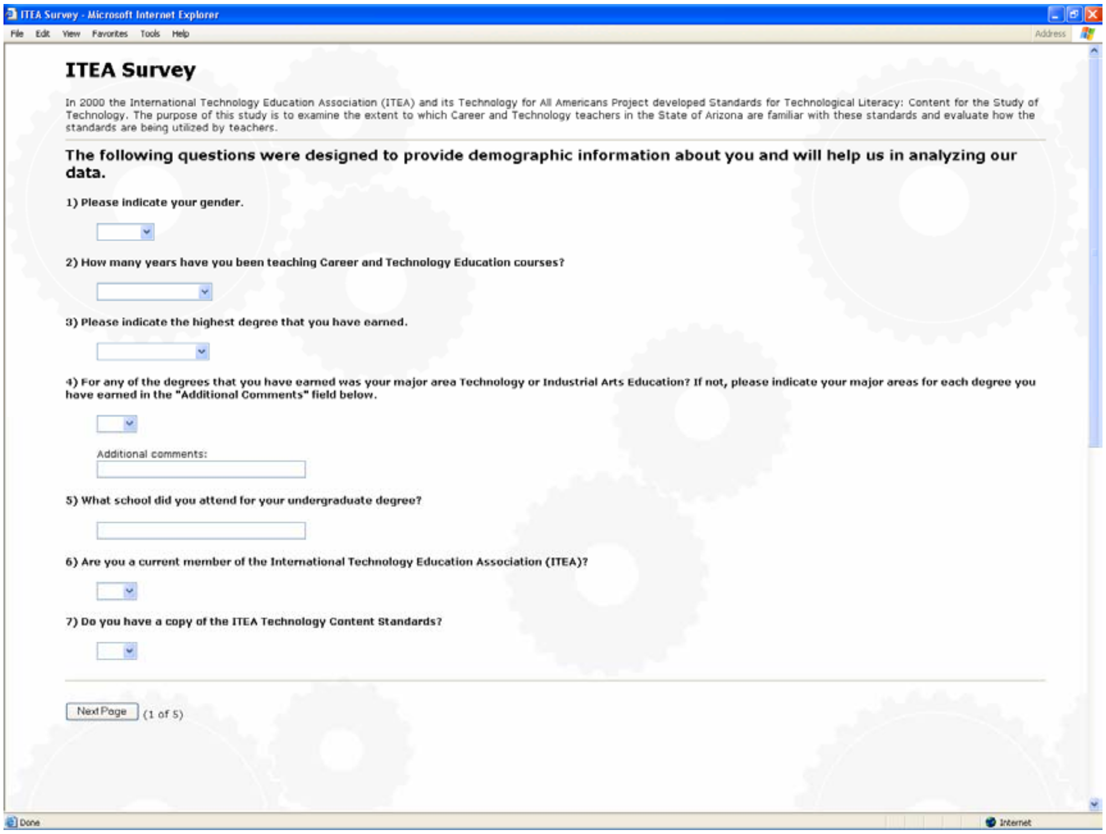
14. If you have graduated with a BS or BA, was your undergraduate major Technology Education/Industrial Arts? ☐YES ☐NO
    If NO, list your undergraduate teaching major: ______________________________
    Name of School where you obtained your undergraduate Degree: ______________

15. Comment (please share ideas or thoughts about training and the standards that you would like to expand on or that were not covered in the survey above)
    ____
    ____
    ____

Please Return this Survey to me via district mail by Tuesday May 25th Thank You!

APPENDIX C

Electronic Survey Instrument



ITEA Survey - Microsoft Internet Explorer

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ITEA Survey

In 2000 the International Technology Education Association (ITEA) and its Technology for All Americans Project developed Standards for Technological Literacy: Content for the Study of Technology. The purpose of this study is to examine the extent to which Career and Technology teachers in the State of Arizona are familiar with these standards and evaluate how the standards are being utilized by teachers.

The following questions were designed to provide demographic information about you and will help us in analyzing our data.

1) Please indicate your gender.

2) How many years have you been teaching Career and Technology Education courses?

3) Please indicate the highest degree that you have earned.

4) For any of the degrees that you have earned was your major area Technology or Industrial Arts Education? If not, please indicate your major areas for each degree you have earned in the "Additional Comments" field below.

Additional comments:

5) What school did you attend for your undergraduate degree?

6) Are you a current member of the International Technology Education Association (ITEA)?

7) Do you have a copy of the ITEA Technology Content Standards?

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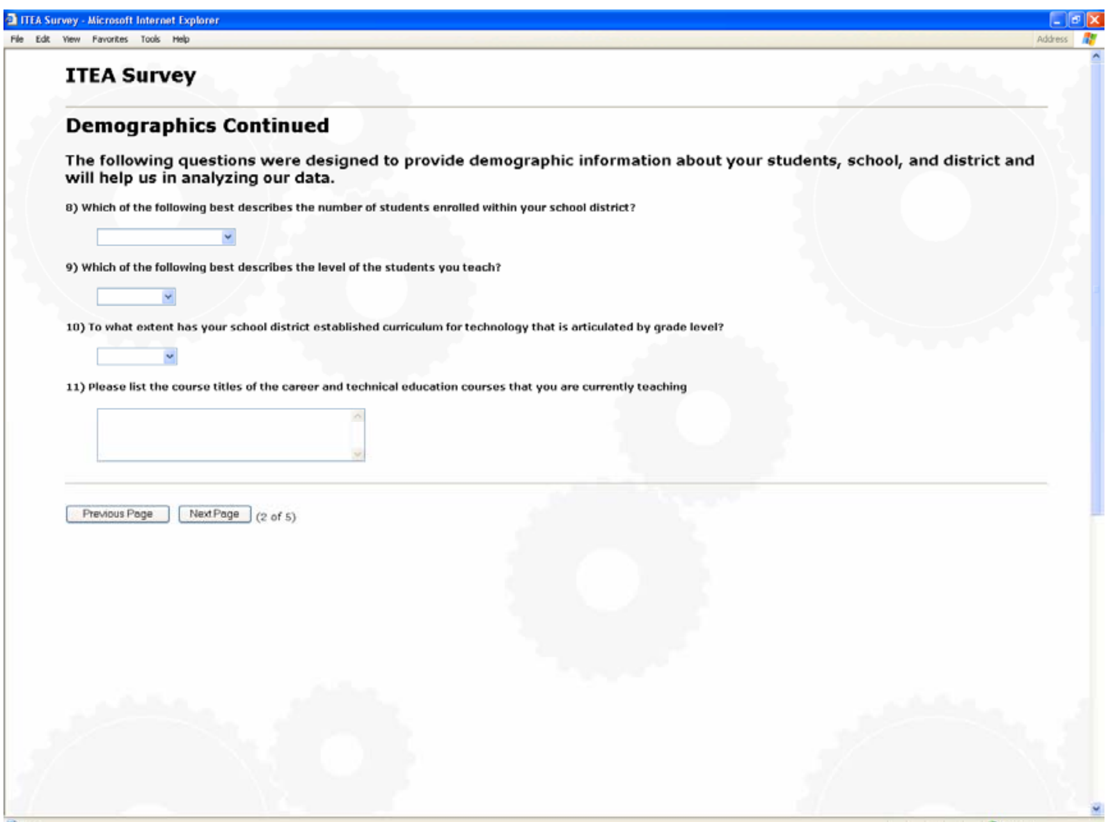

ITEA Survey - Microsoft Internet Explorer

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ITEA Survey

Demographics Continued

The following questions were designed to provide demographic information about your students, school, and district and will help us in analyzing our data.

8) Which of the following best describes the number of students enrolled within your school district?

9) Which of the following best describes the level of the students you teach?

10) To what extent has your school district established curriculum for technology that is articulated by grade level?

11) Please list the course titles of the career and technical education courses that you are currently teaching

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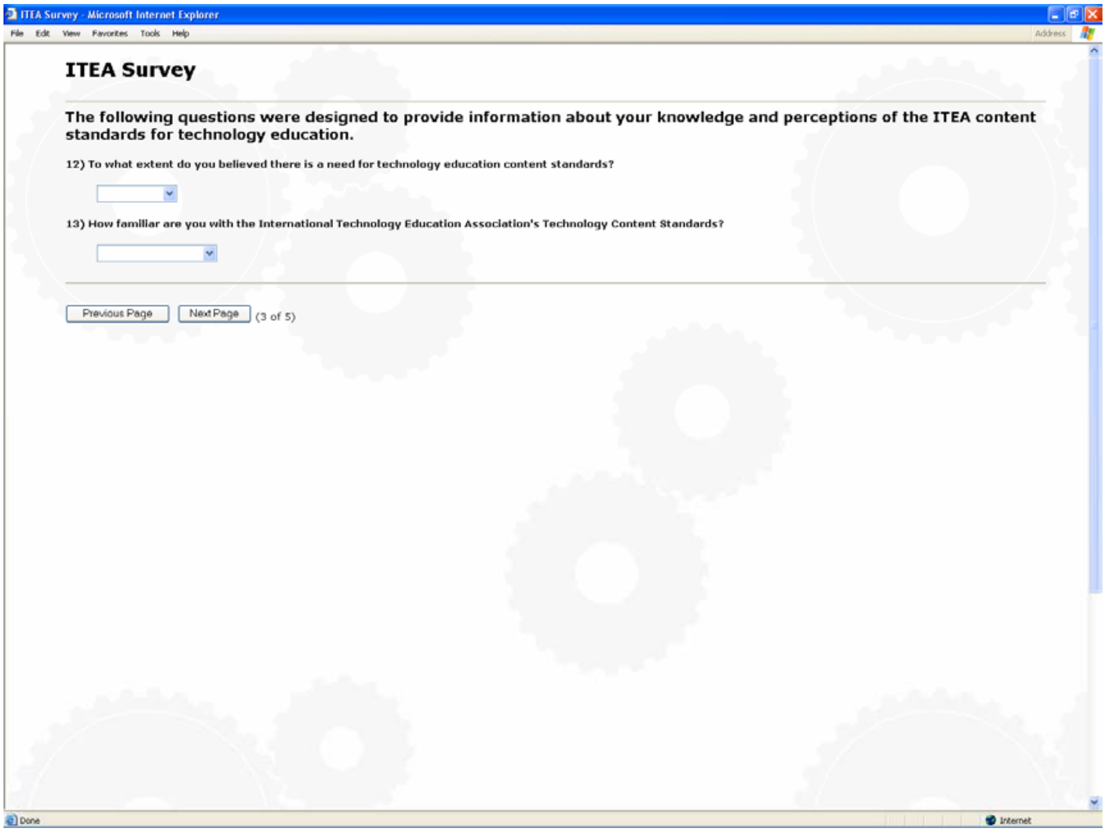

ITEA Survey - Microsoft Internet Explorer

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ITEA Survey

The following questions were designed to provide information about your knowledge and perceptions of the ITEA content standards for technology education.

12) To what extent do you believed there is a need for technology education content standards?

13) How familiar are you with the International Technology Education Association's Technology Content Standards?

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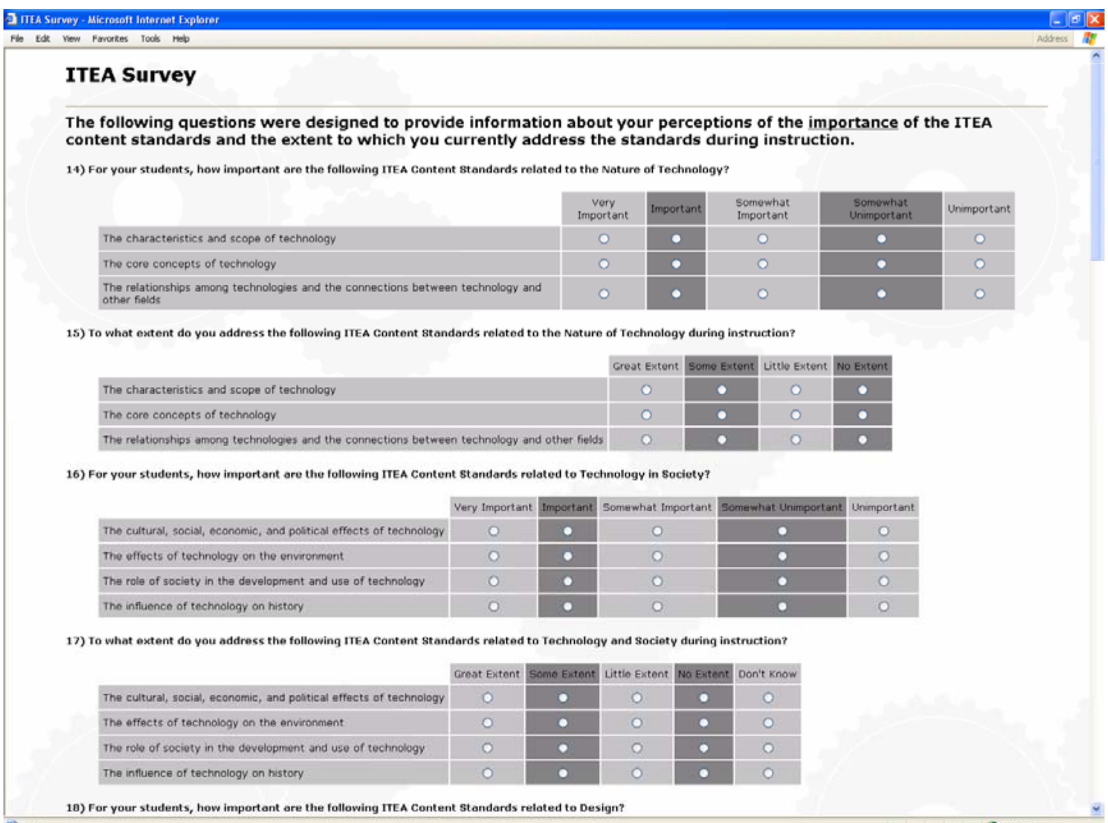

ITEA Survey - Microsoft Internet Explorer

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ITEA Survey

The following questions were designed to provide information about your perceptions of the importance of the ITEA content standards and the extent to which you currently address the standards during instruction.

14) For your students, how important are the following ITEA Content Standards related to the Nature of Technology?

	Very Important	Important	Somewhat Important	Somewhat Unimportant	Unimportant
The characteristics and scope of technology					
The core concepts of technology					
The relationships among technologies and the connections between technology and other fields					

15) To what extent do you address the following ITEA Content Standards related to the Nature of Technology during instruction?

	Great Extent	Some Extent	Little Extent	No Extent
The characteristics and scope of technology				
The core concepts of technology				
The relationships among technologies and the connections between technology and other fields				

16) For your students, how important are the following ITEA Content Standards related to Technology in Society?

	Very Important	Important	Somewhat Important	Somewhat Unimportant	Unimportant
The cultural, social, economic, and political effects of technology					
The effects of technology on the environment					
The role of society in the development and use of technology					
The influence of technology on history					

17) To what extent do you address the following ITEA Content Standards related to Technology and Society during instruction?

	Great Extent	Some Extent	Little Extent	No Extent	Don't Know
The cultural, social, economic, and political effects of technology					
The effects of technology on the environment					
The role of society in the development and use of technology					
The influence of technology on history					

18) For your students, how important are the following ITEA Content Standards related to Design?

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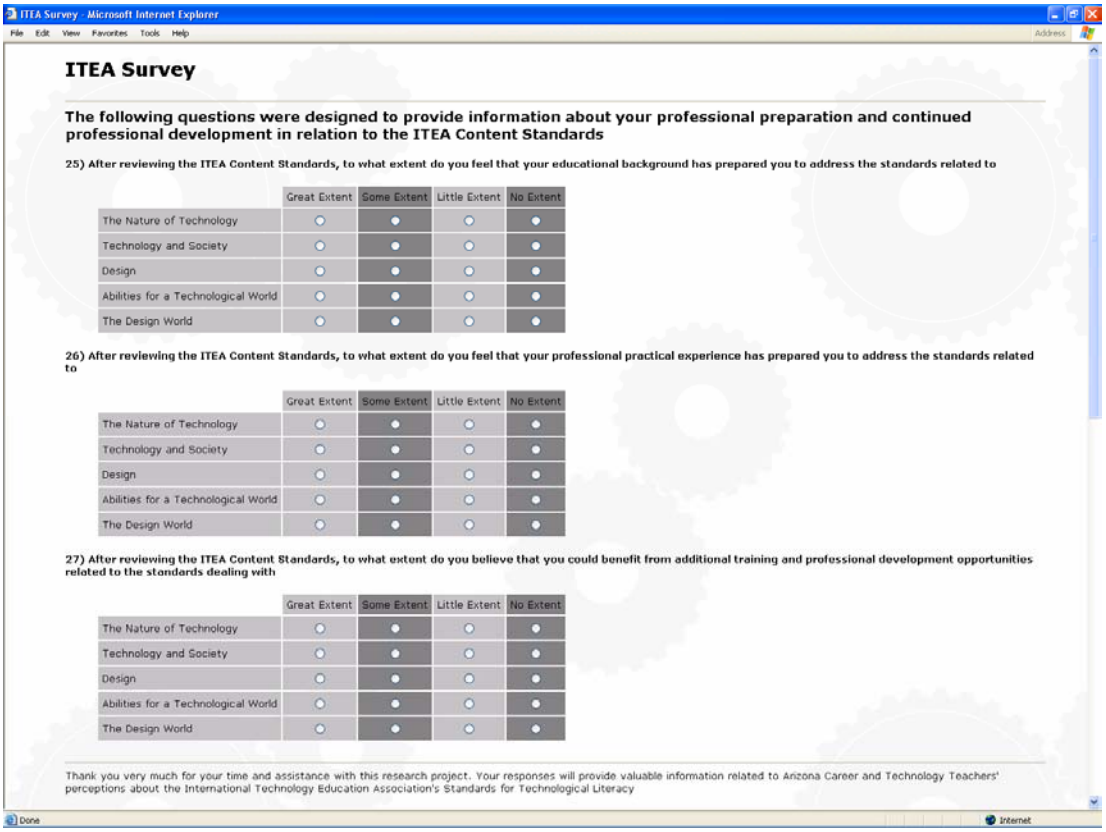
ITEA Survey - Microsoft Internet Explorer

ITEA Survey

The following questions were designed to provide information about your professional preparation and continued professional development in relation to the ITEA Content Standards

25) After reviewing the ITEA Content Standards, to what extent do you feel that your educational background has prepared you to address the standards related to

	Great Extent	Some Extent	Little Extent	No Extent
The Nature of Technology				
Technology and Society				
Design				
Abilities for a Technological World				
The Design World				

26) After reviewing the ITEA Content Standards, to what extent do you feel that your professional practical experience has prepared you to address the standards related to

	Great Extent	Some Extent	Little Extent	No Extent
The Nature of Technology				
Technology and Society				
Design				
Abilities for a Technological World				
The Design World				

27) After reviewing the ITEA Content Standards, to what extent do you believe that you could benefit from additional training and professional development opportunities related to the standards dealing with

	Great Extent	Some Extent	Little Extent	No Extent
The Nature of Technology				
Technology and Society				
Design				
Abilities for a Technological World				
The Design World				

Thank you very much for your time and assistance with this research project. Your responses will provide valuable information related to Arizona Career and Technology Teachers' perceptions about the International Technology Education Association's Standards for Technological Literacy

APPENDIX D

Email Request to Participate

Dear Fellow ITE Teacher:

My name is Allan McRae. I teach technology education and CAD drafting at Greenway High School and am currently working on my master's degree in technology education.

As an ITE teacher in the Glendale Union High School District, I am conducting a study to examine the extent to which ITE teachers in the State of Arizona are familiar with International Technology Education Association's (ITEA) Standards for Technological Literacy: Content for the Study of Technology and evaluate how the standards are being utilized. The ITEA standards can be accessed at http://www.iteawww.org/TAA/Publications/STL/STLMainPage.htm if you would like to review them prior to taking the survey.

Please take the time to contribute to our field by participating in a short online survey. It will take approximately 10-15 minutes to complete the survey. Your participation in this survey is voluntary but greatly appreciated. The information you give will be kept strictly confidential and results of the study can be obtained upon request.

A link to the survey is shown below. If you have any questions or comments, I can be reached at (623) 915-8526 or send an email to armcrae@guhsdaz.org. Thank you for your participation in this study—I appreciate your assistance.

Sincerely,

Allan McRae
Greenway High School

Survey Link
http://webemailer.com/C.dll/Ja70D7kCu6m94B5lfD9wU303J.htm