DISSERTATION

Attitudes of Full-time and Adjunct Electronics Instructors in Texas Community Colleges Toward Technical Skill Standards

Submitted by

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In partial fulfillment of the requirements

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY JASON LEE DAVIS ENTITLED ATTITUDES OF FULL-TIME AND ADJUNCT ELECTRONICS INSTRUCTORS IN TEXAS COMMUNITY COLLEGES TOWARD TECHNICAL SKILL STANDARDS BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

ATTITUDES OF FULL-TIME AND ADJUNCT ELECTRONICS INSTRUCTORS IN TEXAS COMMUNITY COLLEGES TOWARD TECHNICAL SKILL STANDARDS

There is a perceived problem that a gap exists between industry and education in regards to skill standards for electronic technician training. Additionally, there is a perception of a problem arising from variance in attitudes between full-time and adjunct instructors. The purpose of the dissertation was to determine the attitudes of community/junior college electronics instructors (both full-time and part-time) toward validated skill standards in electronic technology. These standards, used for comparison in this dissertation, were developed and validated in a national level study conducted by the Electronic Industries Association and were titled Raising the Standard—Electronics Technician Skills for Today and Tomorrow. In this dissertation study, electronic technology instructors were asked to express their level of agreement regarding the essential knowledge and skill standards developed in the Raising the Standard project. The null hypothesis for the dissertation was that no significant differences existed between the attitudes of electronics instructors toward validated standards developed in the Raising the Standard project.

Fifty-seven electronic technology instructors from 15 Texas community/junior colleges participated in the study. Profiles of electronic technology instructors in the sample population were generated from demographic data collected from the participants. The profile of an electronics instructor in the sample population was concluded to be a person over 35 years of age with a Master's degree in an engineering, science, or technology related discipline and at least one degree in electronics or an electronics related discipline. The participating electronics instructor had more than three years of business or industrial experience and more than two years of teaching experience.

An analysis of the data applying Wilks' Lambda in a 2X2 MANOVA revealed no significant differences at the .05 alpha level between or within groups of full-time, adjunct, rural, and urban electronics instructors toward the identified technical skill standards. The null hypothesis that there is no significant difference in the attitudes of electronics instructors in Texas community/junior colleges toward entry-level technical electronics skills identified in Raising the Standard was not rejected.

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CHAPTER ONE

INTRODUCTION

Technological advancements in the last half of the 20th Century generated an increased need for a well-trained workforce that will be competitive in a 21st Century global market. The manifestation of this need is evident in the areas making use of electronic technology. This need has produced a wide range of job opportunities for skilled electronics technicians (Reis, 1995). The growth of this job market is expected to have the greatest rate of increase of all occupations. This growth will create an increased demand for post-secondary educational institutions to train electronics technicians (Harmon, 1992).

Economic growth and prosperity is highly dependent on an educated workforce and the programs designed to educate workers (Texas Higher Education Coordinating Board, 2000a). The goal identified as having the highest priority in the Texas Strategic Economic Development Plan 1998-2008 is that of building the state's workforce through the strengthening of education in order to develop a knowledge-based economy. The deficiency of technical skills knowledge in the workforce is of paramount concern. The use of standards is stressed as a vehicle necessary to reach the stated goals of the plan (Texas Strategic Economic Development Planning Commission, 1998).

Skill standards are performance objectives and competencies required by a specific occupation and specified by experts within that particular industry (Center for Remediation Design, 1991). It is expected that states will use nationally developed skill standards as benchmarks for their own efforts (Kaplan & Seymour, 1994). A comprehensive framework of nationally validated skill standards has been developed to identify the minimum requirements desirable as a national standard for entry-level electronic technicians.

The study in which these standards were identified focused on input from representatives of industry to determine the necessary technical knowledge and skills for entry-level electronics technicians. These standards, published in a document titled Raising the Standard—Electronics Technician Skills for Today and Tomorrow, were developed through a project of The Electronic Industries Association and the Electronic Industries Foundation under a grant from the U.S. Department of Education's Business and Standards Program (Electronic Industries Foundation,1994b). The Electronic Industries Association, in cooperation with the American Association for Community College's Council for Occupational Education and the Association of Community College Trustees, targeted national businesses and industries in a survey with the goal of determining the supply and demand status of electronic technicians and documenting industries' perception regarding the status of trained technicians. Responses to the survey identified basic electronics as one of the essential competency requirements of entry-level technicians. Industries that responded recognized the utilization of existing community and technical college training programs as one of the leading solutions to address the shortage of qualified technicians (Owen, 1984).

The structure and philosophy of community colleges make them particularly well suited for providing educational training in technical subjects such as electronic technology. Due to the fact that electronic technicians require a greater knowledge than a high school graduate, yet a narrower scope than a graduate engineer, the undertaking of technician preparation is appropriate for community colleges (Thornton, 1972). An important role of the community college is the offering of workforce training programs that culminate with the completion of an associate degree. Training required for a technician level position is generally accomplished with the completion of an associate degree program (Harmon, 1992). Additionally, the adaptability of community/junior colleges makes them the best option for addressing the needs of modern businesses (Rosenfeld, 1996).

The task facing community/junior colleges is that of securing instructors qualified to teach the essential knowledge and skills for entry-level electronic technicians. To meet the demand for instructional personnel in electronic technology programs, community/junior colleges make extensive use of adjunct electronics instructors. Hall (1995) stated that, "in order to provide a high quality education, the community college needs to be aware of the nature of part-time faculty as individuals, as a group, and as a trend" (p. 2). Rose (1992) contended that colleges were making sacrifices in quality for the sake of economic savings by the use of adjunct faculty. Employers surveyed by Van Horn (1995) raised the concern that teachers did not know enough about working in the real world to properly prepare students. Employers in the Van Horn study also suggested increased solicitation of input from businesses. Community/junior college administrators and instructors should make a consorted effort to incorporate industry validated skills standards into their respective programs or courses (Van Horn, 1995).

Need for the Study

There is growing concern over the shortage of qualified entry-level electronics technicians available to industry in Texas. Although Texas is currently enjoying the benefits of a healthy, growing economy, there is urgent concern that this prosperity could turn to crisis if action is not taken to guarantee the availability of an educated workforce to fill the jobs of the future (Texas Higher Education Coordinating Board, 2000a). According to estimates by the American Electronics Association, Texas led the nation between 1990 and 1997 with the creation of over 100,000 new jobs in electronics-related companies (Task Force on Development of the Technology Workforce, 2000). As Texas moves to the forefront as a major location of industries in the high-tech electronics field, there is an increased demand for community/junior colleges to produce entry-level electronics technicians. To meet the needs of the electronics industry, educational institutions must align their programs of instruction to validated technical skill standards of the electronics industries.

A study completed in 1986 compared the perceptions of electronics educators and industry employers regarding entry-level competencies (Wamble, 1986). Texas was not included in Wamble's study. In another study that addressed the perceptions of national industry-based skill standards technical committees regarding the adoption of standards in vocational education programs, a recommendation was made for further research of skill standards at the state level. Committee members surveyed in this study stressed the importance of a commitment by education to develop an understanding of workplace skills and national skill standards (Bunn, 1996). Wamble (1983) also recommended further regional research to determine the existence of significant differences in perceptions regarding the importance of electronics competencies.

Banachowski (1997) reported that since the 1960s, a consistent increase has been observed in the number of adjunct faculty in American community colleges. By the 1970s, the proportion of adjunct faculty exceeded 50 percent of the total community college faculty population (Banachowski, 1997).

Statement of the Problem

There is a national concern by business and industry leaders as to the quality of entry-level technicians who are products of the current education system. In an address to a special session of administrators at the Commissioner's Midwinter Conference, Texas Education Agency, Ed Bales (1995), Director of Education at Motorola Inc. expressed concern that a wide gap currently exists between the needs of business and the outcomes of education.

There is a perception of a weak link that exists between the training workers receive and job standards set by industry (Lankard, 1995). The Texas Higher Education Coordinating Board (2000a) embraced the notion of this perceived 'gap' to the extent of naming the Texas Higher Education Plan, Closing the Gaps, By 2015. The plan emphasizes the urgency of maintaining an educated workforce to ensure the state's continued prosperity and economic growth.

As the major training entity of entry-level technicians, community/junior colleges in Texas have placed a heavy reliance on the teaching staff to design the programs of instruction. Even though educational institutions make use of and seek advice through various avenues from industry, instructor perception of necessary skill and knowledge is primarily the controlling factor that shapes the framework for design and content of programs and courses.

Two overriding concerns emphasized in the literature gave impetus to this study. These recurring concerns guided the formulation of the following problem statements. Firstly, there is a perceived problem that a gap exists between industry and education in regards to skill standards for electronic technician training (Lankard, 1995; Bunn, 1996). Secondly, there is a perception of a problem arising from variance in attitudes between full-time and adjunct instructors (Brewer & Gray, 1997; Friedlander, 1980). This study was designed to address both of these perceived problems.

Purpose

There were two primary purposes guiding this study. The first purpose was to generate profiles of full-time and adjunct electronics instructors in rural and urban community/junior college districts in Texas. Demographic data collected to generate the profiles and serve a dependent variables included position, age, educational level, discipline of highest degree held, business or industrial experience, teaching experience, and setting of college district.

An instructor's perception of need often shapes the design and content of courses. The other purpose of this study was to determine the attitudes of full-time and adjunct electronics instructors in Texas community/junior colleges toward industry validated technical skill standards for entry-level electronic technicians. The technical skill standards used as the benchmark for this study were those identified in the Technical Skills section of Raising the Standard—Electronics Technicians Skills for Today and Tomorrow. Data were also collected to determine the current level of skill standard inclusion in the programs of participants.

Hypothesis

The hypothesis for this study was designed to focus on the attitudes of electronics instructors toward industry validated skill standards for electronic technicians. The hypothesis is stated in the null: There is no significant difference in the attitudes of full-time and adjunct electronics instructors in Texas community/junior colleges toward entry-level technical electronics skills identified in the Technical Skills section of Raising the Standard—Electronics Technicians Skills for Today and Tomorrow.

Research Questions

Two research questions were used to guide this study. One research question to be answered by the study was as follows: What are the profiles of the participating full-time and adjunct electronics instructors at rural and urban community/junior college districts in Texas? The other research question to be answered by this study was as follows: What are the differences between the attitudes of full-time and adjunct electronics instructors toward entry-level electronics technicians skills identified as technical skills in Raising the Standard—Electronics Technicians Skills for Today and Tomorrow?

Delimitations and Limitations

This study was purposefully delimited to the following parameters:

1. Only electronics instructors in public state funded community and junior colleges in the State of Texas were to participate as educators in the study.
2. Only electronics instructors from institutions with programs specifically designated as Electronic Technology were to participate in the study.
3. The study was to include only those instructors who were teaching in the academic year 2001-2002.

4. Several skills areas were identified in Raising the Standard; however, this study was limited to the identified knowledge and skills listed in the technical skills section of Raising the Standard.

Limitations of this study included the possibility of a low response rate and uncertainty regarding the authenticity of the participants completing the instrument. Additionally, it was assumed that instructors would be able to correctly identify the setting of their college district. Further, it was acknowledged that a limitation of the survey instrument used in this study was its inherently limited discriminate power.

Definition of Terms

For the purpose of this study the following terms were defined as follows:

Adjunct or part-time instructor—An instructor who teaches a fewer number of hours than is recommended by the employing institution to qualify as a full-time instructor. This may include instruction in as few as one course.

Attitude—For the purpose of this study, the term attitude was used as the measure of perception and identified by the responses of the survey participants.

Community or Junior College—An accredited public educational institution offering a certificate of completion or an associate degree as the highest level of award conferred.

Competencies—"Competencies for vocational and technical education are those tasks, skills, attitudes, values, and appreciations that are deemed critical to successful employment." (Finch & Crunkilton, 1979, p. 220)

Construct—The term construct was used in this study to define a set of related skill standards generally grouped by the emphasis of the course, or courses, in which they were included.

Electronic technician—A person employed as a technician involved in the repair, maintenance, servicing, design, or manufacture of electronic based components, devices, or systems.

Electronics instructor—An instructor whose duties consist of teaching AC or DC circuits, solid state electronics, linear circuits, electronic data communications, microprocessor systems, industrial electronics, or related specialization courses in a certificate or associate degree electronics program in a Texas community/junior college.

Full-time instructor—An instructor who has at least the minimum number of hours as a teaching load recommended by the employing institution.

Performance Objectives—Precise measurable statements that describe what the learner will be able to do under specified conditions upon completion of a course of study (Molenda, Pershing, & Reigeluth, 1996).

Raising the Standard—The document titled Raising the Standard—Electronics Technician Skills for Today and Tomorrow, published as the product of a project conducted by the Electronic Industries Association (EIA) and the Electronic Industries Foundation (EIF) identifying the minimum requirements desirable as a national standard for entry-level electronic technicians (Electronic Industries Foundation, 1994b).

Skill standards (also called industry-based skill standards)—Performance objectives and competencies required by a specific occupation and specified by experts within that particular industry (Center for Remediation Design, 1991).

Significance of the Study

In a survey of the literature, no studies were found that examine the attitudes of full-time and adjunct community college electronics instructors within the State of Texas toward skill standards. The significance of this study is found in the fact that it includes the growing adjunct population as well as the full-time population of community and junior college faculty within the electronics discipline. Business and industry representatives are often prone to make allegations that community/junior college technology instructors do not deliver instruction that is aligned with expected industry standards. Additionally, this study comes at a time when efforts are being initiated in the State of Texas to call for the infusion of skill standards into post-secondary curriculum (Dorsey, 2000). This study also responds to the recommendations for further research by Bunn (1996) and Wamble (1983) that call for focus on skill standards at the state level and by Davis (1979) that calls for additional studies to compare the attitudes of full-time and adjunct instructors in technical disciplines.

Summary

Demographic data were collected from the participants in the study in order to describe the profiles of full-time and adjunct electronics instructors in rural and urban community/junior college districts in Texas. This study was also designed to assess the attitudes of full-time and adjunct community college electronics instructors in Texas toward selected entry-level electronic technician technical skills as identified in Raising the Standard—Electronics Technician Skills for Today and Tomorrow (Electronic Industries Foundation, 1994b).

As prior studies have documented the attitudes of industrial representatives, this study did not attempt to duplicate those efforts. The industry validated technical skills standards identified in Raising the Standard were utilized as the benchmark for comparison. This study was intended to determine if there was a significant difference between the attitudes of full-time and adjunct electronics instructors and whether or not these attitudes were congruent with the attitudes of industry identified through the established skills standards.

This dissertation consists of five chapters. Chapter two contains a review of the literature related to this study. Chapter three describes the procedures used for the collection and treatment of the data used for the study. Chapter four presents and analyzes the findings of the study. Chapter five presents the summary, findings, conclusions, implications, and recommendations of the study.

CHAPTER TWO

REVIEW OF THE LITERATURE

A comprehensive review of the literature was conducted to locate and document previous related scholarly works that are similar to this study and provide a framework for the proposed research. This review of the literature examines the background and present status of skill standards development and implementation. Crucial to the commitment to voluntarily implement skill standards in the community college electronics curriculum is a positive attitude by both full-time and adjunct faculty based on perception of the standards. This fact was voiced at the Fall Leadership Convocation of the North Texas Community College Consortium in the session, Integration of Texas Skill Standards into the Workforce Education Course Manual (WECM). One of the concerns of skill standards integration into workforce education was the question of positive perception by administrators and instructors (Dorsey, 2000). It is theorized that individuals are prompted to act based on experiences and that behavior is influenced and directed by attitudes (Rajecki, 1982).

The review of the literature has been organized into six major areas. These areas are Skill Standards, The Role of the Community College in Technical Education, Electronic Technology Programs, Research Related to Skill

Standards in Electronic Technology, Community College Faculty, and the Relationship of Attitudes and Behavior.

Skill Standards

Skill standards are performance objectives and competencies required by a specific occupation and specified by experts within that particular industry (Center for Remediation Design, 1991). The National Skill Standards Board (NSSB) subscribes to the following definition of skill standards.

> Skill standards identify what people need to know and be able to do to successfully perform work-related functions at a position within an industry sector. Specifically, they define the work to be performed, how well the work must be done, and the level of knowledge and skill required (National Skill Standards Board, 2000).

At the state level, the Texas Skill Standards Board (TSSB) recognizes the following definition of skill standards.

> Skill standards are performance specifications that identify the knowledge and competencies an individual needs to succeed in the workplace. Standards are defined by occupational areas and validated by representatives from the occupation. Standards include the functions, activities and performance criteria for an occupational area (Texas Skill Standards Board, 1999).

The United States has no strong tradition of skill standard establishment, particularly at the national level (Bunn, 1996; Center for Remediation Design, 1991). Further, the literature repeatedly indicates the perception of a gap between existing and necessary skills. This gives impetus for the establishment of industry validated skill standards (Lankard, 1995).

The review of literature concerning skill standards is divided into four sections. The purpose of skill standards is identified first. The next section of the review examines the document serving as the benchmark study for this research: Raising the Standard—Electronics Technician Skills for Today and Tomorrow (Electronic Industries Foundation, 1994b). The history of the identification and development of skill standards is then explored in the synopsis of skill standards section. The final section is a review of the literature surrounding the implementation of skill standards. Emphasis is placed on entry-level electronics technician skill standards.

Purpose of Skill Standards

Organizations representing a wide range of occupations have sought to identify skill standards used by their respective industries. The goal of each effort has been to generate a critical set of functional skills for the occupation. The American Society for Training and Development (1996) praised the Electronic Industries Association for its exemplary effort in developing the entry-level electronic technician skill standards published in Raising the Standard.

There is a direct relationship between technological and economic superiority in the United States. The survival of the American economy is dependent on the ability to be competitive in meeting global manufacturing and performance standards. The workforce of a globally competitive high performance workplace requires a high degree of skills and competence. Skill standards are developed for the purpose of assurance that trained workers with the necessary competence will be available to fill the increasing demand for a skilled workforce (Kaplan, 1994).

For employers, industry-based standards are intended to merge employment and education, clarify job competencies, improve capabilities and productivity, and aid in the transition to a high performance workplace. Industry-validated standards provide educators the opportunity to develop performance-based curricula that enables graduates to complete a course of study with work-ready skills. These skills provide the ability to obtain, hold, or change jobs and more readily adapt to changes driven by evolving technologies (Kaplan, 1994). Additionally, nationally developed skill standards serve as a benchmark for states to determine if their skill standards establishment efforts are on target (Kaplan & Seymour, 1994).

According to Bunn (1996), vocational educators must acquire knowledge of today's high performance workplace. Failure to do so could hinder production gains and growth of the economy. An understanding of the skills required by business and industry provides a basis for the establishment of an appropriate curriculum capable of preparing workers for the workforce. The implementation of national industry-based skill standards enhances the ability of vocational educators to assess worker skills and enables relevant education reform efforts, particularly in the area of teacher preparation. Implementation of national skill standards will force teachers, schools, and vocational programs to become accountable for the students exiting their programs (Bunn, 1996).

A letter from the Chairman of the National Skill Standards Board stated that rapid progress was being made toward a voluntary system of national skill standards that included assessment and certification. Since its creation in 1994, the National Skill Standards Board has gathered momentum and is gaining support of national leadership from businesses, labor, education, civil-rights organizations, and other community-based groups. The NSSB is thoroughly committed to the promotion of skill standards (Houghton, 1999).

The literature shows a strong emphasis currently placed on skill standards within the manufacturing industry and leading skill standards organizations. As manufacturing has changed so have the skills, training, and experience necessary for the 21st Century Workforce. The Manufacturing Skill Standards Council has been the catalyst that has brought business and industry leaders, workers, educators, and related entities together to create a framework of industry validated skill standards for manufacturing. According to the Manufacturing Skill Standards Council, skill standards are the best practices for high performance work and define the required knowledge and skills necessary for the workforce (Rauschenberger, 2001). One-third of the skill standards currently recognized and conditionally recognized by the Texas Skill Standards Board have specific manufacturing emphasis (Texas Skill Standards Board, 2002).

According to Miller (1999), skill standards are not a cure-all for what ails American manufacturing, but they come close. Standards provide benchmarks that can be used to focus training. Education institutions, community colleges in particular, can use industry validated skill standards to build the frameworks for instructional delivery systems. Individuals in the workplace and students will be able to use the standards as guidelines to determine what they need to know and be able to do to be successful in the workplace. Skill standards for manufacturing are work oriented and describe common critical work elements as well as identify common capabilities that workers must possess. The Manufacturing Skills Standards Council proposes to develop concentration standards that document skills for particular areas in manufacturing and specific standards that concentrate on specific industry sections (Miller, 1999).

Bunn (1996) surveyed the perceptions of members of national industry-based skill standard technical committees. The study found that committee members expected vocational educators to use skill standards to define learning outcomes and establish graduation requirements, define the qualifications of the high performance worker, provide skills that are portable for students, strengthen the vocational diploma, and enhance the placement of students in the workplace. The committee members identified the ultimate goal of industry-based standards at the national level to be the supply of better-prepared entry-level workers to industry. Standards programs enable employers to identify the knowledge, abilities, and skills of individuals as potential employees in the high performance workplace. There must be initiative taken on the part of education to develop an understanding of workplace skills and national skill standards (Bunn,1996).

Raising the Standard

A comprehensive framework of nationally validated skill standards was published in a document titled Raising the Standard—Electronics Technician Skills for Today and Tomorrow (Electronic Industries Foundation, 1994b). These standards were developed to identify the minimum requirements desirable as a national standard for entry-level electronic technicians. The study in which these standards were identified focused on input from representatives of industry to determine the necessary technical knowledge and skills for entry-level electronics technicians. These standards were developed through a project of The Electronic Industries Association (EIA) and the Electronic Industries Foundation (EIF) under a grant from the U.S. Department of Education's Business and Standards Program.

The intent of the project was to provide a focus for employers, educators, and students; provide support for the economic competitiveness of the United States in the global arena; assure the electronic industry's future; and assist educators in the delivery of qualified workers to enter the electronics field. The employment goal of this initiative was to identify and validate detailed clusters of skills and competencies that an entry-level technician must possess to meet the needs of the electronics industry. An individual possessing these minimum skills would be prepared to enter the workforce as a productive employee and would require a minimum of additional training to be qualified for any one of the eleven identified specialty occupations. These eleven specialty occupations are identified as: general electronics, avionics, business machine service, biomedical, microcomputer systems, microcomputer field service, industrial electronics, instrumentation, telecommunications, and automobile service (Electronic Industries Foundation,1994b).

The Raising the Standard project was born from initiatives originating from the Secretaries Commission on Achieving Necessary Skills (SCANS). Funding to the Electronic Industries Foundation, working under the Electronic Industries Association, provided by the United States Department of Education's Business and Standards Program in October 1992, initiated the National Skill Standards Development Project (NSSDP). The management of the project was a collaborative effort of groups representing diverse disciplines associated with the electronics industry. To ensure that the varied needs of employers would be met, the EIF and EIA were joined by a coalition of industry, labor, and education organizations including the National Association of State Directors of Vocational Technical Education and the International Association of Machinists and Aerospace Workers. Approximately 100 participating organizations provided over 200 educators, executives, administrators, supervisors, and workers to take part in the standards development project and assemble the draft standards. More than 300 educators, company representatives, and labor representatives responded to a detailed questionnaire and call for comments regarding the draft standards.

Following adjustments to the draft standards based on feedback received, the developed standards were assessed by independent agencies against international benchmarks to assure that they would meet or exceed standards established anywhere in the world. Further review of the standards was conducted by human resource specialists to assure that they contained no racial, sexual, or ethnic biases. These standards, having been developed in consensus among education, government, industry, and labor and proven valid in the workplace, were accepted by the National Skill Standards Development Project Executive Advisory Board. The standards were ratified and adopted by the Electronic Industries Association Board of Governors in March 1994 (Electronic Industries Foundation,1994b).

The Raising the Standard document serves as a resource manual for students, school counselors, educators, trainers, educational administrators, employees and employers. Students use the standards to assist them in determining whether to pursue electronics careers and meeting prerequisite requirements. Counselors use the standards to advise potential electronics technicians regarding their likelihood of successful completion of training and employment. The standards provide educators and trainers with information necessary to develop content in training curricula and serve as a basis for discussing content with employers. Educational administrators use the standards as a basis for planning, developing, and implementing training programs, requesting resources, and soliciting participation and cooperation from electronics companies. Prospective employees trained to meet the standards use them as a means of assuring competency. Employers use the standards as a hiring criterion and as a tool to assist local schools in the development of programs that meet company needs. As increasing numbers of new workers meet the standards, training resources are directed to the development of company specific employee knowledge and skills rather than to the remediation of basic skills (Electronic Industries Foundation,1994b).

The skills in the Raising the Standard document are organized into five categories: Desirable Behaviors and Work Habits, Technical Skills, Test Equipment and Tools Skills, Basic and Practical Skills, and Additional Skills. Standards addressed in this dissertation study are limited to those identified in the Technical Skills section of Raising the Standard. The Technical Skills category contains 161 identifiable skills grouped into eight, course-area constructs. These eight constructs and the number of skills in each construct are: (a) General, 12 skills; (b) DC Circuits, 24 skills; (c) AC Circuits, 32 skills; (d) Discrete Solid State Devices, 17 skills; (e) Analog Circuits, 30 skills; (f) Digital Circuits, 33 skills; (g) Microprocessors, 8 skills; and (h) Microcomputers, 5 skills. A complete list of all of these technical skills is included in Appendix A.

A supplement to Raising the Standard was published as a document titled Characteristics of Competency. Measurement Criteria for Entry-Level Electronics Technician Skills (Electronic Industries Foundation, 1994a). This companion document provides specific detailed information on each skill in the five skill categories outlined in the standards manual. These details identify the knowledge and skills necessary for competence in each skill and include: occupation, proficiency area, skill, measurement criteria, and results (Electronic Industries Foundation, 1994a).

The overall project was conducted in two distinct parts: Phase I and Phase II. Each phase lasted 18 consecutive months during a 3-year period. Phase I was intended to establish measurable skill standards for electronic technicians and culminated with the release of the product fulfilling this objective, Raising the

Standard. Phase II facilitated the development of a detailed implementation plan for industry-wide certification based on the skills standards established in the first phase (Losh, 1995).

Synopsis of Skill Standards

The roots of formal consideration of skill standards by education in the United States can be traced back to a group of industrial arts educators attending the 1927 convention of the American Vocational Association. These educators joined forces in a new committee, referred to as the committee on Standards of Attainment in Industrial Arts Teaching. As a goal, the committee addressed concerns voiced by critics that there was disagreement among educators regarding program content and objectives and standards expected of students. At this time, the product of the committee's efforts was heralded as the most used and significant publication advancing public industrial arts education in the United States. Although these educators focused on students at the junior high level their accomplishments established a framework and set the stage for subsequent skill standards development at all levels of education (Barlow, 1967).

Recent efforts to develop skill standards arose from a joint government-industry effort through the Secretaries Commission of Achieving Necessary Skills (SCANS) in 1991. SCANS gave life to many projects in Texas. Among those was the Texas Skill Standards and Certification Project for Electronic Engineering Technicians. This statewide project sought to develop and deliver a system of education and training capable of producing a competitive workforce (Teddlie, Lovelace, & LaBrecque, 1994).

The National Skill Standard Development Project (NSSDP) in 1992, provided by the U.S. Department of Education's Business and Education Program, enabled the Electronic Industries Foundation, through a study conducted by the Electronic Industries Association, to identify and validate skills and competencies for entry-level electronic technicians. The resulting skill standards determined through this effort were validated by the electronics industry and published in Raising the Standard. The intended result of the development of these skill standards was to improve workplace standards in the American electronics industry by the year 2000 and to enable American workers to meet international standards (Kaplan, 1994). The national scale and comprehensive development of Raising the Standard sets a previously unavailable benchmark for consideration of skill competencies for electronic technicians. In today's expansive job market it is no longer sufficient to depend on locally validated skill standards to guide curriculum and set desired program outcomes.

The United States Congress enacted two significant sets of laws in 1994 with the goal of improving the competitiveness of U.S. industries by fostering the development and adoption of voluntary skill standards into technical education curricula. These initiatives came in the form of the National Skill Standards Act, also referred to as the 'Goals 2000: Educate America Act,' and the School-to-Work Opportunities Act and provided for the creation of the National Skill

Standards Board. The needs of the electronics industry were addressed through an NSSB partnership with, and funding provisions for, the American Electronics Association. The National Skill Standards Board achieved an essential goal in securing the support and endorsement of national unions for the concept of skill standards (Barron, 1996). Additional accomplishments of the NSSB made in 1998 include the production of a common language document ensuring standards portability, examination process development for Specialty Certification Program endorsement requirements, and funding and sustainability model development for assisting industry coalitions. Accomplishments also included the development of links with other countries for benchmarking standards internationally, a workforce needs monitoring strategy implementation that was to be addressed through educational programs and the Workforce Investment Act, and the inclusion of information on additional apprenticeship and certification programs (Houghton, 1999).

There is evidence in the literature of skill standards projects undertaken prior to and concurrently with the national movement; however, these were generally of limited scope and geographically restricted. Trego (1958) performed an investigation to determine the extent to which Temple University's electronic technology curriculum was aligned the job skill requirements identified by electronics industry employers. Vasek (1967) conducted a study to analyze the electronics content in post-high school in order to determine if industries' needs were being met through those programs. Vasek's findings indicated that electronics instructors placed more emphasis on basic content than was deemed necessary by industrial personnel.

The effectiveness of industrial technology programs at 4-year institutions was the subject of a study by Prewitt (1973). Prewitt found that a strong general agreement existed between industry and education regarding knowledge and skills necessary for an electronic technician. A localized study conducted at the secondary level by Gates (1981) sought to determine the extent to which students were being prepared for careers in New York State high school electronics programs based on industry needs identified in the Rochester area. Gates found that the goals and priorities of the electronic programs examined did not reflect industry changes. The discrepancies between industry and education indicated that modifications were needed in the curriculum in order to prepare students competent for employment (Gates 1981).

The introduction of legislation in 1991 to establish the Texas Skills Development Corporation signified the formal beginning of interest in addressing the concept of a skill standards system in Texas. The bill never became law; however, it's outlined purpose of identifying occupational skill requirements in the Texas workforce through collaboration with existing industry associations and groups became a model for later efforts. In 1992, Texas Governor, Ann Richards, authorized the Texas Department of Commerce to convene a panel of industry, business, and labor representatives in an effort termed the Texas Skills Development Program to create a skills development program to establish employability standards. The resulting report to the governor, in 1993, contained recommendations for: setting standards for core skills, benefits marketing, measurement and certification of skills, and the establishment of a State Board of Professional and Technical Standards for curricula and assessment distribution (Texas Skill Standards Board, 2001a).

The Texas Skill Standards Research and Communications Project (TSSRCP) for 1995-1996 was established to build on the recommendations of the Texas Skills Development Program and review national and international skills standards literature, survey employers in Texas, conduct education and training provider focus groups, and meet with United States, Canadian, and Mexican skill standards officials. This project was funded through the Tri-Agency Partnership of the Texas Higher Education Coordinating Board, the Texas Education Agency, and the Texas Department of Commerce. The project's final report in 1996 contained evaluations of national skill standards projects and systems implemented in other states and countries and recommendations including a model for the skill standards system and adoption of a common nomenclature and skill standards format (Texas Skill Standards Board, 2001a). The common nomenclature endorsed by the National Skill Standards Board and adopted by the Texas Skill Standards Board contains seven elements that comprise a skill standard. The elements included in a skill standard are critical work functions, key activities, performance criteria, academic skills and knowledge, employability knowledge and skills, occupational knowledge and skills, and statements of assessment (Texas Skill Standards Board, 2001b).

The current effort to promote and facilitate a statewide system of voluntary skill standards in the State of Texas is under the leadership of the Texas Skill Standards Board (TSSB). The Texas Skill Standards Board was established in 1995, by the 74th Texas Legislature under House Bill 1863 as a component of the workforce development system to serve as an advisory body to the State Legislature and Governor. The focus of the board in its advisory capacity is on "the development of a statewide system of industry-defined and industry-recognized skill standards for all major skilled, sub-baccalaureate occupations that provide strong employment and earnings opportunities." (Texas Skill Standards Board, 2001c, ¶1) Also acknowledged by the board is the necessity that skill standards go beyond enhancing entry-level and incumbent worker skills and be forward oriented to strengthen the competitiveness of Texas industries in the global economy. Amendments were made in 1999, by the 76th Texas Legislature through the passage of House Bill 3431 which charged the TSSB with four specific mandates:

1. validate and recognize nationally-established skill standards to guide curriculum development, training, assessment, and certification of workforce skills;
2. convene industry groups to develop skill standards and certification procedures for industries and occupations in which standards have not been established or adopted and recognize the skill standards and certification procedures;
3. review standards developed by other states and nations and enter into agreements for mutual recognition of standards and credentials to enhance portability of skills; and
4. promote the use of standards and credentials among employers (Texas Skill Standards Board, 2001c, ¶1).

The Texas Legislature's vision for a state skill standards system was laid out by House Bills 1863 and 3431. The Texas Skill Standards Board can not set skill standards, rather it plays a leadership role for groups developing standards by establishing development and validation criteria and by maintaining and providing accessibility to a repository of skill standards. Additional primary functions within the leadership and system-building role of the TSSB include: catalyst for industry, quality assurance agent and facilitation of usage. The Texas Skill Standards Infrastructure (TSSI) is the conceptual umbrella that promotes the creation and use of skill standards through public-private partnerships and defines the process and requirements for groups seeking skill standards recognition by the TSSB. (Texas Skill Standards Board, 2001c)

Implementation of Skill Standards

In the late 1990's, skill standards for core curriculum and all career education areas were formally introduced into Texas public secondary school curricula by way of Legislative mandate. These skill standards, known as the Texas Essential Knowledge and Skills (TEKS), provide the framework for competency based learning and provide goals and objectives specific to each foundation and enrichment area (Texas Education Agency, 1998). Anne Dorsey (2000), Assistant to the Executive Director of the Texas Skill Standards Board, in a presentation at the 2000 Fall Leadership Convocation of the North Texas Community College Consortium, outlined the TSSB's planned efforts to encourage the voluntary adoption of skill standards into Texas post-secondary curricula. Don Perry, Interim District Executive Director of Academic and Student Programs for the Dallas County Community College District, has been appointed to examine areas related to electronic technology for statewide linkage of skill standards to curricula established in the Workforce Education Course Manual (Dorsey, 2000).

Initial steps to formally encourage the voluntary adoption of recognized skill standards at the community college level began in 2000 through an outreach and awareness campaign conducted by the Texas Skill Standards Board utilizing federal Perkins funds awarded by the Texas Higher Education Coordinating Board in a state leadership grant. Numerous workshops and presentations were conducted throughout the state as part of the grant. A process for incorporating recognized skill standards into workforce education programs and courses using the Workforce Education Course Manual maintenance process was also developed through the grant. The Workforce Education Course Manual (WECM) is the state inventory of workforce education courses for public two-year colleges designed to improve the responsiveness of Texas colleges to industry needs and enhance the statewide consistency and quality of learning outcomes in workforce courses.

Outcomes of the grant project included (a) the development of program and course review triggering mechanisms, (b) establishment of instructions and processes for the use of skill standards in the construction or review of WECM courses and programs and (c) piloting recommendations. The Competency-Based Curriculum (CBC) Taskforce, comprised of workforce education administrators in Texas technical and community colleges, was convened by the TSSB to provide technical assistance. The final report of the grant included the recommendation of piloting the processes and instruction of two TSSB-recognized skill standards sets in 2001: Machining and Heating Ventilation and Air Conditioning. The two recognized skill standards sets most closely related to electronic technology in the TSSB's repository in 2000 were Telecommunications Maintenance Technician and Computer Network Technician. (Texas Skill Standards Board, 2000)

Pertinent learning is the result of a relevant curriculum developed by educators who know and focus on industry needs. When educators work closely with employers to develop appropriate curricula students are afforded a greater opportunity to acquire applicable job or occupational skills (Bunn, 1996).

The Role of the Community College in Technical Education

The review of literature concerning community colleges is included in a single section. Changes in technology initiate rapid changes in the workplace. Leadership in the development of a flexible and effective workforce is an expectation placed on community colleges (Travis & Travis, 1999). Rosenfeld (1996) statedthat the adaptability of community college make them ideally suited for addressing the needs of modern industry. The Bureau of Labor Statistics projects an increase of 31.2 percent in the number of jobs requiring an associate degree between 1998 and 2008. This rise, representing the largest percentage increase of all educational levels, firmly establishes community colleges as the current leader of occupational training providers (Nock & Shults, 2000). A needs assessment by Quinley (1996) found that 96 percent of the employers participating in the study rated the quality of workforce training provided by community colleges as "good" or "excellent."

In a 2001 report commissioned by the National Education Association and conducted by Educational Systems Research titled, Where we go from here: State legislative views on higher education in the new millennium, sixty-four legislators from fifty states were interviewed in regard to current educational issues. All the legislators interviewed served on the education committees in their respective states. Sandra Ruppert, researcher for the project, reported that one of the findings pointed to the significant role that community colleges play in maintaining the nations economic stability. Legislators agreed that public two-year institutions are more responsive to their respective states needs than public four-year colleges and universities, private not for profit colleges and universities, and for profit providers of higher education. Ruppert also found that legislators were of a consensus that community colleges are able to react quickly to the needs of students. The legislators also acknowledged the ability for community colleges to recognize and respond to emerging trends in career and technology education (Ruppert, 2001).

Community colleges face the challenge of certifying to employers that students possess the necessary skills for jobs that consider the globalization of industry and the rapid escalation of technology in the job place. Employers have begun to express the desire for evidence beyond a college awarded technical certificate or degree as an indication that a potential employee can perform acceptably on the job. This trend has led to the development of specialized professional certifications. Examples of such certifications include A+, Microsoft and Cisco Systems certifications. Efforts by the U.S. Department of Labor's Secretary's Commission on Achieving Necessary Skills (SCANS) in 1991, formally placed the issue of skills verification into a contextual framework (Zeiss, 1999). In order to strengthen the validity of future collegiate awards in technical areas, it is essential that industry validated skill standards be incorporated into the curricula of the instructional programs.

In a study designed to identify existing relationships between business, industry, and the community colleges of Texas, Payne (1996) concluded that one of the most significant developments during the last decade was the establishment of stronger linkages between community colleges, business, and industry. Payne further concluded that workforce training had a foothold in the community colleges included in the study. Community colleges have shown the capability of providing quality training programs by demonstrating flexibility, creativity, and innovativeness, even when the institutions have limited resources (Payne, 1996).

In a related study conducted to determine the workforce needs of business and industry concerning training, retraining, and education, Strain (2000) concluded that community colleges were meeting the workforce training needs of business and industry in North Texas. Strain also concluded that businesses and industries utilizing community colleges as workforce training partners would recommend the training programs to other companies as the preferred training provider (Strain, 2000).

The 1917 passage of the Smith Hughes Act marked the beginning of formal linkages of education with business and industry. This Act standardized collaboration between industry and education by promoting the use of technical advisory committees consisting of industry representatives to guide vocational program operation, evaluation and curriculum planning. Communication between the industries and educators is essential to ensure that students are prepared for today's entry-level occupations. Schools must be willing to respond to the changing needs of employers by making needed curriculum revisions (Bunn, 1996). Linkages to industry are of particular importance to rural educational institutions for economic reasons. While urban institutions enjoy larger budgets associated with a larger tax base and higher enrollments, rural institutions generally find themselves lacking in funds from these sources and are more dependant on industrial linkages for program support (Watson, 1998).

Electronic Technology Programs

Technical programs in community/junior colleges are expected to provide employers with capable employees. To this end, the major focus of curricula is to provide students with those skills sought by potential employers of the program's graduates. A great deal of pressure is placed on the administrators of electronic technology programs to incorporate skill standards into their respective curricula. The recognition of this responsibility can be traced back to studies conducted as early as 1958 with additional supporting studies in the 1960's (Terego, 1958; Vasek, 1967). A report in 1998 made the argument that the best interest of employers is likely served by assisting experienced workers in applying their existing expertise to new technologies. This report's acknowledgement that continuous learning is demanded by a technology-rich workplace further supports the mission of educational programs, particularly in the technical divisions of the community college (Ginsburg & Elmore, 1998).

The literature revealed that industry and education in Texas have not always had similar attitudes. Wright conducted a study in 1969 for the Texas Education Agency that was designed to assess current programs and gather information regarding the employment of electronic technicians in Texas and collect other information useful in planning equipment and facilities. Findings of Wright's study revealed that although industry and education agreed on the future importance of instructional units and equipment that an electronic technician should be able to operate, they were not in total agreement in regards to teaching emphasis. The study also noted that community colleges had not held the status of principal supplier of electronic technicians (Wright, 1969).

Research Related to Skill Standards in Electronic Technology

In past years a number of researchers have sought to identify the relationships between education and industry and the workplace skills needed by industry. Raising the Standard, in 1994, represents the first effort achieving, as a result, a set of industry validated skill standards for entry level Electronic Technicians on a national scale. Significant progress had been made on a smaller scale by earlier projects using locally and regionally validated standards.

This review of the literature found related research conducted as early as 1958 through a doctoral dissertation by J. W. Trego (1958) examining the job requirements of electronic industries in comparison to the Temple University Technical Institute's electrical technology curriculum. A doctoral dissertation by Vasek (1967) compared content in post-high school technical institutes with electronic technology requirements in industry. Vasek found that a much greater emphasis was placed on basic electronics content by instructors than was indicated as necessary by industrial personnel.

Prewitt (1973) investigated the effectiveness of four-year technology programs in the preparation of industrial electronic technicians to meet the requirements of industry. Prewitt's data, collected from a sample population comprised of representatives from four-year electronic technician programs and industry located in eight southern states, indicated a strong agreement between industry and education regarding knowledge and skills necessary for an industrial electronic technician (Prewitt, 1973). An analysis of the data collected in Gates' (1981) study focusing on New York high schools indicated that the needs of industry were not reflected in the secondary electronics programs and there was a need for curriculum modifications to realign the programs.

Manufacturing industries have demonstrated a long and continued interest in technology education competencies. Buskirk (1988) compared the attitudes of manufacturing production managers and teacher educators toward competencies included in the curriculum of secondary industrial arts/technology education programs.

Community College Faculty

Banachowski (1997) reported an increase in adjunct faculty employment from 38 percent in 1962 to 65 percent in 1993 in U.S. community colleges. The report of faculty statistics for the fall 1998 semester by the Texas Higher Education Coordinating Board identified 23,415 faculty members in the community colleges of Texas. Of this number, 14,237 were considered part-time. Approximately 61 percent of the total teaching faculty was classified as adjunct (Texas Higher Education Coordinating Board, 1999). Statistics complied for 2000-2001 by the Texas Community College Teachers Association show the total number of Texas community college faculty to be 24,574 with 15,546 of those classified as adjunct. This figure represents a 2 percent rise in adjunct faculty utilization from 1998 to 2000. This 63 percent adjunct faculty population teaches 32 percent of the course sections offered by the institutions (Texas Community College Teachers Association, 2000).

Statistics compiled by the Texas Community College Teachers Association for the 2001-2002 academic year show a rise in the total number of Texas community college faculty to 25,303 with 16,547 classified as adjunct. This figure shows that the adjunct population has risen to 65 percent of the total faculty population and represents a 2 percent increase in the number of adjunct faculty over the previous academic year. The number of sections taught by adjunct faculty also increased an additional 2 percent to 34 percent of the total number of course sections from the 2000-2001 to the 2001-2002 academic years (Texas Community College Teachers Association, 2001).

A study by Brewer and Gray (1997) that investigated the linkages between educational institutions and the labor market found that vocational faculty have a strong connection with the labor market due to the fact that the survival of their programs depend upon enrollments and job placements. The study also revealed that there was a lower level of connection by adjunct faculty to the labor market as well as a weaker connection to the institution (Brewer & Gray, 1997).

The literature indicates mixed views in regards to the use of adjunct faculty. There is a prevalent concern over the lack of understanding on the part of adjunct faculty regarding expectations placed on them and the mission of the institution. "A question that has been the subject of much debate is whether hiring part-time instructors instead of full-time instructors contributes to or detracts from the quality of a community college's educational programs" (Friedlander, 1980, p. 27).

Banachowski (1997) identified four main reasons for employing adjunct faculty: (a) institutions save money on salary and benefit expenses, (b) flexibility in matching staff to enrollment is made easier, (c) adjuncts often bring a wealth of real-world experience, and (d) service as an adjunct often adds fulfillment and prestige to the lives of instructors and opens doors to opportunities to serve as full-time instructors. The same study also offered disadvantages to the employment of adjunct faculty: (a) full-time faculty positions may be lost or overload availability reduced, (b) adjuncts may suffer from overuse, and (c) may lead to the undermining of the teaching profession in two-year colleges. These findings are supported in a number of studies (Avakian, 1995; Lankard, 1993).

Studies examining the student orientation of adjunct instructors found no differences in service to students or student success rates between the general full-time and adjunct instructor populations (Iadevaia, 1991; Rifkin, 1998).

Relationship of Attitudes and Behavior

Many studies seek to determine the attitudes of members of a population but few examine the significance of the role that attitudes play in guiding behavior. This section of the review of literature provides a basic foundation of knowledge regarding attitudes and their relationship to behavior. In addition to attitude and behavioral relationships the literature addresses various methodologies implemented to determine attitudes.

Much of the early research in social psychology was concerned with the concept of attitude. So important was the term that early researchers often used attitudes as the definition of social psychology. Ajzen and Fishbein (1980) reported that Herbert Spencer argued as early as 1862 that the arrival at a correct judgment is dependent on the attitude of mind preserved as an observer to or participant in the controversy. In the literature, the first use of attitudes as a concept to explain behavior is credited to Thomas and Znaniecki who theorized in 1918 that attitudes are associated with the mental processes that are determinants of an individual's actual or potential response (Ajzen & Fishbein, 1980).

Rajecki (1982) expanded the 1935 works of Allport by classifying attitudes into four major categories. The first category explores the concept that attitude is a mental or neural state that resides in the experience of the individual. He contended that if this was the case, then attitudes could be measured only indirectly. Secondly, Rajecki concluded that attitudes are organized through experience and they are developed from single and multiple experiences and are both direct and indirect. He concluded that some experiences are gained from other individuals. Thirdly, Rajecki theorized that individuals are prompted to act based on experiences. He theorized that attitudes exert both directive and dynamic influence on behavior. Attitudes stem from various sources and can have important implications on attitude-behavior consistency. Of extreme importance is whether attitudes toward an object are due to direct or indirect experience. His fourth category concludes that attitude not only influences behavior but also directs behavior in an orderly and coherent fashion. This orderly and coherent fashion leads to consistency. He agreed with writers in general that perhaps attitudes have three distinct components. The first of these components is affect, more specifically the evaluative element. Secondly the behavior element may be concerned with past, present, or future actions toward an object. The last component is cognition, which can cover a variety of things, but specifically in this definition is considered to be any information, fact, or knowledge relevant to the attitude in question (Rajecki, 1982).

Ajzen and Fishbein (1980) concluded that attitude is a hypothetical construct that can not be subjected to direct observation and must be inferred by using measurable responses which reflect positive or negative evaluations of the attitude in question. According to their theory of reasoned action, attitudes are a function of beliefs. In general a person that believes that performance of a behavior will result in a positive outcome will have a favorable attitude toward the behavior. They contend that there is virtually no limitation on the kinds of studies that can be designed based on attitudinal response (Ajzen & Fishbein, 1980).

McMillan (1996) defined attitude as a predisposition to respond favorably or unfavorably to an object. He contends that likes and dislikes of a subject are generally accepted as a predictor of behavior related to achievement or outcomes.

Measurement of attitudes is most commonly accomplished through the use of scaled items. A scale is a series of gradations that are used as a method of description. The most common use of scaled measurement of attitudes are those that measure responses from very positive to very negative. Typically a scaled item will be a question or statement followed by potential responses.

Attitudes can be measured toward self, others, institutions, situations and a variety of other activities. There are four basic types of scales used to measure attitudes: Thurstone scale, Guttman scale, semantic differential scale, and the Likert scale (Gay, 1996, Dwyer, 1993). The Likert scale is the scale most commonly used to measure attitudes (McMillan, 1996).

The major breakthrough of measuring attitudes is attributed to L.L. Thurstone who applied psychometric methods to the problem. He defined attitude as the affect for or against a psychological object. Thurstone contended that the continuum of valid measurement for attitudinal research ranged from positive to negative or favorable to unfavorable (Thurstone, 1931). The

Thurstone equal-appearing interval scale is dependent on a large number of scale items that possess the potential of measuring the dimension of the researchers interest. Selection of scale items is based on the consensus of a panel of judges. Bringing together of a panel of qualified judges can be a difficult and expensive process for the researcher. This has created major opposition by researchers to using the Thurstone method of measuring attitudes (Rajecki, 1982). In the Thurstone scale an individual's attitude score is the average of all values selected. An eleven point scale of values is commonly used with the Thurstone scale (Gay,1996).

Like the Thurstone scale, the Guttman scale developed by Guttman in 1950 asks the respondent to agree or disagree with a number of statements. A Guttman scale attempts to determine if an attitude is unidimensional. Unidimensional scales are cumulative, as a result a subject who agrees with a particular statement will also agree with all preceding statements (Gay, 1996).

The Semantic Differential, which was originally designed to measure the meaning of a concept, was found to be beneficial in the measurement of attitudes. The principle of semantic differences is based on the use of paired bi-polar adjectives that act as end anchors on a scale with equally separated intervals. Usually the scale will possess seven interval points between the bi-polar adjective pair. Responses are scored from –3 on the negative side to +3 on the positive side the sum of all intervals across the scale measures the subjects attitude (Osgood, Suci, & Tannenbaum, 1957). Three clusters or types of adjectives seem to be the most often used to indicate attitudes toward persons, concepts or ideas. The three types are evaluative, such as good/bad, potency, such as strong/weak, and activity, such as slow/fast.

According to McMillan, (1996) the Likert scale is the most widely used scale for measuring attitudes. In a true Likert scale the statement includes a positive or negative direction and the subject agrees or disagrees with the statement. Some Likert scales begin with a neutral statement with the direction of gradation provided in the response options. A Likert scale does not require a panel of judges as does the Thurstone scale. The Likert scale does not always have the same number of responses. The number of responses may range from four to eleven. Most applications utilize two positive responses and two negative responses with a neutral response in the middle. The neutral option prevents the subject from being forced to make an inaccurate response. Likert scales are also used to measure traits other than attitudes (McMillan, 1996). Responses on a five level Likert scale are sought on the survey instrument utilized to identify attitudes of electronics instructors participating in this study.

In a related study, Davis (1979) compared the attitudes of full-time and adjunct instructors in a single discipline. The purpose of the study was to compare the attitudes of full-time and adjunct drafting instructors in the public community colleges of Texas related to five selected philosophical areas of the community college. Areas selected for the study were the need for an educated citizenry, open admissions, diversified curriculum, guidance, and excellent teaching. The population for the study consisted of 53 full-time and 42 adjunct drafting instructors. Comparisons were made between groups as identified by the demographic characteristics of job description, age, educational level, business or industrial experience, teaching experience, and professional preparation. The full-time drafting instructor in the sample population was a person over thirty-five years of age, holding a master's degree, more than three years of business or industrial experience, and more than two years of teaching experience. Participating adjunct drafting instructors were persons over thirty-five years of age, holding a bachelor's degree or less, more than three years of business or industrial experience, and more than two years of teaching experience. The population differed significantly the greatest number of times according to educational level. Examination of the data were made through the use of the Chi-square test, analysis of variance, and the t-test. An alpha level of .05 was used as the critical point at which the null hypotheses were rejected. A recommendation was made that studies be conducted to compare the attitudes of full-time and adjunct instructors in other technical disciplines.

Summary of Review of the Literature

The literature indicates that the United States must maintain a qualified workforce to ensure that America remains competitive in global markets. The adoption of skill standards was identified to be a means of assurance that a world-class workforce is prepared and made available to industries. The success of voluntary adoption of skill standards is dependent on attitudes toward those standards. Skill standards have been developed at the national level and the literature gives evidence of a growth of interest in state recognition of standards.

Community/junior colleges are recognized in the literature to be the primary provider of training for entry-level electronic technicians. There are conflicting reports concerning the alignment of educational programs and instructors with the needs of industry. One specific area of discrepancy involves differences between the characteristics and demographics of full-time and adjunct college instructors. A lack of recent research is noted concerning the attitudes of Texas community/junior college electronics instructors toward skill standards, more importantly, of the distinct groups—full-time and adjunct.

CHAPTER THREE

METHODOLOGY

Introduction

There were two primary purposes guiding this study. The first purpose was to generate a profile of participating full-time and adjunct electronics instructors in rural and urban community/junior college districts in Texas. The second purpose was to determine the attitudes of full-time and adjunct electronics instructors in Texas community/junior colleges toward industry validated technical skill standards for entry-level electronic technicians. The study was based on a comparative design making use of a survey instrument and employing the techniques of quantitative research and convenience sampling. This chapter describes the sample population, instrument development, data collection procedures, and data analysis.

Population

Participants were full-time and adjunct electronics instructors in community/junior colleges with electronics programs in the State of Texas. Community/junior colleges meeting the selection criteria were those offering either associate degree or certificate programs in Electronic Technology were identified by the US Department of Education's Classification of Instructional

Programs (CIP) code from the Workforce Education Program Inventory of statewide community and technical colleges complied by the Texas Higher Education Coordinating Board. The relevant CIP code for programs targeted in this study is 15.0303, which is designated as Electrical, Electronic, and Communications Engineering Technology/Technician programs. An evaluation of the program inventory approved by the Texas Higher Education Coordinating Board in 2000, revealed 31 public community/junior colleges in Texas meeting the selection criteria (Texas Higher Education Coordinating Board, 2000b). A convenience sample of electronics instructors from 15 institutions participated in the study.

Both full-time and adjunct instructors were included in the study. Perceptions of all responding electronics instructors toward industry validated skill standards were compared between groups of full-time and adjunct faculty and urban and rural institutions across age, educational level, business or industrial experience, and teaching experience. The population included all full-time and adjunct instructors teaching electronics in either associate degree or certificate programs in public, state-funded community/junior colleges in the State of Texas.

Development and Design of the Instrument

An earlier investigation serving as a model for this study was conducted by John W. Trego at Temple University Technical Institute. Trego's study, conducted in 1958, examined the extent to which Temple University's electronic technology curriculum met the job skill requirements identified by electronics industry employers (Trego, 1958). Another study conducted by Davis (1979) compared attitudes of full-time and adjunct instructors in community college drafting programs. Davis' instrument provided the design model on which the demographic questions and characteristics used in this study are based.

The survey instrument was developed in the form of a questionnaire designed to identify the participant's attitudes of technical skill standards and obtain demographic information. Participants provided demographic information regarding position, age, educational level, discipline of highest degree held, business or industrial experience, teaching experience, and setting of college district. Position is the employment classification of full-time or adjunct. Age was classified as thirty-five years old or younger and over thirty-five years old. Educational Level was classified as no college or professional certificate, college or professional certificate, associate degree, master's degree, and doctoral degree. Participants were also asked to identify the discipline of their highest degree and indicate if they held any certificates or degrees in electronics or an electronics related discipline. Business or industrial experience is identified as three years or less and more than three years. Teaching experience was classified as two years or less and more than two years. Setting of college district was classified as rural or urban.

A Likert scale was used in the instrument to record the responses to each skill standard statement. The technical skill standards statements were derived from validated statements contained within the eight constructs in the Technical

Skills section of Raising the Standard—Electronics Technician Skills for Today and Tomorrow. Those technical skills constructs are: (a) general skills, (b) DC circuits, (c) AC circuits, (d) discrete solid state devices, (e) analog circuits, (f) digital circuits, (g) microprocessors, and (h) microcomputers. The derived statements were maintained within the same eight constructs. A complete list of the 161 technical skills as they appear in the original Raising the Standard document is shown in Appendix A . The survey instrument including the 67 derived statements is shown in Appendix B. Validated skill standards identified in Raising the Standard were developed through a project of The Electronic Industries Association and the Electronic Industries Foundation under a grant from the U.S. Department of Education's Business and Standards Program.

The research is comparative with a 2X2 factorial design evaluated across eight dependent variables. The two independent variables include faculty position and district setting. Each of the two independent variables have two levels. Faculty position is classified as full-time faculty and adjunct faculty. District setting is classified as rural and urban. The participants identified their attitudes regarding the importance of each derived skill standard on a five-step Likert-type scale ranging from "1" strongly disagree to "5" strongly agree with a center neutral. The mean response to the derived statements within each of the eight constructs served as the eight dependant variables used for comparison. Each participant was asked to indicate whether or not each of the eight groups of skills standards were currently included in the instructor's program. The survey instrument concluded with an open-ended request for additional comments.

Members of the Industrial Advisory Committee to the Electronic Technology Department at Paris Junior College were invited to validate the instrument. Committee members were asked to complete the survey instrument and respond to the following questions: (a) Were the instructions clear – did you understand what you were being asked to do? (b) Was there anything you would consider to be biased about the survey? (c) Approximately how long did it take you to complete the survey? and (d) Do you have any other comments or suggestions regarding the survey instrument or the research project in general? Respondents indicated that the instructions were clear and there were no evident biases in the instrument. The approximate time required to complete the survey was ten minutes. One respondent expressed concern with the length of the survey.

Data Collection Procedures

Data collection was achieved through the use of a questionnaire designed to identify the participant's perception of technical skill standards and obtain demographic information. Demographic data were collected as attribute independent variables. With the exception of the question regarding educational level and discipline, all data from the demographic section of the survey had two levels of the independent variable. Educational level had six levels of the independent variable and discipline is a descriptive independent variable. Responses to validated skills statements from the Electronic Industries Association's (1994b) Raising the Standard were identified as the dependent variables. In order to ensure participant's anonymity no information was collected that could be used to identify individuals in the population.

Institutions offering certificates or Associate in Applied Science degrees in electronics were identified by Classification of Instructional Program (CIP) code from the Texas Higher Education Coordinating Board's program inventory. Only public, state-funded community junior colleges were targeted for participation. A search of the inventory list revealed that 31 institutions met the criteria for inclusion. Those institutions were: Alvin Community College, Amarillo College, Angelina College, Austin Community College, Brazosport College, Central Texas College, College of the Mainland, Collin County Community College District, Del Mar College, Eastfield College (Dallas County Community College District), Grayson County College, Hill College, Kilgore College, Laredo Community College, Lee College, Midland College, Mountain View College (Dallas County Community College District), North Central Texas Community College, North Harris College, North Lake College, Paris Junior College, San Antonio College, San Jacinto College, South Campus Tarrant County College District, South Plains College, South Texas Community College, St. Philip's College, Texarkana College, Texas Southmost College, Tyler Junior College, and Wharton County Junior College.

Application for permission to conduct human research was made to Colorado State University's Office of Regulatory Compliance and granted in the letter shown in Appendix C. Initial contact with each of the target institutions was made through a letter to the institution's president. The letter, shown in Appendix

D, requested a response from the presidents in the form of a letter of permission on the institution's letterhead to conduct research involving the electronics faculty at their institution. The presidents were asked to include statements in their permission letters indicating that: (a) the institution was familiar with the project and project's purpose, (b) the institution believed the individuals it involved were adequately protected and their participation would be voluntary, and (c) the institution's involvement in the project would be limited to granting permission to survey the instructors and identifying a contact person that would be asked to assure delivery of the survey to electronics faculty mailboxes. This letter was included in a packet containing sample copies of all materials to be used in the data collection process. The packet mailed to the presidents also contained a form to be used for identifying a contact person, or persons, to whom the survey instruments would be sent for distribution to the faculty mailboxes of the electronics instructors.

Presidents granting permission for their electronics faculty to participate in the study were instructed to return the appropriate letter of permission and contact identification form in the provided postage pre-paid envelope. Eighteen of the 31 institutions responded favorably by returning either the requested letter of permission, the completed contact form, or both. Fifteen returned the letter of permission as required by the Colorado State University Office of Regulatory Compliance. Three institutions returned only the contact identification form with no official letter of permission, thus, not fulfilling the requirements for participation in the study. The 15 letters of permission were forwarded to the Office of

Regulatory Compliance and approval was granted to solicit the participation of instructors at those institutions. Original letters of permission were retained by the Office of Regulatory Compliance. Institutions approved for participation were: Amarillo College, Angelina College, Austin Community College, Brazosport College, Eastfield College (Dallas County Community College District), Hill College, Kilgore College, Laredo Community College, North Central Texas Community College, North Harris College, North Lake College, Paris Junior College, San Antonio College, South Texas Community College, and St. Philip's College.

Persons identified by the approved institutions' presidents were contacted and asked to specify the number of faculty employed as full-time or adjunct instructors in the electronic technology program at the contact's campus. As a result of this poll, 94 sets of survey packets were distributed to the contacts for dissemination to the electronics faculty. The packets sent to the contacts contained a cover letter to the contact and survey packets for distribution to potential respondents. Survey packets consisted of a letter to the contact providing an overview of the study and instructions for participation, a copy of the survey instrument, and a postage pre-paid return envelope. Copies of the contact and participant letters are shown in Appendices E and F respectively. Fifty-seven usable questionnaires were returned by participants.

Analysis of the Data

Data were entered into a computer database upon receipt of the submitted survey instruments. After allowing sufficient time for return of the instruments, the database was converted into a tab delimited text file and read into the Statistical Package for the Social Sciences (SPSS) software for analysis. Demographic data collected were used to identify the characteristic profile of the sample population. Group characteristics for full-time, adjunct, rural, and urban electronics instructors were identified. Profiles of the instructors within each group were described. The profile of the electronics instructor was also described.

Means were computed from the likert scale responses to statements within each of the eight constructs for the 57 subjects. These sets of eight means formed the data set used in further analysis to determine the presence of significant differences between and within groups of full-time, adjunct, rural, and urban electronics instructors.

Cronbach's alpha, the method of choice for determining interitem reliability of Likert scale multiple choice survey variables, was applied in this study (Gliner & Morgan, 1999). McMillan (1996) warns against making the mistake of running separate analysis on each dependent variable rather than the proper procedure of applying a multivariate statistical procedure. A Multiple Analysis of Variance (MANOVA), applying Wilks' Lambda, was used to test for significant differences between and within the groups of full-time and adjunct instructors. The MANOVA was selected as the statistical procedure for a variety of reasons. Type I error rates are lower for the MANOVA than for multiple ANOVAs. The MANOVA takes into account the correlations between dependent variables, thus avoiding redundant information in the results. Additionally, the MANOVA offers a richer data analysis and can detect group differences on a system of variables (Weinfurt, 1995). Univariate tests were used to determine the existence of between-subject differences for each of the eight constructs. A nominal alpha level of .05 was used for significance in all tests. No instances of significant differences were found; thus, post-hoc tests were not applied.

CHAPTER FOUR

RESULTS

The purpose of this study was to generate a profile of the sample population and to determine the attitudes of full-time and adjunct electronics instructors in Texas community/junior colleges toward industry validated technical skill standards for entry-level electronic technicians. Full-time and adjunct electronics instructors from the electronic technology programs in 15 public, state-funded community/junior colleges in Texas were asked to participate in the study. Institutions from which instructor participation was solicited were: Amarillo College, Angelina College, Austin Community College, Brazosport College, Eastfield College (Dallas County Community College District), Hill College, Kilgore College, Laredo Community College, North Central Texas Community College, North Harris College, North Lake College, Paris Junior College, San Antonio College, South Texas Community College, and St. Philip's College.

Instructors electing to participate provided demographic information regarding position, age, educational level and discipline, business or industrial experience, teaching experience, and district setting. Demographic data were collected to develop a profile of the full-time and adjunct electronic technology instructors in rural and urban community/junior colleges in Texas.

Participants were asked to respond to a set of 67 statements regarding technical skill standards for electronic technicians. The technical skill standards statements were derived from validated statements contained within eight constructs in the Technical Skills section of Raising the Standard—Electronics Technician Skills for Today and Tomorrow. These statements are found in Appendix A. The participants identified their attitude toward each skill standard on a 5-step Likert-type scale ranging from "1" strongly disagree to "5" strongly agree with a center neutral. Independent variables used in the study were position and district setting. Position classified the electronics instructors as full-time or adjunct and setting classified the community/junior college districts as rural or urban. Data from responses to the skill standards statements served as the dependant variables for purposes of analysis. Participants were also asked to give a "yes" or "no" response to the question of whether the knowledge and skills were included in the instructor's program for each of the eight constructs. Finally, participants were invited to provide any additional comments. The survey instrument used appears in Appendix B.

Contacts identified by the presidents of each of the 15 institutions indicated the need for a total of 94 survey packets for full-time and adjunct electronic technology instructors. Fifty-eight of the 94 instruments were returned. One incomplete survey was discarded resulting in 57 usable responses. This represents a 61 percent response rate from the sample population.

Description of the Sample Population

A detailed tabulation of responses to demographic questions by groups is provided in Table 1. These data were used to develop the following profiles of electronics instructors participating in the study.

Table 1

Demographic profile of participants

		Faculty Position								
		full-time			adjunct			Total		
		District Setting			District Setting			District Setting		
		rural N=5	urban N=27	Total N=32	rural N=6	urban N=19	Total N=25	rural N=11	urban N=46	Total N=57
Age group	35 years old or younger		3	3	0	0	0	0	3	3
	over 35 years old		24	29	6	18	24	11	42	53
	no response		0	0	0	1	1	0	0	1
Educational level	no college or professional certificate		0	0	1	0	1	1	0	1
	college or professional certificate	0	1	1	1	1	2	1	2	3
	Associate degree	3	2	5	2	2	4	5	4	9
	Bachelor's degree	0	8	8	2	8	10	2	16	18
	Master's degree	2	15	17	0	7	7	2	22	24
	Doctoral degree	0	1	1	0	1	1	0	2	2
Degree in electronics or electronics related discipline	yes		26	30	5	14	19	9	40	49
	no		1	2	1	3	4	2	4	6
	no response		0	0	0	2	2	0	2	2
Business or industrial experience	3 years or less		1	1	0	1	1	0	2	2
	more than 3 years		26	31	6	18	24	11	44	55
Teaching experience	2 years or less		1	1	0	1	1	0	2	2
	more than 2 years		26	31	6	18	24	11	44	55

Table 2 shows that 56.1 percent of the participants held full-time faculty status and 43.9 percent held adjunct faculty status. Within the rural institutions, 45.5 percent of the respondents were classified as full-time instructors while 54.5 percent were classified as adjunct instructors. Within the urban institutions, 58.7 percent of the respondents were classified as full-time instructors while 41.3 percent were classified as adjunct instructors. The values given refer to the numbers of faculty within the sample population only and do not reflect the number of courses or the percentage of contact hours taught by either group of instructors.

Table 2

Position of participants

Faculty Position	Number	Percent
Full-time	32	56.1
Adjunct	25	43.9
Total	57	100

Electronics instructors from urban institutions accounted for 80.7 percent of the total participant population. Participants from rural institutions accounted for the remaining 19.3 percent of responses as shown in Table 3.

As shown in Table 4, only 5.3 percent of the respondents were age 35 or younger. The three instructors in this lower age category were full-time instructors in urban institutions. Ninety-three percent of respondents reported their age as over 35 years. One respondent did not disclose age.

Table 3

Setting of participant's college district

District Setting	Number	Percent
Rural	11	19.3
Urban	46	80.7
Total	57	100

Table 4

Age of participants

Age group	Number	Percent
35 years old or younger	3	5.3
over 35 years old	53	93.0
no response	1	1.8
Total	57	100

The education levels of the sample population are shown in Table 5. One participant, making up 1.8 percent of the 57 total participants, responded as having no college or professional certificate. The respondant indicating no college or professional certificate did disclose that some training had been been received from the United States Air Force Technical School. A college or professional certificate was earned by 5.3 percent of the instructors while 15.8 percent were awarded the Associate degree. Bachelor's degrees were earned by 31.6 percent of the respondents. The Master's degree was earned by 42.1

percent of the sample population. Two instructors held a Doctoral degree accounting for 3.5 percent of the instructors.

No adjunct respondents from rural districts held degrees beyond the Bachelor's degree level. Full-time participants from rural districts held only Associate and Master's degrees. No rural instructors held Doctoral degrees. Sixty percent of the full-time instructors at rural instituions held the Associate degree as their highest degree earned. Master's degrees were held by 55.6 percent of the full-time instructors at urban institutions and by 53.1 percent of all urban instructors.

Table 5

Educational level of participants

Educational level	Number	Percent
No college or professional certificate	1	1.8
College or professional certificate	3	5.3
Associate degree	9	15.8
Bachelor's degree	18	31.6
Master's degree	24	42.1
Doctoral degree	2	3.5
Total	57	100

The number and percentage of participants holding a degree in electronics or electronics related discipline are shown in Table 6. Eighty-six percent of the participants indicted that they held at least one degree in electronics or an electronics related discipline. Participants indicating no electronics or electronics related discipline represented 10.5 percent of respondents. Two participants, accounting for 3.5 percent of the sample population, provided no response.

Table 6

Participants holding degree in electronics or electronics related discipline

Electronics degree	Number	Percent
yes	49	86.0
no	6	10.5
no response	2	3.5
Total	57	100

Table 7 shows that 3.5 percent of the participants had three years or less experience in business or industry. More than three years of business or industrial experience was indicated by 96.5 percent of the respondents. All respondents from rural institutions had more than three years of business or industrial experience as did 95.7 percent of all urban instructors.

Table 7

Business or industrial experience of participants

Business or industrial experience	Number	Percent
3 years or less	2	3.5
more than 3 years	55	96.5
Total	57	100

The teaching experience of the participants is shown in Table 8. Two years of teaching experience or less was indicated by 3.5 percent of the total participants. Respondents with more than two years of teaching experience made up 96.5 percent of the sample population. All respondents from rural institutions had more than two years of teaching experience. This was also true for 95.7 percent of all urban instructors.

Table 8

Teaching experience of participants

Teaching experience	Number	Percent
2 years or less	2	3.5
more than 2 years	55	96.5
Total	57	100

Respondents were asked to report the discipline of their highest college degree. Responses were grouped into eight categories for analysis. These categories along with the number of participants holding their highest degree in each category are shown in Table 9. The highest degree held by the largest group of full-time and adjunct instructors in both rural and urban districts was in an engineering, science, or technology related discipline. The highest degree held by the second largest group of instructors was in vocational or technical education. This category was primarily represented by instructors in urban institutions. Smaller groups of instructors held degrees in the following categories: arts, business, or business admininstration; military training;

mathematics; computer science or media technology; chemistry or biology; and social science. Twenty-eight percent of the participants did not indicate the discipline of their highest degree.

Table 9

Discipline of highest degree held by participants

	Faculty Position								
	full-time			adjunct			Total		
	District Setting			District Setting			District Setting		
Discipline	rural N=5	urban N=27	Total N=32	rural N=6	urban N=19	Total N=25	rural N=11	urban N=46	Total N=57
Engineering/Science/ Technology	2	9	11	2	7	9	4	16	20
Arts/Business/ Business Administration	0	1	1	0	2	2	0	3	3
Vocational/ Technical Education	1	6	7	0	1	1	1	7	8
Military	0	0	0	1	0	1	1	0	1
Mathematics	0	1	1	0	2	2	0	3	3
Computer Science/ Media Technology	0	2	2	0	1	1	0	3	3
Chemistry/Biology	0	0	0	0	2	2	0	2	2
Social Science	0	0	0	0	1	1	0	1	1
no response	2	8	10	3	3	6	5	11	16

The profile of the full-time electronics instructor at a rural district within the sample population is a person over 35 years of age with either an Associate degree or a Master's degree in an engineering, science, or technology related discipline and at least one degree in electronics or an electronics related discipline. The participating full-time rural electronics instructor has more than three years of business or industrial experience and more than two years of teaching experience.

The profile of the full-time electronics instructor at an urban district within the sample population is a person over 35 years of age with a Master's degree in an engineering, science, or technology related discipline and at least one degree in electroics or an electronics related discipline. The participating full-time urban electronics instructor has more than three years of business or industrial experience and more than two years of teaching experience.

The profile of the adjunct electronics instructor at a rural district within the sample population is a person over 35 years of age with a degree at the Bachelor's level or below in an engineering, science, or technology related discipline and at least one degree or certificate in electronics or an electronics related discipline. The participating adjunct rural electronics instructor has more than three years of business or industrial experience and more than two years of teaching experience.

The profile of the adjunct electronics instructor at an urban district within the sample population is a person over 35 years of age with a Master's degree in an engineering, science, or technology related discipline and at least one degree in electronics or an electronics related discipline. The participating adjunct urban electronics instructor has more than three years of business or industrial experience and more than two years of teaching experience.

The profile of the electronics instructor within the sample population is a person over 35 years of age with a Master's degree in an engineering, science, or technology related discipline and at least one degree in electronics or an electronics related discipline. The participating electronics instructor has more than three years of business or industrial experience and more than two years of teaching experience.

Analysis of Responses to Skill Standard Statements

The interitem reliability for the study was measured using Cronbach's Alpha. Cronbach's Alpha is the method of choice for measuring interitem reliability of Likert scale responses (Gliner & Morgan, 1999). An Alpha of .80 or greater is considered an acceptable reliability coefficient (University of California Los Angeles Academic Technology Services, 2001). Cronbach's Alpha computed for the 67 skill standard responses in this study was .9762 indicating a high interitem reliability as shown in Table 10.

Participants indicated their level of agreement to statements addressing specific skill standards using a five-step Likert-type scale ranging from "1" strongly disagree to "5" strongly agree with a center neutral. Statements given no response by participants were completed with the participant's mean response within the construct. Table 11 shows the number of statements within each construct, the number of participants contributing to the mean, and the construct means for each of the eight constructs.

Table 10

Reliability Analysis – Scale (Alpha)

	Mean	Minimum	Maximum	Range	Max/Min	Variance
Item Means	4.3186	3.7018	4.8772	1.1754	1.3175	.0632
Item Variances	.4972	.1096	1.1059	.9962	10.0857	.0410
Inter-item Covariances	.1886	-.0573	.7701	.8274	-13.4317	.0103
Inter-item Correlations	.3979	-.1345	1.0000	1.1345	-7.4373	.0327

Reliability Coefficients 67 items

Chronbach's Alpha = .9762 Standardized item alpha = .9779

Table 11

Construct means

Skill standard construct	Number of statements in construct	Mean N=57
A) general skills	5	4.4737
B) DC circuits	8	4.6075
C) AC circuits	8	4.4386
D) discrete solid state devices	9	4.4091
E) analog circuits	13	4.0391
F) digital circuits	14	4.3083
G) microprocessors	6	4.1930
H) microcomputers	4	4.2368

A 2X2 factorial Multiple Analysis of Variance (MANOVA), applying Wilks' Lambda, was used to detect significant differences across the eight construct means. As shown in Table 12, no significance differences were found at the .05 nominal alpha level within or between groups of full-time, adjunct, rural, and urban electronics instructors.

Table 12

Multivariate test applying Wilks' Lambda

Effect	Value	F	Hypothesis df	Error df	Sig.	Eta Squared
Faculty Position	.881	.780 [a]	8	46	.662	.119
District Setting	.910	.572 [a]	8	46	.796	.090
Interaction	.959	.249 [a]	8	46	.979	.041

[a] Exact Statistic

The data were evaluated for significant differences between subject groups across each of the eight construct means. Results of the univariate tests of effects are shown in Table 13. No significant differences were found between groups when evaluated at the .05 nominal alpha level across individual construct means.

In Table 14, proper electronic design and fabrication skills had the lowest level of agreement within the general skills construct at 80.7 percent. The lowest level of agreement was among full-time faculty at urban institutions while the highest level of agreement was among adjunct faculty at urban institutions. This statement also received the greatest number of neutral responses. Respondents were in 100 percent agreement with the statement regarding proper techniques and equipment for troubleshooting.

Table 13

Univariate tests of effects

Source	Dependent Variable	df	Mean Square	F	Sig.	Eta Squared
Faculty Position	A mean	1	6.008E-02	.324	.571	.006
	B mean	1	4.677E-03	.028	.867	.001
	C mean	1	6.983E-02	.285	.595	.005
	D mean	1	8.139E-03	.030	.863	.001
	E mean	1	2.572E-02	.061	.806	.001
	F mean	1	.230	.878	.353	.016
	G mean	1	5.358E-02	.102	.751	.002
	H mean	1	4.637E-02	.081	.777	.002
District Setting	A mean	1	5.126E-02	.277	.601	.005
	B mean	1	1.919E-04	.001	.973	.000
	C mean	1	5.253E-02	.215	.645	.004
	D mean	1	.122	.451	.505	.008
	E mean	1	.677	1.610	.210	.029
	F mean	1	.105	.400	.530	.007
	G mean	1	.123	.233	.631	.004
	H mean	1	3.035E-02	.053	.819	.001
Interaction (Faculty Position * District Setting)	A mean	1	1.144E-02	.062	.805	.001
	B mean	1	3.166E-05	.000	.989	.000
	C mean	1	4.472E-03	.018	.893	.000
	D mean	1	5.700E-02	.210	.649	.004
	E mean	1	1.109E-02	.026	.872	.000
	F mean	1	2.628E-02	.100	.753	.002
	G mean	1	3.115E-04	.001	.981	.000
	H mean	1	.115	.200	.656	.004
Error	A mean	53	.185			
	B mean	53	.166			
	C mean	53	.245			
	D mean	53	.271			
	E mean	53	.420			
	F mean	53	.262			
	G mean	53	.526			
	H mean	53	.573			

Table 14

Responses to statements in the General Skills (A) construct

The entry level electronics technician should demonstrate an understanding of...	response[a]	Faculty Position: full-time, District Setting: rural n	%	full-time, urban n	%	adjunct, District Setting: rural n	%	adjunct, urban n	%	Total n	%
proper safety techniques and OSHA standards.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	0	0.0	0	0.0	3	15.8	3	3.5
	Agree	5	100	27	100	6	100	16	84.2	54	96.5
	N	5	100	27	100	6	100	19	100	57	100
proper techniques and equipment for troubleshooting.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Agree	5	100	27	100	6	100	19	100	57	100
	N	5	100	27	100	6	100	19	100	57	100
proper electronic design and fabrication skills.	Disagree	1	20.0	2	7.4	0	0.0	0	0.0	3	5.3
	Neutral	0	0.0	5	18.5	1	16.7	2	10.5	8	14.0
	Agree	4	80.0	20	74.1	5	83.3	17	89.5	46	80.7
	N	5	100	27	100	6	100	19	100	57	100
the interpretation and creation for electronic schematics, technical drawings, flow diagrams, tables, graphs, and data records.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	2	7.4	0	0.0	1	5.3	3	5.3
	Agree	5	100	25	92.6	6	100	18	94.7	54	94.7
	N	5	100	27	100	6	100	19	100	57	100
color codes and component descriptors.	Disagree	0	0.0	1	3.7	0	0.0	1	5.3	2	3.5
	Neutral	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Agree	5	100	26	96.3	6	100	18	94.7	55	96.5
	N	5	100	27	100	6	100	19	100	57	100

[a] Responses of strongly disagree and disagree are classified as disagree and reponses of agree and strongly agree are classified as agree.

No disagreement was indicated with any statement within the DC circuits construct as shown in Table 15. A small percentage of the sample population indicated neutrality toward statements that included sources of electricity and the principles, operation, fabrication, troubleshooting, and repair of various circuit types.

Three of the statements in Table 16 showing responses in the AC circuits construct indicated a small percentage of disagreement. All statements received some neutral response. The statement regarding the principles, operation, troubleshooting, and repair of AC phase locked loop circuits received 5.3 percent disagreement and a relatively high neutrality of 28.1 percent. Two-thirds of the respondents indicated agreement with the AC phase locked loop circuits statement.

As shown in Table 17, a disagreement of less than 2 percent was indicated with the discrete solid state device statements regarding special purpose diodes and optoelectronic circuits. Neutrality was indicated with all statements concerning discrete solid state devices. The statement regarding the principles, operation, fabrication, troubleshooting, and repair of thyristor circuits received the highest level of neutrality at 22.8 percent and the lowest level of agreement at 77.2 percent.

Nine of the 13 analog circuit statements shown in Table 18 received an indication of disagreement from the sample population. Seven percent of the respondents disagreed with the statements regarding signal modulation systems and microwave circuits while 10.5 percent disagreed with the statement regarding motor phase shift control circuits. All statements received relatively high responses of neutrality in comparison to the other constructs. Agreements ranged from 57.9 percent to 94.7 percent. Three statements received less than two-thirds agreement from the respondents. The statement regarding motor phase shift control circuits received the lowest level of agreement at 57.9 percent. The statement regarding photodiodes or LASERS received an indication of 63.2 percent agreement while the statement regarding the principles and operation of microwave circuits received an indication of 64.9 percent agreement. No full-time faculty at rural institutions indicated disagreement with any of the statements in the analog circuits construct.

Six of the 14 statements in the digital circuits construct shown in Table 19 received an indication of disagreement. The statements with the greatest level of disagreement were those regarding Boolean operations and power distribution noise problems, each with 7 percent. All statements in the construct received some indication of neutrality with the greatest neutral response indication toward the statement regarding power distribution and noise problems at 31.6 percent. All statements received a level of agreement greater than 84 percent with the exception of the statement regarding the principles, operation, troubleshooting, and repair of power distribution noise problems with the agreement of 61.4 percent of the participants.

As shown in Table 20, a low level of disagreement was reported for all statements concerning knowledge and skills for microprocessors. Disagreement ranged from 1.8 to 5.3 percent. Levels of neutrality were relatively high for all statements and ranged from 10.5 to 26.3 percent. The highest neutral response of 26.3 percent was received by the statement regarding the principles and operations of microprocessor machine code and instruction sets. The statement regarding microprocessor machine code and instruction sets received the lowest level of agreement at 70.2 percent. No faculty from rural districts indicated disagreement with any statement in the microprocessors construct.

Table 21 shows responses to the four statements in the microcomputer construct. Two statements received a low level of disagreement of 1.8 percent. The levels of neutrality ranged from 15.8 to 19.3 percent and agreement levels ranged from 78.9 to 84.2 percent. All responses indicating disagreement were received from adjunct instructors at urban districts.

Table 22 shows the percentage of inclusion of skill standards in programs by district setting. Percentages for participants in rural and urban districts are shown separately as well as combined.

The construct of greatest inclusion overall was that of general skills at 91.2 percent. General skills also had the highest inclusion among rural districts at 88.1 percent; however, this construct ranked second in inclusion among urban districts at 93.5 percent.

DC and AC circuits are comparably included in the programs of participating instructors. Each construct has an inclusion of 87.7 percent overall with 63.6 percent inclusion in rural districts and 93.5 percent inclusion in urban districts.

Table 15

Responses to statements in the DC Circuits (B) construct

		Faculty Position									
		full-time				adjunct					
		District Setting				District Setting					
		rural		urban		rural		urban		Total	
The entry level electronics technician should demonstrate an understanding of...	response[a]	n	%	n	%	n	%	n	%	n	%
sources of electricity in DC circuits.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	1	3.7	0	0.0	0	0.0	1	1.8
	Agree	5	100	26	96.3	6	100	19	100	56	98.2
	N	5	100	27	100	6	100	19	100	57	100
the relationship of Voltage, Current, and Resistance in DC Circuits (Ohm's Law).	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Agree	5	100	27	100	6	100	19	100	57	100
	N	5	100	27	100	6	100	19	100	57	100
the application of Ohm's Law to series, parallel, and combination circuits.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Agree	5	100	27	100	6	100	19	100	57	100
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, fabrication, troubleshooting, and repair of DC series circuits.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	0	0.0	0	0.0	1	5.3	1	1.8
	Agree	5	100	27	100	6	100	18	94.7	56	98.2
	N	5	100	27	100	6	100	19	100	57	100

[a] Responses of strongly disagree and disagree are classified as disagree and reponses of agree and strongly agree are classified as agree.

Table 15 continued

Responses to statements in the DC Circuits (B) construct

		Faculty Position									
		full-time				adjunct					
		District Setting				District Setting					
		rural		urban		rural		urban		Total	
The entry level electronics technician should demonstrate an understanding of...	response[a]	n	%	n	%	n	%	n	%	n	%
the principles, operation, fabrication, troubleshooting, and repair of DC parallel circuits.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	0	0.0	0	0.0	1	5.3	1	1.8
	Agree	5	100	27	100	6	100	18	94.7	56	98.2
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, fabrication, troubleshooting, and repair of DC combination and bridge circuits.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	0	0.0	0	0.0	3	15.8	3	5.3
	Agree	5	100	27	100	6	100	16	84.2	54	94.7
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, fabrication, troubleshooting, and repair of DC voltage divider circuits.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	1	3.7	0	0.0	2	10.5	3	5.3
	Agree	5	100	26	96.3	6	100	17	89.5	54	94.7
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, fabrication, troubleshooting, and repair of DC RC & RL circuits.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	1	3.7	0	0.0	2	10.5	3	5.3
	Agree	5	100	26	96.3	6	100	17	89.5	54	94.7
	N	5	100	27	100	6	100	19	100	57	100

[a] Responses of strongly disagree and disagree are classified as disagree and reponses of agree and strongly agree are classified as agree.

Table 16

Responses to statements in the AC Circuits (C) construct

		Faculty Position									
		full-time				adjunct					
		District Setting				District Setting					
		rural		urban		rural		urban		Total	
The entry level electronics technician should demonstrate an understanding of...	response[a]	n	%	n	%	n	%	n	%	n	%
sources of electricity in AC circuits.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	1	3.7	0	0.0	0	0.0	1	1.8
	Agree	5	100	26	96.3	6	100	19	100	56	98.2
	N	5	100	27	100	6	100	19	100	57	100
the properties, characteristics, and principles and operation of sinusoidal and non-sinusoidal AC signals.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	1	3.7	0	0.0	0	0.0	1	1.8
	Agree	5	100	26	96.3	6	100	19	100	56	98.2
	N	5	100	27	100	6	100	19	100	57	100
the measurement of power and principles and operation of power conditioning systems.	Disagree	0	0.0	1	3.7	0	0.0	0	0.0	1	1.8
	Neutral	0	0.0	1	3.7	0	0.0	3	15.8	4	7.0
	Agree	5	100	25	92.6	6	100	16	84.2	52	91.2
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, fabrication, troubleshooting, and repair of AC capacitive circuits.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	0	0.0	0	0.0	2	10.5	2	3.5
	Agree	5	100	27	100	6	100	17	89.5	55	96.5
	N	5	100	27	100	6	100	19	100	57	100

[a] Responses of strongly disagree and disagree are classified as disagree and reponses of agree and strongly agree are classified as agree.

Table 16 continued

Responses to statements in the AC Circuits (C) construct

		Faculty Position									
		full-time				adjunct					
		District Setting				District Setting					
		rural		urban		rural		urban		Total	
The entry level electronics technician should demonstrate an understanding of...	response[a]	n	%	n	%	n	%	n	%	n	%
the principles, operation, fabrication, troubleshooting, and repair of AC inductive circuits.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	0	0.0	0	0.0	2	10.5	2	3.5
	Agree	5	100	27	100	6	100	17	89.5	55	96.5
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, fabrication, troubleshooting, and repair of AC RC, RL, and RLC circuits.	Disagree	0	0.0	1	3.7	0	0.0	0	0.0	1	1.8
	Neutral	0	0.0	0	0.0	0	0.0	1	5.3	1	1.8
	Agree	5	100	26	96.3	6	100	18	94.7	55	96.5
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, fabrication, troubleshooting, and repair of AC selective filter circuits.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	4	14.8	0	0.0	2	10.5	6	10.5
	Agree	5	100	23	85.2	6	100	17	89.5	51	89.5
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, troubleshooting, and repair of AC phase locked loop circuits.	Disagree	0	0.0	2	7.4	1	16.7	0	0.0	3	5.3
	Neutral	1	20.0	8	29.6	0	0.0	7	36.8	16	28.1
	Agree	4	80.0	17	63.0	5	83.3	12	63.2	38	66.7
	N	5	100	27	100	6	100	19	100	57	100

[a] Responses of strongly disagree and disagree are classified as disagree and reponses of agree and strongly agree are classified as agree.

Table 17

Responses to statements in the Discrete Solid State Devices (D) construct

		Faculty Position									
		full-time				adjunct					
		District Setting				District Setting					
		rural		urban		rural		urban		Total	
The entry level electronics technician should demonstrate an understanding of...	response[a]	n	%	n	%	n	%	n	%	n	%
the properties of semiconductor materials.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	2	7.4	0	0.0	1	5.3	3	5.3
	Agree	5	100	25	92.6	6	100	18	94.7	54	94.7
	N	5	100	27	100	6	100	19	100	57	100
PN junctions.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	2	7.4	0	0.0	1	5.3	3	5.3
	Agree	5	100	25	92.6	6	100	18	94.7	54	94.7
	N	5	100	27	100	6	100	19	100	57	100
bipolar transistors.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	2	7.4	0	0.0	1	5.3	3	5.3
	Agree	5	100	25	92.6	6	100	18	94.7	54	94.7
	N	5	100	27	100	6	100	19	100	57	100
field effect transistors.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	1	3.7	0	0.0	2	10.5	3	5.3
	Agree	5	100	26	96.3	6	100	17	89.5	54	94.7
	N	5	100	27	100	6	100	19	100	57	100
special purpose diodes.	Disagree	0	0.0	1	3.7	0	0.0	0	0.0	1	1.8
	Neutral	0	0.0	3	11.1	0	0.0	4	21.1	7	12.3
	Agree	5	100	23	85.2	6	100	15	78.9	49	86.0
	N	5	100	27	100	6	100	19	100	57	100

[a] Responses of strongly disagree and disagree are classified as disagree and reponses of agree and strongly agree are classified as agree.

Table 17 continued

Responses to statements in the Discrete Solid State Devices (D) construct

		Faculty Position									
		full-time				adjunct					
		District Setting				District Setting					
		rural		urban		rural		urban		Total	
The entry level electronics technician should demonstrate an understanding of...	response[a]	n	%	n	%	n	%	n	%	n	%
the principles, operation, fabrication, troubleshooting, and repair of diode circuits.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	1	3.7	0	0.0	2	10.5	3	5.3
	Agree	5	100	26	96.3	6	100	17	89.5	54	94.7
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, fabrication, troubleshooting, and repair of optoelectronic circuits.	Disagree	0	0.0	0	0.0	0	0.0	1	5.3	1	1.8
	Neutral	0	0.0	3	11.1	1	16.7	6	31.6	10	17.5
	Agree	5	100	24	88.9	5	83.3	12	63.2	46	80.7
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, fabrication, troubleshooting, and repair of single stage amplifier circuits.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	2	7.4	0	0.0	3	15.8	5	8.8
	Agree	5	100	25	92.6	6	100	16	84.2	52	91.2
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, fabrication, troubleshooting, and repair of thyristor circuits (SCR, TRIAC, DIAC, etc.).	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	5	18.5	0	0.0	8	42.1	13	22.8
	Agree	5	100	22	81.5	6	100	11	57.9	44	77.2
	N	5	100	27	100	6	100	19	100	57	100

[a] Responses of strongly disagree and disagree are classified as disagree and reponses of agree and strongly agree are classified as agree.

Table 18

Responses to statements in the Analog Circuits (E) construct

		Faculty Position									
		full-time				adjunct					
		District Setting				District Setting					
		rural		urban		rural		urban		Total	
The entry level electronics technician should demonstrate an understanding of...	response[a]	n	%	n	%	n	%	n	%	n	%
the principles, operation, fabrication, troubleshooting, and repair of multistage amplifier circuits.	Disagree	0	0.0	1	3.7	0	0.0	0	0.0	1	1.8
	Neutral	0	0.0	2	7.4	0	0.0	3	15.8	5	8.8
	Agree	5	100	24	88.9	6	100	16	84.2	51	89.5
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, fabrication, troubleshooting, and repair of IF circuits.	Disagree	0	0.0	1	3.7	0	0.0	0	0.0	1	1.8
	Neutral	0	0.0	7	25.9	2	33.3	6	32.6	15	26.3
	Agree	5	100	19	70.4	4	66.7	13	68.4	41	71.9
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, fabrication, troubleshooting, and repair of linear power supply and filter circuits.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	3	11.1	0	0.0	3	15.8	6	10.5
	Agree	5	100	24	88.9	6	100	16	84.2	51	89.5
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, fabrication, troubleshooting, and repair of operational amplifier circuits.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	0	0.0	0	0.0	3	15.8	3	5.3
	Agree	5	100	27	100	6	100	16	84.2	54	94.7
	N	5	100	27	100	6	100	19	100	57	100

[a] Responses of strongly disagree and disagree are classified as disagree and reponses of agree and strongly agree are classified as agree.

Table 18 continued

Responses to statements in the Analog Circuits (E) construct

		Faculty Position									
		full-time				adjunct					
		District Setting				District Setting					
		rural		urban		rural		urban		Total	
The entry level electronics technician should demonstrate an understanding of...	response[a]	n	%	n	%	n	%	n	%	n	%
the principles, operation, fabrication, troubleshooting, and repair of audio power amplifier circuits.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	5	18.5	1	16.7	6	32.6	12	21.1
	Agree	5	100	22	81.5	5	83.3	13	68.4	45	78.9
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, troubleshooting, and repair of regulated and switching power supply circuits.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	5	18.5	0	0.0	4	21.1	9	15.8
	Agree	5	100	22	81.5	6	100	15	78.9	48	84.2
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, troubleshooting, and repair of active filter circuits.	Disagree	0	0.0	1	3.7	0	0.0	0	0.0	1	1.8
	Neutral	0	0.0	5	18.5	0	0.0	5	26.3	10	17.5
	Agree	5	100	21	77.8	6	100	14	73.7	46	80.7
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, troubleshooting, and repair of sinusoidal and non-sinusoidal oscillator circuits.	Disagree	0	0.0	2	7.4	0	0.0	0	0.0	2	3.5
	Neutral	0	0.0	5	18.5	0	0.0	5	26.3	10	17.5
	Agree	5	100	20	74.1	6	100	14	73.7	45	78.9
	N	5	100	27	100	6	100	19	100	57	100

[a] Responses of strongly disagree and disagree are classified as disagree and reponses of agree and strongly agree are classified as agree.

Table 18 continued

Responses to statements in the Analog Circuits (E) construct

		Faculty Position									
		full-time				adjunct					
		District Setting				District Setting					
		rural		urban		rural		urban		Total	
The entry level electronics technician should demonstrate an understanding of...	response[a]	n	%	n	%	n	%	n	%	n	%
the principles, operation, troubleshooting, and repair of fiber optic circuits using photodiodes or LASERS.	Disagree	0	0.0	1	3.7	0	0.0	1	5.3	2	3.5
	Neutral	1	20.0	8	29.6	2	33.3	8	42.1	19	33.3
	Agree	4	80.0	18	66.7	4	66.7	10	52.6	36	63.2
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, fabrication, troubleshooting, and repair of Radio Frequency (RF) circuits.	Disagree	0	0.0	2	7.4	0	0.0	0	0.0	2	3.5
	Neutral	0	0.0	6	22.2	1	16.7	6	32.6	13	22.8
	Agree	5	100	19	70.4	5	83.3	13	68.4	42	73.7
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, troubleshooting, and repair of signal modulation systems (AM, FM, stereo).	Disagree	0	0.0	3	11.1	0	0.0	1	5.3	4	7.0
	Neutral	0	0.0	5	18.5	0	0.0	7	36.8	12	21.1
	Agree	5	100	19	70.4	6	100	11	57.9	41	71.9
	N	5	100	27	100	6	100	19	100	57	100
motor phase shift control circuits.	Disagree	0	0.0	3	11.1	1	16.7	2	10.5	6	10.5
	Neutral	1	20.0	8	29.6	0	0.0	9	47.4	18	31.6
	Agree	4	80.0	16	59.3	5	83.3	8	42.1	33	57.9
	N	5	100	27	100	6	100	19	100	57	100
the principles and operation of microwave circuits.	Disagree	0	0.0	3	11.1	0	0.0	1	5.3	4	7.0
	Neutral	0	0.0	6	22.2	1	16.7	9	47.4	16	28.1
	Agree	5	100	18	66.7	5	83.3	9	47.4	37	64.9
	N	5	100	27	100	6	100	19	100	57	100

[a] Responses of strongly disagree and disagree are classified as disagree and reponses of agree and strongly agree are classified as agree.

Table 19

Responses to statements in the Digital Circuits (F) construct

		Faculty Position									
		full-time				adjunct					
		District Setting				District Setting					
		rural		urban		rural		urban		Total	
The entry level electronics technician should demonstrate an understanding of...	response[a]	n	%	n	%	n	%	n	%	n	%
the characteristics of integrated circuit (IC) logic families.	Disagree	0	0.0	1	3.7	0	0.0	0	0.0	1	1.8
	Neutral	0	0.0	2	7.4	0	0.0	1	5.3	3	5.3
	Agree	5	100	24	88.9	6	100	18	94.7	53	93.0
	N	5	100	27	100	6	100	19	100	57	100
minimizing logic circuits using Boolean operations.	Disagree	1	20.0	3	11.1	0	0.0	0	0.0	4	7.0
	Neutral	0	0.0	3	11.1	1	16.7	2	10.5	6	10.5
	Agree	4	80.0	21	77.8	5	83.3	17	89.5	47	82.5
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, troubleshooting, and repair of linear integrated circuits.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	4	14.8	1	16.7	2	10.5	7	12.3
	Agree	5	100	23	85.2	5	83.3	17	89.5	50	87.7
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, fabrication, troubleshooting, and repair of types of logic gates.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	2	7.4	0	0.0	1	5.3	3	5.3
	Agree	5	100	25	92.6	6	100	18	94.7	54	94.7
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, fabrication, troubleshooting, and repair of combinational logic circuits.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	2	7.4	0	0.0	1	5.3	3	5.3
	Agree	5	100	25	92.6	6	100	18	94.7	54	94.7
	N	5	100	27	100	6	100	19	100	57	100

[a] Responses of strongly disagree and disagree are classified as disagree and reponses of agree and strongly agree are classified as agree.

Table 19 continued

Responses to statements in the Digital Circuits (F) construct

		Faculty Position									
		full-time				adjunct					
		District Setting				District Setting					
		rural		urban		rural		urban		Total	
The entry level electronics technician should demonstrate an understanding of...	response[a]	n	%	n	%	n	%	n	%	n	%
the principles, operation, fabrication, troubleshooting, and repair of types of flip-flop circuits.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	3	11.1	1	16.7	0	0.0	4	7.0
	Agree	5	100	24	88.9	5	83.3	19	100	53	93.0
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, fabrication, troubleshooting, and repair of types of registers and counters.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	3	11.1	0	0.0	0	0.0	3	5.3
	Agree	5	100	24	88.9	6	100	19	100	54	94.7
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, fabrication, troubleshooting, and repair of types of clock and timing circuits.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	2	7.4	0	0.0	0	0.0	2	3.5
	Agree	5	100	25	92.6	6	100	19	100	55	94.5
	N	5	100	27	100	6	100	19	100	57	100
. the principles, operation, troubleshooting, and repair of arithmetic-logic circuits.	Disagree	0	0.0	1	3.7	0	0.0	0	0.0	1	1.8
	Neutral	0	0.0	2	7.4	0	0.0	2	1.5	4	7.0
	Agree	5	100	24	88.9	6	100	17	89.5	52	91.2
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, troubleshooting, and repair of multiplexer and demultiplexer circuits	Disagree	0	0.0	1	3.7	0	0.0	0	0.0	1	1.8
	Neutral	0	0.0	2	7.4	0	0.0	2	1.5	4	7.0
	Agree	5	100	24	88.9	6	100	17	89.5	52	91.2
	N	5	100	27	100	6	100	19	100	57	100

[a] Responses of strongly disagree and disagree are classified as disagree and reponses of agree and strongly agree are classified as agree.

Table 19 continued

Responses to statements in the Digital Circuits (F) construct

		Faculty Position									
		full-time				adjunct					
		District Setting				District Setting					
		rural		urban		rural		urban		Total	
The entry level electronics technician should demonstrate an understanding of...	response[a]	n	%	n	%	n	%	n	%	n	%
the principles, operation, troubleshooting, and repair of digital to analog (DAC) and analog to digital (ADC) circuits.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	4	14.8	0	0.0	3	15.8	7	12.3
	Agree	5	100	23	85.2	6	100	16	84.2	50	87.7
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, troubleshooting, and repair of digital display circuits and devices.	Disagree	0	0.0	1	3.7	0	0.0	0	0.0	1	1.8
	Neutral	0	0.0	3	11.1	1	16.7	4	21.1	8	14.0
	Agree	5	100	23	85.2	5	83.3	15	78.9	48	84.2
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, troubleshooting, and repair of power distribution noise problems.	Disagree	0	0.0	1	3.7	1	16.7	2	10.5	4	7.0
	Neutral	1	20.0	10	37.0	1	16.7	6	31.6	18	31.6
	Agree	4	80.0	16	59.3	4	66.7	11	57.9	35	61.4
	N	5	100	27	100	6	100	19	100	57	100
the principles, operation, troubleshooting, and repair of digital encoders and decoders.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	0	0.0	5	18.5	0	0.0	2	10.5	7	12.3
	Agree	5	100	22	81.5	6	100	17	89.5	50	87.7
	N	5	100	27	100	6	100	19	100	57	100

[a] Responses of strongly disagree and disagree are classified as disagree and reponses of agree and strongly agree are classified as agree.

Table 20

Responses to statements in the Microprocessors (G) construct

		Faculty Position									
		full-time				adjunct					
		District Setting				District Setting					
		rural		urban		rural		urban		Total	
The entry level electronics technician should demonstrate an understanding of...	response[a]	n	%	n	%	n	%	n	%	n	%
the principles, operation, troubleshooting, and repair of microprocessor interfaces.	Disagree	0	0.0	0	0.0	0	0.0	1	5.3	1	1.8
	Neutral	1	20.0	6	22.2	2	33.3	1	5.3	10	17.5
	Agree	4	80.0	21	77.8	4	66.7	17	89.5	46	80.7
	N	5	100	27	100	6	100	19	100	57	100
essential microprocessor components.	Disagree	0	0.0	0	0.0	0	0.0	1	5.3	1	1.8
	Neutral	1	20.0	4	14.8	1	16.7	0	0.0	6	10.5
	Agree	4	80.0	23	85.2	5	83.3	18	94.7	50	87.7
	N	5	100	27	100	6	100	19	100	57	100
microprocessor BUS concepts.	Disagree	0	0.0	0	0.0	0	0.0	1	5.3	1	1.8
	Neutral	1	20.0	4	14.8	1	16.7	1	5.3	7	12.3
	Agree	4	80.0	23	85.2	5	83.3	17	89.5	49	86.0
	N	5	100	27	100	6	100	19	100	57	100
microprocessor components and terminology.	Disagree	0	0.0	0	0.0	0	0.0	1	5.3	1	1.8
	Neutral	1	20.0	4	14.8	1	16.7	2	10.5	8	14.0
	Agree	4	80.0	23	85.2	5	83.3	16	84.2	48	84.2
	N	5	100	27	100	6	100	19	100	57	100

[a] Responses of strongly disagree and disagree are classified as disagree and reponses of agree and strongly agree are classified as agree.

Table 20 continued

Responses to statements in the Microprocessors (G) construct

		Faculty Position									
		full-time				adjunct					
		District Setting				District Setting					
		rural		urban		rural		urban		Total	
The entry level electronics technician should demonstrate an understanding of...	response[a]	n	%	n	%	n	%	n	%	n	%
the principles, operation, troubleshooting, and repair of microprocessor memory circuits.	Disagree	0	0.0	2	7.4	0	0.0	1	5.3	3	5.3
	Neutral	1	20.0	6	22.2	2	33.3	2	10.5	11	19.3
	Agree	4	80.0	19	70.4	4	66.7	16	84.2	43	75.4
	N	5	100	27	100	6	100	19	100	57	100
the principles and operations of microprocessor machine code and instruction sets.	Disagree	0	0.0	1	3.7	0	0.0	1	5.3	2	3.5
	Neutral	2	40.0	8	29.6	2	33.3	3	15.8	15	26.3
	Agree	3	60.0	18	66.7	4	66.7	15	78.9	40	70.2
	N	5	100	27	100	6	100	19	100	57	100

[a] Responses of strongly disagree and disagree are classified as disagree and reponses of agree and strongly agree are classified as agree.

Table 21

<u>Responses to statements in the Microcomputers (H) construct</u>

		Faculty Position									
		full-time				adjunct					
		District Setting				District Setting					
		rural		urban		rural		urban		Total	
The entry level electronics technician should demonstrate an understanding of...	response[a]	n	%	n	%	n	%	n	%	n	%
microcomputer operating systems.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	1	20.0	6	22.2	1	16.7	2	10.5	10	17.5
	Agree	4	80.0	21	77.8	5	83.3	17	89.5	47	82.5
	N	5	100	27	100	6	100	19	100	57	100
essential microcomputer components.	Disagree	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Neutral	1	20.0	5	18.5	1	16.7	2	10.5	9	15.8
	Agree	4	80.0	22	81.5	5	83.3	17	89.5	48	84.2
	N	5	100	27	100	6	100	19	100	57	100
the operation, troubleshooting, and replacement of microcomputer peripherals.	Disagree	0	0.0	0	0.0	0	0.0	1	5.3	1	1.8
	Neutral	1	20.0	5	18.5	1	16.7	2	10.5	9	15.8
	Agree	4	80.0	22	81.5	5	83.3	16	84.2	47	82.5
	N	5	100	27	100	6	100	19	100	57	100
the set up and configuration of a microcomputer using available operating systems and software packages.	Disagree	0	0.0	0	0.0	0	0.0	1	5.3	1	1.8
	Neutral	1	20.0	6	22.2	1	16.7	3	15.8	11	19.3
	Agree	4	80.0	21	77.8	5	83.3	15	78.9	45	78.9
	N	5	100	27	100	6	100	19	100	57	100

[a] Responses of strongly disagree and disagree are classified as disagree and reponses of agree and strongly agree are classified as agree.

Table 22

Percentage of inclusion of skill standards in programs by district setting

		District Setting					
		rural		urban		Total	
Skill standard construct	Skill standard included?	n	%	n	%	n	%
A) general skills	Yes	9	81.8	43	93.5	52	91.2
	No	2	18.2	1	2.2	3	5.3
	No response	0	0.0	2	4.3	2	3.5
	N	11	100	46	100	57	100
B) DC circuits	Yes	7	63.6	43	93.5	50	87.7
	No	4	36.4	0	0.0	4	7.0
	No response	0	0.0	3	6.5	3	5.3
	N	11	100	46	100	57	100
C) AC circuits	Yes	7	63.6	43	93.5	50	87.7
	No	4	36.4	2	4.3	6	10.5
	No response	0	0.0	1	2.2	1	1.8
	N	11	100	46	100	57	100
D) discrete solid state devices	Yes	7	63.6	44	95.7	51	89.5
	No	4	36.4	1	2.2	5	8.8
	No response	0	0.0	1	2.2	1	1.8
	N	11	100	46	100	57	100
E) analog circuits	Yes	7	63.6	39	84.8	46	80.7
	No	4	36.4	6	13.0	10	17.5
	No response	0	0.0	1	2.2	1	1.8
	N	11	100	46	100	57	100
F) digital circuits	Yes	7	63.6	41	89.1	48	84.2
	No	4	36.4	4	8.7	8	14.0
	No response	0	0.0	1	2.2	1	1.8
	N	11	100	46	100	57	100
G) microprocessors	Yes	5	45.5	40	87.0	45	78.9
	No	6	54.5	4	8.7	10	17.5
	No response	0	0.0	2	4.3	2	3.5
	N	11	100	46	100	57	100
H) microcomputers	Yes	6	54.5	36	78.3	42	73.7
	No	5	45.5	6	13.0	11	19.3
	No response	0	0.0	4	8.7	4	7.0
	N	11	100	46	100	57	100

Discrete solid state devices ranked second overall in inclusion at 89.5 percent. Instructors from rural districts indicated an inclusion of 63.6 percent. Urban instructors indicated an inclusion of 95.7 percent ranking this construct first in inclusion among urban districts.

Inclusion of analog circuits was indicated to be 80.7 percent overall with 63.6 percent in rural districts and 84.8 percent in urban districts.

Digital circuits were included in programs of 84.2 percent of participating instructors. Instructors reported 63.6 percent inclusion in rural districts and 89.1 percent inclusion in urban districts.

Microprocessors were included in 78.9 percent of the instructors' programs. Instructors ranked microprocessors last in program inclusion in rural districts at 45.5 percent. Eighty-seven percent inclusion was indicated by instructors in rural districts.

The construct indicated to have the least inclusion was microcomputers at 73.7 percent. Rural instructors showed the inclusion of microcomputers to be slightly above that of microprocessors at 54.5 percent. Microcomputers ranked last in inclusion by urban instructors with an inclusion of 78.3 percent. The microprocessor construct also had the highest occurrence of "no " and "no response" from the respondents. The skills within the construct were indicated to not be included by 19.3 percent of the respondents while 7 percent omitted their response to the question.

Inclusion of skills regarding each of the eight constructs was consistently indicated to be lower by instructors in programs in rural districts. The majority of omissions to inclusion questions was found to be among responses from adjunct faculty in urban institutions. The range of inclusion indicated by instructors was from 73.7 percent to 91.2 percent.

Participant Comments

The final question on the survey instrument was an open-ended invitation for the participant to make any additional comments. Sixteen respondents chose to provide comments. Survey instruments were numbered in order of receipt by the researcher. Comments, identified by respondent number, are shown in Appendix G. Comments by six respondents made reference to a transitioning focus from general electronic technology to computer and network related technology (Respondents 7, 13, 17, 24, 29,& 44). Three respondents noted a lack of emphasis on fabrication in their programs (Respondents 6, 8, & 47). Two respondents expressed concern with weak laboratory components in their programs (Respondents 18 & 23).

CHAPTER FIVE

DISCUSSION

The purpose of this study was to determine the profile of the sample population and to determine whether significant differences exist between attitudes of full-time and adjunct electronics instructors in Texas community/junior colleges toward industry validated technical skill standards for entry-level electronic technicians. This chapter contains a discussion of the conclusions, implications, and recommendations resulting from this study.

Data collected from participants in this study were compared to the benchmark skill standards developed through a project conducted by the Electronic Industries Foundation and published in the document, Raising the Standard—Electronics Technicians Skills for Today and Tomorrow (Electronic Industries Foundation, 1994b). The null hypothesis stated for this study was: There is no significant difference in the attitudes of electronics instructors in Texas community/junior colleges toward entry-level technical electronics skills identified in the Technical Skills section of Raising the Standard. The first research question to be answered by this study was: What are the profiles of the participating full-time and adjunct electronics instructors at rural and urban community/junior college districts in Texas? The second research question to be answered by this study was: What are the differences between the attitudes of full-time and adjunct electronics instructors toward entry-level electronics technicians skills identified as technical skills in Raising the Standard?

Findings

Reponses to demographic statements were used to generate a profile of the sample population. The profile of the electronics instructor within the sample population is a person over 35 years of age with a Master's degree in an engineering, science, or technology related discipline and at least one degree in electronics or an electronics related discipline. The participating electronics instructor has more than three years of business or industrial experience and more than two years of teaching experience.

Independent variables used in the study were full-time and adjunct instructor positions and rural and urban college district settings. Eight constructs, serving as the dependent variables, were comprised of groups of skill standard statements derived from the technical skills section of Raising the Standard. A reliability analysis using Chronbach's Alpha yielded an Alpha of .9762. As this is recognized as a very high value for Alpha, the data were reanalyzed for confirmation. The second analysis confirmed the value. It was determined that this high Alpha could likely be attributed to the low discriminate power inherent in the design of the instrument used in this study.

An analysis of the data applying Wilks' Lambda in a 2X2 MANOVA revealed no significant differences at the .05 alpha level between or within any level of the two independent variables across the eight skill standard constructs.

Thus, the null hypothesis that there is no significant difference in the attitudes of electronics instructors in Texas community/junior colleges toward entry-level technical electronics skills identified in Raising the Standard was not rejected.

Based on likert scale responses to skill standard statements, electronics instructors generally agreed that all of the constructs contained knowledge and skills necessary for entry-level electronic technicians. Participating instructors indicated the greatest agreement with statements pertaining to DC circuits. The lowest indication of agreement was for skills related to analog circuits. The 84 percent positive affirmation regarding the question of inclusion of skill standards in the electronics programs indicated an alignment between content in the electronic technology programs in Texas community/junior colleges and the nationally validated technical skill standards in Raising the Standard.

Sixteen of the 57 participants responded to the open-ended invitation to make additional comments. A survey of the comments revealed three recurring issues. The most prevalently noted issue was identified by six respondents. The issue was that of a transitioning of the core content of programs from general electronic technology to computer and network related technology. A positive tone was taken by one instructor who recommended training in computer literacy and networking (Respondent 7) Two respondents viewed the shift of emphasis from electronics to computer related technologies to be detrimental (Respondents 13 & 17) Certification opportunities for students were identified as the reason for shifting emphasis to computer and network related instructional programs (Respondents 24 & 29). One instructor revealed that in the future, only courses supporting the institution's computer degrees would be offered by the department and a degree in electronics would no longer be available. (Respondent 44).

Having previously been a member of the population targeted in this study, the researcher concurs that the noted transition of focus from general electronic technology to computer and network related technology is a growing trend. The researcher has observed several programs in electronic technology in Texas community/junior colleges that have been phased out in recent years and modified to award computer related degrees or eliminated altogether. A review of the literature found a lack of research addressing this trend.

The second most noted issue was identified by three respondents who commented on a lack of emphasis on fabrication in their programs. One instructor indicated that fabrication, troubleshooting and repair were not emphasized; however, component circuits were constructed for value measurement (Respondent 47). Another instructor noted that fabrication techniques were important but were not highly feasible in the program because of cost of instruction. (Respondent 6) A third respondent addressing fabrication noted that instruction in fabrication has almost disappeared and that component repair for microprocessors has become uneconomical (Respondent 8).

A third recurring issue in the comments, noted by two respondents, addressed a lack of, or weakness in, laboratory instruction. Both respondents indicated that the lack of, or weakness in, the hands-on laboratory components of their programs were directly related to the attitudes and practices of instructors in the programs (Respondents 18 & 23).

Conclusions

Based on the findings, the following conclusions were made with respect to the research question regarding attitudes of electronics instructors toward entry-level electronics technicians skills:

1. There are no differences in the attitudes of electronics instructors in Texas community/junior colleges toward entry-level electronics technician skills identified in Raising the Standard.

2. There are no differences within or between groups of full-time and adjunct electronics in rural or urban Texas community/junior colleges toward entry-level electronics technician skills identified in Raising the Standard.

Implications

The findings of this study indicate that no significant differences exist at a nominal alpha level of .05 in the attitudes of electronics instructors in Texas community/junior colleges toward skill standards for entry level electronic technicians. The data suggests that, in regard to entry-level skills necessary for electronic technicians, the alleged gap between education and industry does not exist. The literature reviewed emphasized the necessity of a positive attitude on the part of instructors toward the implementation of skill standards for the integration of those skills into program curricula to be successful. Recent efforts have been undertaken by skill standards organizations to seek voluntary adoption of skill standards in post-secondary programs. The agreement of electronics instructors regarding the importance of skill standards implies that a favorable climate exists among the electronics programs in Texas for the formal adoption of electronics skill standards. Should the need arise for the formal adoption of voluntary skills in electronics, this study reaffirms the validity of the statements found within the technical skills section of Raising the Standard for use as an implementation guide.

No focus group has been formally recognized to work with the Texas Skill Standards Board to address skill standards in the specific field of electronics. Several related areas, such as Computer Technology have already completed a set of skill standards recognized by the TSSB. Skill standards for other related fields are at various stages in the recognition process by the TSSB. An implication is that Texas industries are satisfied that the national skill standards are sufficient to address local needs. In further consideration, findings of this study showed alignment of instructor attitudes with national skill standards. The lack of industry initiatives to form focus groups to seek the voluntary adoption of skill standards in the area of electronic technology affirms the positive attitude of industry toward the electronic technology programs in Texas community/junior colleges.

At the national level during the 1990's, the area of electronic technology enjoyed the greatest amount of support and effort of any technical field in establishing validated skills. Rather than concentrating on general electronics skills, efforts in Texas have had a more narrowly defined occupational focus.

The demographic data collected in this study showed that 96 percent of the electronics faculty surveyed had more than three years of business or industrial experience. This contradicts concerns raised in a study by Van Horn (1995) that teachers did not know enough about working in the real world to properly prepare students. The absence of significant differences between the attitudes of full-time and adjunct electronics instructors combined with the similarity in experience and background implies that both groups of faculty are similarly qualified for instructional roles in the preparation of entry-level electronic technicians. These findings reinforce the findings of an earlier study of 4-year institutions that found a strong general agreement existing between industry and education regarding knowledge and skills necessary for an electronic technician (Prewitt, 1973).

Recommendations

The following recommendations are based on the findings of this research as well as the review of literature:

1. Based on the review of the literature, electronics instructors should continue to provide instruction aligned with the needs of industry in order to prepare students for entry-level employment as electronic technicians.

2. The review of the literature indicates a need for education to be responsive to the evolving needs of industry. Electronics instructors should

monitor national, state, and local efforts regarding skill standards to ensure that changes in the needs of industry are considered in the process of curriculum development, course and program review, and program evaluation.

3. Based on the review of the literature, it is recommended that electronics instructors work to gain partnerships with industry and skill standards organizations to support and assist efforts of research regarding skill standards.

4. The findings of this study show that full-time and adjunct electronics have similar profiles and similar attitudes toward electronics skill standards. Based on these findings, the recommendation is made that equitable consideration be extended to adjunct as well as full-time faculty as educators of entry-level electronic technicians.

5. The review of the literature revealed the importance of industrial support of electronics programs. Business and industry should continue to support Texas community/junior college electronic technology programs.

6. The review of the literature found concern regarding the future availability of workers qualified for employment in high-tech industries. Texas community/junior college administrators should continue to support the electronics programs at their institutions to ensure that an adequate supply of qualified electronic technicians are available to meet the growing demands of industry.

Recommendations for Further Research

Based on this study and the review of literature, the following recommendations for further research are made:

1. As needs of high-tech industries change rapidly, periodic industry studies are recommended to revalidate skill standards.

2. Research should be conducted to determine instructor attitudes toward skill standards established within other technical areas.

3. Research should be conducted to analyze trends to access future needs of electronic technicians in the high-technology workplace.

4. Research should be conducted to determine the significance and affect of the trend identified in the comments identifying a transition in the core content of programs from general electronic technology to computer and network related technology

5. Further research should be conducted similar to this dissertation study; however, care should be taken to design a survey instrument with improved discriminate power.

6. Additional topics for further research may be generated from comments made by participants in this study. Comments offered by participants are shown in Appendix G.

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APPENDICES

APPENDIX A

RAISING THE STANDARD – TECHNICAL SKILLS

A. General

A.01 Demonstrate an understanding of proper safety techniques for all types of circuits and components (DC circuits, AC circuits, analog circuits, digital circuits, discrete solid-state circuits, microprocessors)
A.02 Demonstrate an understanding of and comply with relevant OSHA safety standards
A.03 Demonstrate an understanding of proper troubleshooting techniques
A.04 Demonstrate an understanding of basic assembly skills using hand and power tools
A.05 Demonstrate an understanding of acceptable soldering/desoldering techniques, including through-hole and surface mount devices
A.06 Demonstrate an understanding of proper solderless connections
A.07 Demonstrate an understanding of use of data books and cross reference/technical manuals to specify and requisition electronic components
A.08 Demonstrate an understanding of the interpretation and creation of electronic schematics, technical drawings, and flow diagrams
A.09 Demonstrate an understanding of design curves, tables, graphs, and recording of data
A.10 Demonstrate an understanding of color codes and other component descriptors
A.11 Demonstrate an understanding of site electrical and environmental survey
A.12 Demonstrate the use of listening skills or assistive devices to assess signs and symptoms of malfunctions

B. DC Circuits

B.01 Demonstrate an understanding of sources of electricity in DC circuits
B.02 Demonstrate an understanding of principles and operation of batteries
B.03 Demonstrate an understanding of the meaning of and relationships among and between voltage, current, resistance, and power in DC
B.04 Demonstrate an understanding of measurement of resistance of conductors and insulators and the computation of conductance
B.05 Demonstrate an understanding of application of Ohms Law to series, parallel and series-parallel circuits
B.06 Demonstrate an understanding of magnetic properties of circuits and devices
B.07 Demonstrate an understanding of the physical, electrical characteristics of capacitors and inductors

B.08 Understand principles and operations of DC series circuits
B.09 Fabricate and demonstrate DC series circuits
B.10 Troubleshoot and repair DC series circuits
B.11 Understand principles and operations of DC parallel circuits
B.12 Fabricate and demonstrate DC parallel circuits
B.13 Troubleshoot and repair DC parallel circuits
B.14 Understand the principles and operations of DC series-parallel and bridge circuits
B.15 Fabricate and demonstrate DC series-parallel and bridge circuits
B.16 Troubleshoot and repair DC series-parallel and bridge circuits
B.17 Understand the principles and operations of the Wheatstone Bridge
B.18 Understand principles and operations of DC voltage divider circuits (loaded and unloaded)
B.19 Fabricate and demonstrate DC voltage divider circuits (loaded and unloaded)
B.20 Troubleshoot and repair DC voltage divider circuits (loaded and unloaded)
B.21 Understand principles and operations of DC RC and RL circuits
B.22 Fabricate and demonstrate DC RC and RL circuits
B.23 Troubleshoot and repair DC RC and RL circuits
B.24 Demonstrate an understanding of measurement of power in DC circuits

C. <u>AC Circuits</u>

C.01 Demonstrate an understanding of sources of electricity in AC ircuits
C.02 Demonstrate an understanding of the properties of an AC signal
C.03 Demonstrate an understanding of the principles of operation and characteristics of sinusoidal and non-sinusoidal wave forms
C.04 Demonstrate an understanding of basic motor/generator theory and operation
C.05 Demonstrate an understanding of measurement of power in AC circuits
C.06 Demonstrate an understanding of the principle and operation of various power conditioning: (isolation transformers, surge suppressors, uninterruptable power systems)
C.07 Demonstrate an understanding of the principle and operation of safety grounding systems: (lightning arresters, ground fault interrupters, etc.)
C.08 Understand principles and operations of AC capacitive circuits
C.09 Fabricate and demonstrate AC capacitive circuits
C.10 Troubleshoot and repair AC capacitive circuits
C.11 Understand principles and operations of AC inductive circuits
C.12 Fabricate and demonstrate AC inductive circuits
C.13 Troubleshoot and repair AC inductive circuits

C.14 Understand principles and operations of AC circuits using transformers
C.15 Demonstrate an understanding of impedance matching theory
C.16 Fabricate and demonstrate AC circuits using transformers
C.17 Troubleshoot and repair AC circuits using transformers
C.18 Understand principles and operations of AC differentiator and integrator circuits (determine RC and RL time constants)
C.19 Fabricate and demonstrate AC differentiator and integrator circuits
C.20 Troubleshoot and repair AC differentiator and integrator circuits
C.21 Understand principles and operations of AC series and parallel resonant circuits
C.22 Fabricate and demonstrate AC series and parallel resonant circuits
C.23 Troubleshoot and repair AC series and parallel resonant circuits
C.24 Understand principles and operations of AC RC, RL, and RLC circuits
C.25 Fabricate and demonstrate AC RC, RL, and RLC circuits
C.26 Troubleshoot and repair AC RC, RL, and RLC circuits
C.27 Understand principles and operations of AC frequency selective filter circuits
C.28 Fabricate and demonstrate AC frequency selective filter circuits
C.29 Troubleshoot and repair AC frequency selective filter circuits
C.30 Understand principles and operations of AC polyphase circuits
C.31 Understand principles and operations of AC phase locked loop circuits
C.32 Troubleshoot and repair AC phase locked loop circuits

D. <u>Discrete Solid State Devices</u>

D.01 Demonstrate an understanding of the properties of semiconductor materials
D.02 Demonstrate an understanding of PN junctions
D.03 Demonstrate an understanding of bipolar transistors
D.04 Demonstrate an understanding of field effect transistors (FET's/MOS-FET's)
D.05 Demonstrate an understanding of special diodes and transistors
D.06 Understand principles and operations of diode circuits
D.07 Fabricate and demonstrate diode circuits
D.08 Troubleshoot and repair diode circuits
D.09 Understand principles and operations of optoelectronic circuits (gate isolators, interrupt sensors, infra red sensors, etc.)
D.10 Fabricate and demonstrate optoelectronic circuits (gate isolators, interrupt sensors, infra red sensors, etc.)
D.11 Troubleshoot and repair optoelectronic circuits (gate isolators, interrupt sensors, infra red sensors, etc.)
D.12 Understand principles and operations of single stage amplifiers

D.13 Fabricate and demonstrate single stage amplifiers
D.14 Troubleshoot and repair single stage amplifiers
D.15 Understand principles and operations of thyristor circuitry (SCR, TRIAC, DIAC, etc.)
D.16 Fabricate and demonstrate thyristor circuitry (SCR, TRIAC, DIAC, etc.)
D.17 Troubleshoot and repair thyristor circuitry (SCR, TRIAC, DIAC, etc.)

E. Analog Circuits

E.01 Understand principles and operations of multistage amplifiers
E.02 Fabricate and demonstrate multistage amplifiers
E.03 Troubleshoot and repair multistage amplifiers
E.04 Understand principles and operations of IF circuits
E.05 Fabricate and demonstrate IF circuits
E.06 Troubleshoot and repair IF circuits
E.07 Understand principles and operations of linear power supplies and filters
E.08 Fabricate and demonstrate linear power supplies and filters
E.09 Troubleshoot and repair linear power supplies and filters
E.10 Understand principles and operations of operational amplifier circuits
E.11 Fabricate and demonstrate operational amplifier circuits
E.12 Troubleshoot and repair operational amplifier circuits
E.13 Understand principles and operations of audio power amplifiers
E.14 Fabricate and demonstrate audio power amplifiers
E.15 Troubleshoot and repair audio power amplifiers
E.16 Understand principles and operations of regulated and switching power supply circuits
E.17 Troubleshoot and repair regulated and switching power supply circuits
E.18 Understand principles and operations of active filter circuits
E.19 Troubleshoot and repair active filter circuits
E.20 Understand principles and operations of sinusoidal and non-sinusoidal oscillator circuits
E.21 Troubleshoot and repair sinusoidal and non-sinusoidal oscillator circuits
E.22 Understand principles and operations of fiber optic circuits using photodiodes or LASERS
E.23 Troubleshoot and repair fiber optic circuits using photodiodes or LASERS
E.24 Understand principles and operations of RF circuits
E.25 Fabricate and demonstrate RF circuits
E.26 Troubleshoot and repair RF circuits

E.27 Understand principles and operations of signal modulation systems (AM, FM, stereo)
E.28 Troubleshoot and repair signal modulation systems (AM, FM, stereo)
E.29 Demonstrate an understanding of motor phase shift control circuits
E.30 Understand the principles and operations of microwave circuits

F. Digital Circuits

F.01 Demonstrate an understanding of the characteristics of integrated circuit (IC) logic families
F.02 Demonstrate an understanding of minimizing logic circuits using Boolean operations
F.03 Understand principles and operations of linear integrated circuits
F.04 Troubleshoot and repair linear integrated circuits
F.05 Understand principles and operations of types of logic gates
F.06 Fabricate and demonstrate types of logic gates
F.07 Troubleshoot and repair types of logic gates
F.08 Understand principles and operations of combinational logic circuits
F.09 Fabricate and demonstrate combinational logic circuits
F.10 Troubleshoot and repair combinational logic circuits
F.11 Understand principles and operations of types of flip-flop circuits
F.12 Fabricate and demonstrate types of flip-flop circuits
F.13 Troubleshoot and repair flip-flop circuits
F.14 Understand principles and operations of types of registers and counters
F.15 Fabricate and demonstrate types of registers and counters
F.16 Troubleshoot and repair types of registers and counters
F.17 Understand principles and operations of clock and timing circuits
F.18 Fabricate and demonstrate clock and timing circuits
F.19 Troubleshoot and repair clock and timing circuits
F.20 Understand principles and operations of types of arithmetic-logic circuits
F.21 Troubleshoot and repair types of arithmetic-logic circuits
F.22 Understand principles and operations of types of multiplexer and demultiplexer circuits
F.23 Troubleshoot and repair types of multiplexer and demultiplexer circuits
F.24 Understand principles and operations of types of digital to analog and analog to digital circuits
F.25 Troubleshoot and repair types of digital to analog and analog to digital circuits
F.26 Understand principles and operations of types of digital display circuits
F.27 Troubleshoot and repair types of digital display circuits

F.28 Understand principles and operations of power distribution noise problems
F.29 Troubleshoot and repair power distribution noise problems
F.30 Understand principles and operations of types of digital encoders and decoders
F.31 Troubleshoot and repair types of digital encoders and decoders
F.32 Understand principles and operations of digital display devices
F.33 Troubleshoot and repair digital display devices

G. Microprocessors

G.01 Demonstrate an understanding of microprocessor interfaces
G.02 Troubleshoot and repair microprocessor interfaces
G.03 Demonstrate an understanding of essential microprocessor components
G.04 Demonstrate an understanding of microprocessor BUS concepts
G.05 Demonstrate an understanding of microprocessor components and terminology
G.06 Understand principles and operation of types of microprocessor memory circuits
G.07 Troubleshoot and repair types of microprocessor memory circuits
G.08 Understand principles and operations of Microprocessor machine code and instruction sets

H. Microcomputers

H.01 Demonstrate an understanding of microcomputer operating systems
H.02 Demonstrate an understanding of essential microcomputer components
H.03 Demonstrate an understanding of microcomputer peripherals
H.04 Set up and configure a microcomputer using available operating systems and software packages
H.05 Troubleshoot and replace microcomputer peripherals

(Electronic Industries Foundation, 1994b)

APPENDIX B

SURVEY INSTRUMENT

Entry-Level Electronic Technician

Skills Standards Survey

Participation is voluntary and all questions are optional. Submission of this form signifies your willingness to participate anonymously in this research project. Please respond to the following items.

DEMOGRAPHIC DATA

Position

☐ Full-time electronics instructor ☐ Adjunct electronics instructor

Age

☐ thirty-five years old or younger ☐ over thirty-five years old

Educational Level (select highest applicable)

☐ no college or professional certificate
☐ college or professional certificate
☐ associate degree
☐ bachelor's degree
☐ master's degree
☐ doctoral degree

Please indicate discipline of highest degree (if applicable) ____________________

Were any of your certificates or degrees in electronics or an electronics related discipline?

☐ yes ☐ no

Business or industrial experience

☐ three years or less ☐ more than three years

Teaching Experience

☐ two years or less ☐ more than two years

Setting of college district

☐ rural college district ☐ urban college district

ELECTRONICS TECHNICAL SKILLS SURVEY

Mark the appropriate box that reflects your level of agreement regarding each statement and indicate if the topic is currently addressed in the curriculum of the program in which you teach. (Topics may be addressed in lecture and/or lab setting.)

General Knowledge and Skills

The entry-level electronic technician should demonstrate an understanding of...	rate from Strongly Disagree to Strongly Agree SD - D - Neutral - A - SA

proper safety techniques and OSHA standards.	SD ☐ ☐ ☐ ☐ ☐ SA
proper techniques and equipment for troubleshooting.	SD ☐ ☐ ☐ ☐ ☐ SA
proper electronic design and fabrication skills. (use of appropriate tools and components)	SD ☐ ☐ ☐ ☐ ☐ SA
the interpretation and creation of electronics schematics, technical drawings, flow diagrams, tables, graphs, and data records.	SD ☐ ☐ ☐ ☐ ☐ SA
color codes and component descriptors.	SD ☐ ☐ ☐ ☐ ☐ SA
Are these General Knowledge and Skills currently included in your program?	☐ YES ☐ NO

Technical Knowledge and Skills for DC Circuit Analysis

The entry-level electronic technician should demonstrate an understanding of...	rate from Strongly Disagree to Strongly Agree SD - D - Neutral - A - SA
sources of electricity in DC circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the relationship of Voltage, Current, and Resistance in DC Circuits (Ohm's Law).	SD ☐ ☐ ☐ ☐ ☐ SA
the application of Ohm's Law to series, parallel, and combination circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, fabrication, troubleshooting, and repair of DC series circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, fabrication, troubleshooting, and repair of DC parallel circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, fabrication, troubleshooting, and repair of DC combination and bridge circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, fabrication, troubleshooting, and repair of DC voltage divider circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, fabrication, troubleshooting, and repair of DC RC & RL circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
Are these Technical Knowledge and Skills for DC Circuit Analysis currently included in your program?	☐ YES ☐ NO

Technical Knowledge and Skills for AC Circuit Analysis

The entry-level electronic technician should demonstrate an understanding of...	rate from Strongly Disagree to Strongly Agree SD - D - Neutral - A - SA
sources of electricity in AC circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the properties, characteristics, and principles of operation of sinusoidal and non-sinusoidal AC signals.	SD ☐ ☐ ☐ ☐ ☐ SA
the measurement of power and principles and operation of power conditioning systems.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, fabrication, troubleshooting, and repair of AC capacitive circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, fabrication, troubleshooting, and repair of AC inductive circuits.	SD ☐ ☐ ☐ ☐ ☐ SA

the principles, operation, fabrication, troubleshooting, and repair of AC RC, RL, and RLC circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, fabrication, troubleshooting, and repair of AC selective filter circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, troubleshooting, and repair of AC phase locked loop circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
Are these Technical Knowledge and Skills for AC Circuit Analysis currently included in your program?	☐ YES ☐ NO

Technical Knowledge and Skills for Discrete Solid State Devices

The entry-level electronic technician should demonstrate an understanding of...	rate from Strongly Disagree to Strongly Agree SD - D - Neutral - A - SA
the properties of semiconductor materials.	SD ☐ ☐ ☐ ☐ ☐ SA
PN junctions.	SD ☐ ☐ ☐ ☐ ☐ SA
bipolar transistors.	SD ☐ ☐ ☐ ☐ ☐ SA
field effect transistors (FET's/MOS-FET's).	SD ☐ ☐ ☐ ☐ ☐ SA
special purpose diodes and transistors.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, fabrication, troubleshooting, and repair of diode circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, fabrication, troubleshooting, and repair of optoelectronic circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, fabrication, troubleshooting, and repair of single stage amplifier circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, fabrication, troubleshooting, and repair of thyristor circuits (SCR, TRIAC, DIAC, etc.).	SD ☐ ☐ ☐ ☐ ☐ SA
Are these Technical Knowledge and Skills for Discrete Solid State Devices currently included in your program?	☐ YES ☐ NO

Technical Knowledge and Skills for Analog Circuits

The entry-level electronic technician should demonstrate an understanding of...	rate from Strongly Disagree to Strongly Agree SD - D - Neutral - A - SA
the principles, operation, fabrication, troubleshooting, and repair of multistage amplifier circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, fabrication, troubleshooting, and repair of IF circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, fabrication, troubleshooting, and repair of linear power supply and filter circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, fabrication, troubleshooting, and repair of operational amplifier circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, fabrication, troubleshooting, and repair of audio power amplifier circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, troubleshooting, and repair of regulated and switching power supply circuits.	SD ☐ ☐ ☐ ☐ ☐ SA

the principles, operation, troubleshooting, and repair of active filter circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, troubleshooting, and repair of sinusoidal and non-sinusoidal oscillator circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, troubleshooting, and repair of fiber optic circuits using photodiodes or LASERS.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, fabrication, troubleshooting, and repair of Radio Frequency (RF) circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, troubleshooting, and repair of signal modulation systems (AM. FM, stereo).	SD ☐ ☐ ☐ ☐ ☐ SA
motor phase shift control circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles and operation of microwave circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
Are these Technical Knowledge and Skills for Analog Circuits currently included in your program?	☐ YES ☐ NO

Technical Knowledge and Skills for Digital Circuits

The entry-level electronic technician should demonstrate an understanding of...	rate from Strongly Disagree to Strongly Agree SD - D - Neutral - A - SA
the characteristics of integrated circuit (IC) logic families.	SD ☐ ☐ ☐ ☐ ☐ SA
minimizing logic circuits using Boolean operations.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, troubleshooting, and repair of linear integrated circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, fabrication, troubleshooting, and repair of types of logic gates.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, fabrication, troubleshooting, and repair of combinational logic circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, fabrication, troubleshooting, and repair of types of flip-flop circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, fabrication, troubleshooting, and repair of types of registers and counters.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, fabrication, troubleshooting, and repair of types of clock and timing circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, troubleshooting, and repair of arithmetic-logic circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, troubleshooting, and repair of multiplexer and demultiplexer circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, troubleshooting, and repair of digital to analog (DAC) and analog to digital (ADC) circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, troubleshooting, and repair of digital display circuits and devices.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, troubleshooting, and repair of power distribution noise problems.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, troubleshooting, and repair of digital encoders and decoders circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
Are these Technical Knowledge and Skills for Digital Circuits currently included in your program?	☐ YES ☐ NO

Technical Knowledge and Skills for Microprocessors

The entry-level electronic technician should demonstrate an understanding of...	rate from Strongly Disagree to Strongly Agree SD - D - Neutral - A - SA
the principles, operation, troubleshooting, and repair of microprocessor interfaces.	SD ☐ ☐ ☐ ☐ ☐ SA
essential microprocessor components.	SD ☐ ☐ ☐ ☐ ☐ SA
microprocessor BUS concepts.	SD ☐ ☐ ☐ ☐ ☐ SA
microprocessor components and terminology.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles, operation, troubleshooting, and repair of microprocessor memory circuits.	SD ☐ ☐ ☐ ☐ ☐ SA
the principles and operations of microprocessor machine code and instruction sets.	SD ☐ ☐ ☐ ☐ ☐ SA
Are these Technical Knowledge and Skills for Microprocessors currently included in your program?	☐ YES ☐ NO

Technical Knowledge and Skills for Microcomputers

The entry-level electronic technician should demonstrate an understanding of...	rate from Strongly Disagree to Strongly Agree SD - D - Neutral - A - SA
microcomputer operating systems.	SD ☐ ☐ ☐ ☐ ☐ SA
essential microcomputer components.	SD ☐ ☐ ☐ ☐ ☐ SA
the operation, troubleshooting, and replacement of microcomputer peripherals.	SD ☐ ☐ ☐ ☐ ☐ SA
the set up and configuration of a microcomputer using available operating systems and software packages.	SD ☐ ☐ ☐ ☐ ☐ SA
Are these Technical Knowledge and Skills for Microcomputers currently included in your program?	☐ YES ☐ NO

Any additional comments?...

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Thank you for your time and consideration in completing and returning this survey.

***-Jason Lee Davis** jdavis@paris.cc.tx.us 4619 Wolf Creek, Powderly, Texas 75473-9544*
Instructor, Paris Junior College, Paris, Texas
Ph.D. candidate, Colorado State University, Ft. Collins, Colorado

APPENDIX C

HUMAN RESEARCH APPROVAL LETTER

COPY

Colorado State University

Office of Regulatory Compliance
Office of Vice President for Research
and Information Technology
Fort Collins, CO 80523-2046
(970) 491-1563
FAX: (970) 491-2293

MEMORANDUM

TO: Duane Jansen, School of Education, 1588
FROM: Celia Walker, Administrator for the
Human Research Committee
SUBJECT: **PROJECT APPROVAL**
Title: Attitudes of Electronics Instructors in Texas Community/Junior Colleges toward Industry Validated Technical Skill Standards for Entry-Level Electronic Technicians.
Protocol No.: 01-085H
Funding Agency: N/A
Funding Agency Deadline: N/A
DATE: January 15, 2002

I am pleased to inform you that the above-referenced project was approved by the Human Research Committee on January 14, 2002 for the period January 14, 2002 to January 14, 2003. Because of the nature of this research, it will not be necessary to obtain a signed consent form. However, all subjects must receive a copy of the approved cover letter printed on department letterhead. The requirement of documentation of a consent form is waived under § __.117 (c) (2) with the return of the approved survey. **Approval is for 250 full time electronic instructors and 250 adjunct electronics instructors.**

A status report of this project will be required within a 12-month period from the date of approval. You will be sent a reminder approximately two months before the protocol expires. The Principal Investigator will report on the numbers of subjects who have participated this year and project-to-date, about problems encountered, and provide a verifying copy of the consent form or cover letter used. The necessary form (H-101) is available from the Regulatory Compliance web page (see below). Should the protocol not be renewed before expiration, all activities must cease until the protocol has been re-reviewed.

It is the responsibility of the investigator to immediately inform the Committee of any serious complications, unexpected risks, or injuries resulting from this research. It is also the investigator's responsibility to notify the Committee of any changes in experimental design, participant population, or consent procedures or documents. This can be done with a memo which completely describes the changes and their consequences (new consent form or cover letter, or altered survey instrument, for example). Students serving as Co-Principal Investigators may not alter projects without first obtaining PI approval. The PI is ultimately responsible for the conduct of the project.

This approval is issued under Colorado State University's OHRP Federal Wide Assurance 00000647 issued July 1, 2001. If approval did not accompany a proposal when it was submitted to a sponsor, it is the researcher's responsibility to provide the sponsor with the approval notice.

Please direct any questions about the Committee's action on this project to me for routing to the Committee. Additional information is available from the Regulatory Compliance web site at www.research.colostate.edu/regulatory/

Attachment

xc: Jason Davis w/attachment

Animal Care & Use • Drug Review • Human Research • Institutional Biosafety • Radiation Safety
410 University Services Center

APPENDIX D

LETTER TO PRESIDENTS

Colorado State University

School of Education
Fort Collins, Colorado 80523-1588

January 28, 2002

President __________,

My name is Jason Lee Davis and I am an instructor at Paris Junior College, Paris, Texas. Currently I am a Ph.D. Candidate at Colorado State University and I am in the process of completing a dissertation under the direction of Drs. Duane G. Jansen and Thomas Maness. The purpose of the dissertation is to determine the attitudes of community/junior college electronics instructors (both full-time and part-time) toward validated skill standards in electronic technology. These standards were developed and validated in a national level study conducted by the Electronic Industries Association and were titled "Raising the Standard." Participants in the study consisted of representatives from government, business, industry and education across the United States.

As you are aware, business and industry representatives are often prone to make allegations that community/junior college technology instructors do not deliver instruction that is aligned with expected industry standards. In this dissertation study, electronic technology instructors will be asked to express their attitudes toward the essential knowledge and skill standards developed by the project "Raising the Standard." The hypothesis for the dissertation is that no significant differences exist between the attitudes of electronics instructors and validated standards of the project "Raising the Standard." Results of the study will either dispel the allegations or will be an indicator that community/junior colleges in Texas need to align the electronic technology curriculum and instructional delivery to better meet the needs of industry.

I am asking for your assistance in identifying a contact person at your institution through whom I may distribute the survey instrument to the full-time and part-time electronics instructors. This could be a Dean, division chair, department head, or other individual who serves in a supervisory position for the electronic technology department and has authority to distribute the survey materials to the instructors' mailboxes. Multiple contacts may be identified if necessary to reach all campuses with electronics instructors in your college's district. Participation of individuals is voluntary and confidential and no information will be collected that can be used to identify the individual participants. The Colorado State University Office of Regulatory Compliance requires that I obtain a letter of permission from the college president of each institution included in the study. The letter must be on the institution's letterhead and include (1) a statement that the institution is familiar with the project and projects purpose, (2) a statement that the institution believes the individuals it involves are adequately protected and their participation will be voluntary, and (3) a brief outline of the institution's involvement in the project. The involvement by the institution will be limited to granting permission to survey the instructors and identifying a contact person that will be asked to assure delivery of the survey to faculty mailboxes.

The contact person will be asked to distribute packets containing the survey instrument, instructions, and a postage pre-paid return envelope to the mailboxes of all electronics instructors at your institution. The instructors will complete the survey instrument and mail it directly to me. Copies of materials that will be sent to the contact and participants are enclosed for your inspection. I ask that you assist my research efforts by providing contact information on the form enclosed and return it to me in the postage pre-paid return envelope. Findings of the research will be disseminated to the presidents of all institutions participating in the study. Please contact me if you have any questions regarding this research study at (903) 784-7360 or jdavis@paris.cc.tx.us. Your assistance is deeply appreciated and critical to the success of this study.

Respectfully,

Jason Lee Davis
4619 Wolf Creek
Powderly, Texas 75473-9544

APPENDIX E

LETTER TO CONTACTS

Colorado State University

School of Education
Fort Collins, Colorado 80523-1588

Dean _________,

My name is Jason Lee Davis and I am an instructor at Paris Junior College, Paris, Texas. Currently I am a Ph.D. Candidate at Colorado State University in the process of completing a dissertation under the direction of Drs. Duane G. Jansen and Thomas Maness. The purpose of the dissertation is to determine the attitudes of community/junior college electronics instructors (both full-time and part-time) toward validated skill standards in electronic technology. These standards were developed and validated in a national level study titled "Raising the Standard." Participants in the study consisted of representatives from government, business, industry and education across the United States.

As you are aware, business and industry representatives are often prone to make allegations that community/junior college technology instructors do not deliver instruction that is aligned with expected industry standards. In this dissertation study, electronic technology instructors will be asked to express their attitudes toward the essential knowledge and skill standards developed by the project "Raising the Standard." The hypothesis for the dissertation is that no significant differences exist between the attitudes of electronics instructors and validated standards of the project "Raising the Standard." Results of the study will either dispel the allegations or will be an indicator that community/junior colleges in Texas need to align electronic technology curriculum and instructional delivery to better meet the needs of industry.

The president of your institution has granted authorization for this research study on your campus and has identified you as the contact person in a position most able to assist in disseminating the enclosed survey materials. Dissemination will be to the mailboxes of each of the full-time and part-time electronics instructors on your campus. Participation of individuals is voluntary and confidential and no information will be collected that can be used to identify the individual participants. The instructors will complete the survey instrument and mail it directly to me. Completion of the instrument is expected to take approximately ten minutes.

This research is considered by the Colorado State University Office of Regulatory Compliance to have no more than "minimal risk" to participants. Findings of the research will be disseminated to the presidents of all institutions participating in the study. Please contact me if you have any questions regarding this research study at (903) 784-7360 or jdavis@paris.cc.tx.us. Your assistance is deeply appreciated and critical to the success of this study.

Respectfully,

Jason Lee Davis

APPENDIX F

LETTER TO PARTICIPANTS

Colorado State University

School of Education
Fort Collins, Colorado 80523-1588

Dear Colleague,

My name is Jason Lee Davis and I am an instructor at Paris Junior College, Paris, Texas. Currently I am a Ph.D. Candidate at Colorado State University in the process of completing a dissertation under the direction of Drs. Duane G. Jansen and Thomas Maness. The purpose of the dissertation is to determine the attitudes of community/junior college electronics instructors (both full-time and part-time) toward validated skill standards for entry-level electronic technicians. The importance of skill standards is emphasized to us, as technical educators, through the Secretary's Commission on Achieving Necessary Skills (SCANS) Competencies and through the adoption of standardized course curricula for workforce education in the Texas Higher Education Coordinating Board's Workforce Education Course Manual (WECM).

The president of your institution has granted authorization for this research effort and I ask for your support through the completion of the enclosed survey instrument. A postage pre-paid return envelope is included for your convenience in submitting the survey instrument. Your participation is voluntary and confidential and no information will be collected that can be used to identify you within the population. Completion of the instrument consists of responding to general demographic questions and statements regarding specific skill standards and is expected to take approximately ten minutes. A high response rate will greatly increase the strength and validity of the study. Findings of the research will be disseminated to the presidents of all institutions participating in the study.

This research poses no known risks and is considered by the Colorado State University Office of Regulatory Compliance to have no more than "minimal risk" to participants. Questions about participants' rights may be directed to Celia S. Walker at (970) 491-1563. Questions regarding this research study may be directed to Jason Lee Davis at (903) 784-7360 or jdavis@paris.cc.tx.us. Submission of the survey instrument indicates that you have read this information and understand that you are participating voluntarily and without obligation. Your participation is deeply appreciated and critical to the success of this study.

Respectfully,

Jason Lee Davis
4619 Wolf Creek
Powderly, Texas 75473-9544

APPENDIX G

COMMENTS FROM PARTICIPANTS

Respondent No.	Comment
6.	Fabrication techniques are very important but not of the highest feasibility in our program (costly).
7.	Some training in computer literacy and networking is recommended.
8.	The need for fabrication of all levels of electronics has almost disappeared. The requirements for component repair for the microprocessor has become uneconomical.
11.	Some, but not all digital knowledge is taught here. The prevailing philosophy is to replace boards, not to troubleshoot and replace components in digital. A philosophy I strongly disagree with.
13.	Digital used to be taught as two courses - now changed to one. Weakens coverage. Others in dept. given survey don't even teach electronics, have an agenda against it to build their own empires in networking and computers. Their results will skew your survey.
14.	In microcomputer is in 2 different classes. In solid state we do 2 classes - one devices and the other is circuits. Between both class all knowledge and skills are meet.
17.	I feel the field of electronics education has gotten away from learning electronics and gone more towards the computer service industry which doesn't require anywhere near as much technical training. As a result the country's level of technical expertise is diminishing.
18.	The reason I answered NO to the "included in your program" questions is because our hands on lab work for our students is very weak. Some of our instructors don't like doing labs and will find any excuse to avoid them.
23.	All of these skills should be required. Our two primary electronics instructors do not do hands on labs.
24.	Microprocessors and microcomputers has recently been discontinued from our program in lieu of training in Cisco and computer repair so students can obtain certificates in those disciplines.

29. A fiber optics course is currently being developed. Also wireless communications is being introduced. Students are prepared for A+ Certification.

41. Summary questions are too vague.

44. Our program will offer only AC/DC, fabrication, semiconductors, digital fundamentals, and computer maint. next catalog to support the computer degrees. We will no longer offer an Electronics degree.

47. We don't do much fabrication or troubleshooting or repair but we do build circuits with components and measure appropriate values.

51. All you did was list what we cover today. Most colleges do. You should have ask what is not covered. Most courses are seriously dated and omit modern technology critical job skills. A missed opportunity I'd say about this survey.

56. All the technical skills listed above are very important to the entry level technician, but the class I am teaching does not deal with these areas.

VITA

Jason Lee Davis was born in Denton, Texas, on March 19, 1969, the son of Harley Davis and LeNita Joyce Moore Davis. He graduated from Cooper High School, Cooper, Texas, in 1987, and entered Paris Junior College, Paris, Texas, where he received an Associate of Science degree in 1989. After transferring to East Texas State University, Commerce, Texas, he received the Bachelor of Science degree in Physics in 1991, and Master of Science degree in Physics in 1993. He was employed by Paris Junior College in 1993 as an instructor of Electronic Technology. During the 1998-1999 academic year, he served as a Graduate Teaching Assistant in the Department of Manufacturing Technology and Construction Management at Colorado State University while completing Doctoral coursework. In 1999, he accepted the position of Technology and Learning Specialist at Paris Junior College. Following this two-year appointment, he returned to the classroom as instructor of Physics and Mathematics at Paris Junior College. In 2002, Jason accepted a position as Assistant Professor in the Department of Secondary and Higher Education at Texas A&M University-Commerce. On September 16, 1994, he married Jennifer Gail Benson. One son, Justin Lee Davis, was born on May 20, 2001.