PERCEPTIONS OF SELECTED CHARACTERISTICS

OF TECHNOLOGY EDUCATION

IN OKLAHOMA

By

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CHAPTER 1

INTRODUCTION

Our nation is in the middle of a rapidly evolving cycle from the industrial age to the information age. The introduction of automation into our manufacturing sector, the growth of information processing, advanced technological innovations, and increasing world competition are changing the look of today's workers (Baker, Boser, & Householder, 1992). In order for tomorrow's leaders to be successful and contributors to this nation's well-being and competitiveness, all of today's youth must possess a better understanding of work and the concepts that make up this technical society (Meeks, 1986).

Across America, there is an intensified awareness that our educational system is not meeting the needs of all students in our changing and increasing technological society, as stated in numerous reports (e.g. A Nation At Risk, 1983; Educating Americans for the Twenty-first Century, 1983; Transforming American Education: Reducing the Risk to the Nation, 1986; Science for All Americans, 1989).

One of the suggestions of what "ought" to be done to prepare students for tomorrow is in the study, Science for All Americans, by The American Association for the Advancement of Science (1989).

> The terms and circumstances of human existence can be expected to change radically during the next human life span. Science, mathematics, and technology will be at the center of that change ---causing it, shaping it, responding to it. Therefore, they will be essential to the education of today's children for tomorrow's world. (p. i)

The profession of technology education has been taking steps in changing the full spectrum of its structure to meet the needs of today's students and tomorrow's society (Maley, 1989; Snyder, 1981; Stacy, 1986; Stern, 1991). The basis for this change has been defined by several authors as a foundation in technological literacy through an integrated curriculum (Maley, 1987; Sicilliano, 1989; Stern, 1991; Wright, 1990). Besides modifying the perceptions of technology education professionals, the preconceptions of people outside of the field must be dealt with effectively and quickly (Stone, 1989). The literature indicates that there are many perceptions of technology education from outside the profession that do not align with the accepted characteristics of technology education within the field (DeVore, 1987; Dyrenfurth & Mihalevich, 1987; Johnson, 1989).

Statement of the Problem

The educational system in Oklahoma has a discipline called technology education that enables students to focus on becoming technologically literate (Stacy, 1986). In order for technology education to have a valid and strong position in the educational system, the profession must determine and address the perceptions held by the secondary education faculty and staff about the characteristics of technology education (Ritz, 1991). The problem is that there is a lack of sufficient empirical data on the perceptions of the characteristics of technology education by technology education faculty, guidance counselors, and administrators, as well as mathematics and science faculty in Oklahoma.

Purpose of the Study

The purpose of this research is to determine and compare the perceptions held by technology education faculty, guidance counselors, administrators, and mathematics and science faculty pertaining to the characteristics affiliated with the funded technology education programs in Oklahoma.

Research Questions

Based on the purpose of this study, the following research questions were developed for investigation.

1. What are the characteristics that technology education faculty, guidance counselors, administrators, mathematics faculty, and science faculty in Oklahoma identify with technology education?

2. Is there a statistically significant difference between the perceptions of the technology education faculty and the perceptions held by guidance counselors, administrators, mathematics faculty, and science faculty in Oklahoma?

Scope of the Study

The sample selected for this study was limited to the technology education instructor, one mathematics instructor, one science instructor, one guidance counselor, and one administrator at each of the 155 state and locally funded technology education program sites in Oklahoma. Information on the 155 funded technology education programs in the state of Oklahoma was obtained from the Oklahoma Department of Vocational and Technical Education Division of Technology Education.

The instrument to obtain the data was based upon a model for the study of technology in a report called <u>A Conceptual Framework for Technology Education</u> (Savage & Sterry, 1990) and a review of literature. The obtained data were limited to those instruments which have been returned from the initial mailing, post card reminder, and the follow up mailing.

Assumption of the Study

For the purpose of the study, the following assumption was made:

1. The responses to the questionnaire by the subjects are conscientious expressions of their attitudes, opinions, and beliefs.

Limitations of the Study

The following limitations were made for this study:

1. Since the questionnaire was developed outside the context of this study (Daugherty, 1991), the researcher of this study did not have control over the development and verification of the questionnaire.
2. The subjects were selected from only the sites where a technology education program was funded through the Oklahoma Department of Vocational and Technical Education, and excluded traditional industrial arts programs.

Definitions of Terms

The following definitions are presented as they apply to the study:

Technology: A body of knowledge and the systematic application of resources to produce outcomes in response to human needs and wants (Savage & Sterry, 1990).

Technology Education: The study of technology and its effect on individuals, society, and civilization (Savage & Sterry, 1990).

Perceptions: An awareness of the elements of an organization influenced by values, attitudes, experience, education, and environment (Goens & Clover, 1991).

Interdisciplinary: Involving two or more academic disciplines (Webster, 1990).

Characteristic: A distinguishing trait, procedure, or property that identifies an academic subject as a distinct field of study (e.g. Technology education provides exploratory activities).

Perceived Characteristics: An opinion, belief, or idea one uses to typify or distinguish between entities (Daugherty, 1991).

CHAPTER II

REVIEW OF LITERATURE

Introduction

As the twenty-first century approaches, our society is experiencing rapid technological and social change (Wright, 1990). These changes affect the way we live and work in our homes, offices, and factories and place new demands on the citizens of United States. Individuals must learn more and take a greater responsibility in their role as a citizen and consumer (Wright, 1990).

The United States has gone through several cycles of economic and social transitions since the latter part of the eighteen century. Baker, Boser, and Householder (1992) state that the United States is currently in its fifth long cycle ,a shift from the industrial to information age, which began in the mid 1970's and is still evolving today. With each cycle came a response from the education field to prepare the workers for the changing society (e.g. post-Sputnik reaction) (Baker, et. al, 1992).

Several reports in the eighties (e.g. <u>A Nation At Risk</u>, 1983; <u>Educating Americans for the Twenty-first Century</u>, 1983; <u>Transforming American Education: Reducing the Risk to the Nation</u>, 1986; <u>Science for All Americans</u>, 1989) have suggested what is wrong with today's educational system and what the response should be to correct the problems for the future. A common response in the reports is the urgent need to develop technological literacy in all students.

In the past most technological devices were mechanical and the workings were visible. "We could see the pulleys and the belts and the gears, and an intelligent person could figure it out. But now its very electronic and digital and mysterious" (Cushman, 1991; p. 7). This mysterious feeling has left most people illiterate on how devices function in modern civilization (Wright, 1990).

In order to combat the lack of technological literacy and rise to the demands of the current technological and information society, educational systems must be willing to educate all people to have a broad technological literacy background. This will equip people with the ability to adapt to the current technological advancements and to keep them current as new technologies continue to emerge (Berger & Daugherty, 1988). One of the primary vehicles to accomplish the goal of technological literacy for society is the discipline technology education, formerly known as industrial arts.

The industrial arts classroom and laboratories have seen little change over the past seventy years. Industrial arts has served society well in the past with the philosophy of teaching tools, processes, materials of industry, and developing manipulative skills (Johnson, 1989). However, if the industrial arts program is to survive, have a place in the general education curriculum, and meet the needs of society and technology, it must change and be based on the 21st century and beyond (Clark, 1989). In order for this change to have a lasting affect, the change scenario must be closely monitored to make adjustment to keep the profession on target (Wenig, 1989).

Oklahoma has realized the need to improve the quality of the industrial arts curriculum (Stacy, 1986). An advisory council was formed in the early part of 1980 to address this situation. The council consisted of industrial arts teachers, teacher educators, representatives from the teacher's association, public school administrators, and staff from the Oklahoma State Department of Vocational and Technical Education. After one and one half years of monthly meetings the council presented the curricula direction based on <u>Jackson's Mill Industrial Arts Curriculum</u> (1980) and the implementation plan for a new technology education program to the State Board of Vocational and Technical Education.

After the State Board approved the proposal for technology education programs in Oklahoma, the plan was taken to the state legislature where it was received very favorably and funded (Stacy, 1986). So far in 1992, there has been a total of 155 traditional industrial arts programs that have been converted to a technology education program.

Characteristics of Technology Education

The mission of the technology education program is to give all students, regardless of their ability or career aspirations, an understanding of technology and its effect on individuals, society, and civilization (Maley, 1989; Savage & Sterry, 1990). Two reports, Task Force 2000 (1989) and The Oklahoma Curriculum Committee (1990), stated all students, whether they are honor students, average students, or at-risk students, should have the opportunities to participate in technology education at some level in their education. The technology education programs in Oklahoma consist of several major practical implications for the study of technology for all students in grades six through ten.

Hands-On-Activity

Students no longer go to woodworking class to work in the shop, they go to the laboratory to participate in daily hands-on laboratory activities (Stacy, 1986). This laboratory approach provides the link between theory and practice, which is often absent in education (McCade, 1991).

An accurate understanding of technology as a human/cultural activity cannot be accomplished by knowledge alone. There must be more activity oriented curriculum and far less textbook oriented curriculum taking place (Cushman, 1991). By "doing" and experiencing technology, students gain the insights into technology and career opportunities (Oklahoma Curriculum Committee, 1990), so they can make meaningful life decisions and educational choices (e.g. college, vocational education, or Tech Prep) (Betts, Welsh, & Ryerson, 1992). The drawback to this approach is when the activities become the sole purpose of the course and completely overshadow the intended content of the course. The technology education curriculum must have a balance between the technical and social concepts and the activity labs (McCade,1991).

The hands-on exploratory curriculum focuses on the technology systems: communication, construction, manufacturing, transportation, power, and bio-technology (Oaks & Pedras, 1992; Snyder & Haley, 1980). Technology education programs use the systems approach in the study of technology, because throughout history people have utilized technological systems as the means to adapt the environment to the needs and desires of humans (Savage & Sterry, 1990). The curriculum is not based on how proficient students become at certain skills, but the understanding of the concepts and how the students are allowed to ". . . capitalize on the individual's potential for reasoning and problem solving, for imagining and creating, and for constructing and thinking critically through the use of tools and materials related to technology" (Oklahoma Technology Education, 1992, p.2).

Interdisciplinary Approach

One of the technology education program's dimensions is the need for an interdisciplinary approach to the study of technology (Maley, 1987). This comes about due to the proposition that the content of technology education is integrally related to essentially all of the disciplines of the secondary school (Meeks, 1986). Technological knowledge can stand alone, but there are regions of overlap which form a relationship with the other disciplines. Therefore, an interdisciplinary approach is required for a full understanding of technology and the total development of the student (Oaks & Pedras, 1992).

Technology education provides the students with manipulative materials and a hands-on experience in a real-world laboratory. This allows the students to discover their potential and abilities (Sawyer, 1986). This diverse program provides the connection between mathematics, science, and the humanities, so students can see the practical side of theoretical subject matter and put the basics to work in their lives (Collelli, 1980; Sawyer, 1986).

The primary objective of technology education's interdisciplinary approach is to produce students who are technological literate, so that they can adapt and change with the ever changing world (Maley, 1985; Waetjen, 1987). The secondary objective is an improved understanding of mathematics and science and its practical uses (Colelli, 1980; Maley, 1985). Dr. Barry E. Stern (1991), the Past Deputy Assistant Secretary of Vocational and Adult Education at the U.S. Department of Education, stated that the education system must address the poor achievement in mathematics and science, and technology education is likely to play an important role. Technology education cannot solve all the problems, but it has many characteristics that can improve the understanding of mathematics and science (Stern, 1991).

Technology education's holistic approach can reduce levels of abstraction through concrete and cognitive activities (Colelli, 1980; Oaks & Pedras, 1992; Waetjen, 1987). The use of manipulative materials in a hands-on approach provides a human centered atmosphere. This increases learning because students can see the relevance of things through using more than one sensory device (Meeks, 1986; Selby, 1988). The activist nature of technology education also aids students to synthesize and make connections between concepts, which leads to better understanding and retention (Waetjen, 1987). There are several studies that support the benefits of technology education's role in an interdisciplinary approach towards learning.

A study by Kennedy (1986) showed that manipulative materials allow students to connect the gap between the real world and the abstract areas of mathematics and science. In a similar study Suydam (1986) found that students who use manipulative materials have a higher probability of obtaining greater mathematics achievement than students who do not use such materials. Manipulative materials are objects that appeal to several senses and can be touched, moved about, rearranged, and handled by students (Hyunes, 1988; Kennedy, 1986). Ziemer (1987) discovered that science should be experienced through the senses of young people, because that is how they learn: they touch, taste, smell, hear, and see. Students learn by actively participating in mathematics and science not just by being told and doing (Heddens, 1986).

Perceptions Affecting Technology Education

In order for a change from an industrial base to a technology base program to have a lasting effect, the change scenario must be closely monitored to make adjustments to keep the profession on target (Wenig, 1989). To monitor the change scenario, technology educators must have the ability to identify and understand the perceptions affiliated with technology education held by the educational system, because the perceptions held by an educational organization can adversely affect the effectiveness of technology education programs (Sprague & Bies, 1988).

In 1991 the Technology Education Advisory Council met to discuss issues related to the profession. Of the twenty-three recommendations generated during this meeting, eighteen dealt with improving public relations to combat the nonproductive perceptions held by technology educators and outside personnel concerning the technology education program (Moorhead, 1992). These recommendations centered on identifying the perceptions and beliefs of individuals within and outside the field of technology education as the beginning to improving the image of technology education.

The technology education profession must first identify the perceptions of the people who make the decisions affecting technology education programs (Stone, 1989). If technology educators do not know the perceptions of educational decision makers, there is little the profession can do to effect change (Waetjen, 1991). These parents, administrators, members of boards of education, university deans and presidents, and legislators are populated almost entirely of individuals who are themselves not technological literate. This population consists of individuals who lack the ability to comprehend what is wrong when the red light flashes on their car's dashboard (Stone, 1989). Decision makers also ". . . seem at best to be unaware of the importance of technology, whether they oppose it, or are indifferent to it" (Waetjen, 1991; p. 4).

Betts, Yuill, and Bray (1989) stated that there is a population of decision makers who do not have a positive image of the technology education program and its value to the students. When looking at the educational system for reforms to meet the needs of the students for tomorrow's world, the emphasis is usually placed on the college preparatory courses (e.g. mathematics, science, english, foreign languages, humanities) of the system (Stone, 1989). The perception held by a few is that technology education is not necessary in a modern curriculum and is not seen as a separate subject by itself (Johnson, 1992).

If the decision makers look at technology education, they do so as an area for dropout prevention and for ". . . other peoples's kid, because my kids are going to college" (Stone, 1989; p. 43) not as a viable and integral part of the educational system. Dr. Robert D. Stone (1989) from the Davenport, Iowa Community School District stated:

> The point here is that, just as blacks, women and other minorities have been discriminated against, so too have technology students, technology educators and technology education programs been victims of discrimination. And you should know if you do not, that the cause for civil rights and women's rights did not get better until blacks and women become sufficiently aroused that they made their case known. Made it known with sufficient volume, force and evidence that the nation as a whole stopped to reconsider its previously held misconceptions. (p. 41)

The 1990-91 annual survey of the technology education profession lists the lack of understanding and support from faculty and staff as the second highest response in the problems facing technology education (Dugger, French, Peckham, & Starkweather, 1992). This lack of understanding could be caused by the perceptions that technology education teachers have towards their own programs.

In the effort of changing from industrial arts to technology education, the change has occurred in name only in a few programs. The instructors often do not perceive a difference between industrial arts and technology education (Clark, 1989). These conversions from the old programs still have a focus on the technical plane, because the instructors feel comfortable with the technical plane, not the social and value plane (Johnson, 1992; Moorehead, 1992). The activities focusing solely on technical skills too often become the sole purpose of the course and overshadow the intended content of the class (McCade, 1991). This is apparent in the 1990-1991 annual survey of the technology discipline (Dugger, et. al, 1992).

Of the top ten courses taught in technology education, the top five are woodworking (41.5%), drafting (41.5%), architectural drafting (29.5%), general metals (27%), and mechanical drawing (26.1%). The general technology education course (26.1%) had a sixth ranking, which is down from the fourth ranking and a 27.8 percentage in the 1989-90 survey (Dugger, et. al., 1991; Dugger, et. al, 1992). The concentration on the traditional industrial arts courses (e.g. woodworking, drafting, and metals) has been reduced over the years, but they still consist of a large proportion of the technology education classroom (Dugger, et. al, 1992).

Pullias (1992) stated the ". . . blinders are going to have to be removed and educators are going to have to accept the fact that technology education is something totally new " (p. 4), not a remake of industrial arts. During this transitional period, technology education must gain a clear perception of what change is and the conditions that can seriously setback the effort (Sprague & Bies, 1988).

Confusion Between Science and Technology

Technology education cannot evolve in isolation. It must be part of a multi-disciplinary approach in order for students to develop an understanding of technology (Sprague & Bies, 1988). In order for this to happen the perceptions that have built artificial barriers between the academic subjects and technical subjects must be overcome, because they hinder the connection of knowledge in our technological world (Cushman, 1991).

Educational organizations (e.g. The National Science Board Commission on Precollege Education in Mathematics, Science and Technology, 1983; The American Association for the Advancement of Science, 1989; and National Research Council, 1987) are forming efforts to incorporate technology into the curriculum, but the intentions are far better than the practice (Waetjen, 1991). The reason is the confusion between science and technology. Is science and technology the same thing or different? Should you teach about technology or in it? Is technology computer applications or instructional devices? (Waetjen, 1991).

DeVore (1987) stated there is not a consensus on the meaning and use of the words, science and technology. Dyrenfurth and Mihalevich (1987) showed that there are so many interpretations of the word technology, an exhaustive synthesis is almost impossible. There is also confusion within the fields commonly identified as science and technology, and in the minds of educators as well as the public.

In America's public belief system science is superior to technology and is a uniform good (Roy, 1990). The word science is usually inserted whenever either science or technology is discussed, which gives rise to the notion that the word technology means science to the vast majority of our citizens (Roy, 1990). When the subject of technological literacy is discussed, there is usually a reference to the science and mathematics disciplines, because of the notion that doing good science will lead instinctively to better technological innovations and more jobs (DeVore, 1987; Roy, 1989).

However, the word technology conjures up a negative image as it is shown to have ties to pollution, worker layoffs, and the cause of health problems (Roy, 1990). These assumptions, which are "egregious errors," form culture bias that have been created by the science community and aided by the media (Roy, 1989). An individual's perceptions of science and technology are usually dependent on the person's background and personal experiences (DeVore, 1987). This can be seen in the following reports.

The American Association for the Advancement of Science (AAAS) created the Project 2061 to look at educational reform for the future. There first report, Science for All Americans (1989), is on the effort to establish learning goals in science, mathematics, and technology for all young people. Authors of this report stated that the central goal of education should be scientific literacy, because it encompasses literacy in science, mathematics, and technology. These recommendations indicate that the component of technology most closely allied to scientific literacy is engineering, because engineers use the theories provided by science and mathematics and the tools provided by technology in their work.

Project 2061 director, James Rutherford (1989), in a separate report called, Technology, Report of the Project 2061 Phase I Technology Panel, stated there is a need for technological literacy, but as a part of the general scientific literacy (AAAS, 1989). This adds to the confusion about what is meant by scientific and technological literacy and the difference and similarities between the two.

Another report called the Interdisciplinary Research in Mathematics, Science, and Technology Education (1987) described technology education as an understanding of technological systems and the teaching of computer science. On the aspect of understanding technological systems, the reports say basic science creates technology and the teaching of technological systems is essentially blank in today's traditional school curriculum. Another aspect of the report is the major role of learning computer literacy as a way of becoming technological literate.

This misconception in mistaking computer literacy for technological literacy is just another confusion that exist in the educational system. Technology is not a part of computer science, rather computing consists of just a small aspect of technology (Dyrenfurth & Mihalivich, 1987). The study, High School: A Report on Secondary Education in America, by Ernest Boyer (1983) stated there is an inclination to equate technology to computers in the schools, but the great urgency is not computer literacy but technological literacy. The need for the students ". . .is not learning how to use the latest piece of hardware but asking when and why it should be used" (p. 111).

These reports also show that the distinctions between science and technology are not perceived in the same way as the technology education profession. The educational system is satisfied that "science education" is what the students need (Johnson, 1992).

Rustum Roy (1990), Director of the Science, Technology, and Society Program at Pennsylvania State University, stated that the public must be made aware that the present "science-emphasis" approach has been a failure for American technology and economy. Anyone concerned with technology education must clarify the relationship between science and technology and the place for both in the education system (Roy, 1990).

The education system must come to realize and understand that there is a difference between technology education, science, and computer usage (Johnson, 1992). A review of literature suggests there are many usages of the word technology, but in order to develop a good viable program the perceptions about technology must be understood (Kline, 1985).

The International Technology Education Association's Conceptual Framework for Technology Education (1990) defined technology as ". . . a body of knowledge and the systematic application of resources to produce outcomes in response to human needs and wants" (p. 7). Technology should be treated as a discipline with social lineage and responsibility (Dugger, 1988), not as an object (e.g. tool, device, or artifact). The term technology denotes a field of study in the same way as biology, physics, and American History. Technology should be viewed as a legitimate area of study with its own knowledge base, distinct from science (Dugger, 1988).

The technology education's curriculum content and laboratories show the differences between technology and science, and the regions where the two overlap and form a symbiotic relationship (Savage & Sterry, 1990). Technology is described as being oriented toward creating an object or system to meet the needs of humans, and its success or failure is determined by society and the marketplace, while science is different. Science aims at obtaining a fundamental understanding of the natural world and physical universe, and its success or failure is not judged by society (DeVore, 1987; Savage & Sterry, 1990).

One of the leading authorities of technology, Melvin Kranzberg (1983), stated:

> "For much of history, science and technology were two separate activities carried out by different communities who rarely came in contact with one another; they used different methods and sought different goals" (p. 8)

This statement shows that technology is not the same thing as science, and most often technological innovations precede scientific understanding. The opposite to what the public and educators have been taught. A good example of this is that basis for the understanding of the field of thermodynamics owes more to the development of the steam engine than vice versa (Roy, 1989).

Perceptual Impacts on Education

The significance of how perceptions held by people in the educational system can impact a specific program is provided in the following studies.

Roger Stacy (1980) at Oklahoma State University conducted a study to determine the perceptions of industrial arts teachers and industrial arts teacher educators in the state of Oklahoma. These perceptions studied were concerned with the characteristics of the contemporary curriculum content in the state plan for industrial arts. Stacy found that the industrial arts teachers' perceptions of the content characteristics were not aligned with the content stated in the state plan. However, the teacher educators perceptions were aligned with content characteristics in the state plan.

The author concluded that the teacher educators perceptions had a greater agreement with the state plan, because the teacher educators perceived a need for a change from the traditional and probably had a greater familiarity with the new program (Stacy, 1980). Stacy (1980) also reasoned that the significant difference within the teacher group could be due to the lack of understanding of the characteristics of the contemporary content approach or the inability to break from traditionalism. The perceptions of this group reflects an image, as seen by administrators and faculty, as whether the program is traditional in nature, or is a contemporary program necessary to meet the needs of the students for the future.

To combat this image the author stated that the profession must improve the perceptions of its teachers toward the new plan and allow the teachers of industrial arts to become comfortable with the contemporary curriculum. This can be accomplished by providing more information through workshops and seminars concerning the theory and implementation of the contents of the state plan to the teachers (Stacy, 1980).

Stacy (1980) also found that a majority of the teachers of industrial arts perceived their administrators to be in strong agreement with the traditional approach, but he feels with a better understanding of the state plan the administrators may perceive the need to support and become involved in changing the program.

Another study from the University of Idaho supports this last finding. Heidari (1990) studied the perceptions held by administrators concerning the technololgy education program. Of the respondents only 39% of the administrators had positive perceptions of the program name change from industrial arts to technology education, compared to a 85% positive response to the name change from technology education leaders in Idaho. Although the name of the program had been changed, most of the administrators perceived the course content as unchanged. The data showed that the teachers and administrators disagreed on the perception concerning the adequacy of funds for curriculum development, equipment, and faculty development. This disagreement might be due to the perceptions of the administrators toward technology education (Heidari, 1990). This shows an example where the perceptions of a group can control the kind of thinking that affects their position toward change for the future or for the traditional.

In a similar study, Daugherty (1991) determined the perceived characteristics of technology education held by technology education, mathematics, and science teachers from 154 schools across the United States. Daugherty (1991) used a mailed questionnaire to first identify each group's perceived characteristics of technology education and then to see if there was a significant difference between the groups.

He discovered that the technology education teachers strongly agreed with a majority of the characteristics of technology education identified in the technology education field of literature. The faculty group, mathematics and science, indicated a moderate agreement with the characteristics of technology education. The mathematics and science teachers did not perceive teaching biological systems, development of technology, and the transportation system as being characteristic of technology education. There was agreement for the need to integrate mathematics, science, and technology education, but the mathematics and science group did not strongly agree upon this statement (Daugherty, 1991).

Using a mixed model ANOVA and post-hoc examinations, Daugherty (1991) also found there existed a statistically significant difference in the perceived characteristics of technology education between the groups, technology education and mathematics and science. This showed that the perceptions about the characteristics of technology education were not constant across the disciplines. Since perceptions influence the practice and transformations in schools in the positive or negative sense (Goens & Clover, 1991), Daugherty (1991) concluded that a plan consisting of presentations and workshops should be provided to bring the stereo-typical perceptions held presently by mathematics and science into alinement with the perceptions of the characteristics held by the technology education profession.

These studies clearly show examples of how perceptions can influence the practice and have a positive or negative impact on the transformation of technology education. Because of this reason, technology education in Oklahoma must study and monitor the perceptions concerning technology education from within and outside the program. Perceptions control the kind of thinking in a school which can affect the disposition held by administrators and staff toward change or the status quo (Goens & Clover, 1991). An understanding of the perceptions allow the organization to respond with the best activities to have an important impact on meeting the needs of the students for the future and building coalitions between the disciplines, so the technology education has an important position in the school systems.

CHAPTER III

METHODOLOGY

Introduction

The purpose of this research is to determine and compare the perceptions held by technology education faculty, guidance counselors, administrators, and mathematics and science faculty pertaining to the characteristics affiliated with the funded technology education programs in Oklahoma. After identifying the perceived characteristics of technology education, a comparison was made in order to determine similarities and differences in perceptions. This chapter will be devoted to the methodology of the research. The chapter will be divided into the following sections: (a) Institutional Review Board, (b) Instrumentation, (c) Population, (d) Data collection, and (e) Data Analysis.

Institutional Review Board

To begin any research that involves human subjects, the Institutional Review Board (IRB) at Oklahoma State University (OSU) must review and approve the study. This review is required by federal regulations and OSU to help protect the rights and welfare of human subjects. In compliance with the IRB policy, an application was submitted and permission was granted on April 13, 1992, to begin the research. This study was assigned the following research project number: ED-92-041.

Instrumentation

A mailed questionnaire was chosen as the instrument for the study. The first reason to use a mailed questionnaire was that it allowed for a large population to be studied economically and quickly. Secondly, each respondent received the same set of questions phrased in exactly the same way, which makes the data more comparable than information obtained by the means of an interview (Sax, 1968).

The instrument used in this study was developed and validated by Daugherty (1991). (See Appendix A) The questionnaire developed by Daugherty was based on the content model for the study of technology, A Conceptual Framework for Technology Education (Savage & Sterry, 1990), and a review of literature. The questionnaire was used on a national scale to determine the perceived characteristics of the technology education discipline by technology education teachers and mathematics and science teachers in the following areas: (a) methodological characteristics, (b) content characteristics, (c) need to integrate mathematics, science, and technology education, and (d) actions the technology education professionals should take to overcome stereotypical perceptions.

The methodology characteristics category was utilized to locate the perceived characteristics concerning the teaching methods used in the technology education programs. The content characteristics category was utilized to identify the perceptions concerning the curriculum content of technology education. The third section was used to locate the perceptions of the need to integrate the three disciplines, mathematics, science, and technology education. The fourth section of the questionnaire sought to identify the actions the technology education professionals should take to overcome stereotypical perceptions.

Daugherty (1991) conducted a pilot study of the questionnaire with technology education, mathematics, and science teachers from eighteen selected schools in Oklahoma serving as participants. The participants completed a questionnaire and a follow-up interview was conducted to see the reactions of the participants. The responses from the pilot study were analyzed using the Cronbach coefficient alpha test to establish the reliability and validity of the questionnaire. The coefficient alpha test was utilized because it provides a consistent method of calculating reliability and internal consistency with data from a single pilot test administration (Keppel, 1991). The questionnaire had a reliability index of 0.82 (Daugherty, 1991).

Daugherty's questionnaire was changed in the following manner in order for it to match the broadened scope of this study (See Appendix B). The title was changed from "Characteristics of Technology Education Survey" to "Characteristics of Technology Education in Oklahoma" to indicate it was a statewide study. The purpose statement and question number five on the demographics information were also changed to broaden the scope of the study to include administrators and guidance counselors. Statement number 38 on Daugherty's questionnaire stated "The technology education discipline should develop strategies for overcoming stereo-typical perceptions often held by administrators and secondary education faculty members". This was changed to "The technology education discipline should develop strategies for overcoming stereo-typical perceptions often held by administrators, counselors, and secondary education faculty members" in order to include the guidance counselor group.

Population

One hundred and fifty- five state and locally funded technology education programs in the state of Oklahoma were identified with the assistance of the Oklahoma Department of Vocational and Technical Education, Division of Technology Education. The study enlisted the participation of faculty and staff at each of the funded sites. One instructor or staff member at each school in the following five categories were asked to respond to a questionnaire: (1) technology education faculty, (2) general science faculty, (3) general mathematics faculty, (4) guidance counselors, and (5) administrators. Since eight schools each had two funded programs, only one instrument was sent to the administrators, guidance counselors, general science, and general mathematics groups within these schools. This resulted in the following total number of participants in each group: technology education faculty (155), administrators (147), guidance counselors (147), mathematics faculty (147), and science faculty (147).

Data Collection

A list of addresses and printed mailing labels for the funded technology education programs in Oklahoma were obtained from the Oklahoma Technology Education Division in the early part of March, 1992. The mailing labels (155) contained the technology education instructor's name and school address. The researcher then made mailing labels (588) addressed to the other participants in the study. The mailing labels for the administration group listed the principal's name and school address. The counseling group listed "guidance counselor" and the school address. The mathematics group listed "mathematics department chairman" and the school address. The science group listed "science department chairman" and the school address.

A cover letter (see Appendix C), a questionnaire (see Appendix B), and a stamped self-addressed envelope were mailed to the participants of this study on April 15, 1992. A return date of April 29, 1992 was decided upon to allow the participants two weeks in which to respond to the questionnaire.

The cover letter was designed to encourage participation in the study and to anticipate and answer any of the respondents questions (Dillman, 1978). In order to accomplish this, the cover letter explained the purpose of this study, a way to contact the researcher if questions arise, the reward for participants, and an assurance of confidentiality (Dillman 1978).

To enlist the greatest number of respondents, a coding system was designed to enable a follow-up postcard and follow-up letter to be sent to all non-respondents in the initial mailing. After the study was completed the coding system, which identified each participant, was destroyed.

After the April 29, 1992 deadline elapsed, a postcard (Appendix D) was sent to all the non-respondents asking them to return the questionnaire by May 15, 1992. To further increase the return percentage, a follow-up letter (Appendix E), another questionnaire, and a stamped self-addressed envelope was mailed to non-respondents. The design of the follow-up letter was similar to the initial cover letter and listed a final deadline for return of May 27, 1992.

Analysis of Data

The data were obtained from the 38 questionnaire statements dealing with personal and professional information (demographics) and the four categories concerning the characteristics of technology education listed in the instrumentation section of this chapter. The first five statements dealt with the personal and professional information of the respondents. These statements provided a demographic description in order to compare the responses. The remaining 33 statements provided data pertinent to the main study questions.

The results of the last 33 statements were utilized to assess the perceptions of the technology education faculty, guidance counselors, administrators, mathematics faculty, and science faculty concerning the characteristics of technology education. Each participant was asked to use a five point Likert scale to indicate their degree of agreement with each of the statements in the four categories. The five possible choices on the Likert scale were assigned the following numerical values: strongly disagree = 1; disagree = 2; no opinion = 3; agree = 4; strongly agree = 5. Real limits were set at 1.000 to 1.499 for strongly disagree, 1.500 to 2.499 for disagree, 2.500 to 3.499 for no opinion, 3.500 to 4.499 for agree, and 4.500 to

5.000 for strongly agree. Data from all the statements were analyzed using the statistical package SYSTAT, Version 5.03.

To answer the first research question, the raw scores for the statements in the four categories were first analyzed using descriptive statistics. The usage of descriptive statistics allowed the researcher to reduce a large amount of data into meaningful values that described the results of the entire set of data (Bartz, 1988).

The descriptive statistics used in this study were the mean score and standard deviation. The mean score for each statement was calculated and compared to the real limits of the Likert scale to identify the perceptions of the characteristics of technology education within each group.

In order to answer the second research question, the one-way analysis of variance (ANOVA) and Tukey post hoc comparison tests were utilized to test and locate the variability between the groups. The one-way ANOVA test allowed for the analysis of the possible interaction between two or more different independent variables and told the researcher whether or not the results as a whole were statistically significant (Sowell & Casey, 1982). The outcome of the ANOVA test utilized to determine the significant differences between the groups was a F-value (F-ratio) (Bartz, 1988). The F-values for the groups were compared to a defined table of F-values at a certain level of significance, p. = .05 or p. = .01. If the F-value was less than the defined value, then the test showed a nonsignificant F-value and any differences found must be attributable to chance or sampling fluctuations (Sowell, 1982). However, if the F-value was equal or exceeded the defined F-value, then the F-value was significant and the differences between the variable was not due to sampling errors (Bartz, 1988).

The one-way ANOVA was utilized to test if a statistically significant differences in perception occurred between the technology education faculty and the guidance counselors, administrators, mathematics faculty, and science faculty for each characteristic statement on the questionnaire. Since unequal sample sizes occurred in this single-factor design study, the unequal sample sizes had to be dealt with in order to eliminate any possible errors due to a lack of homogeneity of variance (Keppel, 1991). Homogeneity of variance must be maintained in order for the outcome variability to be based solely on the normal variance between the groups, not the unequal sample sizes (Keppel, 1991).

In order to maintain homogeneity of variance, the method of unweighted means was incorporated. This handled the problem of unequal sample sizes by treating each mean equally. This was accomplished by substituting an average sample size, called a harmonic mean, for the actual sample sizes associated with the different groups (Keppel, 1991).

This harmonic mean was used to obtain a single unweighted mean score for each of the five groups for each characteristic statement on the questionnaire.

These mean scores served as the dependent variables, and the groups, technology education faculty, guidance counselors, administrators, mathematics faculty, and science faculty, served as the independent variables in the calculation of the ANOVA F-values.

The one-way ANOVA produced a F-value for each characteristic statement on the questionnaire. These F-values were then compared to a defined table of F-values to determine if there was a significant difference in perceptions between the groups at the .05 and .01 levels of significance. If the F-value for a characteristic statement was statistically significant, then a post hoc comparison test was used to find the causes of the statistically significant differences.

The ANOVA test told the researcher only if the results as a whole were statistically significant. The post hoc comparison test investigated the possible interactions between the groups to determine the precise sources that were responsible for the overall significant F-value (Sowell, 1982). The Tukey Honestly Significant Difference Test (Tukey HSD) was the best post hoc comparison test used to pinpoint the cause of the significant results, because it employed a harmonic mean when testing unequal sample size (Ryan & Hess, 1991).

Summary

This chapter described the methodology used in this study to answer the two research questions. A mailed questionnaire was chosen as the instrument to obtain the necessary data. The population consisted of 155 technology education faculty from the state and local funded technology education programs in Oklahoma and 147 guidance counselors, 147 administrators, 147 mathematics faculty, and 147 science faculty from the schools having a funded technology education programs. The mean scores derived from the data were used to identify the perceptions of the characteristics of technology education within each group. The one-way analysis of variance (ANOVA) was utilized to test if a significant difference occurred between the technology education faculty and guidance counselors, administrators, mathematics faculty, and science faculty concerning the characteristics of technology education. A Tukey HSD comparison test was used to locate the cause of the significant difference for each characteristic statement on the questionnaire.

CHAPTER IV

ANALYSIS AND INTERPRETATION OF THE DATA

The purpose of this research was to determine and compare the perceptions held by technology education faculty, guidance counselors, administrators, and mathematics and science faculty pertaining to the characteristics affiliated with the funded technology education programs in Oklahoma. This chapter will report the findings from the data gathered from the faculty and professional staff used in the study.

Research Questions

Based on the purpose of this study, the following research questions were developed for investigation.

1. What are the characteristics that technology education faculty, guidance counselors, administrators, mathematics faculty, and science faculty in Oklahoma identify with technology education?
2. Is there a statistically significant difference between the perceptions of technology education teachers and the perceptions held by mathematics and science teachers, guidance counselors, and administrators in Oklahoma?

Questionnaire Responses

A cover letter and questionnaire (see Appendices B and C) were sent to the sample groups in April. A postcard (see Appendix D) was sent two weeks later as a reminder to complete and return the questionnaire. A follow up letter (see Appendix E) and questionnaire were sent to all non-respondents two weeks after the postcard mailing to help increase the return rate.

The total response rate for the mailed questionnaire was 65.3 percent. Four returns were unusable and not included in the return rate. Table I reported the number of responses and percentage of responses for the selected sample. The sample groups had the following group response percentages: technology education (80%), guidance counselors (64%), administrators (71%), mathematics (63%), and science (47%).

Analyzing Data

The five sections of the questionnaire provided the means for obtaining the data necessary to answer the research questions. Those sections include: (a) personal and professional information; (b) methodological characteristics of technology education; (c) content characteristics of technology education; (d) need to integrate mathematics, science, and technology education; (e) actions the technology education professionals should

TABLE I

QUESTIONNAIRE RESPONSES

Sample Group	Total Population	Number Response	Group Response Percentage*	Total Response Percentage
Technology Education	155	124	80	25.6
Science	147	69	47	14.2
Mathematics	147	93	63	19.2
Counseling	147	94	64	19.4
Administration	147	105	71	21.6
Total	743	485	65	100

*rounded off to the nearest whole percentage take to overcome stereotypical perceptions.

The personal and professional information section provide a profile of the demographics of the sample groups. This profile is presented in Tables II through V as a frequency distribution of the age of the participants, years employed with current school, years employed in their specific educational area, and the highest level of education attained. The information on the area affiliation is presented in Table I as part of the response data. The remaining sections of the questionnaire were used to obtain the data necessary to answer the stated research questions.

Research Question One

Research question one asked " What are the characteristics that technology education faculty, guidance counselors, administrators, mathematics faculty, and science faculty in Oklahoma identify with technology education?"

To answer this first question each participant responded to the 33 statements on the questionnaire concerning the characteristics of technology education. The data were analyzed and several distribution tables (Table VI through XXV) of the group mean scores and standard deviations were constructed. These distribution tables serve as the means to search for and identify the perceptions within each sample group.

TABLE II

FREQUENCY DISTRIBUTIONS OF RESPONSES TO PERSONAL AND PROFESSIONAL CHARACTERISTICS BY AGE

	Age (Question 1)					
	21-30	31-40	41-50	Over 50	No Response	Total
Technology Education	21	46	42	15	0	124
Science	5	20	37	6	1	69
Mathematics	6	32	43	12	0	93
Counseling	2	24	42	25	1	94
Administration	1	21	60	23	0	105

TABLE III

FREQUENCY DISTRIBUTIONS OF RESPONSES TO PERSONAL AND PROFESSIONAL CHARACTERISTICS BY CURRENT SCHOOL EMPLOYMENT

	Years Employed with Current School (Question 2)					
	1-3	4-8	9-15	Over 15	No Response	Total
Technology Education	29	31	31	33	0	124
Science	15	13	24	17	0	69
Mathematics	16	17	27	33	0	93
Counseling	26	14	23	28	3	94
Administration	24	16	24	41	0	105

TABLE IV

FREQUENCY DISTRIBUTIONS OF RESPONSES TO PERSONAL AND PROFESSIONAL CHARACTERISTICS BY TEACHER EMPLOYMENT IN YOUR SPECIFIC EDUCATIONAL AREA

	Years Employed in Specific Area (Question 3)					
	1-3	4-8	9-15	Over 15	No Response	Total
Technology Education	23	31	34	34	1	124
Science	8	13	21	27	0	69
Mathematics	7	11	26	49	0	93
Counseling	12	22	23	36	1	94
Administration	7	22	37	39	0	105

TABLE V

FREQUENCY DISTRIBUTIONS OF RESPONSES TO PERSONAL AND PROFESSIONAL CHARACTERISTICS BY HIGHEST LEVEL OF EDUCATION ACHIEVED

	Highest Level of Education Achieved (Question 4)					
	Bachelors	Masters	Doctorate	Other	No Response	Total
Technology Education	67	55	0	2	0	124
Science	27	42	0	0	0	69
Mathematics	47	44	1	1	0	93
Counseling	2	87	2	0	3	94
Administration	1	97	6	1	0	105

Technology Education Faculty. Tables VI through IX give the technology education faculty's responses to the questionnaire. Table VI lists the responses for statements number 6 through 15 in the area, methodological characteristics of technology education, by the group mean scores and standard deviations. These statements are all agree or strongly agree upon as characteristics of the teaching methods used in technology education. The only statements to be strongly agreed upon are numbers 6, 9, and 15. Item 6 ($\overline{X}$ = 4.589) states "Technology education emphasizes problem solving." Item 9 ($\overline{X}$ = 4.540) states "Cooperative learning and small group interaction is encouraged in technology education." Item 15 ($\overline{X}$ = 4.532) states "Technology education provides activity-oriented laboratory instruction that reinforces abstract concepts with concrete experiences."

Statements 16 through 28 are recorded in Table VII. These statements are concerned with the content characteristics of technology education. The mean group score for statement 18 indicates that it is the only statement in this section that is not agreed or strongly agreed upon by the group. The mean group score ($\overline{X}$ = 3.149) represents a no opinion or neutral response to statement 18, which states "A portion of the technology education instructional content is based on using biological organisms to make or modify products."

TABLE VI

FREQUENCY DISTRIBUTION OF QUESTIONNAIRE RESPONSES FOR TECHNOLOGY EDUCATION FACULTY'S PERCEPTIONS OF THE METHODOLOGICAL CHARACTERISTICS OF TECHNOLOGY EDUCATION

Item	Topic	Number Cases	Mean*	SD
6.	Emphasis on problem solving	124	4.589	0.827
7.	Provides exploratory activities	124	4.395	0.815
8.	Instruction is goal oriented	124	4.274	0.839
9.	Cooperative learning encouraged	124	4.540	0.790
10.	Verbal activity emphasized	124	4.145	0.843
11.	Cognitive strategies developed	124	4.008	0.888
12.	Interdisciplinary activities	124	4.298	0.796
13.	Broad range of assessment strategies	124	4.347	0.807
14.	Lessons are hypothesis driven	124	3.782	0.842
15.	Activity oriented laboratory instruction	124	4.532	0.737

* Strongly Disagree = 1.000 to 1.499,
Disagree = 1.500 to 2.499,
Neutral (No Opinion) = 2.500 to 3.499,
Agree = 3.500 to 4.499,
Strongly Agree = 4.500 to 5.000

TABLE VII

FREQUENCY DISTRIBUTION OF QUESTIONNAIRE RESPONSES FOR TECHNOLOGY EDUCATION FACULTY'S PERCEPTIONS OF THE CONTENT CHARACTERISTICS OF TECHNOLOGY EDUCATION

Item	Topic	Number Cases	Mean*	SD
16.	Content is uniquely technological	124	4.137	0.877
17.	Based on knowledge of development of technology	124	4.177	0.875
18.	Based on the use of biological organisms	121	3.149	1.078
19.	Based on transferring information	123	4.317	0.739
20.	Based on modifying resources	123	4.203	0.778
21.	Based on the study of transportation	123	4.455	0.692
22.	Assists student in developing insight	123	4.480	0.772
23.	Application of tools, materials, processes	123	4.537	0.771
24.	Aids in development of individual potential	123	4.496	0.824
25.	Aids in development of problem solving skills	123	4.577	0.789
26.	Prepares students for lifelong learning	123	4.480	0.793
27.	Utilizes math and science skills	122	4.398	0.787
28.	Allows for connection of math and science	122	4.328	0.847

* Strongly Disagree = 1.000 to 1.499,
Disagree = 1.500 to 2.499,
Neutral (No Opinion) = 2.500 to 3.499,
Agree = 3.500 to 4.499,
Strongly Agree = 4.500 to 5.000

The mean group scores of the other statements in the content characteristics section indicates the technology education faculty agreed with all the statements except statements 23 and 25. The technology education professionals strongly agree with these statements. Item 23 ($\bar{X}$ = 4.537) states "The technology education curriculum allows for the application of tools, materials, machines, processes, and technical concepts." Item 25 ($\bar{X}$ = 4.577) states "The technology education curriculum aids in the development of student problem solving and decision making skills."

The mean group scores for the statements in the area, the need to integrate mathematics, science, and technology education (Table VIII), show that technology education respondents agree with all the statements. Not one characteristic statement is strongly agreed upon. Item 29 ($\bar{X}$ = 4.398) states "Technology education provides an avenue for applying concepts learned in math and science." Item 30 ($\bar{X}$ = 4.431) states "Technology education should be available to all students who enroll in math and science." Item 31 ($\bar{X}$ = 4.246) states "Technology education is an applied science." Item 32 ($\bar{X}$ = 4.407) states "The technology education curriculum reflects industry and technology." Item 33 ($\bar{X}$ = 4.260) states "Technology education is guided by the technological literacy needs of students."

TABLE VIII

FREQUENCY DISTRIBUTION OF QUESTIONNAIRE RESPONSES FOR TECHNOLOGY EDUCATION FACULTY'S PERCEPTIONS OF THE NEED TO INTEGRATE MATHEMATICS, SCIENCE, AND TECHNOLOGY EDUCATION

Item	Topic	Number Cases	Mean*	SD
29.	Provides avenue for applying concepts	123	4.398	0.847
30.	Should be available for all math/science students	123	4.431	0.821
31.	Technology education is an applied science	122	4.246	0.973
32.	Curriculum reflects industry and technology	123	4.407	0.818
33.	Guided by technological literacy needs of students	123	4.260	0.876

* Strongly Disagree = 1.000 to 1.499,
Disagree = 1.500 to 2.499,
Neutral (No Opinion) = 2.500 to 3.499,
Agree = 3.500 to 4.499,
Strongly Agree = 4.500 to 5.000

TABLE IX

FREQUENCY DISTRIBUTION OF QUESTIONNAIRE RESPONSES FOR TECHNOLOGY EDUCATION FACULTY'S OPINIONS ON THE ACTIONS THE TECHNOLOGY EDUCATION PROFESSIONALS SHOULD TAKE TO OVERCOME STEREOTYPICAL PERCEPTIONS

Item	Topic	Number Cases	Mean*	SD
34.	Form interdisciplinary committees	122	3.984	0.936
35.	Revise curriculum strategies	123	4.154	0.906
36.	Make presentations at national conferences	123	3.951	0.957
37.	Conduct research on integration	123	3.870	0.975
38.	Develop strategies to overcome perceptions	123	4.382	0.910

* Strongly Disagree = 1.000 to 1.499,
Disagree = 1.500 to 2.499,
Neutral (No Opinion) = 2.500 to 3.499,
Agree = 3.500 to 4.499,
Strongly Agree = 4.500 to 5.000

Table IX records statements 34 through 38. These statements are related to the actions the technology education professionals should take to overcome stereotypical perceptions. The mean group scores for these statements show the respondents agreed with all of the action statements. These actions include: forming interdisciplinary committees ($\bar{X}$ = 3.984), revising curriculum strategies ($\bar{X}$ = 4.154), making presentations at national conferences ($\bar{X}$ = 3.951), conducting research on integration ($\bar{X}$ = 3.870), and developing strategies to overcome stereotypical perceptions ($\bar{X}$ = 4.382).

Guidance Counselors. A second part to this research question is to identify the guidance counselors' perceived characteristics of technology education. The guidance counselors' responses are analyzed and the mean group scores and standard deviations are listed in Tables X through XIII.

Table X reports the results for statements 6 through 15. The mean group scores for this section, methodological characteristics of technology education, denote an agreement with all the statements. These agreed upon statements include: problem solving ($\bar{X}$ = 4.054), exploratory activities ($\bar{X}$ = 4.255), goal oriented ($\bar{X}$ = 4.191), cooperative learning ($\bar{X}$ = 4.138), verbal activity ($\bar{X}$ = 3.638), cognitive strategies ($\bar{X}$ = 3.670), interdisciplinary activities($\bar{X}$ = 3.968), assessment strategies ($\bar{X}$ = 4.053), hypothesis driven lessons

TABLE X

FREQUENCY DISTRIBUTION OF QUESTIONNAIRE RESPONSES FOR GUIDANCE COUNSELORS' PERCEPTIONS OF THE METHODOLOGICAL CHARACTERISTICS OF TECHNOLOGY EDUCATION

Item	Topic	Number Cases	Mean*	SD
6.	Emphasis on problem solving	92	4.054	0.817
7.	Provides exploratory activities	94	4.255	0.655
8.	Instruction is goal oriented	94	4.191	0.723
9.	Cooperative learning encouraged	94	4.138	0.850
10.	Verbal activity emphasized	94	3.638	0.914
11.	Cognitive strategies developed	94	3.670	0.753
12.	Interdisciplinary activities	94	3.968	0.740
13.	Broad range of assessment strategies	94	4.053	0.753
14.	Lessons are hypothesis driven	93	3.559	0.773
15.	Activity oriented laboratory instruction	94	4.117	0.815

* Strongly Disagree = 1.000 to 1.499,
Disagree = 1.500 to 2.499,
Neutral (No Opinion) = 2.500 to 3.499,
Agree = 3.500 to 4.499,
Strongly Agree = 4.500 to 5.000

($\overline{X}$ = 3.559), and activity oriented laboratory ($\overline{X}$ = 4.117).

Table XI illustrates the guidance counselors' mean group scores and standard deviations for the statements concerned with the content characteristics of technology education. The mean group scores indicate the majority of the statements are concentrated around the fourth Likert scale, except for statement 18. The statements concentrated around the fourth Likert scale represent an agreement by the guidance counselors, and statement 18 denotes a no opinion or neutral response. Statement 18 ($\overline{X}$ = 3.138) states "A portion of the technololgy education instructional content is based on using biological organisms to make or modify products."

The statements that are agreed upon include: content is uniquely technological ($\overline{X}$ = 4.043), knowledge of development of technology ($\overline{X}$ = 3.926), transferring information ($\overline{X}$ = 3.894), modifying resources ($\overline{X}$ = 3.670), study of transportation ($\overline{X}$ = 3.596), developing insight ($\overline{X}$ = 4.181), application of tools ($\overline{X}$ = 4.223), development of individual potential ($\overline{X}$ = 4.191), problem solving skills ($\overline{X}$ = 4.106), lifelong learning ($\overline{X}$ = 4.181), utilizes math and science skills ($\overline{X}$ = 4.194), and connection of math and science ($\overline{X}$ = 4.021).

The guidance counselors' mean group scores in Table XII reveal an agreement with all the statements on the perceptions of the need to integrate mathematics, science,

TABLE XI

FREQUENCY DISTRIBUTION OF QUESTIONNAIRE RESPONSES FOR GUIDANCE COUNSELORS' PERCEPTIONS OF THE CONTENT CHARACTERISTICS OF TECHNOLOGY EDUCATION

Item	Topic	Number Cases	Mean*	SD
16.	Content is uniquely technological	94	4.043	0.828
17.	Based on knowledge of development of technology	94	3.926	0.676
18.	Based on the use of biological organisms	94	3.138	0.697
19.	Based on transferring information	94	3.894	0.647
20.	Based on modifying resources	94	3.670	0.662
21.	Based on the study of transportation	94	3.596	0.859
22.	Assists student in developing insight	94	4.181	0.803
23.	Application of tools, materials, processes	94	4.223	0.778
24.	Aids in development of individual potential	94	4.191	0.766
25.	Aids in development of problem solving skills	94	4.106	0.796
26.	Prepares students for lifelong learning	94	4.181	0.867
27.	Utilizes math and science skills	93	4.194	0.741
28.	Allows for connection of math and science	94	4.021	0.816

* Strongly Disagree = 1.000 to 1.499,
Disagree = 1.500 to 2.499,
Neutral (No Opinion) = 2.500 to 3.499,
Agree = 3.500 to 4.499,
Strongly Agree = 4.500 to 5.000

TABLE XII

FREQUENCY DISTRIBUTION OF QUESTIONNAIRE RESPONSES FOR GUIDANCE COUNSELORS' PERCEPTIONS OF THE NEED TO INTEGRATE MATHEMATICS, SCIENCE, AND TECHNOLOGY EDUCATION

Item	Topic	Number Cases	Mean*	SD
29.	Provides avenue for applying concepts	94	4.064	0.787
30.	Should be available for all math/science students	94	4.149	0.789
31.	Technology education is an applied science	94	3.989	0.898
32.	Curriculum reflects industry and technology	93	4.215	0.806
33.	Guided by technological literacy needs of students	93	3.892	0.926

* Strongly Disagree = 1.000 to 1.499,
Disagree = 1.500 to 2.499,
Neutral (No Opinion) = 2.500 to 3.499,
Agree = 3.500 to 4.499,
Strongly Agree = 4.500 to 5.000

TABLE XIII

FREQUENCY DISTRIBUTION OF QUESTIONNAIRE RESPONSES FOR GUIDANCE COUNSELORS' OPINIONS ON THE ACTIONS THE TECHNOLOGY EDUCATION PROFESSIONALS SHOULD TAKE TO OVERCOME STEREOTYPICAL PERCEPTIONS

Item	Topic	Number Cases	Mean*	SD
34.	Form interdisciplinary committees	94	3.947	0.808
35.	Revise curriculum strategies	94	4.128	0.765
36.	Make presentations at national conferences	94	3.926	0.845
37.	Conduct research on integration	94	3.957	0.854
38.	Develop strategies to overcome perceptions	94	4.074	1.029

* Strongly Disagree = 1.000 to 1.499,
Disagree = 1.500 to 2.499,
Neutral (No Opinion) = 2.500 to 3.499,
Agree = 3.500 to 4.499,
Strongly Agree = 4.500 to 5.000

and technology education. Within the area of integration, the topics include: an avenue for applying concepts ($\bar{X}$ = 4.064), available to all students ($\bar{X}$ = 4.149), technology is applied science ($\bar{X}$ = 3.989), reflects industry and technology ($\bar{X}$ = 4.214), and guided by the technological literacy needs ($\bar{X}$ = 3.892).

The results for the fourth category, actions the technology education professionals should take to overcome stereotypical perceptions, are represented in Table XIII. The mean group scores indicate the guidance counselors are in agreement on all the statements 34 through 38. These actions include: interdisciplinary committees ($\bar{X}$ = 3.947), revise curriculum strategies ($\bar{X}$ = 4.128), presentations at national conferences ($\bar{X}$ = 3.926), research on integration ($\bar{X}$ = 3.957), and strategies to overcome stereotypical perceptions ($\bar{X}$ = 4.074).

Administrators. The third part of research question one is to identify the administrators' perceived characteristics of the technology education program in Oklahoma. Tables XVI through XVII represent the administrators' analyzed responses in the form of mean group scores and standard deviations.

Statements 6 through 15 are recorded in Table XVI. These statements are concerned with the methodological characteristics of technology education. The mean group scores indicate that the administrators, like the guidance

TABLE XIV

FREQUENCY DISTRIBUTION OF QUESTIONNAIRE RESPONSES FOR ADMINISTRATORS' PERCEPTIONS OF THE METHODOLOGICAL CHARACTERISTICS OF TECHNOLOGY EDUCATION

Item	Topic	Number Cases	Mean*	SD
6.	Emphasis on problem solving	104	4.221	0.763
7.	Provides exploratory activities	105	4.352	0.855
8.	Instruction is goal oriented	105	4.238	0.803
9.	Cooperative learning encouraged	104	4.356	0.934
10.	Verbal activity emphasized	105	3.800	0.945
11.	Cognitive strategies developed	104	3.904	0.865
12.	Interdisciplinary activities	105	4.076	0.817
13.	Broad range of assessment strategies	105	4.076	0.863
14.	Lessons are hypothesis driven	105	3.714	0.896
15.	Activity oriented laboratory instruction	105	4.257	0.910

* Strongly Disagree = 1.000 to 1.499,
Disagree = 1.500 to 2.499,
Neutral (No Opinion) = 2.500 to 3.499,
Agree = 3.500 to 4.499,
Strongly Agree = 4.500 to 5.000

counselors, are in agreement with all of these statements. None of the statements are strongly agreed or disagreed upon by the administrators. Within the area of methodology, the agreed upon characteristics include: problem solving ($\overline{X}$ = 4.221), exploratory activities ($\overline{X}$ = 4.352), goal oriented ($\overline{X}$ = 4.238), cooperative learning ($\overline{X}$ = 4.356), verbal activity ($\overline{X}$ = 3.800), cognitive strategies ($\overline{X}$ = 3.904), interdisciplinary activities ($\overline{X}$ = 4.076), assessment strategies ($\overline{X}$ = 4.076), hypothesis driven ($\overline{X}$ = 3.714), and activity oriented laboratory ($\overline{X}$ = 4.257).

Table XV lists the results for the administrators in the section, content characteristics of technology education. The mean group scores acknowledge an agreement with all the statements except for statement 18. Statement 18 ($\overline{X}$ = 3.133) states "A portion of the technology education instructional content is based on using biological organisms to make or modify products." This mean group score for statement 18 indicates the administrators had a no opinion response. Statement 18 also received a no opinion response from the technology education faculty and guidance counselors.

The statements that are agreed upon include: content is uniquely technological ($\overline{X}$ = 4.038), knowledge of development of technology ($\overline{X}$ = 3.867), transferring information ($\overline{X}$ = 4.076), modifying resources ($\overline{X}$ = 3.943), study of transportation ($\overline{X}$ = 3.762), developing insight

TABLE XV

FREQUENCY DISTRIBUTION OF QUESTIONNAIRE RESPONSES FOR ADMINISTRATORS' PERCEPTIONS OF THE CONTENT CHARACTERISTICS OF TECHNOLOGY EDUCATION

Item	Topic	Number Cases	Mean*	SD
16.	Content is uniquely technological	105	4.038	0.867
17.	Based on knowledge of development of technology	105	3.867	0.867
18.	Based on the use of biological organisms	105	3.133	0.867
19.	Based on transferring information	105	4.076	0.675
20.	Based on modifying resources	105	3.943	0.718
21.	Based on the study of transportation	105	3.762	0.861
22.	Assists student in developing insight	105	4.276	0.778
23.	Application of tools, materials, processes	105	4.400	0.839
24.	Aids in development of individual potential	105	4.229	0.858
25.	Aids in development of problem solving skills	105	4.248	0.794
26.	Prepares students for lifelong learning	105	4.276	0.872
27.	Utilizes math and science skills	105	4.181	0.841
28.	Allows for connection of math and science	105	4.124	0.917

* Strongly Disagree = 1.000 to 1.499,
Disagree = 1.500 to 2.499,
Neutral (No Opinion) = 2.500 to 3.499,
Agree = 3.500 to 4.499,
Strongly Agree = 4.500 to 5.000

($\bar{X}$ = 4.276), application of tools ($\bar{X}$ = 4.400), development of individual potential ($\bar{X}$ = 4.229), problem solving skills ($\bar{X}$ = 4.248), lifelong learning ($\bar{X}$ = 4.276), utilizes math and science skills ($\bar{X}$ = 4.181), and connection of math and science ($\bar{X}$ = 4.124).

Table XVI illustrates the administrators' mean group scores and standard deviations for questionnaire statements 29 through 33. These statements deal with the perceptions for the need to integrate mathematics, science, and technology education. The mean group scores denote an agreement with all of these statements. The technology education faculty and guidance counselors also agreed with all of the statements in this section. Within the area of integration, the agreed upon characteristics include: an avenue for applying concepts ($\bar{X}$ = 4.210), available to all students ($\bar{X}$ = 4.057), technology is applied science ($\bar{X}$ = 3.933), reflects industry and technology ($\bar{X}$ = 4.095), and guided by the technological literacy needs ($\bar{X}$ = 3.962).

The results for statements 34 through 38 are illustrated in Table XVII. These statements are related to the actions the technology education professionals should take to overcome stereotypical perceptions. The mean group scores acknowledge the administrators are in agreement with all of the statements in this category, just as the technology education faculty and guidance counselors are in agreement with all of the statements. These action

TABLE XVI

FREQUENCY DISTRIBUTION OF QUESTIONNAIRE RESPONSES FOR ADMINISTRATORS' PERCEPTIONS OF THE NEED TO INTEGRATE MATHEMATICS, SCIENCE, AND TECHNOLOGY EDUCATION

Item	Topic	Number Cases	Mean*	SD
29.	Provides avenue for applying concepts	105	4.210	0.781
30.	Should be available for all math/science students	105	4.057	0.959
31.	Technology education is an applied science	105	3.933	0.983
32.	Curriculum reflects industry and technology	105	4.095	0.791
33.	Guided by technological literacy needs of students	104	3.962	0.869

* Strongly Disagree = 1.000 to 1.499,
Disagree = 1.500 to 2.499,
Neutral (No Opinion) = 2.500 to 3.499,
Agree = 3.500 to 4.499,
Strongly Agree = 4.500 to 5.000

TABLE XVII

FREQUENCY DISTRIBUTION OF QUESTIONNAIRE RESPONSES FOR ADMINISTRATORS' OPINIONS ON THE ACTIONS THE TECHNOLOGY EDUCATION PROFESSIONALS SHOULD TAKE TO OVERCOME STEREOTYPICAL PERCEPTIONS

Item	Topic	Number Cases	Mean*	SD
34.	Form interdisciplinary committees	105	3.895	0.929
35.	Revise curriculum strategies	104	4.183	0.798
36.	Make presentations at national conferences	105	3.724	1.005
37.	Conduct research on integration	105	3.981	0.940
38.	Develop strategies to overcome perceptions	105	3.971	0.925

* Strongly Disagree = 1.000 to 1.499,
Disagree = 1.500 to 2.499,
Neutral (No Opinion) = 2.500 to 3.499,
Agree = 3.500 to 4.499,
Strongly Agree = 4.500 to 5.000

statements include: forming interdisciplinary committees ($\overline{X}$ = 3.895), revising curriculum strategies ($\overline{X}$ = 4.183), making presentations at national conferences ($\overline{X}$ = 3.724), conducting research on integration ($\overline{X}$ = 3.981), and developing strategies to overcome stereotypical perceptions ($\overline{X}$ = 3.971).

Mathematics Faculty. The fourth part to this research question is to identify the mathematics faculty's perceived characteristics of the technology education programs in Oklahoma. The mathematics faculty's responses to the 33 questionnaire statements are analyzed and the mean group scores and standard deviations are listed in Tables XVIII through XXI.

The results for the section, methodological characteristics of technology education, are given in Table XVIII. The mathematics faculty's mean group scores for this category indicate an agreement with the majority of the statements 6 through 15, except for statement 11. Statement 11's mean group score represents a no opinion or neutral response as a perceived characteristic of technology education's methodology. Statement 11 ($\overline{X}$ = 3.484) states "Student cognitive strategies have clearly been developed." The mathematics faculty is the only group not in agreement with statement 11.

Within the area of methodology, the mathematics faculty's agreed upon characteristics include: problem

TABLE XVIII

FREQUENCY DISTRIBUTION OF QUESTIONNAIRE RESPONSES FOR MATHEMATICS FACULTY'S PERCEPTIONS OF THE METHODOLOGICAL CHARACTERISTICS OF TECHNOLOGY EDUCATION

Item	Topic	Number Cases	Mean*	SD
6.	Emphasis on problem solving	93	4.097	0.609
7.	Provides exploratory activities	93	4.237	0.772
8.	Instruction is goal oriented	93	4.075	0.695
9.	Cooperative learning encouraged	93	4.000	0.780
10.	Verbal activity emphasized	93	3.570	0.865
11.	Cognitive strategies developed	93	3.484	0.701
12.	Interdisciplinary activities	93	3.925	0.695
13.	Broad range of assessment strategies	93	3.925	0.663
14.	Lessons are hypothesis driven	93	3.527	0.731
15.	Activity oriented laboratory instruction	93	4.129	0.695

* Strongly Disagree = 1.000 to 1.499,
Disagree = 1.500 to 2.499,
Neutral (No Opinion) = 2.500 to 3.499,
Agree = 3.500 to 4.499,
Strongly Agree = 4.500 to 5.000

solving ($\bar{X}$ = 4.097), exploratory activities ($\bar{X}$ = 4.237), goal oriented ($\bar{X}$ = 4.075), cooperative learning ($\bar{X}$ = 4.000), verbal activity ($\bar{X}$ = 3.570), interdisciplinary activities ($\bar{X}$ = 3.925), assessment strategies ($\bar{X}$ = 3.925), hypothesis driven ($\bar{X}$ = 3.527), and activity oriented laboratory ($\bar{X}$ = 4.129).

Table XIX reports the mathematics faculty's results for statements 16 through 28. The mean group scores for this section, content characteristics of technology, indicate an agreement with all of the statements except for statements 17 and 18. Statements 17 and 18 denote a neutral or no opinion response. Statement 17 ($\bar{X}$ = 3.452) states "Technology education content is based on knowledge about the development of technology and its effect on people, the environment, and culture." Statement 18 ($\bar{X}$ = 3.075) states "A portion of the technology education instructional content is based on using biological organisms to make or modify products." Statement 18 also received a neutral response from the technology education faculty, guidance counselors, and administrators.

The statements that are agreed upon include: content is uniquely technological ($\bar{X}$ = 3.688), transferring information ($\bar{X}$ = 3.826), modifying resources ($\bar{X}$ = 3.677), study of transportation ($\bar{X}$ = 3.581), developing insight ($\bar{X}$ = 4.065), application of tools ($\bar{X}$ = 4.140), development of individual potential ($\bar{X}$ = 4.151), problem solving skills

TABLE XIX

FREQUENCY DISTRIBUTION OF QUESTIONNAIRE RESPONSES FOR MATHEMATICS FACULTY'S PERCEPTIONS OF THE CONTENT CHARACTERISTICS OF TECHNOLOGY EDUCATION

Item	Topic	Number Cases	Mean*	SD
16.	Content is uniquely technological	93	3.688	0.751
17.	Based on knowledge of development of technology	93	3.452	0.841
18.	Based on the use of biological organisms	93	3.075	0.663
19.	Based on transferring information	92	3.826	0.689
20.	Based on modifying resources	93	3.677	0.628
21.	Based on the study of transportation	93	3.581	0.648
22.	Assists student in developing insight	93	4.065	0.719
23.	Application of tools, materials, processes	93	4.140	0.731
24.	Aids in development of individual potential	93	4.151	0.751
25.	Aids in development of problem solving skills	93	4.011	0.684
26.	Prepares students for lifelong learning	93	4.151	0.625
27.	Utilizes math and science skills	93	4.129	0.711
28.	Allows for connection of math and science	93	4.043	0.736

* Strongly Disagree = 1.000 to 1.499,
Disagree = 1.500 to 2.499,
Neutral (No Opinion) = 2.500 to 3.499,
Agree = 3.500 to 4.499,
Strongly Agree = 4.500 to 5.000

($\bar{X}$ = 4.011), lifelong learning ($\bar{X}$ = 4.151), utilizes math and science skills ($\bar{X}$ = 4.129), and connection of math and science ($\bar{X}$ = 4.043).

Table XX illustrates the mathematics faculty's mean group scores and standard deviations for questionnaire statements 29 through 33. These statements deal with the perceptions for the need to integrate mathematics, science, and technology education. The mean group scores denote an agreement with all of these statements. Technology education faculty, guidance counselors, and administrators also agreed with all of these statements. Within the area of integration, the agreed upon characteristics include: an avenue for applying concepts ($\bar{X}$ = 4.172), available to all students ($\bar{X}$ = 4.129), technology is applied science ($\bar{X}$ = 4.000), reflects industry and technology ($\bar{X}$ = 4.140), and guided by the technological literacy needs ($\bar{X}$ = 3.860).

The results for the fourth category, actions the technology education professionals should take to overcome stereotypical perceptions, are presented in Table XXI. The mean group scores indicate the mathematics faculty is in agreement with statements 34 through 38. These actions include: interdisciplinary committees ($\bar{X}$ = 3.742), revise curriculum strategies ($\bar{X}$ = 4.032), presentations at national conferences ($\bar{X}$ = 3.925), research on integration ($\bar{X}$ = 3.892), and strategies to overcome stereotypical perceptions ($\bar{X}$ = 4.097). The technology education faculty,

TABLE XX

FREQUENCY DISTRIBUTION OF QUESTIONNAIRE RESPONSES FOR MATHEMATICS FACULTY'S PERCEPTIONS OF THE NEED TO INTEGRATE MATHEMATICS, SCIENCE, AND TECHNOLOGY EDUCATION

Item	Topic	Number Cases	Mean*	SD
29.	Provides avenue for applying concepts	93	4.172	0.746
30.	Should be available for all math/science students	93	4.129	0.875
31.	Technology education is an applied science	93	4.000	0.780
32.	Curriculum reflects industry and technology	93	4.140	0.760
33.	Guided by technological literacy needs of students	93	3.860	0.815

* Strongly Disagree = 1.000 to 1.499,
Disagree = 1.500 to 2.499,
Neutral (No Opinion) = 2.500 to 3.499,
Agree = 3.500 to 4.499,
Strongly Agree = 4.500 to 5.000

TABLE XXI

FREQUENCY DISTRIBUTION OF QUESTIONNAIRE RESPONSES FOR MATHEMATICS FACULTY'S OPINIONS ON THE ACTIONS THE TECHNOLOGY EDUCATION PROFESSIONALS SHOULD TAKE TO OVERCOME STEREOTYPICAL PERCEPTIONS

Item	Topic	Number Cases	Mean*	SD
34.	Form interdisciplinary committees	93	3.742	0.820
35.	Revise curriculum strategies	93	4.032	0.786
36.	Make presentations at national conferences	93	3.925	0.811
37.	Conduct research on integration	93	3.892	0.800
38.	Develop strategies to overcome perceptions	93	4.097	0.795

* Strongly Disagree = 1.000 to 1.499,
Disagree = 1.500 to 2.499,
Neutral (No Opinion) = 2.500 to 3.499,
Agree = 3.500 to 4.499,
Strongly Agree = 4.500 to 5.000

guidance counselors, and administrators also agreed with all of the statements in this category.

Science Faculty. The fifth and last part of research question one was to identify the science faculty's perceived characteristics of the technology education programs in Oklahoma. Tables XXII through XXV represent the science faculty's responses in the form of mean group scores and standard deviations.

Table XXII records the results for the science faculty in the section, methodological characteristics of technology education. The mean group scores indicate the science faculty are in agreement with all of the statements except for statements 10 and 14. Statements 10 and 14 received a neutral or no opinion response by the science faculty. Statement 10 ($\overline{X}$ = 3.449) states "Verbal activity is emphasized in technology education. Statement 14 ($\overline{X}$ = 3.420) states "Technology education lessons are hypothesis driven." The technology education faculty, guidance counselors, administrators, and mathematics faculty's perceptions agreed with statements 10 and 14.

The statements that are agreed upon as characteristics include: problem solving ($\overline{X}$ = 3.870), exploratory activities ($\overline{X}$ = 4.174), goal oriented ($\overline{X}$ = 4.072), cooperative learning ($\overline{X}$ = 3.971), cognitive strategies ($\overline{X}$ = 3.551), interdisciplinary activities ($\overline{X}$ = 3.754), assessment strategies ($\overline{X}$ = 3.870), and activity oriented

TABLE XXII

FREQUENCY DISTRIBUTION OF QUESTIONNAIRE RESPONSES FOR SCIENCE FACULTY'S PERCEPTIONS OF THE METHODOLOGICAL CHARACTERISTICS OF TECHNOLOGY EDUCATION

Item	Topic	Number Cases	Mean*	SD
6.	Emphasis on problem solving	69	3.870	0.906
7.	Provides exploratory activities	69	4.174	0.804
8.	Instruction is goal oriented	69	4.072	0.754
9.	Cooperative learning encouraged	69	3.971	0.857
10.	Verbal activity emphasized	69	3.449	0.948
11.	Cognitive strategies developed	69	3.551	0.916
12.	Interdisciplinary activities	69	3.754	0.976
13.	Broad range of assessment strategies	69	3.870	0.821
14.	Lessons are hypothesis driven	69	3.420	0.864
15.	Activity oriented laboratory instruction	68	3.971	0.946

* Strongly Disagree = 1.000 to 1.499,
Disagree = 1.500 to 2.499,
Neutral (No Opinion) = 2.500 to 3.499,
Agree = 3.500 to 4.499,
Strongly Agree = 4.500 to 5.000

laboratory ($\bar{X}$ = 3.971).

The results for statements 16 through 28 are illustrated in Table XXIII. These statements are related to the content characteristics of technology education. The mean group scores indicate the science faculty is in agreement with all of the statements except for statement 18. Statement 18 ($\bar{X}$ = 2.899) states "A portion of the technology education instructional content is based on using biological organisms to make or modify products." The mean group score for statement 18 indicates the science faculty had a neutral or no opinion response. Statement 18 also received a neutral response by the technology education faculty, guidance counselors, administrators, and mathematics faculty.

The statements that are agreed upon include: content is uniquely technological ($\bar{X}$ = 3.739), knowledge of development of technology ($\bar{X}$ = 3.623), transferring information ($\bar{X}$ = 3.809), modifying resources ($\bar{X}$ = 3.647), study of transportation ($\bar{X}$ = 3.559), developing insight ($\bar{X}$ = 3.941), application of tools ($\bar{X}$ = 4.224), development of individual potential ($\bar{X}$ = 4.147), problem solving skills ($\bar{X}$ = 3.940), lifelong learning ($\bar{X}$ = 3.853), utilizes math and science skills ($\bar{X}$ = 3.853), and connection of math and science ($\bar{X}$ = 3.779).

Table XXIV illustrates the science faculty's mean group scores and standard deviations for questionnaire statements

TABLE XXIII

FREQUENCY DISTRIBUTION OF QUESTIONNAIRE RESPONSES FOR SCIENCE FACULTY'S PERCEPTIONS OF THE CONTENT CHARACTERISTICS OF TECHNOLOGY EDUCATION

Item	Topic	Number Cases	Mean*	SD
16.	Content is uniquely technological	69	3.739	0.798
17.	Based on knowledge of development of technology	69	3.623	0.909
18.	Based on the use of biological organisms	69	2.899	0.926
19.	Based on transferring information	68	3.809	0.718
20.	Based on modifying resources	68	3.647	0.707
21.	Based on the study of transportation	68	3.559	0.741
22.	Assists student in developing insight	68	3.941	0.826
23.	Application of tools, materials, processes	67	4.224	0.755
24.	Aids in development of individual potential	68	4.147	0.815
25.	Aids in development of problem solving skills	67	3.940	0.795
26.	Prepares students for lifelong learning	68	3.853	0.996
27.	Utilizes math and science skills	68	3.853	1.123
28.	Allows for connection of math and science	68	3.779	1.049

* Strongly Disagree = 1.000 to 1.499,
Disagree = 1.500 to 2.499,
Neutral (No Opinion) = 2.500 to 3.499,
Agree = 3.500 to 4.499,
Strongly Agree = 4.500 to 5.000

29 through 33. These statements deal with the perceptions for the need to integrate mathematics, science, and technology education. The mean group scores denote an agreement with all of these statements. The technology education faculty, guidance counselors, administrators, and mathematics faculty also agreed with all of the statements in this section. Within the area of integration, the agreed upon characteristics include: an avenue for applying concepts ($\overline{X}$ = 4.103), available to all students ($\overline{X}$ = 4.221), technology is applied science ($\overline{X}$ = 4.206), reflects industry and technology ($\overline{X}$ = 4.059), and guided by the technological literacy needs ($\overline{X}$ = 3.721).

The results for the fourth category, actions the technology education professionals should take to overcome stereotypical perceptions, are presented in Table XXV. The mean group scores indicate the science faculty are in agreement on all the statements 34 through 38. These actions include: interdisciplinary committees ($\overline{X}$ = 4.103), revise curriculum strategies ($\overline{X}$ = 4.235), presentations at national conferences ($\overline{X}$ = 4.059), research on integration ($\overline{X}$ = 4.015), and strategies to overcome stereotypical perceptions ($\overline{X}$ = 4.118). The technology education faculty, guidance counselors, administrators, and mathematics faculty were also in agreement on all of the statements in this category.

TABLE XXIV

FREQUENCY DISTRIBUTION OF QUESTIONNAIRE RESPONSES FOR SCIENCE FACULTY'S PERCEPTIONS OF THE NEED TO INTEGRATE MATHEMATICS, SCIENCE, AND TECHNOLOGY EDUCATION

Item	Topic	Number Cases	Mean*	SD
29.	Provides avenue for applying concepts	68	4.103	0.995
30.	Should be available for all math/science students	68	4.221	0.844
31.	Technology education is an applied science	68	4.206	0.839
32.	Curriculum reflects industry and technology	68	4.059	0.826
33.	Guided by technological literacy needs of students	68	3.721	0.912

* Strongly Disagree = 1.000 to 1.499,
Disagree = 1.500 to 2.499,
Neutral (No Opinion) = 2.500 to 3.499,
Agree = 3.500 to 4.499,
Strongly Agree = 4.500 to 5.000

TABLE XXV

FREQUENCY DISTRIBUTION OF QUESTIONNAIRE RESPONSES FOR SCIENCE FACULTY'S OPINIONS ON THE ACTIONS THE TECHNOLOGY EDUCATION PROFESSIONALS SHOULD TAKE TO OVERCOME STEREOTYPICAL PERCEPTIONS

Item	Topic	Number Cases	Mean*	SD
34.	Form interdisciplinary committees	68	4.103	0.831
35.	Revise curriculum strategies	68	4.235	0.755
36.	Make presentations at national conferences	68	4.059	0.929
37.	Conduct research on integration	68	4.015	0.922
38.	Develop strategies to overcome perceptions	68	4.118	0.873

* Strongly Disagree = 1.000 to 1.499,
Disagree = 1.500 to 2.499,
Neutral (No Opinion) = 2.500 to 3.499,
Agree = 3.500 to 4.499,
Strongly Agree = 4.500 to 5.000

Research Question Two

Research question two asked "Is there a statistically significant difference between the perceptions of technology education teachers and the perceptions held by mathematics and science teachers, guidance counselors, and administrators in Oklahoma?"

To answer the second question, an one-way analysis of variance (ANOVA) test was utilized to search for and identify the statistically significant differences in perceptions on each of the 33 characteristic statements on the questionnaire. If the ANOVA test indicated that a statistically significant difference existed between the groups perceptions, then a Tukey HSD pos hoc test was utilized. The Tukey HSD test investigated the possible interactions between the technology education faculty and the guidance counselors, administrators, mathematics faculty, and science faculty to determine the precise locations of the statistically significant differences at the .05 and .01 levels of significance.

Table XXVI summarizes the results for the analysis of variance and Tukey HSD tests on each statement concerning the characteristics of technology education. The statements 6 through 15 on Table XXVI deal with the methodological characteristics of technology education. The F-values are statistically significant on most of these statements except for statements 7 and 8.

The F-values on statements 7 and 8 show there is not a significant difference between the five groups' perceptions on these two statements. The other statements indicate the methodological characteristics are perceived differently by at least one of the five groups.

The F-value for statement 6, emphasis on problem solving, is statistically significant (F = 11.825, p<.01). The Tukey HSD test indicates that a statistically significant difference exists between the mean scores of the technology education faculty and each of the other groups. The technology education faculty's mean score differed from the guidance counselors (P = 0.534, p<.01), administrators (P = 0.368, p<.01), mathematics faculty (P = 0.492, p<.01), and science faculty (P = 0.719, p<.01).

The F-value for statement 9, cooperative learning is encouraged, is statistically significant (F = 8.422, p<.01). The Tukey HSD test indicates that there is a statistically significant difference between the mean scores of the technology education faculty and guidance counselors (P = 0.402, p<.01), the technology education faculty and mathematics faculty (P = 0.540, p<.01), and the technology education faculty and science faculty (P = 0.569, p<.01).

The F-value for statement 10, verbal activity emphasized, is statistically significant (F = 9.276, p<.01). The Tukey HSD test indicates that a statistically significant difference exists between the mean scores of the

TABLE XXVI

ANALYSIS OF VARIANCE AND TUKEY HSD TESTS BETWEEN THE TECHNOLOGY EDUCATION FACULTY AND GUIDANCE COUNSELORS, ADMINISTRATORS, MATHEMATICS FACULTY, AND SCIENCE FACULTY REGARDING THE CHARACTERISTICS OF TECHNOLOGY EDUCATION

		ANOVA	Tukey HSD Test-Pairwise Mean Differences			
Item	Topic	F-value	T.E vs. G.C.	T.E vs. Admin.	T.E vs. Math	T.E. vs. Science
	Methodological Characteristics					
6.	Emphasis on problem solving	11.825**	0.534**	0.368**	0.492**	0.719**
7.	Provides exploratory activities	1.242	--	--	--	--
8.	Instruction is goal oriented	1.379	--	--	--	--
9.	Cooperative learning encouraged	8.422**	0.402**	0.185	0.540**	0.569**
10.	Verbal activity emphasized	9.276**	0.507**	0.345*	0.575**	0.696**
11.	Cognitive strategies developed	7.509**	0.338*	0.104	0.524**	0.457**
12.	Interdisciplinary activities	6.162**	0.330*	0.222	0.374**	0.545**
13.	Broad range of assessment strategies	5.742**	0.294*	0.271	0.422**	0.477**
14.	Lessons are hypothesis driven	2.978*	0.233	0.068	0.255	0.362*
15.	Activity oriented laboratory instruction	6.800**	0.415**	0.275*	0.403**	0.562**
	Content Characterstrics					
16.	Content is uniquely technological	5.537**	0.095	0.099	0.449**	0.398*
17.	Based on the development of technology	11.483**	0.252	0.311*	0.726**	0.554**
18.	Based on the use of biological organisms	1.115	--	--	--	--
19.	Based on transferring information	9.912**	0.423**	0.241**	0.491**	0.508**
20.	Based on modifying resources	12.430**	0.533**	0.260*	0.526**	0.556**
21.	Based on the study of transportation	27.542**	0.860**	0.693**	0.875**	0.896**
22.	Assists student in developing insight	6.741**	0.299*	0.230	0.415**	0.538**
23.	Tools, materials, processes	4.516**	0.313*	0.137	0.397**	0.313
24.	Development of individual potential	3.609**	0.304*	0.267	0.345*	0.349*
25.	Development of problem solving skills	10.992**	0.471**	0.330*	0.566**	0.637**
26.	Prepares students for lifelong learning	6.690**	0.299	0.203	0.329*	0.627**
27.	Utilizes math and science skills	4.833**	0.205	0.217	0.269	0.545**
28.	Connection of math and science	4.717**	0.307	0.204	0.285	0.548**

TABLE XXVI (Continued)

Item	Topic	ANOVA F-value	Tukey HSD Test-Pairwise Mean Differences T.E vs. G.C.	T.E vs. Admin.	T.E vs. Math	T.E. vs. Science
	Need For Integration					
29.	Provides avenue for applying concepts	2.669*	0.335*	0.189	0.226	0.295
30.	Available for all math/science students	3.181*	0.282	0.374**	0.302	0.210
31.	Technology education is applied science	2.440	--	--	--	--
32.	Reflects industry and technology	3.167*	0.191	0.311*	0.267	0.348*
33.	Guided by technological literacy needs	5.272**	0.368*	0.299	0.400**	0.540**
	Actions For Technology Technology					
34.	Form interdisciplinary committees	1.905	--	--	--	--
35.	Revise curriculum strategies	0.727	--	--	--	--
36.	Presentations at national conferences	1.606	--	--	--	--
37.	Conduct research on integration	0.424	--	--	--	--
38.	Strategies to overcome perceptions	3.247*	0.308	0.411**	0.285	0.264

Note. T.E. = Technology education faculty
G.C. = Guidance counselors
Admin. = Administrators
Math = Mathematics faculty
Science = Science faculty

$^{*}p<.05$. $^{**}p<.01$.

technology education faculty and each of the other groups. The technology education faculty's mean scores differed from the guidance counselors (P = 0.507, p<.01), administrators (P = 0.345, p<.05), mathematics faculty (P = 0.575, p<.01), and science faculty (P = 0.696, p<.01).

The F-value for statement 11, cognitive strategies developed, is statistically significant (F = 7.509, p<.01). The Tukey HSD test indicates that a statistically significant difference exists between the mean scores of the technology education faculty and each of the other groups except the administrators. The technology education faculty's mean scores differed from the guidance counselors (P = 0.338, p<.05), mathematics faculty (P = 0.524, p<.01), and science faculty (P = 0.457, p<.01).

The F-value for statement 12, interdisciplinary activities, is statistically significant (F = 6.162, p<.01). The Tukey HSD test indicates that a statistically significant difference exists between the mean scores of the technology education faculty and each of the other groups except the administrators. The technology education faculty's mean scores differed from the guidance counselors (P = 0.330, p<.05), mathematics faculty (P = 0.374, p<.01), and science faculty (P = 0.545, p<.01).

The F-value for statement 13, broad range of assessment strategies, is statistically significant (F =5.742, p<.01). The Tukey HSD test indicates that there is a statistically significant difference between the mean scores of the technology education faculty and guidance counselors ($\underline{P}$ =0.294, $\underline{p}$<.05), technology education faculty and mathematics faculty ($\underline{P}$ =0.422, $\underline{p}$<.01), and technology education faculty and science faculty ($\underline{P}$ =0.477, $\underline{p}$<.01).

The F-value for statement 14, lessons are hypothesis driven, is statistically significant ($\underline{F}$ =2.978, $\underline{p}$<.05). The Tukey HSD test indicates that a statistically significant difference exists only between the mean scores of the technology education faculty and science faculty ($\underline{P}$ =0.362, $\underline{p}$<.05).

The F-value for statement 15, activity oriented laboratory instruction, is statistically significant ($\underline{F}$ =6.800, $\underline{p}$<.01). The Tukey HSD test indicates that a statistically significant difference exists between the mean scores of the technology education faculty and each of the other groups. The technology education faculty's mean score differed from the guidance counselors ($\underline{P}$ =0.415, $\underline{p}$<.01), administrators ($\underline{P}$ =0.275, $\underline{p}$<.05), mathematics faculty ($\underline{P}$ =0.403, $\underline{p}$<.01), and science faculty ($\underline{P}$ =0.562, $\underline{p}$<.01).

Table XXVI lists the results for the analysis of variance (ANOVA) and Tukey HSD tests for statements 16 through 28 in the area, content characteristics of technology education. The F-values are statistically significant on all of the content characteristic statements except statement 18.

The F-value for statement 18 shows there is not a statistically significant difference between the five groups' perceptions on this statement. The other statements indicate the content characteristics are perceived significantly different by at least one of the groups.

The F-value for statement 16, content is uniquely technological, is statistically significant ($\underline{F}$ =5.537, $\underline{p}$<.01). The Tukey HSD test indicates that there is a statistically significant difference only between the mean scores of the technology education faculty and mathematics faculty ($\underline{P}$ =0.499, $\underline{p}$<.01), and the technology education faculty and science faculty ($\underline{P}$ =0.398, $\underline{p}$<.05).

The F-value for statement 17, based on the development of technology, is statistically significant ($\underline{F}$ =11.483, $\underline{p}$<.01). The Tukey HSD test indicates that there is a statistically significant difference between the mean scores of the technology education faculty and mathematics faculty ($\underline{P}$ =0.726, $\underline{p}$<.01), and the technology education faculty and science faculty ($\underline{P}$ =0.554, $\underline{p}$<.01).

The F-value for statement 19, based on transferring information, is statistically significant ($\underline{F}$ =9.912, $\underline{p}$<.01). The Tukey HSD test indicates that a statistically significant difference exists between the mean scores of the technology education faculty and each of the other groups. The technology education faculty's mean score differed from the guidance counselors ($\underline{P}$ =0.423, $\underline{p}$<.01), administrators

(P =0.241, $p<.01$), mathematics faculty (P =0.491, $p<.01$), and science faculty (P =0.508, $p<.01$).

The F-value for statement 20, based on modifying resources, is statistically significant (F =12.430, $p<.01$). The Tukey HSD test indicates that a statistically significant difference exists between the mean scores of the technology education faculty and each of the other groups. The technology education faculty's mean score differed from the guidance counselors (P =0.533, $p<.01$), administrators (P =0.260, $p<.05$), mathematics faculty (P =0.526, $p<.01$), and science faculty (P =0.556, $p<.01$).

The F-value for statement 21, based on the study of transportation, is statistically significant (F =27.542, $p<.01$). The Tukey HSD test indicates that a statistically significant difference exists between the mean scores of the technology education faculty and each of the other groups. The technology education faculty's mean score differed from the guidance counselors (P =0.860, $p<.01$), administrators (P =0.693, $p<.01$), mathematics faculty (P =0.875, $p<.01$), and science faculty (P =0.896, $p<.01$).

The F-value for statement 22, assists student in developing insight, is statistically significant (F =6.741, $p<.01$). The Tukey HSD test indicates that there is a statistically significant difference between the mean scores of the technology education faculty and guidance counselors (P =0.299, $p<.05$), technology education faculty and mathematics faculty (P =0.415, $p<.01$), and technology education faculty and science faculty (P =0.538, $p<.01$).

The F-value for statement 23, application of tools, materials, machines, processes and technical concepts, is statistically significant (F =4.516, $p<.01$). The Tukey HSD test indicates that there is a statistically significant difference between the mean scores of the technology education faculty and guidance counselors (P =0.313, $p<.05$), and technology education faculty and mathematics faculty (P =0.397, $p<.01$).

The F-value for statement 24, development of individual potential, is statistically significant (F =3.609, $p<.01$). The Tukey HSD test indicates that there is a statistically significant difference between the mean scores of the technology education faculty and guidance counselors (P =0.304, $p<.05$), technology education faculty and mathematics faculty (P =0.345, $p<.05$), and technology education faculty and science faculty (P =0.349, $p<.05$).

The F-value for statement 25, development of problem solving skills, is statistically significant (F =10.992, $p<.01$). The Tukey HSD test indicates that a statistically significant difference exists between the mean scores of the technology education faculty and each of the other groups. The technology education faculty's mean score differed from the guidance counselors (P =0.471, $p<.01$), administrators (P =0.330, $p<.05$), mathematics faculty (P =0.566, $p<.01$), and science faculty (P =0.637, p<.01).

The F-value for statement 26, prepares students for lifelong learning, is statistically significant (F =6.690, p<.01). The Tukey HSD test indicates that a statistically significant difference only exists between the mean scores of the technology education faculty and mathematics faculty (P =0.329, p<.05), technology education faculty and science faculty (P =0.627, p<.01).

The F-value for statement 27, utilizes math and science skills, is statistically significant (F =4.833, p<.01). The Tukey HSD test indicates that a statistically significant difference only exists between the mean scores of the technology education faculty and science faculty (P =0.545, p<.01).

The F-value for statement 28, connection of math and science, is statistically significant (F =4.717, p<.01). The Tukey HSD test indicates that a statistically significant difference only exists between the mean scores of the technology education faculty and the science faculty (P =0.548, p<.01).

Table XXVI also summarizes the results for the analysis of variance (ANOVA) and Tukey HSD tests for statements 29 through 33 in the area, the need to integrate mathematics, science, and technology education. The F-values are statistically significant on most of these statements except for statement 31.

The F-value for statement 31, technology education is applied science, indicates there is not a significant difference between the five groups' perceptions on this statement. The other statements indicates that the need to integrate mathematics, science, and technology education characteristics are perceived differently by at least one of the five groups.

The F-value for statement 29, provides avenue for applying concepts, is statistically significant ($F = 2.669$, $p < .05$). The Tukey HSD test indicates that a statistically significant difference only exists between the mean scores of the technology education faculty and guidance counselors ($P = 0.335$, $p < .05$).

The F-value for statement 30, available for all mathematics and science students, is statistically significant ($F = 3.181$, $p < .05$). The Tukey HSD test indicates that a statistically significant difference only exists between the mean scores of the technology education faculty and administrators ($P = 0.374$, $p < .01$).

The F-value for statement 32, reflects industry and technology, is statistically significant ($F = 3.167$, $p < .05$). The Tukey HSD test indicates that there is a statistically significant difference between the mean scores of the technology education faculty and administrators ($P = 0.311$, $p < .05$), and the technology education faculty and science faculty ($P = 0.348$, $p < .05$).

The F-value for statement 33, guided by technological literacy needs, is statistically significant (F =5.272, p<.01). The Tukey HSD test indicates that a significant difference exists between the mean scores of the technology education faculty and guidance counselors (P =0.368, p<.05), technology education faculty and mathematics faculty (P = 0.400, p<.01), and technology education faculty and science faculty (P =0.540, p<.01).

Table XXVI summarized the results for the analysis of variance (ANOVA) and Tukey HSD tests for statements 34 through 38 in the area, actions the technology education professionals should take to overcome stereotypical perceptions. The F-values for these statements on actions are not statistically significant except for statement 38.

Statement 38, strategies to overcome stereotypical perceptions, is the only statement in this area in which the F-value was statistically significant (F = 3.247, p<.05). The Tukey HSD test indicates that a statistically significant difference exists only between the mean scores of the technology education faculty and the administrators (P = 0.411, p<.01).

CHAPTER V

SUMMARY AND CONCLUSIONS

Purpose of the Study

The purpose of this research was to determine and compare the perceptions held by technology education faculty, guidance counselors, administrators, mathematics faculty, and science faculty pertaining to the characteristics affiliated with the funded technology education programs in Oklahoma. The study looked at the characteristics of technology education in the areas methodology, content, and integration. The study also determined the perceived actions the technology education professionals should take to overcome stereotypical perceptions.

Since perceptions can have a positive or negative impact on the present and future transformation and practice of technology education, the information obtained in this study should allow the technology education profession to understand the similarities and differences of perception inside and outside the technology education programs. This understanding will allow the technology education profession to take actions, if needed, to build stronger coalitions between the academic disciplines, administrators, and guidance counselors, so technology education can have an important impact on meeting the needs of the students for the future.

Data Collection

Data were obtained through the use of a mailed questionnaire. The questionnaire was mailed to 743 participants in the state of Oklahoma. The participants included 155 technology education faculty, 147 guidance counselors, 147 administrators, 147 mathematics faculty, and 147 science faculty. The total response rate for the mailed questionnaire was 65 percent. Technology education faculty had an 80 percent return rate, the guidance counselors had a 64 percent return rate, the administrators had a 71 percent return rate, the mathematics faculty had a 63 percent return rate, and the science faculty had a 47 percent return rate.

Results of the Study

The data obtained in this study was used to answer the following research questions.

Research Question One

Research question one stated "What are the characteristics that technology education faculty, guidance counselors, administrators, mathematics faculty, and science faculty in Oklahoma identify with technology education?"

The analysis of the data indicates that the Oklahoma technology education faculty's perceptions are in agreement with the characteristics of technology education identified through the review of literature. The Oklahoma guidance counselors, administrators, mathematics faculty, and science faculty's perceptions are also in agreement with the characteristics of technology education identified through the review of literature.

In a national study similar to this study, Daugherty (1991) found that the national technology education teachers' perceptions agreed with the technology education characteristics identified through the review of literature. This indicated that a similarity may exist between the perceptions of the characteristics of technology education by Oklahoma technology education faculty and the nationally identified technology education faculty.

Daugherty's national study also found that the science and mathematics teachers were in agreement with the characteristics of technology education identified through the review of literature. The same outcome exists with the Oklahoma mathematics and science faculty.

To get a better picture of the identified perceptions by the Oklahoma technology education faculty, guidance counselors, administrators, mathematics faculty, and science faculty, a look at the characteristic sections, methodology, content, and integration, was necessary. Within the section, methodological characteristics of technology education, the Oklahoma technology education faculty's perceptions strongly agree with three characteristics. These characteristics include: (a) "Technology education emphasizes problem solving"; (b) "Cooperative learning and small group interaction is encouraged in technology education"; and (c) "Technology education provides activity-oriented laboratory instruction that reinforces abstract concepts with concrete experiences." These same characteristics are also emphasized as the major practical implications for the study of technology by the Oklahoma Curriculum Committee and throughout the literature in the technology education profession.

The other four groups' perceptions do not strongly agree with any of the methodological characteristics. The administrators' perceptions agree that exploratory activities, cooperative learning, and activity oriented laboratory instruction are characteristic of technology education in Oklahoma. The guidance counselors' perceptions also agree that providing exploratory activities are characteristic of technology education in Oklahoma.

The Oklahoma mathematics faculty does not perceive technology education as a discipline in which student cognitive strategies have clearly been developed. The science faculty does not perceive technology education as a discipline which emphasizes verbal activity and a discipline where lessons are hypothesis driven. The mathematics and science teachers' perceptions in Daugherty's national study were also in disagreement with these same three characteristics, indicating a similarity between the Oklahoma mathematics and science faculty and the national science and mathematics teachers perceptions on these characteristics.

Within the content characteristics of technology education section, the technology education faculty in Oklahoma strongly perceived that the technology education curriculum content allows for the application of tools, materials, machines, processes, and technical concepts and aids in the development of student problem solving and decision making skills. The Oklahoma technology education faculty, guidance counselors, administrators, mathematics faculty, and science faculty's perceptions indicate a disagreement in that a portion of the instructional content is based on using biological organisms to make or modify products as being characteristic of technology education in Oklahoma.

The Oklahoma participant's perceptions about the teaching of biological systems were similar and also different from the national study by Daugherty. The national study indicated that the national mathematics and science teachers did not perceive that the study of biological systems were characteristic of the technololgy education content. This disagreement is similar to the Oklahoma's mathematics and science faculty's disagreement about the study of biological systems within the technology education program. However, Daugherty's study indicated that the exemplary technology education teachers' perception was in agreement that biological systems should be part of the curriculum content, while the technology education faculty in Oklahoma disagreed.

The Oklahoma technology education faculty's perceptions that the study of biological systems is not characteristic of the technology education program, does not follow the learner outcomes listed by the Oklahoma Curriculum Committee. The learner outcomes for technology education in Oklahoma lists bio-technology as a part of the curriculum content to allow students to become more aware of different career opportunities available to them.

This disagreement by technology education faculty in Oklahoma can possibly be explained by looking through the literature and Oklahoma's implementation plan for technology education. In the curriculum implementation plan, biological systems are viewed only as an additional option. The main systems are communications, construction, manufacturing, and energy, power, and transportation. Also, throughout the review of literature, whenever technology education was talked about in terms of applying science concepts in the curriculum, the literature usually talked about the physical sciences, physics and chemistry.

The Oklahoma mathematics faculty does not perceive that the content of technology education is based on knowledge about the development of technology and its effect on people, the environment, and culture. This was the same outcome obtained in Daugherty's national study.

Within the section, the need to integrate mathematics, science, and technology eduction, the perceptions of all the groups, Oklahoma technology education faculty, guidance counselors, administrators, mathematics faculty, and science faculty, agree that technology education provides an avenue for applying concepts learned in mathematics and science. All the other groups also agree that technology education should be available to all students who enroll in mathematics and science.

The technology education faculty, guidance counselors, administrators, mathematics faculty, and science faculty also agree technology education should be characterized as an applied science. The review of literature indicates that technology education needs to be treated as a field of study with its own knowledge base, distinct from science. Technology education content and laboratories show the areas where mathematics and science concepts form a relationship with technological knowledge. However, technology is distinguished from science by making clear the differing purposes each serves.

The Oklahoma technology education faculty, guidance counselors, administrators, mathematics faculty, and science faculty also agree that actions should be taken to improve stereotypical perceptions of technology education. These actions include: (a) "Technololgy education teachers should form interdisciplinary committees to develop integration strategies"; (b) "Technology education programs should continue to revise curriculum strategies to more accurately reflect mathematics and science concepts"; (c) "Technology education professionals should make presentations at state and national mathematics and science conferences addressing the need to integrate mathematics, science, and technology education"; (d) "Technology education professionals should conduct research to determine the integration needs of mathematics and science teachers"; and (e) "Technology education should develop strategies for overcoming stereotypical perceptions often held by administrators, counselors, and secondary education faculty members".

Research Question Two

Research question two states "Is there a statistically significant difference between the perceptions of technology education faculty and the perceptions held by guidance counselors, administrators, mathematics faculty, and science faculty in Oklahoma?"

An analysis of the data reveals that a statistically significant difference exists between the perceptions of the technology education faculty and that of the guidance counselors, administrators, mathematics faculty, and science faculty. A closer view of the significant differences in perceptions concerning the characteristics of technololgy education reveals some interesting results.

A statistically significant difference exists between the technology education faculty's perceptions and the guidance counselors, administrators, mathematics and science faculty's perceptions concerning several methodological characteristics. The statistically significant differences exist between the groups perceived characteristics that technology education places an emphasizes on problem solving, verbal activity, and activity-oriented laboratory instruction, while throughout the review of literature, problem solving, verbal activity, and activity-oriented laboratory instruction are indicated as major parts of the technology education program.

The analysis of variance and the Tukey HSD tests also reveal that a statistically significant difference exists between the technology education faculty and the guidance counselors, mathematics faculty, and science faculty's perceptions on several other characteristics of technology education. The statistically significant differences between these groups exist on the perceived characteristics:

(a) cooperative learning is encouraged, (b) cognitive strategies have been developed, (c) interdisciplinary activities emphasized, and (d) a broad range of assessment strategies have been utilized in technology education. A statistically significant difference also exists between the science faculty and technology education faculty's perceptions that the lessons in technology education are hypothesis driven.

The ANOVA test indicated that the groups' perceptions on two characteristic statements were not significant. The lack of a statistically significant difference between all of the groups' perceptions on the characteristic statements (a) technology education provides exploratory activities, and (b) the instruction is goal oriented, indicate that the groups' perceptions are similar.

Also within this section, methodological characteristics of technology education, the technology education faculty's perceptions of the technology education are more closely aligned with the administrators' perceptions than the perceptions of the guidance counselors, mathematics faculty, and science faculty.

The next section, content characteristics of technology education, was analyzed to determine if a statistically significant difference existed between the groups perceptions. The analysis of variance and Tukey HSD tests indicate that there is a statistically significant difference between the technology education faculty's perceptions and the guidance counselors, administrators, mathematics faculty, and science faculty's perceptions concerning several content characteristic of technology education.

A statistically significant difference exists between the technology education faculty and the other groups' perceptions that the content characteristics of technology education are based upon the study of transportation, production technology, communication, and the development of problem solving skills. These statistically significant differences indicate that the level of agreement with these content characteristics are not identical. This is interesting since the Oklahoma technology education's curriculum shows that the content is mainly focused on the technological systems, communications, construction, manufacturing (production), and transportation and the development of problem solving skills.

The results of the analysis of variance and the Tukey HSD tests also indicate that there is a statistically significant difference between the technology education faculty's perceptions and the mathematics and science faculty's perceptions of two content characteristics. These the content characteristics of technology education are (a) based on an organized set of concepts, processes, and systems that are uniquely technological, and (b) helps prepare students for lifelong learning in a technological society.

Another statistically significant difference exists between the technology education faculty and the science faculty's perceptions that the technology education program utilizes mathematics and science skills to perform tasks and is an asset to the students to enable them to see the connections between scientific and mathematics skills and its application to technology. However, the technology education faculty's perceptions are closely aligned with the guidance counselors, administrators, and mathematics faculty's perceptions on these two characteristics.

The Oklahoma technology education learner outcomes state that the students who complete the Oklahoma technology education program will appreciate the importance of technology and understand the impact technology has on the environment and society. However, a statistically significant difference exists between several of the groups' perceptions that the technology education content is based on the development of technology and its effect on people, its environment and culture. This statistically significant difference indicates that the technology education faculty's perceptions are not aligned with the perceptions of the administrators, mathematics faculty, and science faculty. However, the lack of a statistically significant difference exists between the technology education faculty and the guidance counselors' perceptions. This indicates that the technology education faculty's perceptions are aligned with the guidance counselors' perceptions that the technology education content is based on the development of technology.

The administrators and technology education faculty's perceptions are at the same level of agreement on two content characteristics. These characteristics are: (a) "The technology education curriculum assists students in developing insight, understanding, and application of technological concepts, processes, and technical concepts", and (b) "The technology education curriculum aids in the development of student skills, creative abilities, positive self-concepts, and individual potential technology". However, a statistically significant difference exists between the technology education faculty and the guidance counselors, mathematics faculty, and science faculty's perceptions of these same two characteristics.

Also within this section, content characteristics, the Tukey HSD tests illustrate that the technology education faculty's perceptions are more aligned with the administrators' perceptions than with the perceptions of the guidance counselors, mathematics faculty, and science faculty.

The section, the need to integrate mathematics, science, and technology education, reveals that a statistically significant difference exists between the perceptions of the technology education faculty and the other groups' perceptions on the integration characteristics. The results of the analysis of variance and the Tukey HSD tests indicate that there is a statistically significant difference between the technology education and administrators' perceptions that technology education should be available to all students who enroll in math and science. However, a statistically significant difference does not exist between the other groups' perceptions and technology education faculty's perceptions of the characteristic listed above.

A statistically significant difference also exists between the technology education faculty's perceptions and the guidance counselors' perceptions that technology education provides an avenue for applying concepts learned in mathematics and science. However, the administrators, mathematics faculty and science faculty's perceptions are aligned with the technology education faculty's perceptions.

The findings reveal that a statistically significant difference exists between the technology education faculty's perceptions and the administrators and science faculty's perceptions that the technology education curriculum reflects industry and technology. A significant difference also exists between the technology education faculty's perceptions and the guidance counselors, mathematics faculty, and science faculty's perceptions that technology education was guided by the technological literacy needs of the students. This indicates that the technology education faculty's perceptions are not aligned with the perceptions of the guidance counselors, mathematics faculty, and science faculty on this characteristic of technology education.

Within the section, actions the technology education professionals should take to overcome stereotypical perceptions, the level of agreement with the perceived actions indicates that a statistically significant difference does not exist between the technology education faculty and the other groups on most of the action characteristics. The groups aligned perceptions indicate that the actions should include: (a) form interdisciplinary committees to develop integration strategies, (b) revise curriculum strategies to reflect mathematics and science concepts, (c) make presentations at national conferences, and (d) conduct research on integration.

A statistically significant difference does exists between the perceptions of the technology education faculty and the administrators on the need to develop strategies for overcoming stereotypical perceptions. However, a statistically significant difference does not exist between the perceptions of the technology education faculty and the guidance counselors, mathematics faculty, and science faculty on the need to develop strategies for overcoming stereotypical perceptions.

Conclusions

Based on the findings in this study, the following conclusions were made:

1. The Oklahoma technology education faculty agree with the identified characteristics of technology education.

2. The Oklahoma guidance counselors, administrators, mathematics faculty and science faculty's perceptions agree with the identified characteristics of technology education.

3. The study of biological systems is perceived as not being characteristic of the Oklahoma technology education program.

4. All of the groups agree that technology education provides the means through which mathematics and science can be applied, and this should be characteristic of the technology education programs in Oklahoma.

5. Technology education faculty's perceptions concerning the characteristics of technology education in Oklahoma are closely aligned with the administrators' perceptions.

6. Technology education faculty's perceptions concerning the characteristics of technology education in Oklahoma are not closely aligned with the perceptions of the guidance counselors, mathematics faculty, and science faculty.

Recommendations

Based on the results and conclusions of this study, the following recommendations are suggested:

1. Oklahoma technology education professionals should develop strategies to overcome stereotypical perceptions often held by guidance counselors, administrators, and secondary education faculty.

2. Strategies should be developed by the technology education discipline in Oklahoma to align the perceptions of the people outside the technology education profession with the perceptions of the technology education faculty.

3. Workshops and presentations should be developed to provide the technology education faculty the tools and knowledge of how the study of biological systems can take place within the realm of the technology education laboratory.

4. Interdisciplinary committees consisting of mathematics teachers, physical and natural science teachers, and technology education teachers should be formed to develop appropriate integration strategies to meet the needs of the students, and also to accurately reflect mathematics and science concepts within the technology education curriculum.

Recommendations for Further Research

Based on the results and conclusions of this study, the following recommendations for further research are suggested:

1. Research should be conducted to see if additional training is needed by the technology education faculty in Oklahoma, so they will have the correct tools and knowledge to meet the technological literacy needs of the students in an interdisciplinary environment.

2. Research should be conducted investigating whether the technology education profession in Oklahoma is providing the necessary instruction and activities to meet the requirements in the recommended learner outcomes set by the Oklahoma Curriculum Committee.

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APPENDIXES

APPENDIX A

DAUGHERTY'S QUESTIONNAIRE

CHARACTERISTICS OF TECHNOLOGY EDUCATION SURVEY

The purpose of this research is to determine the perceived characteristics of technology education as discerned by teachers of technology education, as well as teachers of mathematics and science.

DIRECTIONS: Please answer the following questions by circling or providing the appropriate answer/response to each statement.

1. Indicate your age (circle one).	21-30	31-40	41-50	Over 50
2. Indicate the number of years you have been employed with this school (circle one).	1-3	4-8	9-15	Over 15
3. Indicate the total number of years you have been employed in the educational arena (circle one).	1-3	4-8	9-15	Over 15
4. Indicate the highest level of education which you have achieved (circle one).	BS/BA	MS/MA	Ed D/Ph D	Other
5. Indicate your predominant area of affiliation (circle one).	Technology Education	Mathematics	Science	

PART II: The following questions relate to your perception of the teaching methods used in technology education.

1. Strongly disagree	(conflicts radically with my perception)
2. Disagree	(statement is inconsistant with my perception)
3. No opinion	(no perception of this issue)
4. Agree	(statement agrees with my perception)
5. Strongly agree	(exemplifies my perception)

6. Technology education emphasizes problem solving.	1	2	3	4	5
7. Technology education provides exploratory activities that include modeling, graphing, and production.	1	2	3	4	5
8. Technology education instruction is goal oriented.	1	2	3	4	5
9. Cooperative learning and small group interaction is encouraged in technology education.	1	2	3	4	5
10. Verbal activity is emphasized in technology education.	1	2	3	4	5
11. Student cognitive strategies have clearly been developed.	1	2	3	4	5
12. Technology education emphasizes interdisciplinary activities.	1	2	3	4	5
13. A broad range of assessment strategies (design porfolios, project work, performance testing) are used in technology education.	1	2	3	4	5
14. Technology education lessons are hypothesis driven.	1	2	3	4	5
15. Technology education provides activity-oriented laboratory instruction that reinforces abstract concepts with concrete experiences.	1	2	3	4	5

PART III: The following questions relate to your perception of the content characteristics in technology education.

16. Technology education content is based on an organized set of concepts, processes, and systems that are uniquely technological.	1	2	3	4	5
17. Technology education content is based on knowledge about the development of technology and its effect on people, the environment, and culture.	1	2	3	4	5
18. A portion of the technology education instructional content is based on using biological organisms to make or modify products.	1	2	3	4	5
19. A portion of the technology education instructional content is based on using resources to transfer information, and communication.	1	2	3	4	5
20. A portion of the technology education instructional content is based on combining and modifying resources in standard stocks, goods, and structures (production).	1	2	3	4	5
21. A portion of the technology education instructional content is based on the study of transportation systems.	1	2	3	4	5
22. The technology education curriculum assists students in developing insight, understanding, and application, of technological concepts, processes, and systems.	1	2	3	4	5
23. The technology education curriculum allows for the application of tools, materials, machines, processes, and technical concepts.	1	2	3	4	5

24. The technology education curriculum aids in the development of student skills, creative abilities, positive self-concepts, and individual potential in technology.	1	2	3	4	5
25. The technology education curriculum aids in the development of student problem solving and decision making skills.	1	2	3	4	5
26. Technology education helps prepare students for lifelong learning in a technological society.	1	2	3	4	5
27. Students in technology education use math and science skills to perform tasks in technology education.	1	2	3	4	5
28. The technology education teacher assists students to see the connection between scientific and math skills and its application to technology.	1	2	3	4	5

PART IV: The following questions relate to your perception of the need to integrate math, science, and technology education.

29. Technology education provides an avenue for applying concepts learned in math and science.	1	2	3	4	5
30. Technology education should be available to all students who enroll in math and science.	1	2	3	4	5
31. Technology education is an applied science.	1	2	3	4	5
32. The technology education curriculum reflects industry and technology.	1	2	3	4	5
33. Technology education is guided by the technological literacy needs of students.	1	2	3	4	5

PART V: The following questions relate to actions that the technology education profession can take to improve perceptions of the field.

34. Technology education teachers should form interdisciplinary committees to develop integration strategies.	1	2	3	4	5
35. Technology education programs should continue to revise curriculum strategies to more accurately reflect mathematics and science concepts.	1	2	3	4	5
36. Leaders in the technology education profession should make presentations at state and national mathematics and science conferences addressing the need to integrate.	1	2	3	4	5
37. Technology education professionals should conduct research to ascertain the integration needs of math and science teachers.	1	2	3	4	5
38. The technology education discipline should develop strategies for overcoming stereo-typical perceptions often held by administrators and secondary education faculty members.	1	2	3	4	5

Return to: Michael Daugherty
102B IND BLDG
Oklahoma State University
Stillwater, OK 74078

APPENDIX B

QUESTIONNAIRE

CHARACTERISTICS OF TECHNOLOGY EDUCATION IN OKLAHOMA

The purpose of this research is to determine the perceived characteristics of technology education as discerned by teachers of technology education, mathematics, and science, as well as Administrators and Guidance Counselors in Oklahoma.

DIRECTIONS: Please answer the following questions by circling the appropriate answer/response to each statement.

1. Indicate your age. 21-30 31-40 41-50 over 50

2. Indicate the number of years you have been employed with this school. 1-3 4-8 9-15 over 15

3. Indicate the total number of years you have been employed in your specific educational area. 1-3 4-8 9-15 over 15

4. Indicate the highest level of education which you have achieved. BS/BA MS/MA EdD/PhD other

5. Indicate your predominant area of affiliation. Counseling Tech Ed Math Science Admin.

PART II: The following questions relate to your perception of the teaching methods used in technology education.

1. Strongly Disagree	(conflicts radically with my perception)
2. Disagree	(statement is inconsistent with my perception)
3. No Opinion	(no perception of this issue)
4. Agree	(statement agrees with my perception)
5. Strongly Agree	(exemplifies my perception)

6. Technology education emphasizes problem solving. 1 2 3 4 5

7. Technology education provides exploratory activities that include modeling, graphing, and production. 1 2 3 4 5

8. Technology education instruction is goal oriented. 1 2 3 4 5

9. Cooperative learning and small group interaction is encouraged in technology education. 1 2 3 4 5

10. Verbal activity is emphasized in technology education. 1 2 3 4 5

11. Student cognitive strategies have clearly been developed. 1 2 3 4 5

12. Technology education emphasizes interdisciplinary activities. 1 2 3 4 5

13. A broad range of assessment strategies (design portfolios, project work, performance testing) are used in technology education. 1 2 3 4 5

14. Technology education lessons are hypothesis driven. 1 2 3 4 5

15. Technology education provides activity-oriented laboratory instruction that reinforces abstract concepts with concrete experiences. 1 2 3 4 5

PART III: The following questions relate to your perception of the content characteristics in technology education.

16. Technology education content is based on an organized set of concepts, processes, and systems that are uniquely technological. 1 2 3 4 5

17. Technology education content is based on knowledge about the development of technology and its effect on people, the environment, and culture. 1 2 3 4 5

18. A portion of the technology education instructional content is based on using biological organisms to make or modify products. 1 2 3 4 5

19. A portion of the technology education instructional content is based on using resources to transfer information and communication. 1 2 3 4 5

20. A portion of the technology education instructional content is based on combining and modifying resources in standard stocks, goods, and structures (production). 1 2 3 4 5

21. A portion of the technology education instructional content is based on the study of transportation systems. 1 2 3 4 5

22. The technology education curriculum assists students in developing insight, understanding, and application of technological concepts, processes, and systems. 1 2 3 4 5

23. The technology education curriculum allows for the application of tools, materials, machines, processes, and technical concepts. 1 2 3 4 5

24. The technology education curriculum aids in the development of student skills, creative abilities, positive self-concepts, and individual potential in technology. 1 2 3 4 5

25. The technology education curriculum aids in the development of student problem solving and decision making skills. 1 2 3 4 5

26. Technology education helps prepare students for lifelong learning in a technological society. 1 2 3 4 5

27. Students in technology education use math and science skills to perform tasks in technology education. 1 2 3 4 5

28. The technology education teacher assists students to see the connection between scientific and math skills and its application to technology. 1 2 3 4 5

PART IV: The following questions relate to your perception of the need to integrate math, science, and technology education.

29. Technology education provides an avenue for applying concepts learned in math and science. 1 2 3 4 5

30. Technology education should be available to all students who enroll in math and science. 1 2 3 4 5

31. Technology education is an applied science. 1 2 3 4 5

32. The technology education curriculum reflects industry and technology. 1 2 3 4 5

33. Technology education is guided by the technological literacy needs of students. 1 2 3 4 5

PART V: The following questions relate to actions that the technology education profession can take to improve perceptions of the field.

34. Technology education teachers should form interdisciplinary committees to develop integration strategies. 1 2 3 4 5

35. Technology education programs should continue to revise curriculum strategies to more accurately reflect mathematics and science concepts. 1 2 3 4 5

36. Leaders in the technology education profession should make presentations at state and national mathematics and science conferences addressing the need to integrate. 1 2 3 4 5

37. Technology education professionals should conduct research to ascertain the integration needs of math and science teachers. 1 2 3 4 5

38. The technology education discipline should develop strategies for overcoming stereo-typical perceptions often held by administrators, counselors, and secondary education faculty members. 1 2 3 4 5

APPENDIX C

COVER LETTER

votech
OKLAHOMA DEPARTMENT
OF VOCATIONAL
AND TECHNICAL EDUCATION

April 15, 1992

Dear Educator,

Technology is becoming increasingly important in today's society. Students who do not understand the processes and uses of technology will have a difficult time succeeding in the job market. Technology Education classes are designed to introduce students to the field of technology. I am interested in your thoughts on these classes. As I am surveying a limited number of persons, your input is especially important.

You may be assured of complete confidentiality. The questionnaire has an identification number for mailing purposes only. This is so that I may check your name off of the mailing list when your questionnaire is returned. Your name will never be placed on the questionnaire.

The results from this study will help determine the current attitudes of mathematics, science, and technology education teachers, as well as administrators and guidance counselors relating to the role of technology education in the educational setting. Your help in this effort by answering the enclosed questionnaire will provide the necessary data, which may help the technology education profession develop strategies and procedures for the improvement of the educational system in Oklahoma. Results of this research will be available upon request. However, to ensure complete anonymity, you are asked not to write your name or the name of your school on the questionnaire.

Please take a few minutes to contribute to this study by completing the survey and returning it in the enclosed postage paid envelope by **April 29, 1992.**

I would be very happy to answer any questions you might have. Please write or call. My telephone number is (405) 628-2581.

Thank you for your time and consideration.

Sincerely,

Brian Box
Research Coordinator
Northern Oklahoma College

Approved by:

Dr. Gary Oakley
Occupational and Adult Education
Oklahoma State University

1500 West Seventh Avenue
Stillwater, OK 74074-4364
(405) 377-2000

APPENDIX D

POST CARD

votech
OKLAHOMA DEPARTMENT
OF VOCATIONAL
AND TECHNICAL EDUCATION

Nonprofit Org.
U.S. POSTAGE
PAID
Stillwater, Okla.
Permit No. 244

Dear Educator:
Two weeks ago a questionnaire concerning Technology Education was mailed to you. Your response to this is vitally important for assessing the perceptions of the characteristics of Technology Education in Oklahoma.

If you have already completed and returned the questionnaire, please accept my sincere thanks. If not, please do so by May 15, 1992.

Sincerely,

Brian Box

APPENDIX E

FOLLOW UP LETTER

votech
OKLAHOMA DEPARTMENT
OF VOCATIONAL
AND TECHNICAL EDUCATION

May 14, 1992

Dear Educator,

Recently, you should have received a letter from me, asking for your personal opinion regarding the role of technology education in the educational setting in Oklahoma. As of today, I have not yet received a completed questionnaire from you.

I am writing to you again because of the significance each response has to the usefulness of this study. The results from this study will help determine the current perception of mathematics, science, and technology education teachers, as well as administrators and guidance counselors relating to the characteristics of technology education. This data may help the educational system in Oklahoma develop procedures for improvement in the future.

You may be assured of complete confidentiality. The questionnaire has an identification number for mailing purposes only. This is so that I may check your name off of the mailing list when your questionnaire is returned. Your name will never be placed on the questionnaire.

I know this is a very busy time for all educators, but please take a few moments and complete the survey and return it in the enclosed postage paid envelope by **May 27, 1992.**

I would be very happy to answer any questions you might have. Please write or call. My telephone number is (405) 628-2581.

Thank you for your time and consideration.

Sincerely,

Brian Box
Research Coordinator
Northern Oklahoma College

Approved by:

Dr. Gary Oakley
Occupational and Adult Education
Oklahoma State University

1500 West Seventh Avenue
Stillwater, OK 74074-4364
(405) 377-2000

V

VITA

Brian W. Box

Candidate for the Degree of

Master of Science

Thesis: PERCEPTIONS OF SELECTED CHARACTERISTICS OF TECHNOLOGY EDUCATION IN OKLAHOMA

Major Field: Technology Education

Biographical:

Personal Data: Born in Clinton, Oklahoma, February 15, 1965, the son of Galen L. and Sharon K. Box; married Luanna D. Young, March 13, 1993.

Education: Graduated from Fairview High School, Fairview, Oklahoma, in May 1983; received Bachelor of Science Degree in Education and a Bachelor of Science Degree in Mathematics from Southwestern Oklahoma State University, Weatherford, Oklahoma, in May 1988; completed requirements for the Master of Science Degree at Oklahoma State University in December, 1993.

Professional Experience: Teaching Assistant, Department of Mathematics, Oklahoma State University, Stillwater, Oklahoma, August, 1988, to December, 1988; Research Assistant, School of Occupational and Adult Education, Oklahoma State University, Stillwater, Oklahoma, January, 1989, to August, 1989; Physics and Mathematics Instructor, Department of Science and Engineering, Northern Oklahoma College, Tonkawa, Oklahoma, August, 1989, to present.

Professional Organizations: American Association of Physics Teachers, Oklahoma Association of Community Colleges.