A DESCRIPTIVE STUDY OF WAYS HIGH TECHNOLOGY
INDUSTRIES' TRAINING NEEDS CAN BE MET
THROUGH OKLAHOMA VOCATIONAL AND
TECHNICAL SCHOOLS

Thesis Approved:

Clyde B. Knight
Thesis Adviser

Linda M. Vincent

Wayne B. James

James P. Key

H. Dean Smith

Norman N. Durham
Dean of the Graduate College

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CHAPTER I

INTRODUCTION

Today's society is changing from industrialization to an era called "high technology" (Hull, 1982). High technology industries compete in the international market with other countries where the competition is intense. To achieve this purpose, the industries improve their productivity and reduce costs, therefore, the efficiency and effectiveness of these organizations are increased.

Industries adapted high technology and became automated in order to increase their productivity, reduce costs, and compete in the world market. This would creat a need for trained, skilled workers who understand the system and can maintain, operate and service the state-of-the-art equipment. According to Aton et al. (1982), the Labor Department projected a national increase of 7.1 million jobs and $402 billion in sales for the next two decades. This leaves high technology industries with a need for trained, skilled workers and technicians. This training need creates a challenge for Vocational and Technical education to provide high technology industries with a trained work force to meet their new job skill requirements.

According to Aton et al. (1982), the Vocational and Technical schools move quickly and carefully toward satisfying these needs and meeting the challenge. Schools should provide new curricula, improve facilities and equipment, hire new instructors and retrain the present ones, and redesign the laboratories in order to train and turn out graduates with saleable skills and broad knowledge bases. According to Aton et al. (1982), the implementation of high technology programs with the state-of-the-art equipment and new curricula may be the greatest challenge for Vocational and Technical schools to train and retrain future workers and to satisfy the training demand of high technology industries. This study focused on the discovery of high technology industry's training needs and how Vocational and Technical schools are going to meet these needs.

According to Carlson and Walling (1982), in order to improve productivity and reduce costs, high technology devices are used in industry. With the help of computers, robots, laser electro-optics, and micro-electronics, automation is achieved,and these automated machines are replacing workers in many types of jobs. High technology industries are looking for trained skilled workers and technicians in order to service and maintain new technology devices. A shortage of technicians with a broad knowledge base and an understanding of electronics and computers has been created. Thus, high technology is changing the role of workers drastically. Some workers who are obsolete in terms of job skills and knowledge need retraining for the new vocations in automated industries.

Statement of the Problem

Currently, no information is available concerning high technology industries training needs in Oklahoma or how Vocational and Technical schools are planning to meet these needs.

Purpose of Research

The purpose of this research was to identify the perceived high technology industry training needs in Oklahoma and the ability of Vocational and Technical schools to meet these needs. Specifically what are the present needs of high technology in Oklahoma, and what are the Vocational and Technical schools doing about it?

Research Questions

This study sought to answer the following questions:

1. Will existing programs in Vocational and Technical schools be changed to high technology programs?

2. Will some existing programs in Vocational and Technical schools be phased out in order to phase in high technology programs?

3. What are the problems for implementation of high technology programs in Vocational and Technical schools in Oklahoma?

4. What method of instruction is preferred, and how effective would the chosen method be to implement the high technology programs?

5. What kinds of programs are offered in Vocational and Technical schools in Oklahoma that are geared toward high technology employment?

6. What changes are required to upgrade high technology programs to state-of-the-art equivalent?

7. What kind of jobs will be available in Oklahoma in the next two decades and beyond?

8. What kind of skills and training will be needed to perform those indicated jobs?

Basic Assumptions

For the purpose of this research, the following assumptions were accepted:

1. The questionnaire developed by Aton et al. (1982) for Georgia is valid and reliable.

2. The instruments provided the necessary information for this study.

Scope and Limitations

This study was limited to the Vocational and Technical schools and a sample population of high technology industries in Oklahoma. One of the instruments used to obtain the data was developed by Aton et al. (1982), and was mailed to all the superintendents of area vocational and technical schools in Oklahoma. Another similar questionnaire was designed and mailed to the sample population of high technology industries in Oklahoma.

Definitions

These terms were used in the study:

Area Vocational and Technical School (AVTS): A vocational school established in a specific geographic district to provide training programs in Vocational and Technical education for those students of participating high schools and for adults within that district (State Department of Vocational and Technical Education, 1980).

Area Vocational and Technical School Superintendent: The chief Administrator who coordinates and directs the operation of an Vocational and Technical school, and coordinates the activities of the school system in accordance with school board standards.

Avionics: Aton et al. (1982) defined the term as follows:

> A hybrid from the combination of "aviation" and "electronics". Avionics is the science and technology of the use of electrical and electronic devices in aviation, this technology includes guidance logic, electronic warfare, electronic aids to navigation, take off and landing instrumentation, and surveillance (p. 26).

Biotechnology: According to Aton et al. (1982, p. 31), Biotechnology includes "genetic engineering (modifying of organisms), bio-engineering (artificial body parts), and electronic medical equipment."

Chief Executive Officer: The highest ranking officer in charge of the operation and coordination of activities in a high technology industry.

Communications: Aton et al. (1982, p. 24), indicates that communications includes "satellites; terrestial services such as cable television, telecommunications, teleconferencing, and electronic mail, and related fiber optic technology".

Computer Manufacturing: According to Aton et al. (1982, p. 20), computer manufacturing includes "main frame, mini-and micro-computers, peripheral computer equipment, and copiers".

Computer Services: Aton et al. (1982, p. 16), defines computer service as "an area which can be divided into the following three segments: processing service, professional services, and software products".

High Technology: New machinery utilizing computers, robots, and electronics in order to improve productivity and increase efficiency.

High Technology Industry: Industry involved in the production, operation, service, maintenance, and sale of new machinery which is operated mainly by computers, electronics, and robots.

Laser: According to Dorak and Rice (1982, p. 1),

a laser is a device which could produce a concentrated beam of intense monochromatic light. The device produces light by a means of a process called laser, an acronym for light amplication by stimulated emission of radiation.

Optical Fibers: Gunderson and Keck (1983, p. 32-44) define an an optical fiber as

a thread of purest glass five thousandths of an inch in diameter, about the size of a human hair, through which laser light of high purity and intensity can be transmitted. It is used for transmitting information from place to place.

Robots: According to Zemke (1983, p. 18-31), a robot is

A programmable, multifunctional device, designed to both manipulate and transport tools, parts or special manufacturing implements through variable programmed paths for the performance of specific manufacturing tasks.

Solar Energy: Aton et al. (1982, p. 34) defined solar energy as consisting of

two principal techniques, photovoltaic and solar thermal, by which radiant energy from the sun may be collected, converted, stored, and used in a wide variety of practical applications.

CHAPTER II

REVIEW OF LITERATURE

The review of literature covered the broad picture of the high technology field with eight areas reviewed and described in detail as follows: (1) industrial automation, (2) high technology characteristics and change, (3) high technology's effect on economy and employment, (4) high technology industries' training needs, (5) Vocational and Technical education and high technology, (6) training for high technology, (7) meeting high technology's challenge, and (8) coping with the world of high technology.

Industrial Automotation

Carlson and Walling (1982) indicate that the years 1980-2000 are going to be surprising since many jobs are going to be created. Workers are going to be displaced due to the use of computers and robots as high technology industries become automated. Industrial automation is achieved by computer-aided manufacturing (CAM) and robots which displace many workers from manufacturing jobs. Automation is further classified as "Sensors, computer aided design (CAD), industrial robots, factory automation, and artificial intelligence expert systems" (p. 7).

High technology industries started to become automated by the 1980s which in turn affected employment, prices, and products. There should also be a significant effect in the 1990s. Depending on the kind of industry, the rate of displacement will vary for workers. This change is mainly expected to affect the automobile and office equipment manufacturing. Automation will also probably affect employment in more mature industries as it causes a price reduction and produces new products (Carlson and Walling, 1982).

According to Aton et al., (1982), the effect of automation on manufacturing is going to be significant during the period from 1980 to 2000. Aton further indicated that a study conducted by Carnegie-Mellon University indicates seven million industrial employees and thirty-eight million office employees have been affected by automation during this period. Table I is the description of jobs in the United States (U.S.) that will be directly affected by automation from 1980-2000.

The development of robots and computers had the greatest impact on manufacturing. The robots or automated machines eliminated the boring, repetitive and dangerous tasks. Automation also would replaced some production workers who needed to be retrained and used in a variety of other new jobs (Aton, Hodges, Tarpley, Thomas, and Wyvill, 1982).

High technology will create some new jobs and eliminate some old occupations. This change due to automation mainly affects the following jobs: bank tellers, secretaries, stenographers, assembly workers, key punch operators, and retail sales clerks (Carlson and Warling, 1982).

According to Aton et al. (1982), robots and computers are the heart of automation. The minicomputer has helped to decentralize the control and extreme growth in high technology automation. Currently, it is estimated that 3,000 robots are in operation in this country, with 500 of these being used in the automobile industry, mainly in assembly lines.

Robots and computers are the tools of automation in high technology

TABLE I

JOBS IN THE U.S. THAT WILL BE DIRECTLY
AFFECTED BY AUTOMATION
1980-2000

Industrial		Office	
Assemblers	1,289,000	Managers	9,000,000
Checkers, Examiners, Inspectors, Testers	746,000	Secretaries and Support Workers	14,000,000
Production Painters	185,000	Clerks	5,000,000
Welders, Flame Cutters	713,000	Other Professionals	10,000,000
Packagers	626,000		
Machine Operatives	2,385,000		
Other Skilled Workers	1,043,000	Total	38,000,000
Total	6,987,000		

Source: "The Impacts of Robotics on the Workforce and Workplace." School of Urban and Public Affairs, Department of Engineering and Public Policy (Carnegie Institute of Technology), Department of Humanities and Social Sciences, Pittsburg, Pa.: Carnegie-Mellon University, 1981.

industries. Robots help industries to become automated, increase productivity, reduce costs and, as a result, will replace some workers.

An annual rate of 35 percent in robot sales is forecasted, a rate which can be quadruppled by 1985. It has been estimated that the sale of robots will reach two to four billion by 1990. Japan is the leading country to use robots, with 10,000 machines in use, followed by the United States with 3,000, and West Germany with 850 (Abram, Ashley, Faddis, and Wiant, 1982).

As time passes, robots get more sophisticated and complex, the sales price declines, and high technology industries can afford to use these automated machines and be more compatible with other industries. According to Abram et al. (1982), the following forecast has been made:

> By 1982, five percent of all assembly systems will use robotic technology.
> By 1985, 20 percent of the labor in the final assembly of autos will be replaced by automation.
> By 1987, 15 percent of all assembly systems will use robot technology.
> By 1998, 50 percent of the labor in small component assembly will be replaced by automation.
> By 1990, the development of sensory techniques will enable robots to approximate human capability in assembly (p. 20).

The use of robots and computers in high technology industries is increasing every day. The Robotic Institute of the Society for Manufacturing Engineers estimates that there will be 15,000 robots in use in the United States by 1985, and between 75,000 and 100,000 by 1990. Officials of Cincinnati Milacron and the Robotics Institute estimate that presently five robots can be operated by one technician. Based on this estimate, 3,000 technicians will be needed nationally to service robots by 1985, and between 15,000 -20,000 will be needed by 1990 (Aton et al., 1982).

According to Aton et al. (1982), as industries move to high technology by upgrading traditional systems through installation of computers and robots, there will be a need for skilled and trained employees. To achieve this goal previous employees should be retrained, and new entrants must be trained. Maintenance personnel are required to have diagnostic skills in order to be able to identify the problem, fix the part, and put the system back on line.

High technology and automation go through changes every few years. This will require a lot of training and retraining which Vocational and Technical education can support.

High Technology Characteristics and Change

It is impossible to list or describe all the characteristics of high technology. According to Hull (1982), the principle characteristics are indicated as: "(1) broad knowledge base, (2) heavy involvement with computer, (3) rapidly changing technical content, (4) systems-oriented emphasis, (5) basic understanding, and (6) employee flexibility" (p. 3).

Hull further described the above characteristics and indicated that the technicians, skilled workers, and trained personnel need to know much more than is required to finish a task. The state-of-the-art equipment is complex and sophisticated so that technicians must be skillfully trained and understand the entire system in order to operate it. This understanding requires a broad knowledge base, including knowledge of the technical principles.

As high technology industries become highly automated and robots are used to complete the tasks, sophisticated computers are used to control the robots and automated machines. The technicians working with highly automated machines, robots, and computers must know the use of software and hardware of computer development, installation, service and maintenance.

Technicians must be prepared for the changes which take place in high technology industries. Almost 50 percent of technical specialities will change every three or four years, so technicians must have enough knowledge to cope with the change and be ready for retraining.

Technicians with a broad technical background can cope with the change and go through retraining to understand the new systems and learn the new skills which are required. Such technicians will be flexible in terms of their employment and can accept different responsibilities in high technology industries.

There are other characteristics of high technology which are defined differently. According to Tulsa Area Continuing Education Cooperative, 1983, high technology characteristics are defined as follows:

1. Process is knowledge based
2. Intense concentration of technical skill and knowledge
3. Integrates scientific knowledge, reinforces innovative activity and mobilizes technical resources
4. High level of research and development incorporates new concepts and ideas from research and development
5. Radically new in its scientific and technical content
6. Incorporates advanced level of automation in manufacturing and production control (p. 3).

Tulsa Area Continuing Education Cooperative further indicated the changes that are occurring in industries as a result of high technology and described them as:

A. Increased use of computers
B. Increasing automotation
C. Retooling, installation of sophisticated equipment
D. Formation of new companies
E. Second industrial revolution (p. 12).

High technology affects most of the major fields, especially communication, computer and advanced manufacturing technology. The communication field is one of the most rapidly changing industries due to the new innovations and use of the state-of-the-art equipment. Microprocessors, microelectronics, fiber optics, lasers , and computers, have a great impact on productivity, speed, availability, cost, effectiveness, and efficiency.

The adoption or adaptation of high technology will affect the work force, labor demand, occupations, job content, and skill requirements. Due to automation and the use of computers and robots, high technology will affect the employment of women. In the field of communication women are expected to have major roles and their employment will increase (Faddis, Ashley, and Abram, 1982).

There is no industry in the United States or other industrial countries that is not affected by computers. Advanced manufacturing technology uses programmable computerized robots and other state-of-the-art equipment to improve manufacturing accuracy, process, efficiency, costs, and safety.

High Technology Effects on the Economy and Employment

According to Lloyd, (1982), currently a high technology revolution is taking place, and it promises to improve life standards. It automates industries and eliminates the routine, repetitive, and boring jobs. It takes society into the second Industrial Revolution or the Technology Revolution. It improves the economy and increases the employment opportunity. The nature of high technology indicates that electronics is a common thread in almost every application: for making decisions, solving problems, specifically in the use of computers to control, monitor, and analyze the data. Microcomputers developed a new horizon for high technology applications, and chips have become the "brain" for the achieved industrial automation (Lloyd, 1982).

High technology developments are minimizing the temporary effects of the worst recession since the 1930s. The 1980s recession has caused 25,346 businesses to go bankrupt; 211,000 auto workers, or 19 percent of industry's blue collar workers were given an indefinite layoff; 119,000 workers were idled in the steel industry which was operating at only 42 percent capacity (Alexander, 1983).

Unemployment rates continue to rise, plants are closing, many never to reopen, and currently over ten million workers are unemployed. According to Time, 1983, this is the effect of recession, and it will change before the century ends. High technology industries are leading the way; in 1983, 566,942 new companies opened the door to unemployed workers, which improves the economy and creates new jobs (Alexander, 1983).

According to Tulsa Area Continuing Education Cooperative (1983), the type of high technology industries that promise the greatest employment growth potential are: "(A) computer services, (B) computer manufacturing, (C) communication, (D) avionics, (E) laser technology, (F) biotechnology, and (G) solar energy" (p. 19).

Sales and employment increase through the year 2000 for the above type of high technology industries is shown in Table II. During the 1980s, the rate of increase for the work force will be 1.5 percent. According to Carlson and Walling (1982), the Labor Department report indicated that 28.5 million will be working in services, and only 22 million in manufacturing. But the high technology industries, like

TABLE II

ANTICIPATED SALES/EMPLOYMENT INCREASES
BY TYPE OF INDUSTRY

INDUSTRY	SALES INCREASE ($ BILLIONS)	NEW NATIONAL EMPLOYMENT
1980-1985		
Computer Services	NA	461,000
Comptuer Manufacturing	$ 30.0	431,000
Communications	$ 17.6	258,000
Avionics	$ 5.9	110,000
Laser Technology	$ 2.6	30,000
Biotechnology	$ 2.8	32,000
Solar Energy	$ 0.3	3,000
	$ 59.2	1,325,000
1985-1990		
Computer Services	NA	461,000
Computer Manufacturing	$ 35.0	486,000
Communications	$ 32.4	476,000
Avionics	$ 7.9	147,000
Laser Technology	$ 5.3	61,000
Biotechnology	$ 5.6	65,000
Solar Energy	$ 0.6	7,000
	$ 86.8	1,703,000
1990-2000		
Computer Services	NA	461,000
Computer Manufacturing	$ 47.0	652,000
Communications	$137.0	2,000,000
Avionics	$ 25.0	468,000
Laser Technology	$ 27.0	313,000
Biotechnology	$ 16.0	184,000
Solar Energy	$ 4.0	38,000
	$256.0	4,116,000

Source: "An advanced technology study for post-secondary Vocational and Technical Schools." Georgia Institute of Technology: Atlanta, Georgia. Aton, C. L., H. W. Hodges, F. A. Trapley, V. A. Thomas, and J. C. Wyville. 1983.

semiconductors and computers, are the fastest-growing field. The old industries will suffer, and this is the sign of a healthy economy. As some jobs decline and others increase, improving the national unemployment level of 10.2 percent.

Americans are hoping to match foreign competition by the use of automation. The auto industries are using 2,800 robots in their assembly lines to improve productivity and accuracy (Alexander, 1983).

Over seven million new jobs will be created by the last 20 years of this century, and 45 million existing jobs will be affected by the high technology application which requires retraining. This retraining is essential to the automation which increases the productivity and improves the economy (Lloyd, 1982).

National Commission for Employment Policy (1982) indicates that there is going to be a change in the labor market in the 1980s. High technology in industries and new innovations are the reasons to believe that the economy is improving and employment opportunities are increasing during the remainder of this century. About 125 million people will be in the labor force, which will change the work force during the 1980s. The benefit of economic change is the supply of jobs and employment opportunities. Advanced technology causes a decrease in the price of goods and an increase in the efficiency of workers which requires better skill and training. Its net effect will be an increase in productivity, economic growth, and employment expansion.

Yseem (1981) indicates the relationship of high technology and economy as follows:

> The economy of industrialized nations is undergoing a profound transformation. Variously labeled the "new industrial revolution", the "electronics revolution," and "age of the integrated

> circuit," the impact of advanced electronic technology has already altered products from wrist watches to office machines to space vehicles. High technology industry is the fastest growing sector of the U.S. economy and its already wide spread impact promises to become even more profound in the future (p. 1).

While some high technology industries experience employment growth, some older industries may have a decline in their employment. High technology is both a threat and opportunity to the nation's economy, but any development in this area will improve the health of the American economy (Carlson and Walling, 1982).

Carlson and Walling (1982) further indicate, "While technology has radically improved worker productivity, it has also drastically reduced costs. Therefore, output has increased by order of magnitude and employment has doubled" (p. 47).

High Technology Industry's Training Needs

An investigation of high technology training needs from an industrial perspective was conducted by Georgia Tech. Twenty high technology firms were involved in this investigation, these firms were surveyed in order to assess industrial training needs with regard to high technology.

The information was gathered with regard to the use of Vocational and Technical school graduates, high technology industry's satisfaction with training results, kinds of training deficiencies, and the interaction between industry and school. The study represented the fields of computers, communications, avionics, lasers, and robotic manufacturing (Aton et al., 1982). They reported the result of this investigation as showing that Vocational and Technical graduates hired by high technology industry have a lack of fundamental skills. This deficiency is caused by the lack of basic technical skills and out-dated equipment and curriculum. Some other deficiencies were indicated in general education skills, such as math, science, and communication. The firms involved in this investigation indicated that they worked with Vocational and Technical schools, and they could do more to help Vocational and Technical programs in their area if they were called upon.

According to Aton et al. (1982), the survey had difficulty in identifying the specific skills required by the firms since the job titles and job descriptions did not match the Dictionary of Occupational Titles (DOT) classifications. But, in general, high technology industries require a broad mixture of skills and need more emphasis on cognitive rather than manipulative skills. If a student knows "why" and "how," he has a better chance to apply his skills to a rapidly changing job environment. The high technology industries involved in the investigation were concerned with equipment, skills, quality of students, training programs and teacher updating in order to consider Vocational and Technical graduates for employment as valuable, and well-trained employess (Aton et al., 1982).

Vocational and Technical schools face a challenge to keep up with rapidly changing high technology in the fields of computers, microelectronics, robots, automated machinery and lasers. These changes require tremendous improvement and change in Vocational and Technical education. Both Vocational and Technical schools and industries are required to keep up to date with advanced technology and make any adaptations that are needed. The industries which do not keep up with the technology will face foreign competition and rising costs of energy, labor and materials. While these industries are struggling, others are adopting new technology to be more effective in marketing, increase productivity, and utilize human resources more effectively. This improvement requires changes in work settings, equipment and processes, job performance requirements, and occupational demands. The Vocational and Technical school and industries in high technology have serious problems with a lack of sufficient human resources and equipment. The high technology and state-of-the-art equipment are affecting labor demands, the kinds of occupations, job content, and skill requirements for industry (Long and Warmbred, 1982).

Long and Warmbred further described increased use of computers, robots, and information processors will develop a fortunate situation for people in the work force to use more mental effort and less physical effort. On the other hand, the high technology skilled work force already requires upgrading to operate, maintain, and service state-of-the-art equipment.

According to Lynch (1982), this training and skill will allow the people in the work force to function in tomorrow's job as well as today's. Also it should provide retraining for those individuals whose current skills become obsolete in the near future. Providing specific training and retraining is the greatest challenge for Vocational and Technical schools during the rest of this century. The Vocational and Technical school should meet this tremendous responsibility by providing a trained and skillful graduate to be employed in tomorrow's work force. Adding new occupational programs, modifying others, and updating materials will optimize the employability opportunities for graduates with salable skills (Lynch, 1982).

According to Aton et al. (1982), the Vocational and Technical school should be concerned with the current technology problem areas identified by some high technology firms. These problems are indicated as follows:

1. Equipment: Graduates do not have knowledge of common equipment; they lack up-to-date experience.

2. Skills: Graduates do not have general education skills and they do not know some basic skills.

3. Quality of students: Bright, intelligent students should be attracted to Vocational and Technical schools.

4. Training programs: General education skills--math, physics and other hard sciences--are required for graduates to be more flexible and effective workers.

5. Teacher update: Intelligent, progressive teachers are needed with up-to-date knowledge of techniques and equipment; they should have hands on job experience (Aton et al., 1982).

Vocational and Technical Education and High Technology

According to Wyvill et al., (1981), high technology industry's training needs can be fulfilled by Vocational and Technical schools. A trained and skillful workforce can be provided by Vocational and Technical education which will in fact attract high technology industries to the region.

Based on the definition of high technology, the following industrial categories are suggested:

1. Computer/computer service,
2. Communications,
3. Avionics,

4. Robotics/automation,

5. Fiber/laser optics,

6. Biology,

7. Solar energy (Wyvill et al., 1981).

"National projection in these areas predicts a $550 billion increase in sales resulting in 9.2 million new jobs between 1980 and 2000" (p. 1).

This opportunity gives responsibility to Vocational and Technical schools to upgrade their present equipment to state-of-the-art equipment and to retrain and upgrade their teachers with new developments in order to meet the industrial training needs in the near future. Vocational education should improve its image and train skillful technicians who can work with complex equipment and meet the requirements to enter the high technology industry. The response should be quick enough to provide industry a skillful work force as the need arises (Wyvill et al., 1981).

Vocational and Technical schools have some barriers to meeting this challenge: lack of equipment, teacher's salaries, certification requirements for teachers, updating of skills, and leadership at the state level are the problems facing vocational education. These barriers need to be minimized, and changes are required to satisfy the future work force demand. According to Wyvill et al. (1981), vocational schools must make these changes and adjust to the high technology industry's requirements to deal with future training needs. Vocational schools should also solve the problems by making a plan to share high-cost equipment, increase teacher salaries to match standard levels, give release time to teachers to upgrade their experience, use industry personnel as guest instructors, and elect a committee to define and direct Vocational and Technical school responses to change in high technology.

Tulsa Area Continuing Education Cooperative (1983) indicated the broad implications of high technology to vocational education as follows: "(1) increased emphasis on basic skills, (2) computer literacy, (3) broad fundamentals versus industry specific, (4) linkage with industry, and (5) increased maintenance trainings" (p. 31). The workshop also recommended the curriculum essentials as "(1) Mathematics, (2) Physical science, (3) Communication skills, and (4) Computer literacy" (p. 35).

One of the implications of high technology to Vocational and Technical education is that it creates the need to design a general curriculum which covers a common core and a speciality sequence. The common core provides the students with a broad knowledge base which includes courses in math, physical science, human relations, communication, and some elective courses in electrical, electronics, mechanical, electro-mechanical, fluid, heating and cooling, optical, and microcomputers. The speciality sequence is five or six courses in whatever system students choose to pursue (Hull, 1982).

Hull further describes the components of a technical core as:

> Support courses, (1) Math, (2) Communications, (3) Shop Skills, and (4) Graphics.
> Principle Courses, (1) Physics, (2) Chemistry, (3) Electro-Mechanical, (4) Mechanical, (5) Fluid, and (6) Heating and Cooling (p. 14).

According to a Job Skills Task Force (1982), research was conducted in Tennessee to investigate future job skill requirements. The specific objectives of the task force in this research were to determine the kinds of jobs that would be available, the skill requirements to perform these jobs, and if the training and education delivery systems are responsive to the projected job skills needs.

The task force described the situation as such that the economic future depends on the ability to respond to the change of high technology industries and to stimulate the expansion of employers and attract new industries. New industry will create new jobs, improve individual incomes and improve the quality of life in the region. The expansion of new industries depends on the availability of employees which are trained to work for those industries.

This educational training must be provided by the Vocational and Technical schools in the region. It will cover the basic knowledge and the Vocational and Technical training necessary to meet the high technology industry training needs.

The specific kind of job skills and training will depend on the growth of new industry and businesses in the region. It is improtant that Vocational and Technical schools respond to the change in employment number and types of job, and the skill requirement for the developed industry in the state which would upgrade the employment and increase the individual's income (Job Skills Task Force, 1982).

Training for High Technology

Vocational and technical schools have the responsibility of providing the trained work force in the future for the high technology industries. The responsibility includes the training and retraining of workers to upgrade them for future employment and to keep them up to date to implement the high technology program. According to Long and Warmbred (1982), to do their tasks, Vocational and Technical schools require the latest equipment, up-to-date faculty, and training programs for new and present workers. They should develop new programs and modify the existing ones.

Long and Warmbred (1982) indicate strategies for a successful practice and appropriate responses as: Program planning, financing and equiping, staff development and recruitment, and curricula development and delivery systems.

According to Aton et al. (1982), Vocational and Technical schools will not train all the work force which is needed for high technology industries, but Vocational and Technical schools should have a major role in providing the work force for emerging new technology. The number of people requiring advanced training depends on the changing ratio of part-producing operators and technicians. The technicians need in-depth skills and fundamentals in hydraulics, electronics, and machinery in order to maintain and operate the complex high technology machines and devices in the future.

Since the computer and microcomputer are the heart of high technology machinery, technicians are required to be well trained in this area. Installation of computers and robots in the emerging technology will produce a need for newly skilled employees to maintain and operate the systems. This can be achieved by the retraining of existing employees rather than hiring new ones.

As the complexity of machines increase and reliability improves, technicians with traditional skills need some upgrading to support the process of automation and robotics in traditional industries. This retraining can be provided by a responsive Vocational and Technical school (Aton et al., 1982).

Meeting the High Technology Challenge

According to Baker (1982), the U.S. is experiencing a revolution in technology that will result in economic growth and increases in productivity. This will reshape the industrial setting in the 1980s and 1990s. Solid state electronics, computers, robots, and lasers are the cause of this change. The automated machinery is so complex and reliable that it can perform boring, repetitive tasks; the machinery can "see," "hear," and "speak."

The U.S. economy has been hit by foreign competition, and the Japanese have the electronic and high technology industry market in world competition. For the purpose of meeting foreign competition, new technology must adapt the manufacturing process, and high technology industries should be expanded. This change in the work place will have an effect on education which must provide individuals capable of creative, responsible, and adaptive work. Vocational and Technical education has the responsibility for training and retraining individuals for future jobs, and should play an important role in economic development with local industries. Vocational education has much more responsibility than training people for jobs that no longer exist (Baker, 1982).

According to Burnham (1981), high technology created a real gap between education and the real world. The advancement in technology has widened this gap considerably. Vocational education should make efforts to exploit the educational opportunities created by new technology. These opportunities can be used to improve the human condition and quality of life. However, as the gap between vocational education and high technology widens, graduates find themselves unprepared to participate in the high technology industry, and they are no longer productive. The rate of growth of high technology and the knowledge related to this area is so great that it is hard for students to achieve competency.

Vocational and Technical schools can meet this challenge and help students get prepared by learning a skill useful for the future thereby, satisfying the training needs of high technology industry in the 1980s.

According to Hull and Pedrotti (1983), high technology does not replace the workers, but it will change the role of the worker drastically. Some workers have already experienced obsolescence in their jobs which requires retraining time again after intervals of a few years in order to stay current with the change in jobs.

According to Hull and Pedrotti (1983), since high technology uses computers in most devices, and it is system-oriented, and its content changes rapidly, it requires workers with a broad knowledge base and understanding of the process to be flexible. Workers with this kind of knowledge and skill do not emerge. They need to be prepared by a Vocational and Technical school with a well-designed program. Vocational and Technical schools should prepare the worker to understand the entire system and be ready to face changes in his job, since 50 percent of any technical speciality will change approximately every three to four years. A broad understanding of basic principles in high technology and a good training program will help the worker be able to cope with the change in his occupation. Advanced technological training must be achieved with high technology equipment, and any support from industry will help for such a purpose. When industries pursue the above goals, the education challenge in the 1980s is to improve learning, effectiveness, and efficiency.

According to Tulsa Area Continuing Education Cooperative (1983), Vocational and Technical school hardware and materials need to be changed by redesigning curriculum and improving instructional methods. Other changes with respect to people are industry's and education's cooperative efforts and staff development. Education must use the new instructional technology devices in order to help the learning and training process for future work forces (Workshop, 1983). This workshop further indicates the challenges to business and industry as "(1) Higher literacy level of employees, (2) Adapable workers, (3) Computer literate workers, (4) Retraining of workers, and (5) Recruiting/training maintenance workers" (P. 42). According to Lynch (1982, p. 2), "the challenge to the vocational education community to provide occupation specific training for the 1980s and 1990s is a tremendous responsibility".

Coping With the World of High Technology

According to Spitler (1982), keeping up with the technological change for vocational education and the society is a great achievement. Computers, microcomputers, electronic devices, lasers, and robots are the forces behind vocational education's need to change its content base, design new curriculum, and stay current in the educational system by adopting new strategies and an advanced program. Vocational education must cope with changes and introduce the current high technology in to the classroom. In order to obtain such a goal, instructors must gain experience in high technology and relate this information to their students. The objective is to cope with high technology and use new concepts and practices in the instructional process. This can be easily achieved by the involvement of high technology industries and their help in allowing the use of their state-of-the-art equipment. Since this equipment is costly, a plan of sharing or borrowing from local industry is helpful in order to get hands-on experience for teachers and students.

Teachers must especially work hard to keep up with high technology changes and help students stay current. Students have the right to be taught with state-of-the-art equipment and not with traditional technology and equipment (Spitler et al., 1982).

Lynch (1982) notes that automotive industries have traditionally used unskilled workers and skilled trades people in their assembly lines. However, as the use of high technology machinery is increasing in manufacturing, the need for a trained work force that can operate and understand the system with more mental effort is needed. Advanced technology and its complexity are changing the way to work. More mental effort than physical effort is needed to understand the system and maintain and service it.

Since assembly line work is going to be performed by computers and robots in the future, assembly line workers will be replaced with highly skilled technicians. As high technology is advancing, the present-day technicians in industries will need upgrading to maintain, operate and service the state-of-the-art equipment. The challenge for Vocational and Technical education is to cope with this need and provide the unskilled workers with skill and training which will help them function in tomorrow's work force for high technology as it emerges (Lynch, 1982).

According to Lynch (1982), high technology is promising industries an increase in productivity and a reduction in the cost of manufacturing and labor. The new technology and automation will free humans from dangerous and boring work. It enhances the quality of human work environments, but it faces humans with tremendous responsibilities in coping with this change and providing trained technicians, operators and engineers who can design, operate, and run the factory of tomorrow.

Vocational education has a considerable task of training in order to turn out fully qualified technicians for future job openings. Vocational education should inform industry of the concern about training and providing skilled technicians for high technology in order to justify all the help which Vocational Education can receive from industries.

Industry should not have the idea that Vocational and Technical education is trying to solve the problem of teacher unemployment; rather they should be aware of vocational education's cooperation in providing industry with a trained work force, in achieving the future goals of increasing productivity, reduced cost in labor, and a greater competition in foreign markets. Vocational and Technical schools can reach such an achievement with significant support from the private and public sectors (Zemke, 1983).

Vocational education should be concerned about the shortage of skilled workers, because most occupations beyond high school that are in high demand require vocational training. There will be great job opportunities in the future due to the use of high technology in industries and businesses. The U.S. Department of Labor estimates an average of 5.5 million job openings annually in the 1980s and 1990s. They estimate 20 million new jobs will open due to replacement. Vocational and Technical schools should meet this demand by a change in their strategy to prepare the students in areas which have the greatest opportunities for employment. They can be responsive to the local shortage of skilled workers needed since they are a decentralized institution (American Vocational Association, 1981).

Society places a great demand on the individual, changing the way he has to learn, what he must know, and what skills he needs to have in order to participate in future society. As technology advances, changes occur constantly, and it is unlikely that skill and knowledge required for today's work will be required a few years from now. Life long training and retraining is necessary to stay current and useful (Office of Technology Assessment, 1982).

CHAPTER III

METHODOLOGY

The purpose of this research was to discover the perceived high technology industry training needs in Oklahoma and the ability of Vocational and Technical Schools to meet these needs.

This study was a guideline to raise questions about high technology, investigate the barriers, problems and facts in order to allow Vocational and Technical schools to determine future training needs. An extensive review of literature was conducted to supplement the research, and it indicates a need in the new fields of high technology to fulfill the lack of information, materials, and facts. The research was specifically designed to be conducted in Oklahoma, to determine if Oklahoma has a great potential for expansion in high technology industries.

This chapter includes a description of procedures used to conduct the study, the instrument used to collect data, the data collection process, and procedures for analyzing the data. Specifically, the following sections are discussed: (1) research design, (2) population and sample, (3) development of instruments, (4) collection of data, and (5) analysis of data.

Research Design

This investigative research was conducted to investigate and obtain information concerning the high technology industry's training needs and how Vocational and Technical schools could meet these needs. The first goal of the survey was to collect data from all the superintendents of Vocational and Technical schools in Oklahoma concerning their views of the high technology industry's training needs, the strategies of vocational education to meet these needs, and the problems facing the implementation process of a high technology program as as perceived by superintendents. The second goal was to survey a sample population of high technology industries in Oklahoma to determine their specific training needs, their demand for vocational and technical school graduates, the number of their jobs openings, and the requirements for hiring Vocational and Technical school program completers.

Population and Sample

The population selected for this survey consisted of two groups. It included all the superintendents of Vocational and Technical schools in Oklahoma and high technology industries representing the areas of computers, semiconductors and integrated circuits, electrical components, communications, medical, control equipment, optical devices, laser and infared instruments, and air craft and military systems. The list of all the superintendents of Vocational and Technical education and high technology industries was gathered through a computer search. All 36 superintendents of Vocational and Technical schools in Oklahoma were selected to be surveyed. A random sampling of 207 high technology industries in Oklahoma was chosen to be involved in the research through a random sample table. Fifty percent of total population was selected randomly as sample. The population list was gathered through a computer search and the sample consisted of nine major high technology representative industries with the percentage for the total population being, (1) electrical components, eight percent; (2) communication, 17 percent; (3) medical, 13 percent; (4) control equipment, 17 percent; (5) computer, 16 percent; (6) aircraft and military systems, seven percent; (7) optical devices, laser and infrared, two percent; (8) semiconductors and integrated circuits, three percent; and (9) instruments, 17 percent.

Development of the Instrument

Two questionnaires were used for the purpose of this study. The first questionnaire was designed by Aton et al. (1982) See Appendix A for a copy of the questionnaire. It was selected to obtain information from the superintendents of Vocational and Technical schools in Oklahoma in order to determine present and future offerings for post-secondary Vocational and Technical schools thereby fulfilling the needs of high technology in Oklahoma. The questionnaire consisted of 10 questions each with several options to be answered "yes" or "no" or answered on a Likert scale from one to five as "extremely effective," "somewhat effective," "effective," "marginally effective," and "least effective," or by a check mark. The last question was open ended for additional comments. Permission to use the questionnaire was granted on October 18, 1983 by Aton. See Appendix B for a copy of the permission letter. A second questionnaire was designed by the author to coincide with the questionnaire sent to the superintendents and was validated by a panel of experts to investigate the high technology industry's training needs in Oklahoma. See Appendix C for a copy of the industry questionnaire. The questions were answered by "yes" or "no" and short answer responses.

Collection of Data

The questionnaires were mailed to all the superintendents of Vocational and Technical schools and to a random sampling of high technology industry's in Oklahoma on January 9, 1984. A cover letter with a self-addressed stamped envelope was included (See Appendix D).

A follow-up questionnaire was mailed three weeks later to those who did not respond asking them to answer within two weeks. See Appendix E for the copy of the second cover letter.

Analysis of the Data

The data were collected by these mailed questionnaires, tabulated and statistically analyzed. The frequency and percentage of data were determined and research questions answered. Tables were provided to show the number and percentage of Vocational and Technical schools and high technology industries which responded to each item in the survey. The unanswered items were tabulated as a "no response." The presentation of the findings, summary, conclusions and recommendations was based on the analysis of the data received by the respondents of the survey.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

Introduction

The purpose of this research was to discover the perceived high technology industry training needs in Oklahoma and the ability of Vocational and Technical Schools to meet these needs. To accomplish this purpose, the following specific questions were formulated:

1. Will existing programs in Vocational and Technical Schools be changed to high technology programs?

2. Will some existing programs in Vocational and Technical Schools be phased out in order to phase in high technology programs?

3. What are the barriers for implementation of high technology programs in Vocational and Technical schools in Oklahoma?

4. What method of instruction is preferred, and how effective would the chosen method be, to implement the high technology programs?

5. What kind of programs are offered in Vocational and Technical schools in Oklahoma which are geared toward high technology employment?

6. What changes are required to upgrade high technology programs to state-of-the-art?

7. What kind of jobs will be available in Oklahoma in the next two decades and beyond?

8. What kind of skills and training will be needed to perform those indicated jobs?

This chapter consists of the findings related to the questions, tables, and analysis of data. Data were collected by two structured questionnaires with the first one being administered to all the superintendents of Vocational and Technical schools in Oklahoma.

Response Rate

There were 36 Vocational and Technical schools in Oklahoma. Since the number was limited, all were selected as subjects of this study. A total of 32 superintendents and directors (89 percent) completed the questionnaire, one questionnaire (three percent) was returned unanswered, and three superintendents did not respond (eight percent). The rate of return on the first questionnaire was 89 percent.

The second questionnaire was administered to a sample of 207 high technology industries. A total of 48 chief executive officers (23 percent) completed the questionnaire and 33 questionnaires (16 percent) were returned unanswered. The samples consisted of nine major high technology representative industries which were (1) electrical components, which had a 29 percent response; (2) communication, which had a 29 percent response; (3) medical, which had a 18 percent response; (4) control equipment, which had a 14 percent response; (5) computers, which had a eight percent response; (6) aircraft and military systems, which had a 29 percent response, (7) optical devices, laser and infrared, which had a 67 percent response; (8) semiconductors and integrated circuits which had a 33 percent response; and, (9) instruments which had a 32 percent response. The number of subjects in each sample, the returns by the Post Office and response frequency are shown in Table III.

TABLE III

SAMPLE AND RESPONSE RATE BY TYPE OF HIGH TECHNOLOGY INDUSTRIES

Type of Industry	Number in Sample	Returned by Post Office		Response	
	n	n	%	n	%
Electrical components	17	3	18	5	29
Communication	34	4	12	10	29
Medical	28	2	7	5	18
Control Equipment	29	3	10	4	14
Computers	36	9	25	3	8
Aircraft and Military Systems	17	4	23.5	5	29.5
Optical Devices, Laser, and Infrared	3	0	0	2	67
Semi Conductors and Integrated Cirucits	6	0	0	2	33
Instruments	37	4	11	12	32

Problems in Implementation of High Technology Programs

The majority of Vocational and Technical school superintendents believed that the following problems exist in implementation of high technology programs as indicated in Table IV. The problems were indicated as follows: money, 94 percent; teacher salaries, 91 percent; competition with industry for qualified personnel, 87.5 percent; equipment, 87.5 percent; expertise of existing teachers, 74 percent; certification requirements, 72 percent; updating skills of existing teachers, 72 percent; recruitment of qualified students, 69 percent; quality of students, 62.5 percent; space (facilities), 53 percent; and availability of jobs, 53 percent. The majority of the superintendents did not perceive the following as problems in the implementation of high technology programs: consumables, 69 percent; governance, 94 percent; leadership at state level, 78 percent; lack of interest by industry, 78 percent; school admissions requirements, 93.5 percent; and image of vocational education, 72 percent.

One of the superintendents believed that lack of cooperation between Vocational and Technical education and higher education was a problem in implementation of high technology programs.

Place to Offer High Technology Program

Data presented in Table V indicate the order of preference for places to offer high technology programs. When all schools were rated, the mean was 2.6. When only schools near an industrial region offering high technology employment were rated, the mean was 2.4. When speciality centers within one existing school were rated, the mean was 2.9. When an

TABLE IV

AREA VOCATIONAL AND TECHNICAL SCHOOL SUPERINTENDENTS RESPONSE TO PROBLEMS IN THE IMPLEMENTATION OF HIGH TECHNOLOGY PROGRAMS IN VOCATIONAL AND TECHNICAL SCHOOLS IN OKLAHOMA

Problems	Response			
	Yes		No	
	n	%	n	%
Money	30	94	2	6
Teacher salaries	29	91	3	9
Competition with industry for qualified personnel	28	87.5	4	12.5
Equipment	28	87.5	4	12.5
Expertise of existing teachers	23	74	8	26
Certification requirements	23	72	9	28
Updating skills of existing teachers	23	72	9	28
Recruitments of qualified students	22	69	10	31
Quality of students	20	62.5	12	37.5
Space (facilities)	17	53	15	47
Availability of jobs	17	53	15	47
Consumables	10	31	22	69
Governance	2	6	30	94
Image of vocational education	9	28	23	72
Leadership at State level	7	22	25	78
Lack of interest by industry	7	22	25	78
School admissions requirements	2	6.5	29	93.5

N = 32

TABLE V

AREA VOCATIONAL AND TECHNICAL SCHOOL SUPERINTENDENTS RESPONSE FOR PLACE TO OFFER HIGH TECHNOLOGY PROGRAMS FOR MOST EFFECTIVE RESULTS IN OKLAHOMA

Place to Offer High Technology Program	Rating 1 N	2 N	3 N	4 N	5 N	Total Points	Mean
All schools	10	4	6	5	4	76	2.6
Only schools near an industrial region offering high technology employment	10	8	4	4	3	69	2.4
Speciality center within one existing school	5	9	6	3	6	83	2.9
An industrial facility or resource center outside the vocational system's existing brick and mortar structures	0	2	4	13	10	118	4.1

1 = Most Preferred, 5 = Least Preferred
N = 32

industrial facility or resource center outside the vocational system's existing brick and mortar structures were rated, the mean was four. Two of the superintendents believed that Vocational and Technical schools are the best place to offer high technology programs, while another believed the Vocational and Technical schools and junior colleges cooperatively could offer high technology programs.

Methods of Instruction

Data presented in Table VI indicate the effectiveness of methods of instruction for high technology courses. The questions to be rated were:

A. High technology courses delivered to all Vocational and Technical schools by a mobile/lab; the mean was four;

B. High technology courses offered in one location then delivered by videotape to other Vocational and Technical schools; the mean was 3.8;

C. High technology courses delivered in conjunction with on-the-job training at industrial sites; the mean was two point three;

D. High technology courses delivered by computer-aided instruction or simulation; the mean was 2.8.

The other methods of instruction which were identified and rated are self-paced individualized instruction, with a mean of one; team teaching with mean of two; high technology course delivered by interactive video disc, with a mean of five. One of the respondents indicated that specific courses designed and offered as high technology programs in well designed and equipped labs were also useful.

TABLE VI

AREA VOCATIONAL AND TECHNICAL SCHOOL SUPERINTENDENTS RESPONSE FOR METHOD OF INSTRUCTION FOR HIGH TECHNOLOGY COURSES

Method of Instruction	Rating: Extremely Effective 1	Somewhat Effective 2	Effective 3	Marginally Effective 4	Least Effective 5	Total Points	Mean
High technology courses delivered to all Vocational and Technical schools by a mobile classroom/lab.	1	2	4	15	10	127	4
High technology courses offered in one location then delivered by videotape to other Vocational and Technical Schools.	0	4	7	13	8	121	3.8
High technology courses delivered in conjunction with on-the-job training at industrial sites.	9	9	9	3	1	71	2.3
High technology courses delivered by computer-aided instruction or simulation.	1	12	13	3	3	91	2.8

N = 32

Cooperative Teaching Ventures

Respondents were asked to rate the effectiveness of a cooperative teaching ventures with traditional Vocational and Technical instructors and other industry personnel for high technology courses. When industry personnel were rated, the mean was 1.8. When training consultants were rated, the mean was 2.6. When university faculty and staff were rated, the mean was 3.3. The data presented in Table VII indicates the description of cooperative teaching between Vocational and Technical schools' instructors and other personnel.

The Programs Which are Geared Toward High Technology Employment

Respondents were asked if the programs offered in Vocational and Technical schools in Oklahoma are geared toward high technology employment. Respondents rated the programs by "yes", "no", or "not offered" as follows: computer service, 56 percent yes; computer manufacturing, 9.6 percent yes; electronic, 69 percent yes; communication, 34.5 percent yes; avionics, 6.5 percent yes; laser technology, six percent no and 94 percent were not offered; biotechnology, 6.5 percent yes; 84 percent not offered; solar energy, 90.5 percent not offered; robotics, 16 percent yes, 71 percent not offered, (See Table VIII). One of the respondents indicated that the hydraulics (motor controls, measurement and controls) program was highly geared toward high technology employment. The analysis of data indicates that computer service and electronics were the major programs perceived to be geared toward high technology employment, and all other programs were reported by the superintendents as not being offered.

TABLE VII

AREA VOCATIONAL AND TECHNICAL SCHOOL SUPERINTENDENTS RESPONSE TO COOPERATIVE TEACHING VENTURES BETWEEN TRADITIONAL VOCATIONAL AND TECHNICAL SCHOOL'S INSTRUCTORS AND OTHER PERSONNEL

Personnel	Rating: Extremely Effective 1	Somewhat Effective 2	Effective 3	Marginally Effective 4	Least Effective 5	Total Points	Mean
Industry personnel	14	12	6	0	0	56	1.8
Training consultants	3	11	15	3	0	82	2.6
University faculty and Staff	1	4	14	9	4	107	3.3

N = 32

TABLE VIII

AREA VOCATIONAL AND TECHNICAL SCHOOL SUPERINTENDENTS RESPONSE FOR CONTENT OF PROGRAMS OFFERED TOWARD HIGH TECHNOLOGY EMPLOYMENT IN OKLAHOMA

Program	No Response		Response				Not Offered	
			Yes		No			
	n	%	n	%	n	%	n	%
Computer Service	1	3	18	56	5	16	8	25
Computer Manufacturing	1	3	3	9.5	3	9.5	25	78
Electronics	1	3	22	69	2	6	7	22
Communication	1	3	11	34.5	3	9.5	17	53
Avionics	0	0	2	6.5	3	9.5	27	84
Laser Technology	0	0	0	0	2	6	30	94
Biotechnology	1	3	2	6.5	2	6.5	27	84
Solar energy	0	0	0	0	3	9.5	29	90.5
Robotics	2	6.5	5	16	2	6.5	23	71

N = 32

Existing Instructional Materials

The majority of Vocational and Technical schools get their instructional material from industry, teachers, and the state curriculum center. The instructional materials for the following programs were acquired from varying sources: for computer service, 69 percent came from industry, 47 percent from teachers, and 31 percent from the state curriculum center; for computer manufacturing, 16 percent from industry, three percent from teachers; for electronics, 50 percent from industry, 34.5 percent from teachers, and 37.5 percent from the state curriculum center; for communication, 25 percent from industry, 25 percent from teachers, and 19 percent from the state curriculum center; for avionics, three percent from industry; for laser technology, three percent from the military, and three percent from teachers; for biotechnology, three percent from consultants, six percent from industry, and three percent from teachers; for robotics, six percent from consultants, 19 percent from industry, and 9.5 percent from teachers.

Data concerning the existing instructional materials are presented in Table IX. Data indicates the place of acquiring these existing instructional materials for the programs geared toward high technology employment. The majority of the respondents indicated that the following programs were offered in Vocational and Technical schools in Oklahoma: computer science, computer manufacturing, electronics, communication, and robotics. The main sources for providing instructional materials are industry, teachers, the state curriculum center, and consultants. The military also aided in providing some instructional materials for high technology programs.

TABLE IX

AREA VOCATIONAL AND TECHNICAL SCHOOL SUPERINTENDENTS RESPONSE FOR SOURCES OF INSTRUCTIONAL MATERIALS FOR HIGH TECHNOLOGY PROGRAMS IN OKLAHOMA

Program	Sources of Instructional Materials									
	Military		Consultants		Industry		Teachers		State Curriculum Center	
	n	%	n	%	n	%	n	%	n	%
Computer Science	3	9.5	8	25	22	69	15	47	10	31
Computer Manufacturing	1	3	1	3	5	16	1	3	0	0
Electronics	4	12.5	8	25	16	50	11	34.5	12	37.5
Communication	2	6	3	9.5	8	25	8	25	6	19
Avionics	0	0	0	0	1	3	0	0	0	0
Laser Technology	1	3	0	0	0	0	1	3	0	0
Biotechnology	0	0	1	3	2	6	1	3	0	0
Solar Energy	0	0	0	0	0	0	0	0	0	0
Robotics	1	3	2	6	6	19	3	9.5	1	3

N = 32

High Technology Course Feedback

Superintendents were asked to indicate the sources of high technology courses feedback. The respondents indicated Vocational and Technical schools received high technology course feedback from the following sources: student in program, 84.5 percent; placement of student in high technology, 73 percent; local advisory councils, 87.5 percent; and high technology personnel, 78.5 percent (See Table X).

High Technology: State-of-the-Art

The respondents were asked if their high technology programs were state-of-the-art; they responded "yes," "no," or "don't know." The programs of concern with the percentage of response were: computer service, 42 percent yes and 29 percent no; computer manufacturing, 25 percent yes and 33 percent don't know; electronic, 54 percent yes and 25 percent no; communication, 39 percent yes and 22 percent no; avionics, 14 percent yes and 28.6 percent no; laser technology, 15 percent yes and 31 percent no; solar energy, 36.5 percent no and 27 percent don't know; and robotics, 23.5 percent no and 35 percent don't know. The majority of the respondents believed that computer service, computer manufacturing, electronics, communication, and robotics programs were state-of-the-art. They also indicated that avionics, laser technology, biotechnology, and solar energy programs were not state-of-the-art.

One of the respondents indicated that a hydraulics program in the Vocational and Technical school was a high technology program and meet the state-of-the-art equipments. Data presented in Table XI indicate the high technology programs which are perceived by the superintendents as state-of-the-art.

TABLE X

AREA VOCATIONAL AND TECHNICAL SCHOOL SUPERINTENDENTS RESPONSE FOR SOURCES OF FEEDBACK ABOUT HIGH TECHNOLOGY COURSES

Sources	Response						No Response	
	Yes		No		Not Applicable			
	n	%	n	%	n	%	n	%
Students in Programs	27	84.5	2	6	3	9.5	0	0
Placement of Students in High Technology Companies	22	73	5	17	3	10	2	6
Local Advisory Councils	28	87.5	1	3	3	9.5	0	0
High Technology Personnel	22	78.5	3	10.5	3	10.5	4	12.5

N = 32

TABLE XI

AREA VOCATIONAL AND TECHNICAL SCHOOL SUPERINTENDENTS RESPONSE TO HIGH TECHNOLOGY PROGRAMS AND STATE-OF-THE-ART

High Technology Program	Number Answering Each Program	Response							
		Yes		No		Don't Know		Not Applicable	
		n	%	n	%	n	%	n	%
Computer Science	24	10	42	7	29	6	25	1	4
Computer Manufacturing	12	3	25	2	17	4	33	3	25
Electronics	28	15	54	7	25	4	14	2	7
Communication	18	7	39	4	22	4	22	3	17
Avionics	14	2	14	4	29	4	29	4	29
Laser Technology	11	0	0	5	45.5	3	27	3	27
Biotechnology	13	2	15	4	31	3	23	4	31
Solar Energy	11	0	0	4	36.5	3	27	4	36.5
Robotics	17	4	23.5	4	23.5	6	35	3	18

N = 32

Changes

Responses to the question concerning what changes are needed to upgrade programs to state-of-the-art in high technology are presented in Table XII. The percentages of respondents who indicated that the development of new curriculum was required for each high technology program are as follows: computer sciences, 47 percent; computer manufacturing, 9.5 percent; electronics, 34.5 percent; communication, 9.5 percent; avionics, six percent; laser technology, three percent; biotechnology, three percent; and robotics, 16 percent. The percentages of respondents who indicated that hiring qualified teachers was a needed change for each high technology program were as follows: computer science, 28 percent; computer manufacturing, three percent; electronics, 22 percent; avionics, 9.5 percent; laser technology, six percent; biotechnology, three per cent; and robotics, 12.5 percent. The percentage of respondents who indicated that updating skills was a needed change for the following programs: computer science, 37.5 percent; electronic, 28 percent; communication, three percent; avionics, three percent; biotechnology, three percent; and robotics, 16 percent.

Percentages for updating equipment indicated for the following programs: computer science, 41 percent; computer manufacturing, six percent; electronic, 44 percent; communication, 9.5 percent; avionics, six percent; biotechnology, three percent; and robotics, 22 percent responded for the change.

The data indicated that the above changes were required in order to upgrade and change existing programs to high technology programs. The response to add programs was as follows: computer science, 19 percent; computer manufacturing, 12.5 percent; electronics, 12.5 percent;

TABLE XII

AREA VOCATIONAL AND TECHNICAL SCHOOL SUPERINTENDENTS RESPONSE FOR CHANGES REQUIRED TO UPGRADE PROGRAMS TO STATE-OF-THE-ART

Change	High Technology Programs																	
	Computer Science		Computer Manufac-turing		Elec-tronics		Communi-cation		Avion-ics		Laser Tech-nology		Bio-tech-nology		Solar Energy		Robo-tics	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Develop New Curriculum	15	47	3	9.5	11	34.5	3	9.5	2	6	1	3	1	3	0	0	5	16
Hire Qualified Teachers	9	28	1	3	7	22	0	0	3	9.5	2	6	1	3	0	0	4	12.5
Update Skills	12	37.5	0	0	9	28	1	3	1	3	0	0	1	3	0	0	5	16
Add Programs	6	19	4	12.5	4	12.5	6	19	6	19	5	16	4	12.5	2	6	6	19
Update Equipment	13	41	2	6	14	44	3	9.5	2	6	0	0	1	3	0	0	7	22

N = 32

communication, 19 percent; avionics, 19 percent; laser technology 16 percent; biotechnology, 12.5 percent; solar energy, six percent; and robotics, 19 percent.

According to the perceptions of the superintendents, the analysis of data indicates that in order to phase in high technology programs, the existing programs need to be modified and programs added. The existing programs will not be phased out in order to phase in high technology programs.

One respondent indicated that high technology programs can be changed to state-of-the-art quality by adding equipment to computer science, electronics, and communication programs. Other changes that were suggested indicate an experimental program for computer science to be offered in the future.

The respondents were asked to provide any additional comments regarding high technology programs in Vocational and Technical schools. The comments were so varied that only the most important ones are indicated. The majority of respondents believed that most programs in Vocational and Technical schools have parts that are high technology, and that high technology programs are a must if they are to maintain the Vocational and Technical schools' image and satisfy the needs and wants of industry. One of the school superintendents indicated a vote was held on January 24, 1984, on funds to build and equip a building for electronics, communications, office equipment repair, electricity, and data processing.

Four of the responses indicated that some of the superintendents of Vocational and Technical schools had no idea about the definition of high technology and did not know any information about state-of-the-art equipment. One of the respondents made a comment regarding high technology programs being so sophisticated that it would take team teaching to be cost-effective or even rational in its delivery. The respondents indicated that Vocational and Technical school graduates should have adequate prerequisites in applied math which should be offered in Vocational and Technical schools or public schools. One of the respondents indicated that for people who are in rural isolated districts with limited or no industry, it was difficult to see the projection of high technology programs when a teacher should relocate a student to an urban area for employment after training.

One of the respondents indicated that curriculum changes needed to be implemented in order to prepare the students to adapt to new processes as changes occur. Another superintendent said in order for high technology programs to be effective, a definite partnership with industrial personel was required for input through advisory committees and for providing employment and equipment. Industry personnel should be available as resource people to assist with instruction.

High Technology Growth

The results of the second questionnaire concerning high technology industries' training needs are discussed here. The respondents were asked to indicate the cause of expending jobs in next 20 years see Table XIII. The majority of the chief executive officers of high technology industry believed and rated the following high technology categories to be the cause of expanding jobs in the 1980s and 1990s in the industry: computer science, 92 percent yes; computer manufacturing, 77 percent yes; electronics, 89 percent yes; communications, 77 percent yes; avionics, 67 percent

TABLE XIII

INDUSTRIAL RESPONSE TO HIGH TECHNOLOGY AS THE CAUSE OF EXPANDING JOBS IN THE 1980S AND 1990S IN INDUSTRY IN OKLAHOMA

High Technology Categories	Number Answering	Response			
		Yes		No	
	n	n	%	n	%
Computer Science	36	33	92	3	8
Computer Manufacturing	31	24	77	7	23
Electronics	38	34	89	4	11
Communication	30	23	77	7	23
Avionics	24	8	33	16	67
Laser Technology	34	20	59	14	44
Biotechnology	27	10	37	17	63
Solar Energy	29	17	58	12	41
Robotics	34	23	68	11	32

N = 46

no; laser technology, 59 percent yes; biotechnology, 63 percent no; solar energy, 59 percent yes; and robotics, 68 percent yes. The respondents did not perceive that avionics and biotechnology would expand jobs in the 1980s and 1990s in industry. Other categories of high technology which were expected to cause job expansion in the 1980s and 1990s were indicated by respondents as medical, computer design, and optics.

The respondents were asked to indicate the growth rates as "high," "medium," or "low." The data presented in Table XIV are the perceived annual employment growth rates of high technology categories during the next 20 years by the chief executive officers.

Computer science was rated by 56.5 percent as having a high growth rate while 33.5 percent rated it as medium; computer manufacturing was rated by 40.5 percent as high and by 35 percent as medium; electronics was rated by 55 percent as high and by 37 percent as medium; communication was rated by 36.5 percent as high and by 48.5 percent as medium; laser technology was rated by 40 percent as high and by 31 percent as low; biotechnology was rated by 26 percent as high and by 48 percent as low; solar energy was rated by 24 percent as high and by 39.5 percent as low; and robotics was rated by 40.5 percent as high and by 35 percent as medium.

The majority of chief executive officers of high technology industries believed that the annual employment growth rate for computer science, computer manufacturing, electronics, laser technology, and robotics would be high; for communications growth would be medium; and for avionics, biotechnology, and solar energy growth would be low in Oklahoma during the next 20 years. One of the respondents also indicated that the annual employment growth rate would be low for "optics" during the next 20 years.

TABLE XIV

INDUSTRIAL RESPONSE TO ANNUAL EMPLOYMENT GROWTH RATE OF HIGH TECHNOLOGY IN INDUSTRY DURING THE NEXT 20 YEARS IN OKLAHOMA

High Technology Categories	Number Answering	Response					
		High		Medium		Low	
		n	%	n	%	n	%
Computer Science	39	22	56.5	13	33.5	4	10
Computer Manufacturing	37	15	40.5	13	35	9	24.5
Electronics	38	21	55	14	37	3	8
Communication	33	12	36.5	16	48.5	5	15
Avionics	30	4	13	12	40	14	47
Laser Technology	35	14	40	9	26	11	31
Biotechnology	31	8	26	7	23	15	48
Solar Energy	33	8	24	12	36.5	13	39.5
Robotics	37	15	40.5	13	35	9	24.5

N = 46

Labor Availability

Responses to the question concerning the degree of difficulty in finding qualified personnel for high technology firms during the next 20 years in Oklahoma rated as "major," "some," or "no" for each of the high technology categories are found in Table XV. Respondents believed that for each of the following categories there would be the degree of difficulty listed. For computer service, 51.5 percent of the respondents felt that there would be some difficulty; for computer manufacturing, 50 percent felt that there would be some difficulty; electronics, 49 percent said some difficulty; for communication, 53 percent said some difficulty; for avionics, 64 percent said some difficulty; laser technology, 58 percent said major difficulty; for biotechnology, 46 percent said major difficulty; for solar energy, 47 percent said some difficulty; and robotics, 62.5 percent said major difficulty.

The majority of the firms had major difficulty in finding qualified personnel only for laser technology and robotics. Most of the high technology firms had some difficulty in finding qualified personnel for computer service, computer manufacturing, electronics, communication, avionics, and solar energy. One respondent indicated that major difficulty in finding "service techs" for the firm was a problem. Another respondent indicated that they have some problems in finding personnel to work with "optics".

The specific employment shortage existing in firms now are presented in Table XVI. The main shortages were indicated as engineers, technicians, and management in the field of high technology. Twelve respondents did not have any specific employment shortages currently in the firms, and 13 other respondents had different kinds of employment

TABLE XV

INDUSTRIAL RESPONSE TO DEGREE OF DIFFICULTY TO FIND QUALIFIED PERSONNEL FOR HIGH TECHNOLOGY FIRMS DURING THE NEXT 20 YEARS IN OKLAHOMA

High Technology Categories	Number Answering	Response					
		Major		Some		No	
		n	%	n	%	n	%
Computer Science	37	15	40.5	19	51.5	3	8
Computer Manufacturing	34	15	44	17	50	2	6
Electronics	37	14	38	18	49	5	13
Communication	34	7	21	18	53	9	26
Avionics	28	1	4	18	64	9	32
Laser Technology	31	18	58	9	29	3	10
Biotechnology	26	12	46	9	35	4	15
Solar Energy	30	7	23	14	47	9	30
Robotics	32	20	62.5	11	34.5	1	3

N = 46

TABLE XVI

INDUSTRIAL RESPONSE TO SPECIFIC EMPLOYMENT SHORTAGES
EXISTING IN THE FIRMS NOW IN OKLAHOMA

Responses	Engineers	Responses	Technicians	Responses	Others
2	Engineers	1	Draftsmen/Technicans	1	People that know how to work not just a paycheck
1	Computer Engineers	6	Technician/Electronics	1	Screening
1	Electronic Design Engineers (Experienced)	1	Service Technician	1	Inspection
1	Technical Sales Engineers	1	Laser Technician	1	Technical manufacturing managers
1	Manufacturing Engineers (digital & analog testing/automation robotics	1	Technician-electronic digital & analog skill technician	1	Computer systems-small business
1	Registered Petroleum engineering - - mechanical engineering	1	Technican	1	Software development
1	Software engineering			1	Service people
				1	Machinist class "A" genera
				1	Biotechnology
				1	Laser Technology
				1	Design drafting
				1	Aircraft experience in bonding & composites
				1	Robotic & automated machining applications
				1	Microprocessor programming
				1	Technical Manufacturing managers
				1	Manufacturing middle management
				12	None

shortages which were categorized under the heading of "other".

The respondents were asked if Vocational and Technical schools in Oklahoma could provide the high technology industry training needs during the next 20 years. These data are presented in Table XVII. The majority of the respondents, 67 percent, indicated "yes," and only 33 percent said "no."

In response as to whether or not high technology industries would be willing to help the Vocational and Technical schools in Oklahoma to implement high technology training programs, 69 percent said "yes," and only 31 percent said "no." These data are shown in Table XVII.

Job Skills

Response to questions concerning problems existing in finding skillful, trained and qualified personnel are presented in Table XVII. The majority of the respondents indicated that a shortage of applicants with appropriate skill (81 percent) was the main problem and only 19 percent believed that it was not a problem. Fifty-eight percent of the respondents did not believe that having no local facility for occupational training was any problem and only 42 percent perceived that was a problem.

The question was asked if the firms can let the Vocational and Technical schools use their facilities, equipment, and space for training and retraining their students and instructors. Seventy-seven percent of the respondents said "no" and only 23 percent were willing to do so (See Table XVII).

Data concerning the firm's minimum employment requirements for technically trained employees are presented in Table XVIII. The

TABLE XVII

INDUSTRIAL RESPONSE TO HIGH TECHNOLOGY INDUSTRIES' TRAINING NEEDS AND IMPLEMENTATION OF HIGH TECHNOLOGY PROGRAMS

Question Concerning High Technology	Number Answering	Response			
		Yes		No	
		n	%	n	%
Training Needs					
Ability of Vocational and Technical meet Training Needs	39	26	67	13	33
Firms					
Will the Firms Help	42	29	69	13	31
Problems					
Shortage of applicants with appropriate skill	42	34	81	8	19
No local facility for occupational training	36	15	42	21	58
Training and Retraining					
Firm's Help to Train and Retrain Vocational and Technical Schools' students and instructors	39	9	23	30	77

N = 46

TABLE XVIII

INDUSTRIAL RESPONSE TO FIRM'S REQUIREMENT FOR EMPLOYMENT, AND GRADUATE COMPETENCY CONCERNING VOCATIONAL AND TECHNICAL SCHOOLS TRAINING PROGRAMS

Question Concerning High Technology	Number Answering	Response: Yes n	Response: Yes %	Response: No n	Response: No %
Employment Requirement					
Vocational and Technical certificate	30	20	67	10	33
A.S. degree in Technology	20	7	35	13	65
B.S. degree in Engineering Technology	22	10	45	12	55
M.S. degree in Engineering	16	3	19	13	81
Compentency					
Basic educational skills	39	30	77	9	23
Vocational training	36	30	83	6	17
Good work habits and training	38	23	60.5	15	39.5
Training Needs					
Do Vocational and Technical Schools provide and match	38	19	50	19	50
Productivity, Cost, and Efficiency					
Can Vocational and Technical School's Graduates Improve productivity?	39	31	79.5	8	20.5

N = 46

percentages of respondents who indicated that a certificate/degree was required are as follows: for Vocational and Technical certificate, 67 percent said yes; for A.S. degree in technology, 35 percent said yes; for B.S. degree in engineering technology, 45 percent said yes; and for M.S. degree in engineering, 19 percent said yes, it was a minimum requirement. The majority of the firms needed at least a Vocational and Technical certificate as the minimum employment requirement for technically trained employees.

Responses to the question related to the competence of Vocational and Technical school graduates are presented in Table XVIII. Respondents indicated that they perceived the following percentages of competence: basic educational skills, 77 percent said yes; vocational training, 83 percent said yes; and good work habits and training, 60.5 percent said yes. The majority of responses indicated the Vocational and Technical school graduates are perceived as competent in the above skills.

As to whether or not Vocational and Technical school training programs provide and match the high technology industry's training needs' 50 percent said yes, and 50 percent said no. These data are presented in Table XVIII.

The data as to whether or not Vocational and Technical school graduates could improve productivity, reduce costs, and increase efficiency in high technology industry are also found in Table XVII. The majority of the respondents (79.5 percent) said yes, Vocational and Technical graduates could improve productivity, while only 20.5 percent said no.

The respondents were asked for additional comments regarding high technology programs for their training needs through the Vocational and Technical schools in Oklahoma. One of the chief executive officers of a high technology industry indicated that the image of Vocational and Technical schools must be improved in the eyes of the high school community. Another said that high school counselors should become more aware of career opportunities for technicans and where training may be acquired. The others indicated that high technology has a fast pace -- too fast for most instructors.

One of the responses indicated that firms were interested in an employee with a good knowledge of basic electronics rather than a "talking" knowledge of computers or communications; the respondent also indicated a need for a person with bio-medical instrumentation training. This respondent also indicated that Vocational and Technical schools met the demand for entry level positions, but did not meet the demand for skilled engineering professionals. Vocational and Technical training was not rigorous enough for today's needs. Provisions should be made for upward mobility from Vocational and Technical schools through engineering without penalities.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The major purpose of this research was to discover the perceived high technology industry training needs in Oklahoma and the ability of Vocational and Technical schools to meet these needs. The specific questions were:

1. Will existing programs in Vocational and Technical schools be changed to high technology programs?

2. Will some existing programs in Vocational and Technical Schools be phased out in order to phase in high technology programs?

3. What are the problems for implementation of high technology programs in Vocational and Technical schools in Oklahoma?

4. What method of instruction is preferred and how effective would the chosen method be to implement high technology programs?

5. What kind of programs are offered in area Vocational and Technical schools in Oklahoma which are geared toward high technology employment?

6. What changes are required to upgrade high technology programs to state-of-the-art?

7. What kind of jobs will be available in Oklahoma in the next two decades and beyond?

8. What kinds of skills and training will be needed to perform those indicated jobs?

There were two populations involved in this study: 36 Vocational and Technical superintendents, and 450 high technology industry's. A structured questionnaire designed by Aton et al., (1982) was administered and three weeks later a follow-up questionnaire was sent. Thirty-two people responded and for the rate of return of 89 percent. Of the 450 high technology industries selected as the second population, 207 firms were proportionally randomly selected as a sample, and a designed structured questionnaire was administered. Three weeks later a follow-up questionnaire was mailed. Forty-six people responded (23 percent), and 33 questionnaires were undelivered (16 percent).

Summary of Findings

Following is a summary of the findings from this study:

1. Some existing programs in Vocational and Technical schools would be changed to higher technology programs.

2. The existing programs in Vocational and Techical schools would not be phased out in order to phase in high technology programs.

3. The majority of Vocational and Technical schools superintendents believe that teacher salaries, certification requirements, competition with industry for qualified personnel, space (facilities), equipment, quality of students, availability of jobs, money, expertise of existing teachers, updating skills of existing teachers, and recruitment of qualified students are the main problems in implementation of the high technology programs.

4. To improve effectiveness, the following methods of instruction were ranked in this order:

A. High technology courses delivered in conjunction with on-the-job training at industrial sites (mean of 2.3).

B. High technology courses delivered by computer aided instruction or simulation (mean of 2.8).

C. High technology courses offered in one location then delivered by videotape to other Vocational and Technical schools (mean of 3.8).

D. High technology courses delivered to all Vocational and Technical schools by a mobile classrom/lab (mean of four).

5. The content of the computer service and electronics program offered in Vocational and Technical schools was geared toward high technology employment.

6. The changes required to upgrade Vocational and Technical schools programs to the state-of-the-art are: develop new curriculum, hire qualified teachers, update skills, add programs, and update equipment.

7. The majority of the chief executive officers of high technology industries believe the following categories should be the cause of expanding jobs during the next 20 years in their industries: computer science (92 percent), computer manufacturing (77 percent), electronics (89 percent), communication (77 percent), laser technology (59 percent), solar energy (59 percent), and robotics (68 percent).

8. The annual employment growth rate was perceived to be high for computer science (56.5 percent), computer manufacturing (40.5 percent), electronics (55 percent), laser technology (40 percent), and robotics (40.5 percent) and medium for communication (48.5 percent).

9. In order of preference, the following places were ranked as best to offer high technology programs:

A. Only schools near an industrial region offering high technology employment (mean of 2.4);

B. All schools (mean of 2.6);

C. Speciality center within one existing school (mean of 2.9);

D. An industrial facility or resource center outside the vocational system's existing brick and mortar structures (mean of four).

10. In order of effectiveness, cooperative teaching between Vocational and Technical instructors and the following personnel for high technology courses were rated.

A. Industry personnel (mean of 1.8);

B. Training consultants (mean of 2.6);

C. University faculty and staff (mean of 3.3).

11. The majority of existing instructional materials for high technology programs were acquired from: industry, teachers, the state curriculum center, and consultants.

12. The sources of feedback for evaluation of high technology programs were indicated as:

A. Students in program (84.5 percent);

B. Local advisory councils (87.5 percent);

C. High technology personnel (78.5 percent);

D. Placement of students in high technology companies (73 percent);

13. The majority of the superintendents believed that computer service, computer manufacturing, electronics, communication, and robotics programs are in the state-of-the-art.

14. The following comments were indicated by the respondents about high technology:

A. Some superintendents did not know about high technology and did not understand the state-of-the-art.

B. A partnership between industry and Vocational and Technical schools must be created for their input, providing employment, equipment and as a source of information;

C. Applied math was suggested as a prerequisite for high technology programs.

15. The majority of the high technology firms had difficulty in finding qualified personnel for their firms.

16. The current specific employment shortages existing in firms were for engineers, technicians, and managers.

17. Sixty-seven percent of the high technology industry believed the Vocational and Technical schools can provide training needs during the next 20 years.

18. Sixty-one percent of the respondents believed that their firms would help Vocational and Technical schools implement a high technology training program.

19. Shortage of applicants with appropriate skills (81 percent) was a problem in finding qualified personnel.

20. Only 23 percent of the high technology respondents believed they could let the Vocational and Technical schools use their facilities, equipment, and space for training and retraining their students and instructors.

21. A firm's minimum employment requirements for technically trained employees was a Vocational and Technical certificate (67 percent).

22. Most of the high technology respondents believed that Vocational and Technical school graduates were competent in:

A. Basic educational skills (77 percent);

B. Vocational training (83 percent);

C. Good work habits and training (60.5 percent).

23. The majority of the high technology respondents (79.5 percent) believed that Vocational and Technical school graduates could improve their productivity, reduce costs, and increase their firm's efficiency.

Conclusions

Based upon the perceptions of the respondents in this study, the following conclusions were drawn:

1. Changes required to upgrade existing high technology programs to state-of-the-art were: hire qualified teachers, update skills of the instructor, equipment, and add programs.

2. Existing programs need to be modified and programs added. Existing programs will not be phased out in order to phase in high technology programs.

3. Vocational and Technical schools in Oklahoma are facing many problems in implementation of high technology programs. These problems can be resolved through advisory committees.

4. The best methods of instruction have been suggested as

A. High technology courses delivered in conjunction with on-the-job training at industrial sites, and

B. High technology courses delivered by computer-aided instruction or simulation.

5. Most of the high technology programs have the potential to be offered in Oklahoma and to create employment.

6. Cooperation, changes, and support are needed to upgrade the Vocational and Technical schools programs to state-of-the-art equipment.

7. High technology would create jobs in Oklahoma during the next 20 years, and the annual employment growth rate would be high.

8. Vocational and Technical schools in Oklahoma need and must train qualified personnel for high technology, for there is a great potential existing during the next 20 years in high technology area.

9. Vocational and Technical schools in Oklahoma are perceived as one of the best places to offer high technology programs.

10. Cooperative teaching between Vocational and Technical school instructors and industry personnel and training consultants was rated most effective.

11. Cooperation between industry, teachers, the state curriculum department, and consultants can provide the best instructional materials.

12. Students, placement of students, local advisory councils, and high technology personnel can be best used as evaluation tools for the improvement of the high technology programs.

13. A training program in high technology is needed to upgrade the superintendents and the directors of the Vocational and Technical schools in Oklahoma.

14. High technology industry's are willing to help Vocational and Technical schools in implementation of high technology programs.

15. The Vocational and Technical schools must provide their own facilities, equipment, and space for training and retraining their students and instructors.

16. There is a need for technically trained employees with Vocational and Technical certificates to work in high technology industries.

17. The high technology industries respondents have confidence in Vocational and Technical schools in Oklahoma and they believe that graduates have competence in skills, training, and good work habits. They also believe that these graduates can improve the industry's productivity, reduce costs, and increase their firms' efficiency.

Recommendations

The analysis of the data, findings, and conclusions are the bases for following recommendations:

1. Some existing programs need to be changed to high technology programs. It is recommended that the Vocational and Technical Schools hire qualified teachers, update skills and equipment, add programs, and modify existing programs.

2. Existing programs would not be phased out in order to change to high technology programs. It is recommended that the schools add programs while modifying the existing curriculum.

3. Vocational and Technical schools are facing problems in implementation of high technology programs. It is recommended that an advisory committee council be set up consisting of students, teachers, consultants, industry, and local community representatives to resolve these problems and set up guide lines and direction for Vocational and Technical schools in Oklahoma.

4. It is recommended that Vocational and Technical Schools offer the high technology courses in conjunction with on-the-job training at industrial sites and computer-aided instruction or simulation as the best method of instruction.

5. Computer service and electronics were the major programs geared

toward high technology employment. It is recommended that the other high technology programs be modified toward employment.

6. To upgrade the Vocational and Technical school programs to the state-of-the-art, it is recommended that the schools improve curriculum, hire qualified teachers, add programs, and update equipment and skills.

7. High technology is the main source of creating jobs during the next 20 years, and Vocational and Technical schools can provide technically trained personnel. It is recommended that the state try to encourage these new high technology industries to come to Oklahoma in order to improve the economy and create jobs.

8. The specific skill areas and training needed to perform high technology jobs were indicated as engineers, technicians, and managers. It is recommended that Vocational and Technical schools train students in the fields of high technology to prepare for future job openings.

9. Cooperative teaching between Vocational and Technical school instructors and industry's personnel was highly rated. It is recommended that some industry personnel be hired to teach the high technology courses and to help provide the instructional materials.

10. It is recommended that an evaluation team constantly evaluate the high technology programs in Vocational and Technical schools, and make recommendations for improvement.

11. A training program in high technology is needed for the superintendents and the directors of the Vocational and Technical schools. It is recommended that a workshop on the subject should be organized by the State Department of Vocational and Technical Schools in cooperation with high technology industries.

12. There is a need for technically trained employees with

Vocational and Technical certificates. It is recommended that students be recruited to pursue high technology careers in Vocational and Technical schools.

13. The field of high technology is new and changing rapidly. It is recommended that further study is needed to investigate the number of jobs which will be created, the possible amount of economic improvement, and the preparation which is required for the future changes.

14. This study was conducted for the state of Oklahoma, it is recommended that a national study should be conducted on the subject of this dissertation.

BIBLIOGRAPHY

Abram, Robert, W. Ashley, C. Faddis, and A. Wiant. "Preparing for High Technology: Programs that Work." Columbus, Ohio: The National Center for Research in Vocational Education, The Ohio State University, 1982.

Alexander, Charles P. "The New Economy." Time, May 30, 1983, pp. 62-70.

American Vocational Association. "The Shortage of Skilled Workers." Washington, D.C., 1981.

Aton, C. L., H. W. Hodges, F. A. Trapley, V. A. Thomas, and J. C. Wyvill. "An Advanced Technology Study for Post-Secondary Area Vocational-Technical Schools." Georgia Institute of Technology: Atlanta, Georgia, August, 1982.

Baker, David E. "The High Tech Challenge to Voc Ed." Voc-Ed, October 1982, pp. 26-28.

Burnham, Brian. "Managing The High Tech Revolution, A Challenge in Search of a Response, Are Educators Ready?" Education Canada, Winter, 1981.

Carlson, Richard C. and Victor D. Walling. "California's Technological Future: Emerging Economic Opportunities in the 1980's." Menlow Park, California: SRI International, March 1982.

Dorak, Robert and Walter Rice. "Laser Electro-Optics Tech." St. Louis, Missouri: Cervante Convention Center, December 2, 1982.

Faddis, Constance, W. A. Ashley, and R. E. Abram. "Preparing for High Technology: Strategies for Change." Columbus, Ohio: Ohio State University, National Center for Research in Vocational Education, 1982.

Gunderson, Les. C. and Donald B. Keck. "Optical Fibers: Where Lights Outperforms Electronics." Technology Review, May/June 1983, pp. 32-44.

Hull, Dan M. "Putting a High-Technology Core Into Your Vocational Program." (A series of Pre-AVA Convention One-Day Workshops for Vocational Educators December 2, 1982). St. Louis, Missouri: Cervantes Convention Center, 1982.

Hull, Daniel M. and Pedrotti, Leno S. "Meeting the High-Tech Challenge." VocEd. May 1983, pp. 28-31.

Job Skills Task Force. Meeting Future Job Skill Requirements in Tennessee. Memphis, Tennessee: Memphis State University, Center for Manpower Studies, 1982.

Lloyd, John H. "The State Role in Implementing a High Technology Program." (A series of Pre-AVA Convention One-Day Workshops for Vocational Educators, December 2, 1982). St. Louis, Missouri: Cervantes Convention Center: 1982, p. 2.

Long, James P. and Warmbred, Catherine P. Preparing for High Technology: A Guideline for Community Colleges. Columbus, Ohio: Ohio State University, The National Center for Research in Vocational Education, 1982.

Lynch, Edward J. Training for High Technology at MaComb Community College. MaComb, Michigan: MaComb Community College, July 1982, p. 2.

Lynch, Edward J. "MaComb Community College Enters the World of High Tech." VocEd. October, 1982. pp. 29-31.

National Commission for Employment Policy. 8th Annual Report, The Work Revolution. Washington, D.C: 1982.

Office of Technology Assessment. "Informational Technology and Its Impact on American Education." Washington, DC: Congress of the United States: 1982.

Spitler, David and Householder, Daniel L. and Daves, Mary Anna. "Coping With Technological Advances." Schools Shop. March 1982, pp. 23,39.

The State Department of Vocational and Technical Education. A Guide to Oklahoma Vocational and Technical Education. Other unpublished Materials. Stillwater, Oklahoma: State Department of Vocational and Technical Education, 1980.

Tulsa Area Continuing Education Cooperative. High Technology Workshop Institute III, Tulsa, Oklahoma, August 22, 1983, pp. 3, 12, 19, 24, 26, 31, 34, 35, 42.

Wyvill, J. C., R. D. Atkins, C. L. Aton, J. Banks, D. Betten, H. W. Hodges, G. E. Kearney, R. G. Schwartz and J. K. Walsh. "An Advanced Technology Study for Post-Secondary Area Vocational-Technical Schools." Atlanta, Georgia: Georgia Institute of Technology Engineering Experiment Station, October 1981, pp. 1.

Yseem, Elizabeth. "Education and High Technology Industry: The Case of Silicon Valley." Boston, Massachusetts: Institute for the Interdisciplinary Study of Education, Northeastern University, August 1981.

Zemke, Ron. "The Robots are Coming! Training Tomorrow's High Tech Workers." Training, June 1983, pp. 18-31.

APPENDIXES

APPENDIX A

QUESTIONNAIRE MAILED TO AREA VOCATIONAL AND TECHNICAL SCHOOL SUPERINTENDENTS

QUESTIONNAIRE

1. Do you perceive the following as problems in the implementation of high technology programs in your vocational/technical school? Please circle the appropriate answer.

A.	Teacher salaries you can pay	YES	NO
B.	Certification requirements	YES	NO
C.	Competition with industry for qualified personnel	YES	NO
D.	Space (facilities)	YES	NO
E.	Equipment	YES	NO
F.	Consumables	YES	NO
G.	Governance	YES	NO
H.	Quality of students	YES	NO
I.	Availabilty of jobs	YES	NO
J.	Leadership at State level	YES	NO
K.	Lack of interest by industry	YES	NO
L.	Money	YES	NO
M.	School admissions requirements	YES	NO
N.	Expertise of existing teachers	YES	NO
O.	Updating skills of existing teachers	YES	NO
P.	Image of vocational education	YES	NO
Q.	Recruitment of qualified students	YES	NO
R.	Other (identify) ______________________________	YES	NO

____

2. Where do you think high technology programs should be offered for most effective results? Rank in order of perference where 1 indicates most preferred and 5 indicates least preferred.

A. All schools ____

B. Only schools near an industrial region offering high technology employment ____

C. Speciality center within one existing school ____

D. An industrial facility or resource center outside the vocational system's existing brick and mortar structures ____

E. Other (identify) ______________________ ____

3. How effective would the following methods of instruction be for high technology courses? Circle your answers according to the following code.

1	2	3	4	5
extremely effective	somewhat effective	effective	marginally effective	least effective

A. High technology courses delivered to all vocational/technical schools by a mobile classroom/lab.

1 2 3 4 5

B. High technology courses offered in one location then delivered by videotape to other vocational/technical schools.

1 2 3 4 5

C. High technoloogy courses delivered in conjunction with on-the-job training at industrial sites.

1 2 3 4 5

D. High technology courses delivered by computer-aided instruction or simulation.

1 2 3 4 5

E. Others (identify and rank)

4. How effective would cooperative teaching ventures between traditional vo-tech instructors and the following personnel be for high technology courses? Circle your answers according to the code in Question 3.

A. Industry personnel

1 2 3 4 5

B. Training consultants

1 2 3 4 5

C. University faculty and staff

1 2 3 4 5

D. Others (identify and rank) ______________________________

1 2 3 4 5

5. Is the content of the following programs offered in your school geared toward high technology employment? Circle your answer.

(1)	computer service	YES	NO	NOT OFFERED
(2)	computer manufacturing	YES	NO	NOT OFFERED
(3)	electronics	YES	NO	NOT OFFERED
(4)	communication	YES	NO	NOT OFFERED
(5)	avionics	YES	NO	NOT OFFERED
(6)	laser technology	YES	NO	NOT OFFERED
(7)	biotechnology	YES	NO	NOT OFFERED
(8)	solar energy	YES	NO	NOT OFFERED
(9)	robotics	YES	NO	NOT OFFERED
(10)	others (identify) ______________	YES	NO	NOT OFFERED

6. Where have you acquired your existing instructional mateirals for the programs you identified in Question 5 as geared toward high technology employment? Check the boxes that apply.

	Military	Consultants	Industry	Teachers	State Curricu-lum Center	Other
Computer Science						
Computer Manufacturing						
Electronics						
Communication						
Avionics						
Laser Technology						
Biotechnology						
Solar Energy						
Robotics						
Others (identify)						

If you need more room please use the back of this page

7. The feedback that you receive about your high technology courses comes from different sources. Have the following sources helped you evaluate your high technology programs? Circle your answer.

A.	Students in program	YES	NO
B.	Placement of students in high technology companies	YES	NO
C.	Local advisory councils	YES	NO
D.	High technology personnel	YES	NO
E.	Others (identify) ________________	YES	NO

8. Do you feel that your high technology programs are state-of-the-art? Circle your answer.

(1)	computer service	YES	NO	DON'T KNOW
(2)	computer manufacturing	YES	NO	DON'T KNOW
(3)	electronics	YES	NO	DON'T KNOW
(4)	communication	YES	NO	DON'T KNOW
(5)	avionics	YES	NO	DON'T KNOW
(6)	laser technology	YES	NO	DON'T KNOW
(7)	biotechnology	YES	NO	DON'T KNOW
(8)	solar energy	YES	NO	DON'T KNOW
(9)	robotics	YES	NO	DON'T KNOW
(10)	others (identify) ____________	YES	NO	DON'T KNOW

9. What changes are required to upgrade your programs to state-of-the-art in high technology? Check the changes that apply.

	Computer Science	Computer Manufacturing	Electronics	Communication	Avionics	Laser Technology	Biotechnology	Solar Energy	Robotics	Others (identify)
Develop New Curriculum										
Hire Qualified teachers										
Update Skills										
Add Program										
Eliminate Program										
Update Equipment										
Others (identify)										

If you need more room please use the back of this page

10. We are interested in additional comments you may have regarding high technology programs in vocational/technical schools.

APPENDIX B

REQUEST TO UTILIZE QUESTIONNAIRE

AND RESPONSE

Oklahoma State University

SCHOOL OF OCCUPATIONAL AND ADULT EDUCATION

STILLWATER, OKLAHOMA 74078
CLASSROOM BUILDING 406
(405) 624-6275

October 13, 1983

Ms. Carol Aton
Georgia Institute of Technology
EES/TAL/TTB
Atlanta, GA 30332

Dear Ms. Aton:

I am a doctoral candidate in the School of Occupational and Adult Education, Oklahoma State University. Presently I am writing my dissertation titled "A Descriptive Research of High-Technology Industries Training Needs Through the Vocational and Technical Schools.

I am seeking your cooperation and written permission to use the questionnaire that you designed for your research titled "An Advanced Technology Study for Post-Secondary Area Vocational-Technical Schools" in August, 1982.

In searching for an instrument your questionnaire is one that is most functional and pertinent for my study.

Your prompt written permission would be most appreciated. If additional information is needed concerning this request please contact me at:

Mahmood Haji-Sadeghi
406 Classroom Building
Oklahoma State University
Stillwater, OK 74078

Thank you for your cooperation.

Sincerely,

Mahmood H. Sadeghi

Mahmood Haji-Sadeghi
Graduate Student/Assistant
OAED

trs

ENGINEERING EXPERIMENT STATION
Georgia Institute of Technology
A Unit of the University System of Georgia
Atlanta, Georgia 30332

October 18, 1983

Mahmood Haji-Sadeghi
406 Classroom Bldg.
Oklahoma State University
Stillwater, OK 74078

Dear Mahmood,

I am pleased to grant you permission to use the questionnaire from "An Advanced Technology Study for Post-Secondary Area Vo-Tech Schools" in your doctoral research.

I would be most interested in the results of your study when it is completed.

Sincerely,

Carol L. Aton

Carol L. Aton, Chief
Technology Transfer Branch
EES/TAL
(404) 894-3623

mep

AN EQUAL EMPLOYMENT EDUCATION OPPORTUNITY INSTITUTION

APPENDIX C

QUESTIONNAIRE MAILED TO CHIEF EXECUTIVE

OFFICERS OF HIGH TECHNOLOGY

INDUSTRIES

QUESTIONNAIRE

I. HIGH TECHNOLOGY GROWTH

1. Do you perceive the following high technology category as the cause of expanding jobs in the 1980's and 1990's in your industry? (Circle your answer)

(1)	computer science	Yes	No
(2)	computer manufacturing	Yes	No
(3)	electronics	Yes	No
(4)	communication	Yes	No
(5)	avionics	Yes	No
(6)	laser technology	Yes	No
(7)	biotechnology	Yes	No
(8)	solar energy	Yes	No
(9)	robotics	Yes	No
(10)	others (identify) ____________	Yes	No

2. Do you percieve the annual employment growth rate of the following high technology categories in your industry during the next twenty years to be high, medium, or low.

		Growth Rate		
(1)	computer science	High	Medium	Low
(2)	computer manufacturing	High	Medium	Low
(3)	electronics	High	Medium	Low
(4)	communication	High	Medium	Low
(5)	avionics	High	Medium	Low
(6)	laser technology	High	Medium	Low
(7)	biotechnology	High	Medium	Low
(8)	solar energy	High	Medium	Low
(9)	robotics	High	Medium	Low
(10)	others (identify) ____________	High	Medium	Low

II. LABOR AVAILABILITY

1. In your opinion, identify the degree of difficulty to finding qualified personnel for the high technology firms during the next twenty years in Oklahoma. (Circle your answer)

(1)	computer service	Major	Some	No
(2)	computer manufacturing	Major	Some	No
(3)	electronics	Major	Some	No
(4)	communication	Major	Some	No
(5)	avionics	Major	Some	No
(6)	laser technology	Major	Some	No
(7)	biotechnology	Major	Some	No
(8)	solar energy	Major	Some	No
(9)	robotics	Major	Some	No
(10)	others (identify) ____________	Major	Some	No

2. Please indicate specific employment shortages existing in your firm now.

   (1) ______________________________

   (2) ______________________________

3. In your opinion, can area vocational and technical schools in Oklahoma, provide your high technology industry training needs during the next twenty years? (Circle your answer)

   Yes No

4. Do you think your firms will be willing to help the area vocational and technical schools in Oklahoma implement high technology training programs? (Circle your answer)

   Yes No

III. JOB SKILLS

1. Do the following problems exist in finding skillful, trained and qualified personnel? (Circle your answer)

(1) shortage of applicants with appropriate skill	Yes	No
(2) no local facility for occupational training	Yes	No

2. Do you believe that your firm can let the Vocatioinal and Technical schools use the facilities, equipment, and space for training and retraining their students and instructors? (Circle your answer)

Yes No

3. What is your firm's minimum employment requirements for technically trained employees? (Circle your answer)

(1) Vocational-Technical certificate	Yes	No
(2) A.S. degree in Technology	Yes	No
(3) B.S. degree in Engineering Technology	Yes	No
(4) M.S. degree in Engineering	Yes	No

4. Do you believe that Vocational and Technical school graduates are competent in:
(Circle your answer)

(1) basic educational skills	Yes	No
(2) vocational training	Yes	No
(3) good work habits and training	Yes	No

5. In your opinion, do Vocational and Technical schools training programs provide and match the high technology industries training needs? (Circle your answer)

Yes No

6. Do you believe that vocational and technical school graduates can improve your productivity, reduce costs, and increase your firm's efficiency? (Circle your answer)

Yes No

7. I am interested in additional comments you may have regarding high technology programs for your training needs through the vocational technical schools in Oklahoma.

APPENDIX D

COVER LETTERS TO AREA VOCATIONAL

AND TECHNICAL SCHOOL

SUPERINTENDENTS

Oklahoma State University
SCHOOL OF OCCUPATIONAL AND ADULT EDUCATION

STILLWATER, OKLAHOMA 74078
CLASSROOM BUILDING 406
(405) 624-6275

Dear Area Vocational Technical School Superintendent:

We are seeking your cooperation in compiling some important data for future growth in vocational education.

As a vocational technical school superintendent you were chosen because of your first-hand knowledge of the school's need as well as having a close relationship with industrial needs.

The questionniare is designed to obtain information regarding high technology program needs now and in the future. The result of this study should help the area vocational technical schools in Oklahoma to implement a high technolgoy program and become more responsive to industry's demand for qualified personnel.

Your reply will be treated confidentially. Please return the questionnaire to us in the enclosed envelope as soon as possible.

Your assistance will be deeply appreciated. A copy of the study results will be made available to you if you so desire.

Mahmood H. Sadeghi
Mahmood Haji-Sadeghi
Doctoral Candidate,
Graduate Assistant

Clyde B. Knight
Dr. Clyde Knight, Ed.D.
Committee Chairman,
Advisor

Oklahoma State University

SCHOOL OF OCCUPATIONAL AND ADULT EDUCATION

STILLWATER, OKLAHOMA 74078
CLASSROOM BUILDING 406
(405) 624-6275

February 3, 1984

Dear Area Vocational Technical School Superintendent:

Three weeks ago I sent you a questionnaire concerning high-technology program needs in area vocational-technical schools in Oklahoma.

I would like to be able to include your opinion in the research results if you have not responded, and are interested in having your opinion included in the survey, please complete the questionnaire and return it to me before February 18, 1984.

Thank you for your consideration of this request.

Sincerely,

Dr. Clyde Knight
Chairman &
Dissertation Advisor

Mahmoud Haji-sadeghi
Graduate Assistance
Doctorate Candidate

/ah

APPENDIX E

COVER LETTERS TO CHIEF EXECUTIVE OFFICERS OF HIGH TECHNOLOGY INDUSTRY

Oklahoma State University

SCHOOL OF OCCUPATIONAL AND ADULT EDUCATION

STILLWATER, OKLAHOMA 74078
CLASSROOM BUILDING 406
(405) 624-6275

Dear Chief Executive Officer:

We are asking you, the ones who know best, to help us up-grade the high technology program which provides the industries training needs through the vocational and technical schools in Oklahoma. The study centers on high technology industry training needs and how area vocational and technical schools can meet these training needs in the future.

Your responses to this questionnaire will be most helpful in providing information which indicates your high technology firms training needs, and improve the implementation of a high technology program in Oklahoma.

Your reply will be treated confidentially. Please return the questionnaire to us in the enclosed envelope as soon as possible.

Your assistance will be deeply appreciated. A copy of the study results will be made available to you if you so desire.

Mahmood H. Sadeghi

Mahmood Haji-Sadegi
Doctoral Candidate,
Graduate Assistant

Clyde B. Knight

Dr. Clyde Knight, Ed.D.
Committee Chairman,
Advisor

Oklahoma State University

SCHOOL OF OCCUPATIONAL AND ADULT EDUCATION

STILLWATER, OKLAHOMA 74078
CLASSROOM BUILDING 406
(405) 624-6275

February 3, 1984

Dear Chief Executive Officer:

Three weeks ago I sent you a questionnaire concerning high-technology industry's training need in Oklahoma.

I would like to be able to include your opinion in the research results. If you have not responded, and are interested in having your opinion included in the survey, please complete the questionnaire and return it to me before February 18, 1984.

Thank you for your consideration of this request.

Sincerely,

Dr. Clyde Knight
Chairman &
Dissertation Advisor

Mahmood Haji-sadeghi
Graduate Assistant
Doctorate Candidate

/ah

VITA

Mahmood Hajisadeghi

Candidate for the Degree of

Doctor of Education

Thesis: A DESCRIPTIVE STUDY OF WAYS HIGH TECHNOLOGY INDUSTRIES' TRAINING NEEDS CAN BE MET THROUGH OKLAHOMA VOCATIONAL AND TECHNICAL SCHOOLS

Major Field: Occupational and Adult Education

Biographical:

Personal Data: Born in Esfahan, Iran, January 21, 1952, the son of Mr. and Mrs. HajiSadeghi.

Education: Graduated from Esfahan Industrial High School in 1972; received an Associate Degree in Mechanical Power Technology from Oklahoma State University in 1980; received a Bachelor of Science degree in Mechanical Power Engineering Technology from Oklahoma State University in 1980; received a Master of Science degree in Technical Education from Oklahoma State University in 1981; completed requirements for the Doctor of Education degree at Oklahoma State University, Stillwater, Oklahoma, in July 1984.

Professional Experience: Two years work study in Oklahoma State University, one year Graduate Assistant in the School of Occupational and Adult Education, Oklahoma State University, worked also in Ren Corporation, Student Maintenance Service, John's Small Engine Repair, and a Sheet Metal Factory.

Professional Organization and Honors: Society of Automative Engineers; National Dean's Honor Roll List.