

A STUDY TO DETERMINE THE NEED FOR AND INTEREST
IN AN ELECTRICITY-ELECTRONICS COURSE IN
THE INDUSTRIAL ARTS DEPARTMENT OF
AMARILLO HIGH SCHOOL

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CHAPTER I

INTRODUCTION

Amarillo, Texas, has developed from the nation's greatest cattle shipping market of the early 1890's into one of the state's fastest growing major industrial locations.

Gas was discovered in September, 1889, twenty miles north of Amarillo. Petroleum was discovered in May, 1921, by Gulf Production Company, on the Burk Burnett 6666 ranch, in Carson County.¹ Amarillo is now the center of a large cattle feeding region highly diversified economically with irrigated farming, agriculturally-oriented industry, oil and gas production, and a vast petrochemical complex.

The electrical industry of Amarillo has also shown a rapid rate of growth. It has developed into approximately eighteen various categories, ranging from electrical appliance repair to the manufacturing of electrical wire and cable. The total number of people employed in Amarillo during the month of January, 1969, was 61,940. Of this number, approximately 1,882 workers were employed by the electrical industry.²

¹Amarillo Chamber of Commerce, A Historical Sketch of Amarillo (Amarillo, Texas, 1968), p. 4.

²Eldrid G. Travis and Bert P. Darden, Manpower Trends Amarillo Area, Texas Employment Commission (Amarillo, Texas, 1968), p. 1.

Statement of the Problem

This study was made to gather information and data concerning the electrical industry of Amarillo, Texas, and to determine the desirability of an electricity-electronics course in the Industrial Arts Department of Amarillo High School, Amarillo, Texas.

Purpose of the Study

The purpose of this study was to ascertain the interest in and need for an electricity-electronics course in the Amarillo High School Industrial Arts Department of Amarillo, Texas. More specifically, the study attempted to answer the following questions:

1. What types of electricity or electronics programs are located in the Amarillo metropolitan area?
2. What phases of electricity and electronics, which could be offered by the Amarillo High School Industrial Arts Department, would be most beneficial to the employees of the electrical industry of Amarillo?
3. How many people are employed by the electrical industry in Amarillo?
4. How many employees of the electrical industry depend upon a working knowledge of basic electricity?
5. What electronic test instruments are the employees of the electrical business firms in Amarillo expected to be able to use?

6. What occupations and professions do the senior students of Amarillo High School plan to prepare for and follow in later life?

7. Are students willing to transfer from Amarillo High School to another high school in Amarillo in order to take a course in electricity or electronics?

8. How many senior students of Amarillo High School use basic applied electrical theory in their part-time jobs and home repairs?

Background and Significance of the Study

Amarillo is located in the center of the Texas Panhandle at the crossroads of five major highways: U.S. 60, U.S. 66, U.S. 87, U.S. 287, and Interstate 40. It covers an approximate land area of 54.5 square miles. The 1968 population estimate was 163,000 for the city and 192,180 for the metropolitan area, which includes Randall and Potter counties. The U. S. Census Bureau estimated the population of Amarillo to be 214,000 by 1975.³

The Amarillo metropolitan area is becoming the center of increasing industrial activity. Presently, there are approximately 200 manufacturing firms in Amarillo, employing an estimated 7,000 workers. Some of these firms are Pantex Ordnance Plant, Levi Strauss and Company, American Smelting and Refining Company, Southwestern Portland Cement Company,

³Amarillo Daily News, March 28, 1969, Sec. 1, p. 1.

Texaco, Diamond Shamrock, Borden Company, Swift and Company, Bell Helicopter Company, and the U. S. Bureau of Mines, which is concerned with the manufacture of helium.⁴

The electrical industry of Amarillo consists of business establishments in the following areas: six companies dealing in automobile electrical service; six electrical appliance repair companies; thirty-one electrical contractors; eight electrical equipment manufacturers; fifteen electrical equipment service, supply, wholesale, and repair companies; one electrical light and power company; five electrical motor manufacturing, wholesale, and repair companies; four electronic equipment supply and repair companies; one electronic instruments company; five radio stations; one telephone company; thirty-eight television repair companies; and three television stations.

Southwestern Public Service Company and Southwestern Bell Telephone Company of Amarillo employ approximately 1,375 workers.⁵ This number is 23 per cent of the total number of workers employed by the eleven largest business firms of Amarillo. Of this number, approximately 50 per cent of the employees rely upon a basic working knowledge of electricity and electronics.

⁴Amarillo Chamber of Commerce, Directory of Manufacturers, (Amarillo, 1968), p. 1.

⁵Texas Employment Commission, Statistical Employment Trends (Amarillo, Texas, 1969), p. 1.

Statistics show that 4.1 per cent of the total population of the Amarillo area, which includes Potter, Randall, Armstrong, Carson, and Oldham counties, were unemployed at the end of 1968. Comparative labor force estimates in Texas show that Dallas has 1.1 per cent of its population unemployed; El Paso, 3.3 per cent; Wichita Falls, 2.1 per cent; Tyler, 1.8 per cent; and San Angelo, 2.2 per cent. The unemployment ratio of the Amarillo area is about 50 per cent men and women, with the greatest number under twenty-five and over forty years of age. The labor force of the Amarillo area is adequate in most occupational fields. The only shortages are in skilled professions, such as aeronautical engineers, electrical technicians, production engineers, credit analysts, hospital orderlies, and machinists.⁶

Amarillo, like other areas of the country, is in need of well trained technical and professional workers.

Of all major occupations requiring special training, technical occupations increased 100 per cent during the 1950's while the rest increased by only about 50 per cent. . . . The Bureau of Labor Statistics predicts a shortage of about 350,000 technicians in 1975--approximately 34 per cent below the net new demand between now and then.⁷

A survey conducted by the American Society for Engineering Education in 1967 found that the ratio of technicians to scientists and engineers was almost two to one. If the labor force

⁶Amarillo Daily News, February 20, 1969. Sec. 2, p. 6.

⁷Charles R. Bowen, "Educators Plus Employers: A Team to Meet the Critical Need for Technicians," School Shop, XXVII (March, 1969), 41-43.

ratio is to be achieved by 1975, industry will need approximately four million technicians. Since the supply projected by the U. S. Bureau of Labor Statistics is less than a million, there would be a deficit of more than three million technicians.⁸

After an eighteen-month study, a Senate committee of the Texas State Legislature recommended that vocational-technical education "be fully integrated into the entire system of education" from the ninth grade through college.⁹ Some of the other recommendations made by the committee are as follows:

- The establishment of a twenty-one-member advisory council on Vocational-Technical Education to be appointed by the Board of Education after consultation with the governor, and with the consent of the Senate. . . .

- A strict licensing law for private trade schools, with felony penalties "for those who willfully defraud and bilk unsuspecting students."

- That a "maintenance allowance" for each vocational teacher in public schools be considered. . . .

- That the James Connally Technical Institute (now the Texas State Technical Institute) be continued.

- That the State Board of Education continue as the State Board of Vocational Education. . . .

- That a pilot in-service counselor training program be funded through and directed by the Texas Education Agency. Also, a pilot summer workshop program for advisors and guidance counselors be established.

- That the secondary schools be authorized to contract with junior colleges for use of expensive facilities. . . .

- That the committee be continued, so it can study such things as recruitment and certification of vocational teachers.¹⁰

⁸Ibid., p. 42.

⁹Amarillo Daily News, May 6, 1969, Sec. 1, p. 17.

¹⁰Ibid., p. 18.

The electrical trades program of Amarillo High School, with an average enrollment of thirty students a year, offers the only course in electronics from which 6,500 Amarillo high school students can choose. The program has the appalling task of supplying terminal students with consumer and technical knowledge, orientation of college-bound students, and supplying Amarillo Junior College and the proposed John Connally Technical Institute with prospective students.

According to a study made by Lee Williamson, Assistant Superintendent of Instruction of the Amarillo Independent School District, the dropout rate of the Amarillo Public Schools during the school year 1967-1968 was 19.5 per cent.¹¹ This compares favorably with an average national dropout rate of 33 per cent. The assistant superintendent also found that the educational level in Amarillo, as determined by the last census, was 12.1 years of school, second highest in the state.

The following three reasons were given for the low dropout rate of the Amarillo Public Schools: (1) the legal age limit for keeping children in school has changed from sixteen to seventeen years; (2) the only Negro high school was closed, and the students integrated into the remaining four high schools; and (3) an occupational training program geared for the potential dropout has been started.

¹¹Amarillo Daily News, August 28, 1968, Sec. 1, p. 4.

¹²Ibid., p. 1.

The programs designed for the potential dropout place emphasis on the development of a salable skill rather than on academic achievement. Presently, classes are offered in the area of home economics, mechanical trades, building trades, and metal trades.

In summation, the significance of the study is due to the following factors: (1) the industrial activity of the Amarillo area should continue to grow and increase the need for trained technicians; (2) Amarillo Junior College and the proposed John Connally Institute should continue to need more and better-orientated students in their electronics programs; and (3) the need for trained electrical technicians and electrical engineers should continue to grow throughout the country.

Definition of Terms

Electricity-Electronics Course describes a course which deals with basic electrical theory and also the control and manipulation of electrical current.

Industrial Arts Program indicates all the courses offered at Amarillo High School which would fall under the classification of industrial arts.

Industrial Arts is a general education subject area which is designed to prepare youth for effective living in an industrial society. Courses are based on technology; learning experiences include work with common tools and

materials and study of industrial processes and problems. Experiences gained in industrial arts provide a foundation for additional technological training.

Electrical Industry describes, as a group, all business concerns that are directly related to the manufacturing, installation, sales, or maintenance of electrical or electronic equipment.

Senior Students describes, as a group, those students who were enrolled in Amarillo High School for the school year of 1968-1969 and who graduated on or before May, 1969.

Basic Assumptions

The study was based on the following assumptions:

1. Business and industry in the Amarillo metropolitan area were on a sound financial footing and would continue to expand in the future as they had in the past.
2. There will be a steadily expanding supply of job opportunity in the electrical industry of the Amarillo metropolitan area for the Amarillo High School terminal students.
3. The electrical trades program of Amarillo High School and the vocational electronics programs of Amarillo Junior College will continue to grow and up-date their curricula.

Limitations of the Study

This study was limited to the response of 403 senior students enrolled at Amarillo High School, Amarillo, Texas,

during the school year 1968-1969. It was also limited to the response of the representatives from the following phases of the electrical industry of Amarillo, Texas: automobile electrical service, electrical appliance repair, electrical contractors, electrical equipment manufacturers, electrical equipment (service and repair), electrical equipment (supply and wholesale), electrical light and power company, electrical motors (repair), electrical motors (wholesale and manufacture), electronic equipment (supply and repair), electronic instruments, radio stations, telephone company, television repair, and television stations.

Related Studies

An examination of previous studies made at North Texas State University and of published abstracts of research in industrial arts revealed one study which was directly related to the investigation at hand. This study was made by Hoyt G. Byrd, in 1951, to determine the desirability of an electricity course in the Merkel High School, Merkel, Texas. Through the use of questionnaires distributed to the high school students and interviews with the local residents, Byrd concluded, among other things, that an electricity course should be included in the secondary schools and should be planned around the interests of the student. He also concluded that the course should be planned in such a way as to give the student

consumer education in electricity, vocational education in electricity, and electricity as a hobby.¹³

In 1950, Robert L. Lanham made a study of the objectives and trends of general education and the needs of the sheet metal industries of Dallas, Texas. Lanham concluded, among other things, that industry is vitally interested in the instruction given in high school education courses. He also concluded that sheet metal courses in high schools should be revised with a view to meeting vocational needs of the students who would enter the sheet metal trades.¹⁴

A recent study by Thomas E. Dennis was made in 1967 to determine the need for and interest in a vocational industrial education program in the Eagle Mountain-Saginaw School District, Saginaw, Texas. Dennis conducted the study by constructing and submitting questionnaires to the administrators of the industrial firms, students, graduates, and adults of the community. Dennis concluded, as follows:

1. There is a definite interest among junior and senior high school students of the Eagle Mountain-Saginaw School District in a vocational industrial education program.

¹³Hoyt G. Byrd, "The Desirability of an Electricity Course in the Merkel High School," unpublished master's thesis, Department of Industrial Arts, North Texas State University, Denton, Texas, 1951, pp. 4-45.

¹⁴Robert L. Lanham, "A Study of the Objectives and Trends of General Education and the Needs of the Sheet Metal Industries of Dallas, Texas, in Order to Determine What Trends Should Be Taken for a Course of Sheet Metal Work at N. R. Crozier Technical High School, Dallas, Texas," unpublished master's thesis, Department of Industrial Arts, North Texas State University, Denton, Texas, 1950, p. 42.

2. A relatively large percentage of the students of the junior and senior high schools are undecided about their future educational and occupational plans.

3. A majority of the graduates of Boswell High School who were questioned believe that their participation in a program of vocational industrial education in high school would have aided them in finding employment.

4. Almost 50 per cent of the graduates and adults questioned expressed an interest in a program of vocational industrial education offered in evening classes for adults.

5. A large majority of the adults questioned believed that a program of vocational industrial education would be beneficial both for high school students and for adults of the community.

6. A sufficient number of employee shortages in industry will exist in the future to justify a vocational industrial education program.¹⁵

A comparative study of the needs and interests of the students as related to the industrial arts curriculum of Highland Park Junior High School and Boude Storey Junior High School of Dallas, Texas, was made by James C. Ellis in 1952.

Ellis collected data through the use of questionnaires which were completed by the industrial arts students in Highland Park and Boude Storey Junior High Schools, in professional literature, and from personal interviews. Ellis concluded, among other things, that a majority of the students from the two schools indicated that they would take more industrial arts courses if there were a wider selection of

¹⁵Thomas E. Dennis, "A Study to Determine the Need for and Interest in a Vocational Industrial Education Program in the Eagle-Mountain-Saginaw School District," unpublished master's thesis, Department of Industrial Arts, North Texas State University, Denton, Texas, 1967, pp. 8-51.

projects from which to choose. It was also found that the industrial arts program of Highland Park Junior High School provided little or no vocational guidance, whereas vocational guidance is included in the industrial arts program of Boude Storey Junior High School.¹⁶

Method of Investigation and Source of Data

In order to make the study, it was necessary to gather data and information from four major sources. These sources were (1) the senior students enrolled at Amarillo High School for the school year 1968-1969, (2) a comprehensive sampling of the electrical industry of Amarillo, Texas, (3) personal interviews, and (4) current literature in the field pertaining to the problem.

Primarily, the questionnaire method was used to gather data needed for this study. Copies of the questionnaires used are included in the Appendix. The total enrollment of Amarillo High School was too large to be included in the scope of this study. Consequently, it was necessary to select a sample group. The senior students were selected to fill out questionnaires to determine their interests in the proposed electricity-electronics course. Information was also

¹⁶James C. Ellis, "A Comparative Study of the Needs and Interests of the Students as Related to the Industrial Arts Curriculum of Highland Park Junior High School and Boude Storey Junior High School, Dallas, Texas," unpublished master's thesis, Department of Industrial Arts, North Texas State University, Denton, Texas, 1952, pp. 5-81.

gathered concerning the senior students' use of basic electrical theory in their part-time employment and repair of home appliances, their selections of college study, future occupations, parents' occupation, and interest in the construction of various electrical projects. Of the 435 senior students enrolled at Amarillo High School for the school year 1968-1969, 403 questionnaires were filled out and returned. Of this number, 182 questionnaires were completed by girls and 221 questionnaires were completed by boys.

During the first week of October, 1968, a mailing list of the electrical business firms was made from the classified pages of the Amarillo Telephone Directory.¹⁷ All firms dealing in the installation, operation, sales, manufacture, and maintenance of electrical and electronic equipment were included in the mailing list. Areas of business which were included in the mailing list consisted of automobile electrical service, electrical appliance repair, electrical contractors, electrical equipment manufacturers, electrical equipment (service and repair), electrical equipment (supply and wholesale), electrical light and power companies, electrical motor (repair), electrical motors (wholesale and manufacture), electronic equipment (supply and repair), electronic instrument, radio stations, telephone companies, television repair, and television stations.

¹⁷Amarillo Telephone Directory, Amarillo, Texas, Southwestern Bell Telephone Company, Issue No. 54, December, 1968.

A postcard of inquiry as to the business firms' interest in participating in the study was designed and mailed to the electrical business firms. Forty-five postcards were returned. Of the returned postcards, twenty-three firms indicated a desire to participate in the study; twelve firms indicated a desire not to participate in the study; and ten firms' addresses were unknown. No further contact was made with the twelve firms which did not wish to participate in the study. The remaining firms which did not return the postcards were contacted through telephone calls and personal interviews. A total of seventy-three business firms were solicited to participate in the study and were mailed questionnaires. Sixty-six firms returned completed questionnaires. Since this was a return of 90 per cent, no further follow-up was made on the seven firms not responding.

As soon as the questionnaires were mailed, an investigation was begun to determine the electricity and electronic offering of the various schools within the Amarillo area. Personal interviews and telephone conversations were used to collect the data. A search was also begun of recent issues of industrial arts, vocational, and technical education magazines, unpublished theses, and related books to collect data pertinent to the study.

When it was determined that no further questionnaires would be returned from the electrical business firms, the sixty-six replies returned by the electrical business firms

were sorted according to their source and then carefully checked against the original mailing list. They were classified according to the type of electrical business firm represented. The 403 questionnaires returned by the senior students of Amarillo High School were categorized according to sex. These replies were tabulated and analyzed, and the results appear in the following chapters of this study.

Organization of the Study

Chapter I is an introduction to the study and includes the introduction, the statement of the problem, the purpose of the study, the background and significance of the study, definition of terms used, basic assumptions, limitations of the study, recent and related studies, method of investigation and source of data, and the organization of the study.

Chapter II will present data concerning the various electricity and electronics programs offered in the Amarillo area.

Chapter III will present data collected from questionnaires submitted to the electrical business firms in Amarillo. Data concerning their interest in an electricity-electronics course in the Industrial Arts Department of Amarillo High School and the instructional phases of electronics which they believed to be most important in the proposed course will be presented.

Chapter IV will present data received from questionnaires submitted to the senior students of Amarillo High School for the school year of 1968-1969. The post-graduate plans of the students, their occupational desires, and their interest in an electricity-electronics course will be presented.

Chapter V will include a summary, conclusions, and recommendations based upon the data collected in the study.

CHAPTER II

ELECTRICAL AND ELECTRONIC PROGRAMS OF THE AMARILLO AREA

A survey of the Amarillo area revealed four various programs with offerings in electricity or electronics. The schools where inquiries were made concerning their electricity-electronic programs were Amarillo High School, Caprock High School, Palo Duro High School, Tascosa High School, Amarillo Junior College, and Canyon High School. Courses in either electricity or electronics were found to exist in Amarillo at Amarillo Junior College, Amarillo High School, and Caprock High School. Canyon High School, of Canyon, Texas, also offered basic electricity as a part of its vocational agriculture program.

The Electronics Program of Amarillo Junior College

The electronics program of Amarillo Junior College is divided into three areas. They are Electronic Technology, Industrial Electronics, and Radio and Television Repair.

The electronic technology program offered at Amarillo Junior College is a two-year job-preparatory program. Students completing the program should have the mathematical and electronic background necessary to analyze, design, and

construct basic electronic systems. Students are prepared to qualify for jobs as electronic technicians in areas of communication, digital systems, medical electronics, and electronic sales and service. Upon successful completion of the sixty-semester-hour program, the student receives the Certificate in Electronic Technology, as well as the Associate in Applied Science Degree.

For the school year of 1967-1968, the electronic technology program of Amarillo Junior College had a graduating class of six. For the school year of 1968-1969, there were thirty-one students enrolled in the program.¹

Amarillo College of Vocational Arts, which is a division of Amarillo Junior College, offers programs in industrial electronics and radio and television repair. Enrollment is open to both high school graduates and non-graduates. Persons under the age of nineteen who were not high school graduates must have been out of high school at least one calendar year prior to enrollment. Previous school records and aptitude and achievement tests were taken into consideration when approving enrollment of a student.

The curriculum is organized into three divisions of instruction: trade skill, related trade information and theory, and general education. Instead of regular college

¹Personal interview, Larry B. Masten, Supervisor of Electronic Technology Program, Amarillo Junior College, Amarillo, Texas, March 8, 1969.

hour credit, the curriculum is divided into quarters with a certain number of quarters required. The students enrolled in the program are required to schedule a general education course each quarter. They are also required to take a related course the first three or four quarters of training, depending on the division in which they are enrolled.

Amarillo College of Vocational Arts has program offerings in the following areas: vocational nursing, air conditioning and refrigeration, auto body repair, automobile mechanics, Diesel engine mechanics, industrial welding, radio and television repair, and industrial electronics.

The industrial electronics program is twenty-four months in length (eight terms), with a total of 2,880 clock hours of instruction offered in consecutive twelve-week terms. The program content is composed of 2,400 clock hours in trade and related instruction and 480 clock hours in general education.²

The trade and related instruction program consists of courses in basic electricity, basic electronics, transmitters and receivers, electronic instruments and instrumentation, pulse and digital computers, micro-wave systems, advanced electronic systems, technical mathematics, computer language, and a preparatory course for the Federal Communications Commission examination.

²Amarillo Junior College School of Vocational Arts, Catalog Volume II, Amarillo Junior College, Amarillo, Texas, 1969, p. 22.

There were forty-three students enrolled in the industrial electronics program for the school year of 1968-1969. There have been no previous graduating classes, owing to the fact that the Amarillo College of Vocational Arts has only been in existence since August, 1967.

The length of the radio and television repair and service program is eighteen months, or 2,160 clock hours, of instruction offered, in consecutive twelve-week terms. The program content is comprised of 1,800 hours in trade and related instruction and 360 hours in general education.³

The trade and related instruction program consists of courses in alternating current and direct current circuit analysis, vacuum tube and transistor circuits, radio receiver circuits, black-and-white television, color television, and radio and television service. The trade related course content consists of classes in basic electrical theory, low power mechanics, theory of automatic control systems, and data analysis.

There were forty-four students enrolled in the radio and television repair course for the school year 1968-1969. The enrollment for the school year 1967-1968 was fifteen. There has been only one graduate of the program.⁴

³Ibid., p. 24.

⁴Personal interview, Robert Van Blommestein, Instructor of Radio and Television Repair Program, Amarillo Vocational College, Amarillo, Texas, March 18, 1969.

The Electrical Trades Program of Amarillo High School

The electrical trades classes, Number 31-32 and Number 41-42, offered at Amarillo High School only, are a part of the vocational education program of the Amarillo Public School System. They are in the category of vocational-industrial programs, which include classes in automechanics offered at all four high schools, auto body and trim offered at Palo Duro High School only, building trades offered at Caprock High School only, and metal trades offered at Amarillo High School and Palo Duro High School only.

These industrial trades courses are open to students sixteen years of age or older. Classes are scheduled for laboratory instruction for three consecutive hours each school day. Participating students are enrolled in non-vocational courses leading to high school graduation, during the remainder of the school day.

These pre-employment shop programs are designed to provide our high school youth with both practical and technical training in the basic skills of these selected trades. Instruction is based upon an analysis of the specific trade or occupation and is centered around the performance of useful or productive jobs or operations, in accordance with the accepted procedures and standards which prevail in the particular occupation being taught. All students enrolled in the Vocational-Industrial programs are eligible for membership in the national youth organization, VICA. . . .⁵

⁵Amarillo Public Schools, "Handbook on Vocational Education Courses of the Amarillo Public Schools," Amarillo Public Schools, Amarillo, Texas, 1969, p. 10.

After acquiring the primary foundation in basic electricity and basic electronics, the students enrolled in electrical trades courses may specialize in either industrial electronics, house wiring, motor repair, or radio and television servicing. Students, if they so desire, may also study for (and take) the test for obtaining the Federal Communications Commission license in the electronic broadcasting and telecasting field.

Students are expected to develop skills in the use of hand tools and test equipment, wiring of electrical and electronic circuits, learning to read schematic diagrams and blueprints, and repairing various appliances. They may practice trouble-shooting on a tube-type and a transistor-type superhetrodyne radio trainer. They may also wire a low-voltage remote-control lighting circuit and a three-phase motor-starting circuit and also rewind single-phase motors.

Students are expected to be able to use effectively the following equipment upon completion of the two-year courses: meggers, multimeters, vacuum-tube voltmeters, tube and transistor testers, resonant frequency and audio signal generators and tracers, capacitor testers, resistance and capacitance decade boxes, sweep signal generators, dynamic sweep circuit analyzer, cathode-ray oscilloscope, television analyst, cathode-ray tube tester and rejuvenator, tachometer, and micrometer. The students should also be able to use the

coil winder, drill press, and grinder, as well as all of the hand tools common to the electrical trades.⁶

Students who have successfully completed the course are now working in various areas of electricity and electronics. The firms in Amarillo that have employed graduates of the program are Bell Helicopter, Southwestern Public Service, Bell Telephone Company, American Telephone and Telegraph, General Electric, KGNC Television Station, and various construction firms.

The vocational electronics program has been in existence for seventeen years. It began as a one-hour industrial arts class in electricity and electronics and developed into a vocational program. The average number of students enrolled was thirty, divided into two classes of fifteen each. The second semester class of 1968-1969 was composed of two students from Caprock High School, ten from Palo Duro High School, five from Tascosa High School, and thirteen from Amarillo High School. There were no girls enrolled in the program.

There were no requirements to enroll in the program other than to be sixteen years of age, or a junior or senior student. For the school year of 1967-1968, seven students completed the two-year electrical trades program, and five students completed one year of the program. In comparison

⁶Ibid., p. 12.

to the total number of students enrolled, the average successful completion of the two-year program was 33 per cent.⁷

The Building Trades Program of Caprock High School

The offerings in electricity at Caprock High School consist of theory and actual practice of house wiring, which is incorporated into the building trades program. The course is generally restricted to students who have not been successful in regular class work and who are potential dropouts. The participants of this program construct buildings from the ground up; after disposition of the completed building, they begin another. Students receive instruction and practice in electrical wiring, blueprint reading, building layout, foundation construction, framing, rafter and truss construction, sheeting and insulation, roofing, flooring, heating and ductwork installation, plumbing, painting, cabinet and trim work, door and sash framing, and drywall and plaster work.

The electrical wiring portion of the program consists of familiarization with city building codes, tools and materials, basic electrical theory, and correct procedure in residential and commercial electrical wiring. The program

⁷Personal interview, Oscar A. Self, Vocational Electronics Instructor, Amarillo High School, Amarillo, Texas, March 13, 1968.

has been in existence for two years, with an average enrollment of twenty students per year.⁸

The Vocational Agriculture Program
of Canyon High School

The offerings in electricity at Canyon High School are incorporated into the vocational agriculture program. Instruction in the program is based upon a study of the knowledge and skills students should possess to become successfully established in one or more of the various types of farming or ranching. Areas of instruction include the subjects of animal science, plant science, soil science, farm management, and agricultural mechanization.

Basic electricity is taught in a three-week unit during the mechanization section of Vocational Agriculture 3, which is offered to students in the eleventh grade. Advanced electricity is taught for a three-week period in Vocational Agriculture 4, a course designed for senior students. The areas of electricity which are stressed are building wiring, farm machinery electrical systems, electric motor repair, and basic electrical theory. The average enrollment is approximately twenty-six students per class.⁹

⁸Personal interview, Gene Davis, Building Trades Instructor, Caprock High School, Amarillo, Texas, April 1, 1969.

⁹Personal interview, Jim Walker, Vocational Agriculture Instructor, Canyon High School, Canyon, Texas, March 20, 1969.

CHAPTER III

DATA CONCERNING THE INTEREST OF THE AMARILLO ELECTRICAL INDUSTRY IN THE INCLUSION OF AN ELECTRICITY- ELECTRONICS COURSE IN THE INDUSTRIAL ARTS DEPARTMENT OF AMARILLO HIGH SCHOOL

The questionnaire method was used to determine the electrical business firms' interest in the inclusion of an electricity-electronics course in the Industrial Arts Department of Amarillo High School. Information was also gathered pertaining to the total number of employees, the number of employees who require a basic understanding of electricity, what areas of electricity and electronics the electrical firms considered most important to the curriculum of the proposed course, and what test instruments the employees of each firm were expected to be able to use.

Table I presents data concerning the percentage of the various types of business firms participating in the study. Of the sixty-six questionnaires received, fifty-six, or 84.8 per cent, of the electrical business firms believed that the inclusion of an electricity-electronics course in the Industrial Arts Department of Amarillo High School would be of benefit to their employees. Nine, or 13.6 per cent, of the questionnaires received indicated that the inclusion of the course would not be of benefit to the firms' employees.

One questionnaire was received in which no response was made to the question.

TABLE I
DATA CONCERNING THE PERCENTAGES OF THE VARIOUS TYPES
OF ELECTRICAL BUSINESS FIRMS PARTICIPATING
IN THE STUDY

Type of Business	Number of Business Firms	Number of Firms Participating in the Study	Per Cent
Automobile Electrical Service	6	2	33
Electrical Appliance Repair (Small)	6	5	83
Electrical Contractor (Construction)	31	3	9
Electrical Equipment Manufacturer	8	4	50
Electrical Equipment (Service and Repair)	5	4	80
Electrical Equipment (Supply and Wholesale)	10	9	90
Electrical Light and Power Co.	1	1	100
Electrical Motors (Repair)	2	2	100
Electrical Motors (Wholesale and Manufacturer)	3	2	66
Electronic Equipment (Supply and Repair)	4	3	75
Electronic Instruments	1	0	0
Radio Stations	5	3	60
Telephone Company	1	1	100
Television Repair	38	24	63
Television Stations	3	3	100
Totals	124	66	53

Nine electrical business firms indicated that the inclusion of an electricity-electronics would not be of benefit

to their employees. These nine electrical businesses represented a total of 110 workers, or 5.8 per cent of the estimated total number of employees of the electrical industry of Amarillo, Texas.¹ They were scattered, with no concentration in any one area of business.

Two firms in television repair indicated that they did not think a course in electricity-electronics would be of value to their employees. The remaining seven firms were (1) electric motor (wholesale and repair), (2) electrical appliance repair, (3) electrical equipment manufacturing, (4) electrical equipment (service and repair), (5) electrical equipment (supply and wholesale), (6) automotive electrical service, and (7) radio stations.

Table II presents data concerning the number of various types of electrical business firms located in the Amarillo area, the total number of employees in each area, and the number of employees in each area which depended upon a basic working knowledge of electricity. The 124 firms represented employed a total of 1,882 workers. Of this total, 1,042, or 55.4 per cent, of the employees depended upon a basic working knowledge of electricity. Two firms, Southwestern Bell Telephone Company and Southwestern Public Service Company, had 886 employees, or 47.1 per cent, of the total number of the workers employed by the electrical industry of Amarillo,

¹Eldrid and Darden, op. cit., p. 1.

TABLE II

NUMBER OF ELECTRICAL FIRMS OF AMARILLO, TEXAS, NUMBER OF EMPLOYEES, AND PER CENT OF EMPLOYEES DEPENDING ON A WORKING KNOWLEDGE OF ELECTRICITY

Type of Business	Number of Electrical Business Establishments	Number of Employees	Number of Employees Depending upon a Basic Working Knowledge of Electricity	Per Cent
Automobile Electrical Service	6	25	20	80.
Electrical Appliance Repair (Small)	6	42	24	57.1
Electrical Contractor (Construction)	31	187	155	82.8
Electrical Equipment Manufacturer	8	48	32	66.6
Electrical Equipment (Service and Repair)	5	60	40	66.6
Electrical Equipment (Supply and Wholesale)	10	160	70	43.7
Electrical Light and Power Company*	1	600	300	50.
Electrical Motors (Repair)	2	10	8	80.
Electrical Motors (Wholesale and Manufacturer)	3	48	26	54.2
Electronic Equipment (Supply and Repair)	4	32	16	50.
Electronic Instruments	1	50	1	2.
Radio Stations	5	48	10	20.8
Telephone Company**	1	286	230	80.4
Television Repair	38	76	58	76.3
Television Stations	3	210	53	25.2
Totals	124	1,882	1,042	55.4

*Southwestern Public Service

**Bell Telephone Company

Texas. Of the 886 employees of these two firms, 530, or 59.8 per cent, of them depended upon a basic working knowledge of electricity.

Table III presents data concerning the eleven largest business employers in the Amarillo metropolitan area. It may be noted that Southwestern Public Service Company and Southwestern Bell Telephone Company are the second and third largest of the eleven businesses listed.

TABLE III
DATA SHOWING EMPLOYMENT OF THE ELEVEN LARGEST
BUSINESS FIRMS IN AMARILLO, TEXAS²

Business	Number of Employees	
	October 1965	March 1968
Southwestern Public Service Co.	652	662
Southwestern Bell Telephone Co.	615	714
Levi Strauss Co.	580	600
Bell Helicopter	-0-	500
American Smelting & Refining Co.	478	470
Sears and Roebuck & Co.	350	350
Southwestern Investment Co.	405	383
Globe-News Publishing Co.	350	376
Pioneer Natural Gas Co.	345	350
Shamrock Oil & Gas Corp.	320	350
Santa Fe Railway Co.	1,427	1,427
Total	5,522	6,182

Table IV presents data showing the course content which the electrical business firms believed should be included in

²"Report of the Chamber of Commerce," Amarillo, Texas (Amarillo, Texas, 1968), p. 1.

the curriculum of the proposed electricity-electronics course to be included in the Industrial Arts Department of Amarillo High School. The order of preference was determined by the number of times each instructional phase was selected. Those phases which received a substantial number of selections are as follows: drawing and reading schematics, 59 times; series circuits, 59 times; Ohms' Law, 57 times; parallel circuits, 57 times; correct use of tools and instruments, 53 times; transformer function, 51 times; electrical symbols, 50 times; identification of tools and instruments, 44 times; conductors and insulators, 44 times; series and parallel resistors, 44 times; fuses and breaks, 42 times; electron theory, 40 times; sources of electricity, 37 times; magnetism, 32 times; the generator, alternator, and motor, 32 times; electronic (communication) selected 31 times; television and radio repair, 28 times; the storage of electricity, 22 times; understanding of static electricity, 18 times; minor appliance repair selected 16 times; and computing the cost of electrical service, 11 times.

The remaining instructional phases were selected five times or less. Five of the phases were written as alternates by the business firms filling out the questionnaire and did not appear on the original list. These phases were fundamentals of alternating current generators, soldering of electronic components, fundamentals of television camera operation, power transmission, and fundamentals of the transistor and electron tube.

TABLE IV

INSTRUCTIONAL PHASES WHICH THE ELECTRICAL BUSINESS FIRMS
OF AMARILLO, TEXAS, BELIEVED SHOULD BE INCLUDED IN
THE CURRICULUM OF THE PROPOSED ELECTRICITY-
ELECTRONICS COURSE AT AMARILLO HIGH SCHOOL

Topics	Number of Times Selected	Per Cent
Drawing and reading schematics	59	6.8
Series circuits	59	6.8
Parallel circuits	57	6.5
Ohm's Law	57	6.5
Correct use of tools and instruments	53	6.1
Transformer function	51	5.8
Electrical symbols	50	5.7
Identification of tools and instruments	44	5.0
Conductors and insulators	44	5.0
Series and parallel resistors	44	5.0
Fuses and breaks	42	4.8
Electron theory	40	4.6
Sources of electricity	37	4.2
Magnetism	32	3.6
The generator, alternator and motor	32	3.6
Electronics (communication)	31	3.5
Television and radio repair	28	3.2
The storage of electricity	22	2.5
National and local electrical codes	22	2.5
Understanding of static electricity	18	2.1
Minor appliance repair	16	1.8
Computing the cost of electrical service	11	1.2
Automotive electrical systems	5	.6
Fundamentals of the alternating current generator	2	.2
Fundamentals of the transistor and electron tube	2	.2
Soldering of electronic components	1	.1
Fundamentals of television camera operation	1	.1
Power transmission	1	.1
Total	871	100

In comparison to the number of times each phase was selected, the electrical business firms were also asked to select five phases, in order of preference from one to five, which they would like to have included in an electricity-electronics course. Table V presents data concerning the course content which the electrical business firms believed to be most important.

Based on duties performed by their employees, the phases selected by four or more of the business firms as being most important to the proposed electricity-electronics course were television and radio repair, identification of tools and instruments, electronics (communication), correct use of tools and instruments, the generator, alternator, and motor, and the national and local electrical codes.

The phases selected by four or more of the business firms as being second most important to the proposed electricity-electronics course were correct use of tools and instruments, drawing and reading schematics, electronics (communication), electron theory, parallel circuits, and electrical symbols.

The phases selected by four or more of the business firms as being third most important to the proposed electricity-electronics course were drawing and reading schematics, parallel circuits, electron theory, electrical symbols, series circuits, and television and radio repair.

The phases selected by four or more of the business firms as being fourth most important to the proposed electricity-

TABLE V

THE INSTRUCTIONAL PHASES WHICH THE ELECTRICAL BUSINESS FIRMS OF AMARILLO, TEXAS, BELIEVED TO BE MOST IMPORTANT TO THE CURRICULUM OF THE PROPOSED ELECTRICITY-ELECTRONICS COURSE AT AMARILLO HIGH SCHOOL

Topics	Number of Firms Responding				
	Choice				
	(1)	(2)	(3)	(4)	(5)
Identification of tools and instruments	5	..	3	..	..
Correct use of tools and instruments	4	12	1	1	5
Electrical symbols	..	4	4	1	1
Source of electricity	1	3	1	4	..
Drawing and reading schematics	2	7	8	6	10
Magnetism	..	1	..	2	..
Electron theory	3	4	5	3	4
Understanding of static electricity	..	..	..	1	..
The storage of electricity	..	..	..	1	1
The generator, alternator, and motor	4	1	1	2	2
Parallel circuits	1	4	6	5	1
Series circuits	..	2	4	4	6
Conductors and insulators	2	..	2	5	2
Fuses and breaks	..	2	2	..	1
Transformer function	1	2	3	3	..
Ohm's law	2	4	3	6	5
Series and parallel resistors	..	..	2	..	2
Electronics (communication)	5	5	..	2	1
National and local electrical codes	4	..	2	1	1
Minor appliance repair	2	..	..	2	..
Computing cost of electrical service	..	..	1	..	..
Television and radio repair	12	3	4	..	4
Automotive electrical systems	..	..	..	1	1
Fundamentals of alternating current generator	2	1	..	..	..
Soldering of electronic components	1	..	..	..	..
Fundamentals of television camera operation	1	..	..	..	..
Power transmission	1	..	..	..	..
Fundamentals of transistor and electron tube	1	..	..	..	..

electronics course were drawing and reading schematics, Ohms' Law, parallel circuits, conductors and insulators, source of electricity, and series circuits.

Although none of the phases were selected four or more times in all five categories, drawing and reading schematics was selected six or more times in each of four categories, or a total of thirty-three times. This phase, together with series circuits, was selected fifty-nine times in Table IV, which represented the highest frequency of all phases listed. Other phases which were selected most frequently in Table V were correct use of tools and instruments, 23 times; television and radio repair, 23 times; Ohms' Law, 20 times; electron theory, 19 times; and parallel circuits, 17 times.

Table VI presents data concerning the electrical test instruments which the business firms believed their employees should be able to operate effectively.

The following instruments were written in by the business firms filling out the questionnaire and did not appear on the original list. They were amperage meter, sweep generator, continuity tester, resonant circuit (series and parallel), oven tester, alignment generator, transistor tester, power factor meter, phase sequence indicator.

TABLE VI

ELECTRONIC TEST INSTRUMENTS OF WHICH THE ELECTRICAL
BUSINESS FIRMS BELIEVED THEIR EMPLOYEES
SHOULD HAVE A WORKING KNOWLEDGE

Test Instrument	Number of Times Chosen
Multimeter	46
Oscilloscope	43
Vacuum Tube Voltmeter	40
Tube Tester	35
Capacity Tester	28
Audio Signal Generator	28
Watt Meter	24
Sine Wave/Bar Generator	22
Marker Generator	22
Field-Strength Meter	22
Vibrator Tester	11
Amperage Meter	6
Sweep Generator	5
Continuity Tester	4
Resonant Circuit (series and parallel)	1
Oven Tester	1
Alignment Generator	1
Transistor Tester	1
Power Factor Meter	1
Phase Sequence Indicator	1

Those test instruments which were selected with the greatest frequency were the multimeter, 46 times; the oscilloscope, 43 times; the vacuum tube voltmeter, 40 times; the tube tester, 35 times; the capacity tester, 28 times; the audio signal generator, 28 times; the watt meter, 24 times; the marker generator, 22 times; and the sine wave/bar generator, 22 times.

CHAPTER IV

DATA CONCERNING THE INTEREST OF THE SENIOR STUDENTS OF AMARILLO HIGH SCHOOL IN AN ELECTRICITY-ELECTRONICS COURSE IN THE INDUSTRIAL ARTS DEPARTMENT

Data concerning the interest of the senior students of Amarillo High School in an electricity-electronics course in the Industrial Arts Department of Amarillo High School are presented in Chapter IV. Questionnaires were distributed among the homeroom teachers of the senior students, with instructions for filling out the questionnaire. Four hundred and three of the 435 senior students completed and returned the questionnaire. One hundred and eighty-two questionnaires were completed by girls, and 221 questionnaires were completed by boys.

Of the 403 senior students who completed the questionnaire, 302, or 75.1 per cent, believed that a course in electricity-electronics in the Industrial Arts Department would be of value to them. One hundred and forty-four, or 79.1 per cent, of the girls and 158, or 71.5 per cent, of the boys were of this opinion.

Table VII presents data concerning a comparison of the choices of elective courses made by the 403 senior students of Amarillo High School. Although 302, or 75.1 per cent, of

the senior students believed that a course in electricity-electronics would be of value to them, only 103, or 22.6 per cent, of the students selected electronics, in comparison to the other courses listed. Crafts was the first choice of the largest single group of students, with 151 selecting this subject area. Electronics was the second choice, with 103 selections.

TABLE VII
COMPARISON OF THE CHOICES OF ELECTIVE COURSES MADE
BY 403 SENIOR STUDENTS OF AMARILLO HIGH SCHOOL

	Girls		Boys		Total	
	No.	%	No.	%	No.	%
Crafts	99	51.5	52	19.6	151	33.0
Electronics	11	5.6	92	34.7	103	22.6
Transportation	33	17.1	54	20.4	87	19.0
Graphic Arts	20	10.4	27	10.2	47	10.3
Basic Electricity	6	3.6	34	12.8	40	8.7
None	23	11.8	6	2.3	29	6.4

Crafts was the first choice of the girls with 99 selections, or 51.5 per cent of the total number of selections. Transportation was the second choice with 33 selections. Graphic arts, electronics, and basic electricity had total selections of 20, 11, and 6 respectively. Thirty-three, or 11.8 per cent, of the girls were not interested in any of the

subjects listed. In comparison, only six, or 2.3 per cent, of the boys were not interested in any of the subjects listed.

Electronics was the first choice of the boys with 92 selections, or 34.7 per cent of the total. Transportation was the second choice with 54, or 20.7 per cent of the total. Crafts, basic electricity, and graphic arts had selections of 52, 34, and 27 respectively.

Table VIII presents data concerning courses in electricity and electronics, which the students chose as those they would prefer to take. Communications was the first choice of the largest single group of students, with 115, or 26.6 per cent of the total number of selections. Radio and television repair was second with 79, or 18.2 per cent of the total. One hundred and sixty, or 37 per cent, of the senior students were not interested in any of the courses listed.

TABLE VIII

COMPARISON OF THE CHOICES OF ELECTRICITY AND
ELECTRONICS COURSES MADE BY 403 SENIOR
STUDENTS OF AMARILLO HIGH SCHOOL

	Girls		Boys		Total	
	No.	%	No.	%	No.	%
Communications	51	27.3	64	26.0	115	26.6
Radio and tele- vision repair	23	12.3	56	22.8	79	18.2
Basic Electronics	7	3.7	49	19.9	56	12.9
Basic Electricity	7	3.7	16	6.5	23	5.3
None	99	53.0	61	24.8	160	37.0

Communications was the first choice of the girls with 51 selections, or 27.3 per cent of the total. It was also the first choice of the boys with 64 selections, or 26 per cent of the total. Radio and television repair was the second selection of both the girls and boys. Ninety-nine, or 53 per cent, of the girls and 61, or 24.8 per cent, of the boys were not interested in any of the courses listed.

Table IX presents data obtained from the questions asked the senior students concerning their willingness to transfer to another high school in order to take a course in electricity or electronics, the number of home repairs made, and part-time employment.

Concerning the question of whether the students would be willing to transfer to another high school in Amarillo in order to take a course in electricity or electronics, 329, or 81.6 per cent, indicated that they would not be willing to transfer. Of the 403 students answering the questionnaire, 183, or 45.5 per cent, indicated that they did make home repairs which required a basic understanding of electricity. Of this number, 34 were girls and 144 were boys. The data show that 221, or 52.7 per cent, of the senior students held regular or part-time jobs. One hundred and thirty-one of the jobs were held by boys, and 90 of the jobs were held by girls. Of the 403 senior students answering the questionnaire, 40, or 10 per cent, of the students indicated that their employment required a general understanding of electricity.

TABLE IX

RESPONSE OF 403 SENIOR STUDENTS TO QUESTIONS CONCERNING
AN ELECTRICITY-ELECTRONICS COURSE IN THE INDUSTRIAL
ARTS DEPARTMENT OF AMARILLO HIGH SCHOOL

	Number Answering					
	Yes		No		Undecided	
	No.	%	No.	%	No.	%
Students willing to transfer to another high school in Amarillo in order to take a course in electricity or electronics	66	16.4	329	81.6	8	2.0
Students making any home repairs which require a basic understanding of electricity	183	45.4	216	53.8	4	.8
Students holding a regular or part-time job	221	52.7	182	47.1	8	2.0
Students employed in a job requiring a general understanding of electricity	40	10.0	256	63.5	107	26.5

Table X presents data concerning courses in the Industrial Arts Department which the 403 senior students had taken beginning with the seventh grade. General Woodwork 10, offered in the ninth grade, had been taken by more of the girls and boys than any of the other subjects listed. General Shop 7 was second in order, while General Shop 8 and General Drafting 10

were third and fourth, respectively. One hundred and sixty-four, or 90 per cent, of the girls had never taken any of the industrial arts courses listed. Twenty-nine, or 13.9 per cent, of the boys had never taken any of the courses listed.

TABLE X

DATA CONCERNING THE INDUSTRIAL ARTS COURSES TAKEN BY
THE SENIOR STUDENTS OF AMARILLO HIGH SCHOOL

Courses	Girls		Boys	
	No.	%	No.	%
General Woodwork 10	8	4.4	117	52.9
General Shop 7	3	1.6	111	50.2
General Shop 8	2	1.1	85	38.4
General Drafting 10	2	1.1	84	38.0
Machine Woodwork 20	...	...	52	25.5
Mechanical Drafting 20	1	.6	49	22.2
Auto-Mechanics 30 and 40	1	.6	34	15.4
Machine Woodwork 40	...	...	31	14.0
Machine Woodwork 30	...	...	23	10.4
Architectural Drafting 30	...	...	19	8.6
General Metals 20	...	...	14	6.3
Pre-Engineering Drafting 30	...	...	10	4.5
Architectural Drafting 40	...	...	10	4.5
Pre-Engineering Drafting 40	...	...	4	1.8
None	164	90.0	29	13.9

Table XI presents data concerning part-time and summer employment of the 403 senior students. Of the 182 senior girls filling out questionnaires, 90, or 48.9 per cent, were employed part time. Of the 221 senior boys filling out questionnaires, 131, or 59.7 per cent, were employed part time. Of the 39 part-time jobs listed, only one was directly related to electronics and three were indirectly related.

TABLE XI
PART--TIME EMPLOYMENT OF THE SENIOR STUDENTS
OF AMARILLO HIGH SCHOOL

Occupation	No. of Students Working		
	Girls	Boys	Total
Grocery Store (package boy)	..	26	26
Clerical Work	21	2	23
Labor (general)	..	23	23
Sales	9	8	17
Secretary	14	..	14
Maintenance (ground and bldg.)	..	11	11
Waitress	11	..	11
Farm and Ranch Work	..	10	10
Cook	1	7	8
Mechanic (auto. and Diesel)	..	8	8
Bus Boy	..	7	7
Baby Sitting	6	..	6
Nurse's Aid	6	..	6
Beautician	5	..	5
Cashier (grocery & variety store)	5	..	5
Newspaper Delivery	..	4	4
Seamstress	4	..	4
Construction Work	..	3	3
Delivery Boy	1	2	3
Dish Washer	..	3	3
Metal Work	..	3	3
Tutor (music and Spanish)	3	..	3
Life Guard	..	2	2
Appliance Repair	..	1	1
Auction Worker	..	1	1
Bookkeeper	..	1	1
Butcher's Helper	..	1	1
Dental Assistant	1	..	1
Display Work	..	1	1
Freight Delivery	..	1	1
Flight Instructor	..	1	1
Florist	1	..	1
Furniture Refinishing	..	1	1
Mail Clerk	..	1	1
Medical Records Clerk	1	..	1
Musician	..	1	1
Printer's Assistant	..	1	1
Physical Therapist Assistant	1	..	1
Television Repair	..	1	1

Table XII presents data concerning the future educational plans of the senior students. Three hundred and thirteen, or 77.4 per cent, of the senior students plan to attend college after graduation. But only 90, or 22.3 per cent, indicated that they plan to attend trade school after graduation. Only 17, or 4.5 per cent, of the students questioned about their plans to attend college were undecided about their future education. When questioned about their plans to attend trade school after graduation, 26, or 6.5 per cent, of the students were undecided about their future educational plans.

TABLE XII

RESPONSE OF 403 SENIOR STUDENTS TO QUESTIONS
CONCERNING THEIR FUTURE EDUCATIONAL PLANS

Question	Number Answering					
	Yes		No		Undecided	
	No.	%	No.	%	No.	%
Do you plan to go to college?	313	77.4	73	18.1	17	4.5
Do you plan to attend trade school after graduation?	90	22.3	287	71.2	26	6.5

Table XIII presents data concerning the frequency of selection of major fields of college study made by the senior students filling out the questionnaire.

TABLE XIII

FREQUENCY OF SELECTION OF MAJOR FIELDS OF COLLEGE
STUDY MADE BY THE 403 SENIOR STUDENTS
OF AMARILLO HIGH SCHOOL

Field of Study	Girls	Boys	Total
Business	28	13	41
Teaching (education)	12	5	17
Electrical Engineering	..	14	14
English	..	5	13
Pre-Medical	6	7	13
Law	1	11	12
Mechanical Engineering	..	11	11
Industrial Arts	..	11	11
Automobile Mechanics	..	10	10
Nursing	10	..	10
Home Economics	9	..	9
History	3	6	9
Psychology	7	2	9
Data Processing	1	7	8
Mathematics	5	3	8
Music	3	5	8
Electronic Technology	..	7	7
Agriculture	..	6	6
Art	4	2	6
Architectural Engineering	..	6	6
Dramatic Arts	2	4	6
Foreign Language	5	1	6
Physical Education	2	4	6
Science	3	3	6
Chemistry	..	5	5
Forestry	..	4	4
Sociology	3	1	4
Physics	..	2	2

In tabulating data for Table XIII, only those major fields which were chosen at least twice were used. Six additional fields were chosen only once; they were biology, commercial art, geology, government, and mortuary science. Out of the twenty-seven subject fields listed, two were directly related to electronics, and five were indirectly related to

electricity and electronics. The data show that electrical engineering was selected the third greatest number of times, in comparison to the other subject fields listed.

Table XIV presents data concerning the occupations which the senior students selected for their life's work after graduation.

TABLE XIV
SELECTIONS OF FUTURE OCCUPATIONS OF 403 SENIOR
STUDENTS OF AMARILLO HIGH SCHOOL

Occupation	Non-College Students	College Students	Total
Teaching	..	49	49
Secretarial Work	7	23	30
Automobile Mechanics	13	10	23
Engineering (elect. & mech.)	..	18	18
Business	..	16	16
Nursing	..	15	15
Data Processing	1	12	13
Stewardess	4	8	12
Electronic Technician	1	10	11
Housewife	6	5	11
Lawyer	..	8	8
Beautician	3	4	7
Commercial Pilot	..	7	7
Fashion Coordinator	..	7	7
Farming and Ranching	3	4	7
Game Management	1	6	7
Architect	..	6	6
Military Career	1	5	6
Doctor	..	5	5
Musician	..	5	5
Professional Sports	1	4	5
Psychology	..	5	5
Chemical Engineering	..	4	4
Ministry	..	3	3
Orthodontist	..	3	3
Veterinarian	..	3	3
Cartoonist	..	2	2
Pharmacist	..	2	2
Interior Decorator	..	2	2
Undecided	32	..	32

Only those occupations which were chosen at least twice were used. There were eleven additional occupations which were selected by only one student.

Students who indicated on their questionnaire they did not plan to attend college selected automobile mechanics the greatest number of times out of the eleven occupations chosen. Two of the occupations chosen, automobile mechanics and electronics technician, were directly related to electronics. Thirty-two of the students not planning to attend college were undecided about their future occupational plans.

Of the students planning to attend college, a greater number were planning to enter the teaching profession than any other field of work. Out of the twenty-nine occupations listed, three were directly related to electronics. Twenty-seven of the senior students planning to attend college were undecided about their future occupational plans.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The specific purpose of this study was to ascertain the interest in and need for an electricity-electronics course in the Industrial Arts Department of Amarillo High School. Data were gathered in an attempt to determine (1) what types of electricity or electronics programs are presently located in the Amarillo metropolitan area; (2) what phases of electricity and electronics, which could be offered by the Amarillo High School Industrial Arts Department, would be most beneficial to the electrical industry of Amarillo; (4) how many employees of the electrical industry depend upon a working knowledge of basic electricity; (5) what electronic test instruments are the employees of the electrical business firms in Amarillo expected to be able to use; (6) what occupations and professions do the senior students of Amarillo High School plan to prepare for and follow in later life; (7) if students were willing to transfer from Amarillo High School to another high school in Amarillo in order to take a course in electricity or electronics; and (8) how many senior students of Amarillo High School use basic applied electrical theory in their part-time employment and home repairs?

Data for this study were obtained from electrical and electronic business firms in Amarillo. Data were also obtained from the senior students at Amarillo High School. Information secured from the business firms and senior students was recorded on prepared information forms. (See Appendices B and C).

Summary

Chapter I introduced the study and presented the statement of the problem, the purpose of the study, and the background and significance of the study. The definition of terms used, basic assumptions, limitations of the study, review of recent and related studies, method of investigation, and organization of the study were also presented.

In Chapter II, an analysis was made of the electricity and electronics programs located in the Amarillo metropolitan area. Data revealed four schools with offerings in either electricity or electronics. They were Amarillo Junior College, Amarillo High School, Caprock High School of Amarillo, and Canyon High School of Canyon, Texas.

It was found that Amarillo Junior College has three programs in electronics. Two of them, industrial electronics and radio and television repair, are offered by the Amarillo College School of Vocational Arts which is a division of Amarillo Junior College. Instead of regular college credit, the curriculum is divided into quarters. The length of the

radio and television repair program was eighteen months, or 2,160 hours, of instruction offered in consecutive twelve-week terms. There were forty-four students enrolled in the program for the school year 1968-1969. The enrollment for the school year 1967-1968 was fifteen, with one graduate of the program. The length of the industrial electronics program was twenty-four months, or 2,880 hours, of instruction offered in consecutive twelve-week terms. There were forty-three students enrolled in the program for the school year 1968-1969. There had been no previous graduating classes. The electronic technology program is a job-preparatory program which earns regular college credit. Upon successful completion of the sixty-semester-hour program, a student will receive the Certificate in Electronic Technology, as well as the Associate in Applied Science Degree. Six students graduated from the program during the school year 1967-1968, and there were thirty-one students enrolled for the school year 1968-1969.

The electrical trades program of Amarillo High School consisted of two classes, Electrical Trades Number 31-32 and Number 41-42. These classes were scheduled for laboratory instruction for three consecutive hours each school day, for two units of credit a year. Participating students were enrolled in non-vocational courses leading to high school graduation during the remainder of the school day. The classes were designed to develop technical skills in the areas of

electricity and electronics. The average number of students enrolled in the program was thirty, divided into two classes of fifteen each. For the school year of 1967-1968, seven students completed the two-year program and five students completed the first year of the program. In comparison to the total number of students enrolled, the average successful completion of the two-year program was 33 per cent.

The offerings in electricity at Caprock High School and Canyon High School were incorporated into related programs. The building trades program at Caprock High School was generally restricted to students who had not been successful in regular class work and were potential dropouts. The participants of this program constructed buildings from the ground up and, in turn, received instruction and actual practice in house wiring. The program had an average enrollment of twenty students per year. The vocational agriculture program of Canyon High School of Canyon, Texas, was divided into two classes to be taken during the junior and senior years. Basic electricity was taught in a three-week unit during the mechanization section of these courses. The average enrollment was twenty-six students per class.

Chapter III presents data compiled from a survey of sixty-six electrical business firms located in the Amarillo area, concerning their attitudes toward and interest in an electricity-electronics program in the Industrial Arts Department of Amarillo High School. A total of 84.8 per cent of the

electrical business firms were of the opinion that the inclusion of the course would be beneficial to their employees. The electrical business firms of Amarillo employed approximately 1,882 workers. Of this number, 55.4 per cent of the employees depended upon a basic working knowledge of electricity. The phases of instruction which the majority of the business firms believed most important to the proposed electricity-electronics course were drawing and reading schematics, correct use of tools and instruments, television and radio repair, Ohm's Law, electron theory, parallel circuits, series circuits, transformer function, electrical symbols, identification of tools and instruments, conductors and insulators, fuses and breaks, series and parallel resistors, and sources of electricity. The test instruments which the majority of the electrical business firms believed their employees should be able to operate effectively were multimeter, the oscilloscope, the vacuum tube voltmeter, and the tube tester.

Chapter IV includes data compiled from a survey of 403 senior students enrolled in Amarillo High School concerning their interest in an electricity-electronics course in the Industrial Arts Department. Data concerning the post-graduate educational and occupational plans of the students were presented. A total of 75.1 per cent of the senior students believed that an electricity-electronics course in the Industrial Arts Department would have been of value to them

and their classmates. Electronics was the first choice of the boys and the fourth choice of the girls in comparison to the following elective areas: crafts, transportation, graphic arts, and basic electricity. The data revealed that 81.6 per cent of the students would not have been willing to transfer to another high school in Amarillo in order to take a course in electricity or electronics. Forty-five and six-tenths per cent of the students indicated they made home repairs which required a basic understanding of the electricity. Two hundred and twenty-one, or 52.7 per cent, of the students indicated that they held regular or part-time jobs, but only forty, or 10 per cent, of the students indicated that their employment required a general understanding of electricity. Of the 403 students, 313, or 77.4 per cent, of the students planned to attend college after graduation.

Conclusions

From the data presented in this study, the following conclusions may be drawn:

1. There is definite interest among the senior students of Amarillo High School in an electricity-electronics course in the Industrial Arts Department.

2. A relatively large percentage of the students was not willing to transfer to another high school in Amarillo in order to take a course in electricity or electronics.

3. Ninety per cent of the senior girls of Amarillo High School had never taken any industrial arts courses.

4. Very few of the senior students required a general understanding of electricity for part-time employment, but approximately one-half of the senior students made domestic electrical appliance repairs.

5. A large percentage of the senior students planned to attend college after graduation.

6. Teaching was chosen the greatest number of times by the students as the occupation they plan to follow in later life.

7. Amarillo Junior College has a comprehensive offering in electronics, with three distinct programs. The only classes in electronics offered by the Amarillo Public School System were in the electrical trades program at Amarillo High School.

8. A substantial majority of the business firms surveyed believed that the inclusion of an electricity-electronics course in the Industrial Arts Department of Amarillo High School would be beneficial to their prospective employees.

9. The electrical business firms of Amarillo employed approximately 1,882 workers. Over half of the employees depended upon a basic working knowledge of electricity.

10. The following phases of instruction were considered to be most important to the electricity-electronics course: drawing and reading schematics, correct use of tools and instruments, television and radio repair, Ohm's Law, electron theory, parallel circuits, transformer function, electrical symbols, identification of tools and instruments, conductors

and insulators, fuses and breaks, series and parallel resistors, and sources of electricity.

11. The employees of the electrical business firms were expected to be able to operate effectively the following test instruments: multimeter, oscilloscope, vacuum tube voltmeter, and tube tester.

Recommendations

The following recommendations were made from the conclusions drawn from the study:

1. A general orientation course in electricity-electronics should be included in the Industrial Arts Department of Amarillo High School in the tenth grade. A more advanced continuation of the course should be offered in the eleventh grade.

2. The curriculum of the electricity-electronics course should be based upon those phases of instruction which the electrical business firms believed to be most important.

3. The test instruments which the employees of the electrical business firms were expected to be able to use should be incorporated into the curriculum of the classes.

4. The industrial arts programs at Amarillo High School and at James Bowie Junior High School and Fannin Junior High School, which two schools are in the Amarillo High School District, should be expanded to include more variety of learning experiences for both girls and boys.

5. A thorough study of the industrial arts program in the Amarillo Independent School District, Amarillo, Texas, should be made to determine what directions can be taken within the existing framework of physical facilities and instructional staff to redistrict the emphasis toward a more comprehensive representation of contemporary industry.

APPENDIX

APPENDIX A

September, 1968

Dear Sir:

In fulfillment of the requirements for the master of science degree, I am conducting a survey of the need for an electricity and electronics class in the industrial arts program of Amarillo High School, Amarillo, Texas.

To validate this study, it is necessary that I determine the needs of the electrical industry of Amarillo in regard to qualified personnel. This information will be gathered by the use of a brief questionnaire which will require no more than five to ten minutes of your time.

Enclosed you will find a self-addressed postcard on which you may indicate your response as to whether or not your firm would like to participate in this project.

Please accept my thanks for this courtesy.

Sincerely yours,

Jacky C. Hicks
4715 Shawnee
Amarillo, Texas 79109

APPENDIX B

ELECTRICITY AND ELECTRONICS CHECK LIST

This check list will be used to determine the desirability and content of an electricity electronics course in the industrial arts program of the Amarillo Public Schools. Please answer the questions below and check each item as accurately as possible.

1. Name of Firm _____
2. Number of Employees _____
3. Which of the following categories would your business fall under?
 - A. Electrical Appliance Repair
 - B. Electrical Contractor (Construction)
 - C. Electrical Equipment Manufacturer
 - D. Electrical Equipment (Service and Repair)
 - E. Electrical Equipment (Supply and Wholesale)
 - F. Electrical Light and Power Company
 - G. Electrical Motors (Repair)
 - H. Electrical Motors (Wholesale and Manufacturer)
 - I. Electrical Supply (Wholesale and Manufacturer)
 - J. Electronic Equipment (Supply and Repair)
 - K. Electronic Instruments
 - L. Automobile Electrical Service
 - M. Telephone Company
 - N. Television Repair
 - O. Television Station
 - P. Others (please specify) _____
4. How many of your employees depend upon a basic working knowledge of electricity in their every day work? _____
5. Do you believe that the inclusion of an electricity and electronics course in the industrial arts program of the Amarillo High Schools would be beneficial to your employees?
 - Yes
 - No

6. Check those topics which you feel should be included in the course content of an electricity-electronics course offered in the industrial arts program which would be beneficial to a graduate seeking employment with your firm.
- A. Identification of tools and instruments
 - B. Correct use of tools and instruments
 - C. Electrical Symbols
 - D. Sources of Electricity
 - E. Drawing and Reading Schematics
 - F. Magnetism
 - G. Electron Theory
 - H. Understanding of Static Electricity
 - I. The Storage of electricity
 - J. The generator, alternator and motors
 - K. Parallel circuits
 - L. Series circuits
 - M. Conductors and insulators
 - N. Fuses and breaks
 - O. Transformer function
 - P. Ohms' Law
 - Q. Series and parallel resistors
 - R. Electronics (communication)
 - S. National and Local Electrical Codes
 - T. Minor appliance repair
 - U. Computing cost of electrical service
 - V. Television and Radio Repair
 - W. Automotive electrical systems
 - X. Others (please specify) _____
-
7. List in order of your preference your first, second, third, fourth, and fifth choices of the phases of electricity and electronics listed above which you think should be stressed in course content. Please list them by letter, such as B, C, F, etc.
-
- Others (please specify): _____
8. Check the major electrical test instruments of which you feel employees should have a working knowledge:
- A. Tube tester
 - B. Capacity tester
 - C. Multimeter (VOM)
 - D. Vacuum tube voltmeter
 - E. Oscilloscope
 - F. Watt meter

- G. Field-strength meter
 - H. VTVM
 - I. Audio Signal generator
 - J. Marker generator
 - K. Vibrator tester
 - L. Sine Wave/Bar Generator
 - M. Others (please specify) _____
-

APPENDIX C

Name _____ Address _____

Age _____ Grade _____

Male _____ Female _____

DIRECTIONS: This questionnaire is designed to determine the interest in an electricity-electronics class for the industrial arts department which should not be confused with the present vocational electronics program. Please answer the following questions as completely as possible.

1. If the industrial arts program of Amarillo High School had offered courses in the following general areas, which of the following would you have been interested in taking?
 - () A. Electricity
 - () B. Electronics
 - () C. Transportation
 - () D. Graphic Arts
 - () E. Crafts

2. Do you think an industrial arts course in electricity-electronics would be of value to students at Amarillo High School?
 - () Yes
 - () No

3. If the following courses had been offered in electricity and electronics by the industrial arts program, which would you have preferred to take?
 - () A. Basic Electricity
 - () B. Basic Electronics
 - () C. Radio and Television Repair
 - () D. Communications
 - () E. None

4. Would you be willing to transfer to another high school in Amarillo in order to take a course in electricity or electronics?
 - () Yes
 - () No

5. Which of the following courses have you taken in the Amarillo public schools?
- A. General Shop 7
 - B. General Shop 8
 - C. Woodwork 10
 - D. Woodwork 20
 - E. Woodwork 30
 - F. Woodwork 40
 - G. General Drafting 10
 - H. Mechanical Drafting 20
 - I. Pre-Engineering Drafting 30
 - J. Pre-Engineering Drafting 40
 - K. Architectural Drafting 30
 - L. Architectural Drafting 40
 - M. Auto-Mechanics 30 and 40
 - N. General Metals 20
 - O. None of the above
6. Do you make any home repairs which require a basic understanding of electricity? (Such as the repair of lamps, toasters, etc.)
- Yes
 - No
7. Do you plan to go to college?
- Yes
 - No
8. If you plan to go to college, what do you plan to select as your major field?
-
9. At this time, what occupation or profession do you think you wish to follow in later life?
-
10. Do you plan to attend a trade school after graduation?
- Yes
 - No
11. Do you hold a regular or part-time job?
- Yes
 - No

12. If so, what type of work do you do?

13. If you are employed, does the job require a general understanding of electricity?

- Yes
- No

14. What is your father's occupation?

15. If you were to take courses in electricity and electronics, which of the following projects would you rather build? List your preferences by placing a number (1) by the first choice, a number (2) by the second choice, a number (3) by the third choice, a number (4) by the fourth choice, and a number (5) by the fifth choice.

- Buzzer
- Telegraph Set
- Electric Motor
- Electric Stove
- Automatic Garage Light Control
- Door Chimes
- Audio Amplifier
- Crystal Radio
- Transistor Radio
- Safety Flasher
- Hi-Fi Set

BIBLIOGRAPHY

Interviews

- Davis, Gene, Building Trades Instructor, Caprock High School, Amarillo, Texas, April 1, 1969.
- Masten, Larry B., Supervisor of Electronic Technology Program, Amarillo Junior College, Amarillo, Texas, March 8, 1969.
- Self, Oscar, A., Vocational Electronics Instructor, Amarillo High School, Amarillo, Texas, March 13, 1968.
- Van Blommestein, Robert, Instructor of Radio and Television Repair Program, Amarillo Vocational College, Amarillo, Texas, March 18, 1969.
- Walker, Jim, Vocational Agriculture Instructor, Canyon High School, Canyon, Texas, March 20, 1969.

Articles

- Bowen, Charles R., "Educators Plus Employers: A Team to Meet the Critical Need for Technicians," School Shop, XVIII (March, 1969), 41-43.

Reports

- Amarillo Chamber of Commerce, A Historical Sketch of Amarillo, Amarillo, Texas, Chamber of Commerce, 1968.
- Amarillo Chamber of Commerce, Amarillo, Amarillo, Texas, Chamber of Commerce, 1968.
- Amarillo Chamber of Commerce, Directory of Manufacturers, Amarillo, Texas, Chamber of Commerce, 1968.
- Amarillo Junior College School of Vocational Arts, Catalog Volume II, Amarillo Junior College, Amarillo, Texas, 1969.
- Amarillo Public Schools, Handbook on Vocational Education Courses of the Amarillo Public Schools, Amarillo Public Schools, Amarillo, Texas, 1969.

Amarillo Telephone Directory, Amarillo, Texas, Southwestern Bell Telephone Company, Issue No. 54, December, 1968.

Travis, Eldrid G. and Bert P. Darden, Manpower Trends Amarillo Area, Texas Employment Commission, Amarillo, Texas, 1969.

Texas Employment Commission, Statistical Employment Trends, Amarillo, Texas, 1969

Unpublished Materials

Bryd, Hoyt G., "The Desirability of an Electricity Course in the Merkel High School," unpublished master's thesis, Department of Industrial Arts, North Texas State University, Denton, Texas, 1951.

Dennis, Thomas E., "A Study to Determine the Need for and Interest in a Vocational Industrial Education Program in the Eagle Mountain-Saginaw School District," unpublished master's thesis, Department of Industrial Arts, North Texas State University, Denton, Texas, 1967.

Ellis, James C., "A Comparative Study of the Need and Interests of the Students as Related to the Industrial Arts Curriculum of Highland Park Junior High School and Boude Storey Junior High School, Dallas, Texas," unpublished master's thesis, Department of Industrial Arts, North Texas State University, Denton, Texas, 1967.

Lanham, Robert L., "A Study of the Objectives and Trends of General Education and the Needs of Sheet Metal Industries of Dallas, Texas, in Order to Determine What Trends Should Be Taken for a Course of Sheet Metal Work at N. R. Crozier Technical High School, Dallas, Texas," unpublished master's thesis, Department of Industrial Arts, North Texas State University, Denton, Texas, 1950.

Newspapers

Amarillo Daily News, August 28, 1969.

Amarillo Daily News, February 20, 1969.

Amarillo Daily News, March 28, 1969.

Amarillo Daily News, May 6, 1969.