AN ASSESSMENT OF SELECTED AREAS OF INSTRUCTION RELATED TO THE FARM POWER AND MACHINERY PRE-EMPLOYMENT LABORATORY TRAINING PROGRAM IN TEXAS

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CHAPTER I

PURPOSE AND DESIGN OF THE STUDY

Introduction

Many changes were brought about by the Vocational Acts of 1963. This Act made it possible for educators to look at the agriculture curriculum and realize a need for change in our vocational agriculture programs. One such realization was the initiation of the Pre-Employment Laboratory Training Program of Farm Power and Machinery in Texas. This program has a major purpose of training and providing farm machinery dealers with trained workers. Farm Power and Machinery is for eleventh and twelfth grade level students, 16 years of age, that have a desire and need to prepare for entry into full-time employment as a mechanic in the farm machinery and equipment industry. The students receive two credits for the course and attend the class two hours per day. The students in this program are also encouraged to participate in the Future Farmers of America Organization.

Course Objectives and Requirements

Each student in the program receives two hours of instruction each day which is centered around the performance of useful or productive jobs and activities and taught by a Vocational Agriculture teacher certified by the Texas Education Agency to teach Farm Power and Machinery.

According to the Suggested Basic Course Outline for Agricultural Machinery Service and Repair (1), the purpose of the course is to provide students with an opportunity to:

1. Develop the basic manipulative skills involved in agricultural machinery service and repair.

2. Develop an understanding of the underlying theories, technical information, and related occupational information to assure sound judgments and proper procedures involved in the repair and servicing of agricultural machinery.

3. Develop an understanding of and respect for the employer-employee relationship and an awareness of the necessity for delivering worthy service for value received.

4. Develop a sense of personal integrity and confidence in his ability to earn his rightful place in the community.

5. Develop those qualities of citizenship which will lead the way toward a happy and productive life.

The basic course outline states the purpose of the program as:

> The purpose of Agricultural Pre-Employment Laboratory Training is to develop basic manipulative skills, safety judgments, proper work habits, desirable attitudes and appreciations for the purpose of fitting young persons for initial employment in agricultural-industrial occupations. Training is provided through practical shop and/or laboratory experiences and other closely related school activities. The local school provides the shop and laboratories, tools, equipment, and materials which are comparable to those used in industry (1).

Problem Statement

In order to update the Farm Power and Machinery Pre-Employment Laboratory Training Program to fulfill the needs of students for future employment, the curriculum must be continuously evaluated. There is a need for a study to evaluate the curriculum.

Purpose of the Study

The purpose of this study was to obtain from the Farm Power and Machinery Pre-Employment Laboratory Training teachers and the university instructors of the Farm Power and Machinery Pre-Employment Training Program, perceptions of the importance placed and time spent on selected areas of instruction. These selected areas were the:

1. Tractor Electrical System
2. Diesel Fuel System
3. Power Trains
4. Hydraulics

It was hoped that this information could be used in giving direction to curriculum development and/or revision. It was the intent of this study, that the program be better developed in curriculum content in order to serve the needs of students being trained through the Pre-Employment Training Program.

Objectives of the Study

The objectives of the study are as follows:

1. To determine from the instructors of the Farm Power and Machinery Pre-Employment Laboratory Training Program the amount of importance they place on instruction of the Tractor Electrical System, Diesel Fuel System, Power Trains and Hydraulics and hours spent on each area.
2. To compare the importance to the hours spent in the classroom and shop on the four different areas.

3. To determine to what extent teachers of the Farm Power and Machinery Program perceive their level of teaching competence and training received in each area necessary to teach these areas adequately.
4. To determine and compare the perceived importance of selected curriculum areas and hours spent in the classroom and shop on the curriculum areas by university instructors of the Farm Power and Machinery Pre-Employment Program.

Scope and Limitations of the Study

Farm Power and Machinery Pre-Employment Laboratory Training is a specialized program. The population of this study was limited to teachers and university instructors of the program. As of the beginning of the school year 1975-1976, there were high school teachers teaching the specialized area of farm power and machinery in 93 schools in Texas. There were six university instructors surveyed that were teaching related courses preparing teachers for certification.

In the review of literature, it was found that certain graduates of the high school program and their employers were surveyed to obtain a measurement of the programs' effectiveness in providing adequate training for skills at the employment level. Because they had been surveyed earlier, this study was limited to the perceptions of teachers and instructors of the program. In this study the teachers and university instructors had the opportunity to express their opinions on selected instructional areas concerning the importance they placed on those areas, the amount of time spent in instruction, their competence level to teach those areas and the amount of training they had received

in those areas. It was believed that teachers and instructors could adequately evaluate their instructional priorities and skills.

It was not the intent of this study to compare instructional qualities of any individual involved in this study, therefore, group comparisons were used and individuals were not compared. It was hoped that through the findings of this educational research project that the program of Farm Power and Machinery might be strengthened in its overall structure.

Rationale for the Study

Today, manufacturers are building tractors with the capability to plow as much as 400 acres per day. Some of these tractors have large V-8 turbo-charged diesel engines of the 400 horsepower range and fuel capacities that enable the operator to work 12 hours without refueling. Breakdowns are very costly to farmers; therefore, students involved in the Farm Power Program should be trained to work on and repair equipment of this type. The high school program should make the future mechanic aware of the need for his training. To become a tractor mechanic holding the skills, knowledge, and competencies necessary for that vocation, a young individual must have the desire to work hard and long. This individual must have a desire to be a mechanic and natural talent as a mechanic. The manipulation of his hands must be directed by the actions of his brain to solve a problem that exists on a complicated piece of farm equipment. In a study by Webb (2) to determine the knowledge and skills needed by beginning farm machinery mechanics, shop service managers expressed their views about what they thought was important in developing a mechanic. The following statements

were made by members of the machinery industry:

1. Pick boys who really want to be mechanics. Teach the basic things that a beginner should know. We need young men in the field of mechanics very, very badly.

2. A mechanic should have a number of basic skills; and with skills, technical knowledge will come naturally. But with technical knowledge, you will not naturally attain the skills.

3. He must be interested in mechanics work. He must know the handicaps and hardships involved and be able to cope with them.

4. After interest comes capability. He must be able to comprehend and develop the skill of mechanics.

5. He must be of good nature to mix well with customers.

6. Shop safety and clean parts are the beginning of the best mechanics (pp. 174-175).

As agriculture becomes more technological and advanced, the ever-growing need for individuals with a background in tractor mechanics becomes more apparent.

In the fall of 1966, the Pre-Employment Laboratory Training Program for Farm Power and Machinery was started in Texas public schools. There were four high schools (Huntsville, Laredo, Dimmitt, and Palacios) participating in the program with four vocational agriculture teachers serving as instructors for the pilot program. There were a total of 38 students enrolled in the program. The program has continued to grow since its initiation. In 1974-75, the Farm Power and Machinery Program had 86 schools, with an average total enrollment of 11.74 students per teacher.

Since initiation of the program, many graduates have completed the course of study in Texas high schools. According to Jones (3), many of these graduates have benefited from this course of study by finding

employment in the mechanics area, thus becoming productive persons in our society. There have been seven vocational agriculture departments that have dropped the program from their curriculum since 1966, and two of the original schools still offer the program (Huntsville and Palacios). The continued operation of this program by these two schools and the continued growth of the program throughout Texas would tend to indicate that the program is an effective and definite part of the overall vocational agriculture program.

Juby (4) stressed that instruction in agriculture mechanics is an integral part of the educational program in vocational agriculture. It provides for the acquisition of knowledge and the development of many skills as well as favorable attitudes, appreciations, and interests that seem essential for a modern society. The many changes that have taken place in agriculture during recent years make it increasingly necessary for teachers of vocational agriculture to be aware of the need for greater emphasis in this field.

Many changes and developments have come about that will affect educational preparation of future workers in agriculture. With rapid developments and new innovations occurring, the kind of worker needed continues to change each day. Workers are required to perform a vast number of series of jobs daily in which they are unskilled. This fact leads to inefficiency in production. Doering (5) found that today there are 2.8 million farms which is only half the number of farms in the United States in 1950. This rapid drop resulted primarily from the expensive cost of improved machinery and advanced technology, which permit a farmer to handle a much larger acreage than he could have 25 years ago. A study by Dye (6) indicates that since the number of

people engaged in actual farming has decreased, and will continue to decrease, those people who will not have a chance to farm and have a farm interest must seek employment elsewhere.

There are great demands for food production, as reported in November, 1974, at the World Food Conference (7). It was agreed that American agriculture is the giant hope of the world and the American farmer is the idol of the world. In our modern society as never before in the history of man, has only a handful of men, produced so much, with such quality, at a low price for the consumer, and received so little in return for his efforts. New attention to the problem of food was also brought to the World Food Conference, which was attended by 130 member countries of the United Nations in Rome, Italy. The Conference proclaimed: "That every human being has the inalienable right to be free from hunger and malnutrition . . . ." (p. 140). Farmers in America will play an even greater role in feeding the world in future years. The fall of this world giant would be a disaster never known to man.

Vocational agriculture in our high schools, colleges, and universities must continue to change to keep abreast of these demands upon American agricultural production. The world hunger problem is an American, as well as a world problem. A well-fed world could be a peaceful one. It is our responsibility as agricultural educators to aid in keeping our world well fed and at peace. Agricultural education has the direct responsibility to teach all phases of production agriculture and the responsibility to teach farm power and machinery. If we, as educators of future workers, are to stay abreast of this rapid trend toward agricultural mechanization, we must continually evaluate our

training programs. Therefore this study was designed to evaluate one such program.

Definition of Terms

Certain terms used in this study should be defined to avoid possible misinterpretations.

Pre-Employment Laboratory Training Program in Farm Power and Machinery Service and Repair--refers to the descriptive title of the course taught in many Texas Public Schools.

Farm Power and Machinery Program--refers to Pre-Employment Laboratory Training in Farm Power and Machinery Service and Repair throughout this study.

Agricultural Mechanics--refers to the instructional areas which develop the mechanical abilities and skills of students needed in on-farm and off-farm agricultural occupations.

Tractor Mechanic--refers to those persons with skills necessary for the operation, maintenance, repair, and overhaul of tractors and equipment.

Formal Training--refers to the preparation an instructor received at the college level.

Informal Training and Pre-Service Training--refers to preparation other than that received at the college level.

In-Service Training--refers to the preparation received by the teachers in workshops sponsored by the Texas Education Agency and by industry to improve the quality of instruction.

Curriculum--refers to the Suggested Basic Course Outline for Agricultural Machinery Service and Repair (1).

CHAPTER II

REVIEW OF LITERATURE

The purpose of this chapter is to present some of the most recent research relating to the program of Farm Power and Machinery Pre-Employment Laboratory Training. This review is to present some of the ideas that have developed in recent years relating to the over-all view of the program. As the researcher developed the review of literature, the four basic objectives became evident. The purpose of this chapter is to present related literature that formulated the basic objectives of this study.

Related Studies and Investigations

The following conclusions were arrived at by Webb (8) in 1974.

1. Students who complete the Pre-Employment Laboratory Program in Farm Power and Machinery Service and Repair and wish to enter the mechanics trade are in great demand by employers as are all mechanics.
2. A majority of the Pre-Employment Laboratory Program shops are as well equipped as are commercial shops.
3. While the program seems to be generally strong in physical facilities, the instructional programs seem to be rather weak in areas of power trains, hydraulics, diesel systems, and electrical systems.

4. The qualifications of many teachers seem to be inadequate as viewed by their former students.

The findings by Webb (8) were reinforced by an earlier study by Webb and Kruse (9) that showed little instruction was offered in power trains, hydraulics, diesel systems and electrical systems. In this earlier study, the purpose was to determine if problems existed in teaching and administering the Pre-Employment Laboratory Program in Farm Power and Machinery. To be more specific, the following questions served as guidelines in conducting the study investigation.

1. Did teachers feel that pre-service and in-service training were adequate to qualify them to teach the program?
2. Were problems being encountered in the selection, teaching, and placement of students who enroll in the Pre-Employment Laboratory Program?
3. Did teachers feel they had adequate physical facilities to train students for entry into the field of Farm Power and Machinery?
4. Of the following preceding questions, what recommendations should be made to improve the program?

A very important finding was that a standard textbook and reference materials should be adopted on a statewide basis.

A study by Jones (3) found a majority of the teachers of the Pre-Employment Laboratory Program were not properly trained to teach Farm Power Machinery and Repair. Jones also found the facilities and tools were adequate in most schools.

Both Webb (2) and Jones (3) found facilities were adequate primarily because of the Vocational Education Act of 1963. The State

of Texas took advantage of the money made available by the Act. The Vocational Education Act of 1963 provided opportunities for persons of all ages and learning abilities to enter training programs that would qualify them with salable skills for employment areas of non-professional occupations. Through financial assistance made available by the Act the existing vocational agriculture programs were expanded. One such program was Farm Power and Machinery Pre-Employment Laboratory Training. As reported by Jones (3) the Vocational Education Act of 1963 made it possible to broaden vocational agriculture from the narrow base of farming to a broadened base encompassing many agriculturally related fields.

Juby (4) reported the passage of the Vocational Education Act of 1963 brought about many significant modifications in vocational agriculture. The purpose of vocational agriculture was broadened to include meeting the needs of all students enrolled.

For a program in vocational agriculture to be effective and efficient for the student, it must be continually changed and redesigned in content. In our society many changes were occurring as a result of students' interests and needs. As a result, many educators have reconstructed curriculum to fulfill needs of students and their interests were reported by Wood (10). The Farm Power and Machinery Pre-Employment Laboratory Training Program in Texas is an example of changing curriculum to fit student needs.

Farm Power and Machinery has been a part of the vocational agriculture program for many years. It was incorporated into the program of vocational agriculture from its beginning in 1917, as the result of the Smith-Hughes Act. It is taught as a sequence of farm mechanics,

such as welding and structures. It has remained to some degree with certain teachers of production agriculture. Many vocational agriculture teachers have in their curriculum an instructional sequence known as tractor maintenance. As the result of the career development theory of the Vocational Education Acts of 1963, Farm Power and Machinery has developed into a major sequence or unit of the curriculum in Texas.

Implications Relating to the Farm Power Instructional Program

Many states have developed programs for teaching tractor mechanics. Lewis (11) described a co-operative type program in Farm Power and Machinery at Helena Vocational Technical Center at Helena, Montana. This program consisted of the student being required to complete 1032 hours per year in technical training and 252 hours in related courses. First year technical courses included:

1. Diesel engine overhaul . . . . . 660 hours
2. Diesel pump repair . . . . . 260 hours
3. Diesel injection and repair and calibration . . . 125 hours
4. Trouble shooting diesel and gas engines . . . . . 72 hours
5. Diesel electrical systems . . . . . 125 hours
6. Machine shop . . . . . 108 hours
7. Trade math . . . . . 72 hours
8. Welding instruction . . . . . 72 hours

In the second year the training evolves around the maintenance and repair of the systems which are a part of the modern tractor. Technical courses included are:

1. Hydraulics . . . . . 172 hours

2. Tractor electrical systems . . . . . 125 hours

3. Tractor repair and service . . . . . 360 hours

4. Implement units repair and service . . . . . 300 hours

5. Business management and implement dealerships . . 72 hours

In addition to regular course work, seminars are held to discuss working conditions, wages, worker benefits, shop organization and management, flat rates, shortcuts in overhaul, maintenance problems facing dealers and warranty work. The very effective thing about the program in Montana is that students work at selected dealerships during the summer under co-ordination and supervision by visits from their instructor. It was noted that each student spends five and one-half hours per day, five days a week in the shop and classroom while undergoing his training in the technical courses. The researcher perceives the program in Montana as being thorough in training prospective mechanics.

Nicholson (12) found that supervised agricultural experience program visitations and student conferences are invaluable in building the rapport necessary to crystallize the students' real career aspirations.

Eck (13) found a need for instruction in Farm Power and Machinery in Kansas. He maintains vocational agriculture, vocational technical schools, and universities have the responsibility to provide instruction in Farm Power and Machinery. Eck asked implement dealers to rate competencies of individuals for employment in a farm machinery dealership. Basic skills were needed, such as servicing tractors, tractor overhauls, machinery repair, hydraulic systems, adjustment and repair. This story

continues to grow daily as the trend toward larger farms demands larger and more complicated equipment and someone needed to repair it.

A study by Baker (14) in Alabama, concluded that considerable emphasis should be placed on developing abilities and understanding in Farm Power and Machinery with emphasis on maintenance service and adjustments. He concluded that considerable emphasis should be placed on teaching mechanical theory along with perfection of manipulative skills.

In a study by Steakly and Webb (15) it was estimated by service managers that 2.5 years of on-the-job training would be required for a person to become a mechanic capable of working without close supervision. Service managers recommended that programs for training mechanics begin with the engine and ignition systems followed by lubrication and fuel systems, electrical systems and instruments, power trains, and hydraulics.

It was noted by Webb (16) that to become a mechanic with salable skills requires many long, hard hours of very intense training. Hodges (17) found that most students find it difficult to see the importance of personal skills for selecting a career. Considerations should be made by the student, and the instructor should advise the student before considerable time is invested in the study of a career, either in the classroom, shop or on-the-job.

Involvement of Implement Dealers in the Program

The Pre-Employment Laboratory Training Program in Farm Power and Machinery was designed by educators to provide implement dealers with trained workers. Many graduates employed as mechanics have been

evaluated by their employers. Jones (3) interviewed employers of certain graduates and relates the following remarks from one of the employers in support of the program.

> The training offered to these young potential mechanics in the Pre-Employment Laboratory Training in Farm Machinery Service and Repair is one of the best training these young men can get. The training is very valuable, especially to those who do not continue their education but choose instead to establish a career in agriculturally-related occupations (p. 60).

As found by Webb (16) implement dealers have been very helpful in the development and measurement of the program.

Emphasis of Teacher Training

Teachers of the program must provide the necessary skills for the student to be successful as a mechanic or serviceman. In order to provide the student with the knowledge required in the different areas of machinery, the teacher must have the knowledge to translate to the student manipulative skills in mechanics. Knotts and Webb (18) asked the question: "What should be taught in courses that will be of the most value to my student?" (p. 236).

Most teachers qualified to teach the program by attending a three-week intensive preparatory course in farm machinery mechanics and repair service taught by personnel at Texas A&M University and sponsored by the Texas Education Agency according to Webb and others (8). Many times, the question has been asked, "Are teachers qualified to teach the program after this three-week period"? This researcher attended the three-week-preparatory course taught in June, 1971, by Paul Chilen, Professor of Agricultural Education and Agricultural Mechanics. Mr. Chilen had the instruction well organized. The workshop consisted of

approximately 120 hours of laboratory and classroom instruction. Mr. Chilen used consultants who were specialists in fields of fuel systems, electrical systems, and engines. In a personal interview with Marvin Cepica (19) who taught one of the pilot programs at Dimmitt, Texas, Cepica stated:

> While teaching Farm Power and Machinery and in relation to teacher training in that area, the non-credit three weeks preparatory course was very beneficial to me. Concerning professional improvement, I would think the Farm Power and Machinery specialty in an undergraduate or graduate plan would be an obvious asset to someone pursuing that occupational goal.

In 1970, Jones (3) recommended that teacher-training institutions should expand their curriculum offerings to provide laboratory training in tractor overhaul, repair, and maintenance, and farm machinery service and repair. He also recommended that such offerings have a proper balance of theory and laboratory time to promote full development of technical knowledge and of the teacher's ability to perform related skills.

The program has grown in popularity throughout the State of Texas and six universities training teachers in production agriculture, have initiated an 18-hour qualification program. These programs were designed for students with a desire to obtain a certificate, certifying them to teach Farm Power and Machinery.

The following qualifications were established by the Texas Education Agency as requirements needed to teach Pre-Employment in Farm Power and Machinery:

1. All students must be certified to teach production agriculture.
2. A minimum of 18 hours would be required.

3. Six hours of designated specialized courses to include Farm Power and Farm Machinery and Equipment.
4. Competencies needed for teaching Farm Power and Machinery should meet the needs of industry.
5. An additional 12 hours of closely related courses to be determined by institutions to meet the requirements of certification for production agriculture.
6. State Agency to approve each institution for training of teachers in this area.

These Texas Universities were certified by the Texas Education Agency on the following dates:

1. Texas A&M University . . . . . May, 1971
2. East Texas State University . . . . . January, 1972
3. Texas A&I University . . . . . February, 1972
4. Southwest Texas State University . . . . . September, 1972
5. Sam Houston State University . . . . . April, 1973
6. Tarleton State University . . . . . January, 1975

The course content of the Farm Power and Machinery Program at the secondary and university levels should be evaluated by the persons involved in the teaching of the program.

Hudson as reported by Juby (4) contended in an Arkansas study that continued emphasis should be given to improving and expanding the instructional program of agriculture mechanics. Special consideration should be given to competencies needed by students who enter the various non-farming occupations.

Summary

The Smith-Hughes Act of 1917 was the beginning of Agricultural Education in our public schools. Farm Mechanics was defined as a part of vocational agriculture and has remained a major part since 1917. Not until the Vocational Education Act of 1963, did specialized areas develop in agriculture curricula. The Pre-Employment Laboratory Training Program in Farm Power and Machinery has been a specialized area of agricultural mechanics since 1966 in Texas public schools.

Many articles and studies have been completed of descriptive nature about the programs, Cepica (20), Taylor (21), Webb (16), Webb (8). Jones (3) and Webb (8) have surveyed the purpose and effectiveness through follow-up studies. Many deficiencies in the program were noted as a result of their studies.

Many individuals, including the vocational agriculture teachers and the Texas Education Agency have been very sincere in developing a curriculum in farm power and machinery to fulfill the needs of students that have a desire to become tractor mechanics. The total program has had a close working relationship with many tractor dealerships in improving the quality of the program.

It is hoped through this research effort the effectiveness of the program might be strengthened, to better prepare young people for the realization of the world of work.

CHAPTER III

DESIGN AND CONDUCT OF THE STUDY

The purpose of this chapter is to describe methods and procedures used in conducting this study. They were identified by the purpose of the study, which was to obtain information from the instructors of Farm Power and Machinery pertaining to the importance and time spent on certain aspects of instruction.

Specific objectives relating to the design of the study had to be identified. In order to collect the information necessary to accomplish the purpose of this study, the following tasks had to be completed:

1. Determine the number of schools and teachers teaching Farm Power and Machinery Pre-Employment Laboratory Training in Texas.
2. Determine the number of universities offering certificates for teachers of Farm Power and Machinery Pre-Employment Training.
3. Develop the instrument for data collection.
4. Develop a procedure for the data collected.
5. Use the proper methods of analyzing the data.

The Study Population

In the fall of 1975, the researcher corresponded by telephone and letter with Mr. Raymond Holt, Consultant with the Agricultural Education Division, Texas Education Agency, Austin, Texas, to obtain information relating to locations and teachers of the Farm Power Program. The six university training centers for teachers offering Farm Power and Machinery certificates were identified. The population of this study consisted of 93 vocational agriculture teachers, teaching Farm Power and Machinery Pre-Employment Laboratory and the six identified farm power and machinery instructors at the six accredited universities.

Development of the Instrument

The information needed for this study was obtained through the use of a questionnaire. The questionnaire was developed with the aid of the author's committee and from the instructional areas Webb (8) found to be deficient in his 1974 report. The areas included:

1. The Tractor Electrical System
2. The Diesel Fuel System
3. Power Trains
4. Hydraulics

The first part of the questionnaire dealt with specific questions concerning the professional background of the respondents. Specific questions were:

1. Years experience teaching vocational agriculture.
2. Years experience teaching Farm Power and Machinery Pre-Employment Laboratory Training Service and Repair.

3. Number of college semester hours you have completed related to Farm Power and Machinery.

4. Your formal course work in Farm Power and Machinery was completed at what institution and when.

The teachers were questioned on the instrument concerning their informal training acquired from other sources. These included:

1. Military (trucks, heavy equipment service and repair).

2. On-farm experience with tractors and equipment repair.

3. Experience related to automobile, truck service and repair (dealerships, part departments, garage work, etc.).

4. Experience at tractor dealerships (mechanic, part departments, equipment service and set-up).

5. Other spcific training (list).

Non-credit in-service workshops are sponsored by the Texas Education Agency and co-operating universities for vocational agriculture teachers throughout Texas. The teachers of the Farm Power and Machinery Program were to respond by checking on the questionnaire those non-credit workshops they had attended. They were to list others they had attended sponsored by the Texas Education Agency, universities and industry, that were not listed.

Listed under the major areas were related topics selected from the Suggested Basic Course Outline for Agricultural Machinery Service and Repair (1). First, the instrument included two divisions, which permitted the teachers to check the number of hours spent in classroom and shop instruction on the listed topics. Next, the teachers were to assess their level of teaching competence on these topics by checking their perceived ability on a five-point scale. The scale

included the categories of "none", "limited", "some", "considerable", and "great deal". Real limits for competencies were set at:

1. 3.5 to 4 for "great deal";
2. 2.5 to 3.49 for "considerable";
3. 1.5 to 2.49 for "some";
4. .50 to 1.49 for "limited";
5. 0 to .49 for "none".

The teachers were next to respond to the type of training they had received on each topic listed under the four instructional areas. The training categories from which the teachers could select a response included: "non-formal", "informal", "in-service", or a combination of the three. It should be noted, however, that other combinations were available to the respondents. These included formal and in-formal, in-service and informal, as well as formal and in-service. These three combinations were not listed on the questionnaire but were analyzed in the final tabulation of the data.

In the last part of this section, to obtain the degree of importance that the teachers felt should be placed on each topic, a five-point scale was used as a measurement technique. The five response categories included: "no", "little", "some", "much", and "great", for importance. Real limits for importance were set at:

1. 4.5 and above for "great";
2. 3.50 to 4.49 for "much";
3. 2.5 to 3.49 for "some";
4. 1.5 to 2.49 for "little";
5. 1.0 to 1.49 for "none".

In the next section, the questionnaire requested the teachers to estimate the total hours they spend in the classroom and the shop on each of the specialized area: the tractor electrical system; the diesel fuel systems; power trains and hydraulics.

The Farm Power and Machinery Pre-Employment Laboratory Training teachers had the opportunity to rank how their knowledge and competence in the specialized areas could be increased. They were to rank the following options: one through five with one equaling their first choice.

There were four stated options that included:

1. Taking courses in Farm Power and Machinery from a college or university.
2. In-service workshops sponsored by industry in the specialized areas of electrical systems, diesel fuel systems, power trains and hydraulics.
3. Workshops relating to Farm Power and Machinery sponsored by the Texas Education Agency using university personnel as instructors.
4. On-the-job training (with pay) at a tractor dealership for three or more weeks during the summer.

The final option provided was a choice to list suggestions for improving knowledge and competence. These suggestions are listed in the final analysis of this study.

The questionnaire that was sent to the six university instructors teaching farm power and machinery related courses remained the same, with the exception of eliminating the rankings of the knowledge and competence section in the specialized areas. The following statement

was inserted in place of that section for the university instructors consideration.

> Please list your suggestions for improving the training of teachers for the Farm Power and Machinery Pre-Employment Laboratory Program.

Those suggestions were listed in Appendix D of this study.

Collection of Data

The questionnaires were mailed to the 93 Farm Power and Machinery Pre-Employment Laboratory training teachers and the six teacher educators on April 1, 1976. A self-addressed, stamped envelope was enclosed to encourage a prompt response and return. A cover letter was enclosed explaining the importance and value of the study and its relationship to the continued success of the program.

The first mailing resulted in returns from 52 teachers and four teacher educators. On May 1, 1976, a follow-up letter was mailed to the non-respondents stressing the importance of them expressing their opinion on the amount of time and importance they placed on specific instructional areas in farm power and machinery.

Mr. Raymond L. Holt, consultant for the Texas Education Agency, sent a letter to the non-respondents on May 12, 1976. A section from Mr. Holt's letter stated:

> We feel that summary of information from this survey of all the farm power and machinery teachers in Texas will greatly assist in future planning of the needs and desires of the Pre-Employment Laboratory Training Program in Farm Power and Machinery.

The follow-up letter and the letter sent by Mr. Raymond Holt, netted an additional 33 responses for a total of 85 instruments of 91.39 per cent return of the total instruments mailed to the teachers

of the program in Texas High Schools. A total of five or 83.33 per cent return was received from the six instruments mailed to the university instructors. Additional effort was made to encourage a 100 per cent return by the cut-off date of June, 1976. The high percentage return was considered to be sufficient to begin analysis of the data.

Analysis of Data

The respondents of this study included 85 of the 93 Farm Power and Machinery Pre-Employment Laboratory Training teachers in Texas. The respondents included five of the six identified university instructors teaching farm power and machinery related courses that are used for certification of Farm Power and Machinery Pre-Employment Laboratory Training teachers.

After consulting with the author's major thesis adviser and a statistical consultant in the Statistics Department, Oklahoma State University, it was decided that descriptive statistics would be the most appropriate treatment to use. The descriptive statistics selected were frequency distribution and percentages.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

Introduction

The primary purpose of this study was to obtain from the Farm Power and Machinery Pre-Employment Laboratory Training teachers and the teacher trainers of the program, the importance and time spent on selected areas of instruction. These selected areas were:

1. The Tractor Electrical System
2. The Diesel Fuel System
3. Power Trains
4. Hydraulics

In order to accomplish the purpose of the study, the following specific objectives were set forth:

1. To determine from the instructors of the Farm Power and Machinery Pre-Employment Laboratory Training Program, the amount of importance they place on instruction of the Tractor Electrical System, Diesel Fuel System, Power Trains and Hydraulics and the hours spent on each area.
2. To compare the importance to the hours spent in the classroom and in the shop on the four different areas.

3. To determine to what extent teachers of the Farm Power and Machinery Program perceive their level of teaching competencies and training received in each area necessary to teach these areas adequately.
4. To determine and compare the perceived importance of selected curriculum areas and hours spent in the classroom and shop on the curriculum areas by the university instructors of the Farm Power and Machinery Pre-Employment Program.

As was discussed in the previous chapter, the questionnaire developed for this study was designed to measure the above objectives from the four selected areas of instruction found to be deficient by Webb (8).

Population

The population of this study consisted of the 93 vocational agriculture teachers, teaching Farm Power and Machinery Pre-Employment Laboratory and the six identified Farm Power and Machinery instructors at the six accredited universities in Texas. The instruments used in this study were received from 85 respondents that were teaching in Texas High Schools, which represented a 91.39 per cent return. Five or 83.33 per cent instruments were returned from the six university instructors of farm power and machinery related courses being taught to certify teachers of the Farm Power and Machinery Pre-Employment Laboratory Training. A copy of the instruments used to secure data for this study are included in Appendixes E and F.

Selected Characteristics of the High School Farm Power and Machinery Pre-Employment Training Teachers

Table I contains the description of the high school farm power and machinery instructors used in this study. The table shows the number of years experience teaching vocational agriculture, the number of teachers by years experience and the per cent of the teachers in each year group that were teaching Farm Power and Machinery Pre-Employment Laboratory Training in Texas during the school year 1975-1976. Years experience in teaching vocational agriculture ranged from 1-37 years with an average experience of 9.42 years.

TABLE I

THE DISTRIBUTION OF TEACHER RESPONSES FOR YEARS EXPERIENCE IN TEACHING VOCATIONAL AGRICULTURE

Years Experience Teaching Vocational Agriculture	Number of Teachers in Each Year	Per Cent of the Teachers in Each Group
1	8	9.41
2	9	10.59
3	9	10.59
4	3	3.53
5	6	7.06
6	5	5.88
7	6	7.06
8	4	4.70

TABLE I (Continued)

Years Experience Teaching Vocational Agriculture	Number of Teachers in Each Year	Per Cent of the Teachers in Each Group
9	4	4.70
10	2	2.35
11	4	4.70
12	3	3.53
13	2	2.35
15	3	3.53
16	1	1.18
17	1	1.18
20	2	2.35
21	2	2.35
22	2	2.35
23	1	1.18
24	1	1.18
25	1	1.18
26	1	1.18
29	1	1.18
30	2	2.35
33	1	1.18
37	1	1.18
Total	85	100.00

Farm Power and Machinery Pre-Employment Laboratory Training has been a part of the vocational agriculture program in Texas since 1966. Table II shows the distribution of the teachers' responses for years of experience teaching Farm Power and Machinery Pre-Employment Laboratory Training.

TABLE II

THE DISTRIBUTION OF TEACHERS' RESPONSES FOR YEARS EXPERIENCE IN TEACHING FARM POWER AND MACHINERY PRE-EMPLOYMENT LABORATORY TRAINING

Years Experience Teaching Farm Power and Machinery Pre-Employment Laboratory Training	Number of Teachers	Per Cent of the Respondents
1	15	17.65
2	15	17.65
3	13	15.29
4	9	10.59
5	9	10.59
6	10	11.76
7	5	5.88
8	6	7.06
9	3	3.53
Total	85	100.00

By observing the table, it can be noted that 43 respondents or 50.59 per cent have taught the course one to three years. In the four, five or six years experienced groups, 28 teachers or 32.94 per cent responded. Fourteen teachers or 16.47 per cent responded as having seven or more years experience. It should be noted that three teachers were teaching in the developmental stages of the program in 1966 and thus had nine years teaching experience. The average years experience teaching farm power and machinery was 3.94 years.

Question three on the instrument requested the teachers to give the number of semester hours they had completed in courses relating to farm power and machinery. Table III data reveals that 23 of the teachers or 28.40 per cent responded as having had no college level courses in farm power and machinery.

Twenty-one or 25.93 per cent had completed from two to eight semester hours. Twenty-three or 28.39 per cent had completed from nine to 17 semester hours and 14 or 17.28 per cent had completed from 18 to 30 semester hours in farm power and machinery related courses. A total of 81 teachers responded to this question. There were four non-respondents.

TABLE III

SUMMARY OF THE SEMESTER HOURS COMPLETED IN RELATED COURSES OF FARM POWER AND MACHINERY

Number of Completed Farm Power and Machinery Semester Hours	Number of Teachers	Per Cent of the Respondents
0	23	28.40
2-8	21	25.93
9-17	23	28.39
18-30	14	17.28
30-above	0	00.00
Totals	81	100.00

In answering question four on the instrument, concerning where the teachers of farm power and machinery had completed formal course work in courses related to farm power and machinery, nine different universities were listed by 56 respondents. Table IV shows a total of 35 or 62.50 per cent had attended Texas A&M University, seven or 12.50 per cent East Texas State University, six or 10.71 per cent, Sam Houston State University. Texas Technological University had two or 3.57 per cent, Texas A&I had two or 3.57 per cent. South West Texas State, Prairie View A&M, Stephen F. Austin State University, and South Plains College each had one or 1.78 per cent completing formal course work in farm power and machinery related courses. Twenty-nine teachers did not respond to the statement.

TABLE IV

SUMMARY OF FORMAL COURSE WORK IN FARM POWER AND MACHINERY COMPLETED

College or University	Number of Teachers Completing Course Work	Per Cent of Teachers Completing Course Work
Texas A&M	35	62.50
East Texas State	7	12.50
Sam Houston State	6	10.72
Texas Technological	2	3.58
Texas A&I	2	3.58
South West Texas State	1	1.78
Prairie View A&M	1	1.78
Stephen F. Austin State	1	1.78
South Plains College	1	1.78
Total	56	100.00

There were four types of informal training listed on the questionnaire, that dealt with the background of the respondents. These areas included:

1. Military training
2. On-farm experience with tractors and equipment repair.
3. Experiences related to automobile/truck service and repair.
4. Experience in tractor dealerships.

Space was provided for the respondents to list other informal training pertaining to farm power and machinery which they had experienced.

Sixteen of the respondents had military training, 79 had on-farm training, 41 had automobile/truck service and repair experience, and 24 indicated that they had worked at tractor dealerships.

Appendix A presents 24 other statements which were listed by the respondents. The statements related to other types of informal training which were not listed on the survey instrument.

Since the initiation of the program, Texas A&M University and the Texas Education Agency have worked closely to certify teachers of farm power, through the use of non-credit workshops. Seventy-three of the respondents indicated that they had attended a non-credit workshop at Texas A&M University for certification. Twenty-four of the respondents attended other types of non-credit workshops sponsored by other universities and the Texas Education Agency. Sixty-seven attended workshops at the Texas Vocational Agriculture Teachers Conference and 46 of the respondents attended workshops that were sponsored by industry. Appendix B shows other non-credit workshops attended by the respondents for Farm power and Machinery Training.

Presentation of Data Concerning the Four Instructional Areas by High School Teachers

The following section of this chapter gives the number and percentages of the responses for the sections listed on the instrument for the four instructional areas. Also, included in this section

are tables that give the comparison of importance for classroom and shop hours spent on each of the topics in the four selected instruction areas.

Importance Placed on the Tractor Electrical System

The data presented in Table V indicate the amount of importance being placed on the tractor electrical system. Each of these items received a mean response of 3.37 or over, with a larger percentage of the teachers responding in the "Some" and "Much" categories on the scale. Diagnosis of electrical systems problems received the highest average (4.17) for "Much" importance. The lowest rating for importance was lighting and accessory systems (3.37). The overall mean importance for all topics was 3.84 or "Much".

Importance Placed on the Diesel Fuel System

Table VI reveals the average importance placed on the diesel fuel system. The importance ranged from a low of 2.69 for trouble shooting the diesel fuel system to a high importance of 4.02 for injection nozzles. All the topics except trouble shooting the diesel fuel system (2.69) ranged from 3.73 to 4.02 for "Much" importance. The overall mean for all topics was 3.71 or "Much" importance.

TABLE V

SUMMARY OF THE FARM POWER AND MACHINERY TEACHERS' PERCEPTIONS OF THE IMPORTANCE OF TOPICS WITHIN THE AREA OF TRACTOR ELECTRICAL SYSTEMS

Tractor Electrical System	(N)	Distribution by Level of Importance										Average Importance
		No		Little		Some		Much		Great		
		No.	%	No.	%	No.	%	No.	%	No.	%	
Theory of Electricity	83	0	0	6	7.23	32	38.55	32	38.55	13	15.66	3.63
Storage Battery	82	0	0	9	10.98	24	29.27	36	43.90	13	15.85	3.64
Charging Systems	81	0	0	1	1.24	25	30.86	37	45.68	18	22.22	3.88
Starting Systems	81	1	1.24	1	1.24	19	23.46	42	51.85	18	22.22	3.92
Ignition Systems	83	1	1.21	1	1.21	14	16.87	43	51.81	24	28.91	4.06
Lighting and Accessory Systems	83	1	1.21	11	13.25	35	42.17	28	33.74	8	9.64	3.37
Use of Testing Equipment	83	0	0	1	1.21	15	18.07	43	51.81	24	28.92	4.08
Diagnosis of Electrical Systems Problems	78	0	0	1	1.28	11	14.10	38	48.72	28	35.90	4.19
Averages	81.75	.38	.46	3.88	4.71	21.88	26.67	37.38	45.76	18.25	22.42	3.84

TABLE VI

SUMMARY OF THE FARM POWER AND MACHINERY TEACHERS' PERCEPTIONS OF THE IMPORTANCE OF TOPICS WITHIN THE AREA OF DIESEL FUEL SYSTEMS

		Distribution by Level of Importance										
		No		Little		Some		Much		Great		Average Importance
Diesel Fuel Systems	(N)	No.	%	No.	%	No.	%	No.	%	No.	%	
Diesel Engine Principles	81	1	1.24	1	1.24	21	25.93	38	46.91	20	24.69	3.92
Diesel Fuel Tanks (Storage and Handling)	82	0	0	5	6.10	29	35.37	29	35.37	19	23.17	3.75
Fuel Transfer Pumps	82	1	1.22	2	2.44	31	37.81	32	29.02	16	19.51	3.73
Fuel Filters	82	0	0	2	2.44	24	29.27	32	39.02	24	29.27	3.95
Injection Pumps	83	0	0	3	3.61	24	28.91	31	37.35	25	30.12	3.94
Injection Nozzles	83	0	0	0	0	24	28.92	33	39.76	26	31.33	4.02
Trouble Shooting for Diesel Fuel Systems	81	5	6.17	36	44.44	25	30.86	9	11.11	6	7.41	2.69
Averages	82	1	1.23	7	8.61	25.43	31.01	29.14	34.08	19.43	23.64	3.71

Importance Placed on Instruction of Power Trains

Table VII shows the importance the respondents placed on instruction of power trains. The average importance for the power train instructional area was 3.77 for "Much" importance. The average importance for the topics ranged from 3.50 to 3.95. All topics were in the "Much" importance range and within the set limits of 3.50 to 4.49 for "Much" importance. The "Some"; "Much"; and "Great" categories showed a very even distribution of responses.

Importance Placed on Instruction of Hydraulics

Data contained in Table VIII shows the importance respondents placed on instruction of hydraulics. The average importance for the hydraulics instructional area was 3.70 or "Much". The topics were all in the "Much" importance range and within the range of 3.55 to 3.80 indicating close to the same importance for all topics.

Classroom Hours Spent on the Tractor Electrical Systems

Table IX contains a summary of the classroom hours spent on the tractor electrical system. The table data show a variation from a low average of 1.72 hours spent teaching lighting and accessory systems to a high of 4.79 hours spent teaching diagnosis of electrical systems in the classroom. It is interesting to note that a great percentage of the respondents (82.72) spent from 1-2 hours teaching storage batteries

TABLE VII

SUMMARY OF THE FARM POWER AND MACHINERY TEACHERS' PERCEPTIONS OF THE IMPORTANCE OF TOPICS WITHIN THE AREA OF POWER TRAINS

		Distribution by Level of Importance										
		No		Little		Some		Much		Great		Average Importance
Power Trains	(N)	No.	%	No.	%	No.	%	No.	%	No.	%	
Theory of Operation and Design	81	0	0	5	6.17	28	34.57	31	38.27	17	20.99	3.74
Clutch Systems	83	0	0	1	1.21	25	30.12	24	40.96	23	27.71	3.95
Transmissions	83	0	0	2	2.41	28	33.74	34	40.96	19	22.89	3.84
Differentials	83	0	0	4	4.82	29	34.94	33	39.76	17	20.48	3.76
Final Drives	82	0	0	4	4.88	29	35.37	34	41.46	15	18.29	3.73
Power Take-Offs	82	0	0	5	6.10	27	32.93	31	37.81	19	23.17	3.78
Special Drives (Belts, Chains, U-Joints)	82	1	1.22	7	8.54	33	40.24	27	32.93	14	17.07	3.56
Averages	82.29	.14	.17	4	4.88	28.43	35.55	30.57	38.85	17.71	21.51	3.77

TABLE VIII

SUMMARY OF THE FARM POWER AND MACHINERY TEACHERS' PERCEPTIONS OF THE IMPORTANCE OF TOPICS WITHIN THE AREA OF HYDRAULICS

		Distribution by Level of Importance										
		No		Little		Some		Much		Great		Average Importance
Hydraulics	(N)	No.	%	No.	%	No.	%	No.	%	No.	%	
Basic Hydraulics (Pumps, Motors, Controls, Oils)	83	0	0	1	1.21	33	39.76	32	38.55	17	20.48	3.78
Theory of Operation for Hydraulic Systems	82	0	0	0	0	34	41.46	32	39.02	16	19.51	3.78
Integral Lift Systems (3 Point Hitch Type)	82	0	0	3	3.66	27	32.93	35	42.68	17	20.73	3.80
Remote Control Cylinders	82	2	4.44	4	4.88	30	36.59	32	39.02	14	17.07	3.63
Hydraulic Braking Systems	82	1	1.22	8	9.76	30	36.59	31	37.81	12	14.63	3.55
Hydraulic Steering Systems	82	0	0	5	6.10	33	40.24	31	37.81	13	15.85	3.63
Averages	82.6	.5	.94	3.5	4.27	31.17	37.92	32.17	39.15	14.83	18.04	3.70

TABLE IX

SUMMARY OF THE FARM POWER AND MACHINERY TEACHERS' ESTIMATES OF CLASSROOM HOURS SPENT ON THE TRACTOR ELECTRICAL SYSTEM TOPICS

		Distribution by Hours Spent in the Classroom										
		0 Hours		1-2 Hours		3-5 Hours		6-10 Hours		11+ Hours		Average Hours
Tractor Electrical System	(N)	No.	%	No.	%	No.	%	No.	%	No.	%	
Theory of Electricity	84	4	4.76	40	47.62	26	30.95	12	14.29	2	2.38	3.27
Storage Battery	81	3	3.70	67	82.72	8	9.88	3	3.70	0	0	1.94
Charging Systems	84	2	2.38	36	42.86	39	46.43	5	5.95	2	2.38	3.26
Starting Systems	84	2	2.38	38	45.24	35	41.67	7	8.33	2	2.38	3.33
Ignition Systems	83	2	2.41	28	33.74	35	42.17	13	15.66	5	6.02	4.20
Lighting and Accessory Systems	84	14	16.67	59	70.24	8	9.52	3	3.57	0	0	1.72
Use of Testing Equipment	83	3	3.61	23	27.71	33	39.76	16	19.28	8	9.64	4.71
Diagnosis of Electrical Systems Problems	80	5	6.25	26	32.50	24	30.00	17	21.25	8	10.00	4.79
Averages	82.88	4.38	5.27	39.63	47.82	26	31.30	9.5	11.50	3.38	4.1	3.40

and also 70.24 per cent spent 1-2 hours teaching lighting and accessory systems. Fourteen or 16.67 per cent of the respondents did not teach lighting and accessory systems at all in the classroom. The largest number of teachers taught 1-2 hours on all topics in the tractor electrical system, except for the charging system, ignition system, and use of testing equipment where the largest number of teachers taught 3-5 hours. The mean average hours spent in the classroom on the tractor electrical system was 3.40 hours.

Classroom Hours Spent on the Diesel Fuel System

Table X indicates the hours spent in the classroom on the diesel fuel system. A considerable number, from 12.05 per cent to 27.71 per cent of the teachers do not spend any classroom time on selected topics of instruction for diesel fuel systems. The average hours spent on topics taught in the classroom was 2.43 hours. The largest number and per cent responding to any category was in the 1-2 hour range for all topics. Approximately 31 per cent to 68 per cent spent 1-2 hours on the various topics. The average hours ranged from 1.64 hours for instruction of diesel fuel tanks to 3.45 hours for diesel engine principles. There was a great amount of variability among topics on average hours spent.

TABLE X

SUMMARY OF THE FARM POWER AND MACHINERY TEACHERS' ESTIMATES OF CLASSROOM HOURS SPENT ON THE DIESEL FUEL SYSTEM TOPICS

		Distribution by Hours Spent in the Classroom										
		0 Hours		1-2 Hours		3-5 Hours		6-10 Hours		11+ Hours		Average Hours
Diesel Fuel Systems	(N)	No.	%	No.	%	No.	%	No.	%	No.	%	
Diesel Engine Principles	83	10	12.05	32	38.55	25	30.12	12	14.46	4	4.82	3.45
Diesel Fuel Tanks (Storage and Handling)	83	18	21.61	25	56.27	7	8.43	3	3.61	0	0	1.64
Fuel Transfer Pumps	83	23	27.71	41	49.40	17	20.48	2	2.41	0	0	1.72
Fuel Filters	83	10	12.05	57	68.68	13	15.66	3	3.61	0	0	1.95
Injection Pumps	82	15	18.29	40	48.78	21	25.61	5	6.10	1	1.22	2.40
Injection Nozzles	82	11	13.42	47	57.32	17	20.73	6	7.32	1	1.22	2.43
Trouble Shooting the Diesel Fuel System	83	14	16.87	26	31.33	27	32.53	14	16.87	2	2.41	3.43
Averages	82.71	14.43	17.43	42.57	50.05	18.14	21.94	6.43	7.77	1.14	1.38	2.43

Classroom Hours Spent on the Power Train

Data found in Table XI shows the average hours spent in the classroom on instruction of power trains. A larger number and per cent of the respondents checked from 1-2 hours on all topics in this area. Fifty or 60.24 per cent checked 1-2 hours for special drives. It is interesting to note that 11 or 13.25 per cent spent no classroom time on special drives, however, the mean overall average for classroom time spent on power train topics was 3.25 hours.

Classroom Hours Spent on Instruction of Hydraulics

Data found in Table XII shows the average hours spent in the classroom on instruction of hydraulics. From 8.43 per cent to 20.73 per cent of the teachers indicated they spent no classroom time on selected topics of instruction of hydraulics. An average of 54.47 per cent of the teachers indicated they spent from 1-2 hours in the classroom. The overall mean average for time spent in the classroom on hydraulics was 2.39 hours, with basic hydraulics being greatest, (3.08 hours) and remote control cylinders averaging least with (1.87) hours.

TABLE XI

SUMMARY OF THE FARM POWER AND MACHINERY TEACHERS' ESTIMATES OF CLASSROOM HOURS SPENT ON THE POWER TRAIN TOPICS

		Distribution by Hours Spent in the Classroom										
		0 Hours		1-2 Hours		3-5 Hours		6-10 Hours		11+ Hours		Average Hours
Power Trains	(N)	No.	%	No.	%	No.	%	No.	%	No.	%	
Theory of Operation and Design	80	10	12.05	27	33.75	21	26.25	9	11.25	13	16.25	3.73
Clutch Systems	84	1	1.19	39	46.43	33	39.29	7	8.33	4	4.76	3.53
Transmissions	84	5	5.95	28	33.33	36	42.86	11	13.10	4	4.76	3.86
Differentials	83	5	6.02	40	48.19	26	31.33	10	12.05	2	2.41	3.25
Final Drives	82	6	7.32	42	51.22	25	30.49	7	8.54	2	2.44	2.98
Power Take-Offs	84	3	3.57	44	52.38	26	30.95	8	9.52	3	3.57	3.25
Special Drives (Belts, Chains, U-Joints)	83	11	13.25	50	60.24	20	24.10	1	1.21	1	1.21	2.12
Averages	82.46	5.86	7.05	38.57	46.51	26.71	32.18	7.57	9.14	4.14	5.06	3.25

TABLE XII

SUMMARY OF THE FARM POWER AND MACHINERY TEACHERS' ESTIMATES OF CLASSROOM HOURS SPENT ON HYDRAULICS TOPICS

Hydraulics	(N)	Distribution by Hours Spent in the Classroom										Average Hours
		0 Hours		1-2 Hours		3-5 Hours		6-10 Hours		11+ Hours		
		No.	%	No.	%	No.	%	No.	%	No.	%	
Basic Hydraulics (Pumps, Motors, Controls, Oils)	83	7	8.43	39	46.99	30	36.15	2	2.41	5	6.02	3.08
Theory of Operation for Hydraulic Systems	83	10	12.05	42	50.60	26	31.33	1	1.21	4	4.82	2.71
Integral Lift Systems (3 Point Hitch Type)	82	10	12.20	46	56.10	18	21.95	6	7.32	2	2.44	2.61
Remote Control Cylinders	82	16	19.51	49	59.76	15	18.29	1	1.22	1	1.22	1.87
Hydraulic Braking Systems	82	16	19.51	45	54.88	17	20.73	3	3.66	1	1.22	2.09
Hydraulic Steering Systems	82	17	20.73	48	58.54	14	17.07	1	1.22	2	2.44	1.97
Averages	82.33	12.67	15.41	44.83	54.48	20	24.25	2.33	2.84	2.5	3.03	2.39

Shop Hours Spent on Teaching Tractor Electrical Systems

According to the data contained in Table XIII, the average hours spent in the shop varied greatly, ranging from 2.36 hours for the storage battery to 6.23 hours teaching diagnosis of electrical systems problems. The overall mean for all shop hours was 4.26. From the presented data, ignition systems (5.39 hours), use of testing equipment (6.16 hours), and diagnosis of electrical systems problems (6.23 hours) rated highest in average hours spent in the shop. All of the teachers spent some time teaching ignition systems and diagnosis of electrical systems problems. Nineteen or 24.36 per cent of the respondents did not teach theory of electricity in the shop at all.

Shop Hours Spent on the Diesel Fuel System

According to the data in Table XIV indicating the shop hours spent on instruction of the diesel fuel system, the respondents spent an average of 2.75 hours for the topics taught. Table XIV reveals that 21.69 per cent to 32.14 per cent of the teachers spent no time on instruction of selected topics within the diesel fuel system area. They indicated spending an average of over three hours (3.21) on instruction of diesel engine principles and trouble shooting the diesel fuel system (3.93 hours) to less than two hours (1.91) on instruction of fuel tanks (storage and handling). There was a wide variety of average hours spent on the various topics.

TABLE XIII

SUMMARY OF THE FARM POWER AND MACHINERY TEACHERS' ESTIMATES OF SHOP HOURS SPENT ON TEACHING TRACTOR ELECTRICAL SYSTEM TOPICS

Tractor Electrical System	(N)	Distribution by Time Spent in the Shop: 0 Hours No.	0 Hours %	1-2 Hours No.	1-2 Hours %	3-5 Hours No.	3-5 Hours %	6-10 Hours No.	6-10 Hours %	11+ Hours No.	11+ Hours %	Average Hours
Theory of Electricity	78	19	24.36	28	35.90	19	24.36	6	7.69	6	7.69	2.93
Storage Battery	81	4	4.94	57	70.37	15	18.52	4	4.94	1	1.24	2.36
Charging Systems	81	1	1.24	31	38.27	40	49.38	4	4.94	5	6.17	3.73
Starting Systems	82	1	1.22	23	28.05	42	51.22	10	12.20	6	7.32	4.36
Ignition Systems	82	0	0	15	18.29	42	51.22	13	15.85	12	14.63	5.39
Lighting and Accessory Systems	83	6	7.23	44	53.01	25	30.12	6	7.23	2	2.41	2.88
Use of Testing Equipment	82	1	1.22	13	15.85	33	40.24	17	20.73	18	21.95	6.16
Diagnosis of Electrical Systems Problems	74	0	0	14	18.67	30	40.00	13	17.33	18	24.00	6.23
Averages	80.5	4	5.02	28.13	34.80	30.75	38.13	9.13	11.36	8.5	10.68	4.26

TABLE XIV

SUMMARY OF THE FARM POWER AND MACHINERY TEACHERS' ESTIMATES OF SHOP HOURS SPENT ON THE DIESEL FUEL SYSTEM TOPICS

Diesel Fuel Systems	(N)	Distribution by Time Spent in the Shop										Average Hours
		0 Hours		1-2 Hours		3-5 Hours		6-10 Hours		11+ Hours		
		No.	%	No.	%	No.	%	No.	%	No.	%	
Diesel Engine Principles	81	19	23.46	29	35.80	20	24.69	5	6.17	8	9.88	3.21
Diesel Fuel Tanks (Storage and Handling)	82	25	30.41	42	51.22	9	10.98	4	4.88	2	2.44	1.91
Fuel Transfer Pumps	84	27	32.14	33	49.29	19	22.62	3	3.57	2	2.38	2.01
Fuel Filters	83	18	21.69	43	51.81	14	16.87	5	6.02	3	3.61	2.40
Injection Pumps	84	20	23.81	28	33.33	26	30.95	7	8.33	3	3.67	2.84
Injection Nozzles	84	18	22.43	30	35.71	26	30.95	6	7.43	4	4.76	2.93
Trouble Shooting the Diesel Fuel System	83	18	21.69	18	21.69	28	33.74	11	13.25	8	9.64	3.83
Averages	83	20.71	25.09	31.86	39.84	20.29	24.4	5.86	7.09	4.29	5.20	2.75

Shop Hours Spent on the Power Train

The data in Table XV indicate the hours spent in the shop on power train instruction. The largest number and percentage of the teachers checked in the 3-5 hour range with an overall mean of 4.28 hours spent in the shop. The average hours spent for all topics was close, indicating an equal distribution for time in the shop. The largest group, with a mean average of 40.85 per cent of the teachers, indicated they spent 3-5 hours on power train instruction. The next largest group, spent from 1-2 hours. There was a mean average of 4.38 per cent of the teachers that indicated no instruction time in the shop on power trains.

Shop Hours Spent on Instruction of Hydraulics

The data in Table XVI indicate the hours spent in the shop on instruction of hydraulics. From 6.10 per cent to 17.50 per cent of the teachers designate as spending no time in the shop on some topics of hydraulics. An average of 43.61 per cent indicate teaching 1-2 hours and an average of 28.56 per cent checked 3-4 hours. The overall mean hours for shop time spent on instruction of hydraulics was 3.23.

Comparison of Classroom and Shop Hours in Importance Placed on the Four Instructional Areas

Table XVII shows the comparisons of importance and classroom and shop hours for topics within the four instructional areas. Average importance and average number of hours spent in the classroom and shop on the topics are listed in the table.

TABLE XV

SUMMARY OF THE FARM POWER AND MACHINERY TEACHERS' ESTIMATES OF SHOP HOURS SPENT ON POWER TRAIN TOPICS

Power Trains	(N)	Distribution by Time Spent in the Shop: 0 Hours No.	0 Hours %	1-2 Hours No.	1-2 Hours %	3-5 Hours No.	3-5 Hours %	6-10 Hours No.	6-10 Hours %	11+ Hours No.	11+ Hours %	Average Hours
Theory of Operation and Design	83	2	2.41	18	21.69	34	40.96	25	30.12	4	4.82	4.37
Clutch Systems	83	1	1.21	22	26.51	42	50.60	7	8.43	11	13.25	4.69
Transmissions	83	4	4.82	18	21.69	39	46.99	8	9.64	14	14.87	5.01
Differentials	83	5	6.02	30	36.15	31	37.35	9	10.84	8	9.64	4.06
Final Drives	81	4	4.94	31	38.27	31	38.27	6	7.41	9	11.11	4.03
Power Take-Offs	83	4	4.82	31	37.75	33	39.76	4	4.82	11	13.25	4.16
Special Drives (Belts, Chains, U-Joints)	78	5	6.41	35	44.87	25	32.05	7	8.97	6	7.69	3.67
Averages	82	3.57	4.38	26.43	32.42	33.57	40.85	9.43	11.46	9	10.45	4.28

TABLE XVI

SUMMARY OF THE FARM POWER AND MACHINERY TEACHERS' ESTIMATES OF SHOP HOURS SPENT ON HYDRAULIC TOPICS

Hydraulics	(N)	Distribution by Time Spent in the Shop: 0 Hours No.	%	1-2 Hours No.	%	3-5 Hours No.	%	6-10 Hours No.	%	11+ Hours No.	%	Average Hours
Basic Hydraulics (Pumps, Motors, Controls, Oils)	82	5	6.10	32	39.02	28	30.15	13	15.85	4	4.88	3.83
Theory of Operation for Hydraulic Systems	79	8	10.13	39	49.37	22	27.85	8	10.13	2	2.43	2.98
Integral Lift Systems (3 Point Hitch Type)	81	8	9.88	31	38.27	25	30.86	10	12.35	7	8.64	3.86
Remote Control Cylinders	80	12	15.00	36	45.00	23	28.75	5	6.25	4	5.00	2.94
Hydraulic Braking Systems	80	14	17.50	37	46.25	20	25.00	6	7.50	3	3.75	2.75
Hydraulic Steering Systems	80	12	15.00	35	43.75	20	28.75	6	7.50	4	5.00	3.04
Averages	80.33	9.83	12.27	35	43.68	23	28.56	8	9.93	4	4.95	3.23

TABLE XVII

SUMMARY COMPARISON OF CLASSROOM AND SHOP HOURS SPENT ON TOPICS WITHIN THE FOUR INSTRUCTIONAL AREAS TO PERCEIVED IMPORTANCE

Tractor Electrical Systems	Average Importance	Classroom Average Hours	Shop Average Hours
Theory of Electricity	3.63	3.27	2.93
Storage Battery	3.64	1.94	2.36
Charging System	3.88	3.26	3.73
Starting System	3.92	3.33	4.36
Ignition System	4.06	4.20	5.39
Lighting and Accessory Systems	3.37	1.72	2.88
Use of Testing Equipment	4.08	4.71	6.16
Diagnosis of Electrical Systems Problems	4.19	4.59	6.23
Averages	3.84	3.40	3.26

Diesel Fuel Systems	Average Importance	Classroom Average Hours	Shop Average Hours
Diesel Engine Principles	3.92	3.45	3.21
Diesel Fuel Tanks (Storage and Handling)	3.75	1.64	1.91
Fuel Transfer Pumps	3.73	1.72	2.01
Fuel Filters	3.95	1.95	2.40
Injection Pumps	3.94	2.40	2.84
Injection Nozzles	4.02	2.43	2.93
Trouble Shooting the Diesel Fuel Systems	2.69	3.43	3.93
Averages	3.71	2.42	2.75

TABLE XVII (Continued

Power Trains	Average Importance	Classroom Average Hours	Shop Average Hours
Theory of Operation and Design	3.74	3.73	4.37
Clutch Systems	3.95	3.53	4.69
Transmissions	3.84	3.86	5.01
Differentials	3.76	3.25	4.06
Final Drives	3.73	2.98	4.03
Power Take-Offs	3.78	3.25	4.16
Special Drives (Belts, Chains, U-Joints)	3.56	2.12	3.67
Averages	3.77	3.25	4.28

Hydraulics	Average Importance	Classroom Average Hours	Shop Average Hours
Basic Hydraulics (Purpose, Motors, Controls, Oils)	3.78	3.08	3.83
Theory of Operation for Hydraulic Systems	3.78	2.71	2.98
Integral Lift System (3 Point Hitch Type)	3.80	2.61	3.86
Remote Control Cylinders	3.63	1.87	2.94
Hydraulic Braking Systems	3.55	2.09	2.75
Hydraulic Steering Systems	3.63	1.97	3.04
Averages	3.70	2.39	3.23

It would appear that the time teachers spent in the classroom and shop on topics within the tractor electrical system was reflected by their average perceived importance on all topics with the exception of the storage battery and lighting and accessory systems. However, in the shop their average hours spent on topics was greater in all instances than those spent in the classroom except for theory of electricity. Theory of electricity, storage batteries and lighting and accessory systems received less time for instruction as compared to other topics. Use of testing equipment and diagnosis of electrical systems problems received the greatest amount of time for shop instruction.

For the diesel fuel system instructional area, it appeared that there was more importance indicated than reflected by hours spent in the classroom and shop, for all topics except diesel engine principles and trouble shooting the diesel fuel system.

In the power train instructional area the average time spent in the classroom and shop was reflected by the average perceived importance the teachers placed on the topics except instruction of final drives and special drives. These two areas had more indicated average importance than reflected by time spent in classroom instruction. The teachers spent more time on instruction of the selected power train topics in the shop than in the classroom.

In the hydraulics instructional area the teachers' average perceived importance for all topics was near the same level. In the classroom the average hours spent among the topics showed a greater variation than those spent in the shop. There was an indication more time was spent on the topics in the shop than in the classroom and that the

shop hours more nearly reflected the importance indicated.

Teacher Competence Levels for the
Tractor Electrical System

The data in Table XVIII is the distribution of teachers' responses for the level of their expressed competence checked on the instrument. The table gives the number and per cent of the responses under the five competence levels for each topic of the tractor electrical system instructional area. Their competencies were ranked and the three lowest ranks were found to be: theory of electricity; diagnosis of electrical systems problems; lighting and accessory systems. The teachers rated their competence to teach ignition systems first. An average rating for competency to teach all areas of the tractor electrical system was 2.26. This data shows that the teachers average level of competence fell within the limits of 1.50 to 2.49 for "Some" competence.

Teacher Competence Levels for the
Diesel Fuel System

The data in Table XIX is the distribution of teachers' responses of the level of their expressed competence for teaching the diesel fuel system. The table gives the number and per cent of the responses for the five competence levels in each of the topics for the diesel fuel system instructional area. The data shows that instruction on fuel filters ranked first with an average rating of 2.21 for "Some" competence. There was little variability among topics. The lowest

TABLE XVIII

SUMMARY OF FARM POWER AND MACHINERY TEACHERS' PERCEIVED COMPETENCE LEVELS FOR THE TRACTOR ELECTRICAL SYSTEMS

		Distribution by Level of Competence											
		Competence None		Competence Limited		Competence Some		Competence Considerable		Competence Great Deal		Average Rating	Rank
Tractor Electrical System	(N)	No.	%	No.	%	No.	%	No.	%	No.	%		
Theory of Electricity	85	1	1.18	16	18.82	37	43.53	27	31.76	4	4.71	2.20	6
Storage Battery	84	2	2.38	12	14.29	35	41.67	29	34.52	6	7.14	2.29	4
Charging Systems	84	1	1.19	13	15.48	37	44.05	30	35.71	3	3.57	2.25	5
Starting Systems	83	1	1.20	12	14.66	30	36.14	34	40.97	6	7.23	2.39	2
Ignition Systems	84	2	2.38	11	13.10	28	33.32	32	38.10	11	13.10	2.46	1
Lighting and Accessory Systems	85	3	3.53	15	17.65	36	42.36	25	29.41	6	7.05	2.19	8
Use of Testing Equipment	85	1	1.18	16	18.82	30	35.29	30	35.29	8	9.42	2.33	3
Diagnosis of Electrical Systems Problems	80	5	6.25	27	33.75	23	28.75	17	21.25	8	10.00	1.95	7
Averages	83.75	2	2.41	15.25	18.30	32	38.14	28	33.38	6.5	7.78	2.26	

TABLE XIX

SUMMARY OF FARM POWER AND MACHINERY TEACHERS' PERCEIVED COMPETENCE LEVELS FOR THE DIESEL FUEL SYSTEMS

		Distribution by Level of Competence											
		Competence None		Competence Limited		Competence Some		Competence Considerable		Competence Great Deal		Average Rating	Rank
Diesel Fuel System	(N)	No.	%	No.	%	No.	%	No.	%	No.	%		
Diesel Engine Principles	81	3	3.70	18	22.22	32	39.51	23	28.40	5	6.17	2.11	2
Diesel Fuel Tanks (Storage and Handling)	80	4	5.00	21	26.25	30	37.50	17	21.25	8	10.00	2.15	3
Fuel Transfer Pumps	82	3	3.66	24	24.97	31	37.80	18	21.95	6	7.32	2.00	4
Fuel Filters	81	1	1.23	16	19.75	35	43.21	23	28.40	6	7.41	2.21	1
Injection Pumps	83	6	7.23	25	30.12	29	34.94	19	22.89	4	4.82	1.88	7
Injection Nozzles	82	4	4.88	21	25.61	36	43.90	16	19.51	5	6.10	1.96	5
Trouble Shooting the Diesel Fuel System	82	6	7.32	20	24.39	33	40.24	20	24.39	3	3.66	1.93	6
Averages	81.57	3.86	4.72	20.71	24.76	32.29	39.59	19.43	23.83	5.29	6.50	2.02	

rating for competence was 1.88 for injection pumps. The topics received an overall average rating for competence of 2.02 or "Some".

Teacher Competence Levels for Power Trains

The data in Table XX indicate the distribution of teachers' responses for the level of their expressed competence checked on the survey instrument. The table gives the number and per cent of the responses under the five competence levels in each topic of the power train instructional area. Their competencies were ranked and from data collected, the respondents indicated more ability to teach clutch systems within the power train area. Differentials and special drives both had a fourth place rating. The lowest or fifth level of competence expressed was the theory of operation and design and final drives. The overall mean average for competence in teaching power trains was 2.19, with real limits that fell between 1.50 and 2.49 or "Some".

Teacher Competence Levels for Hydraulics

The data in Table XXI is the distribution of teachers' responses for the level of their expressed competence for teaching the hydraulic system. The table gives the number and per cent of the responses for the five competence levels in each of the topics for the hydraulic systems instructional area. The data reveals a mean response rating of 1.90 or "Some" competence. The 1.90 mean was lower than the other three major areas in this study. In analysis of the data, an average of 42.25 per cent of the respondents did indicate "Some"

TABLE XX

SUMMARY OF FARM POWER AND MACHINERY TEACHERS' PERCEIVED COMPETENCE LEVELS FOR POWER TRAINS

		Distribution by Level of Competence											
		Competence None		Competence Limited		Competence Some		Competence Considerable		Competence Great Deal		Average Rating	Rank
Power Trains	(N)	No.	%	No.	%	No.	%	No.	%	No.	%		
Theory of Operation and Design	83	2	2.41	18	21.69	34	40.96	25	30.12	4	4.82	2.13	5
Clutch Systems	84	1	1.19	15	17.86	30	35.71	28	33.33	10	11.90	2.37	1
Transmissions	84	2	2.38	18	21.43	34	40.48	24	28.57	6	7.14	2.17	3
Differentials	84	1	1.19	19	22.62	37	44.05	20	23.81	7	8.13	2.15	4
Final Drives	82	1	1.22	18	21.95	37	45.12	21	25.61	5	6.10	2.13	5
Power Take-Offs	82	1	1.22	16	19.51	36	43.90	22	26.83	7	8.54	2.22	2
Special Drives (Belts, Chains, U-Joints)	82	2	2.44	21	25.60	27	32.93	27	32.93	5	6.10	2.15	4
Averages	83	1.43	1.72	17.86	21.52	33.57	40.45	23.86	28.74	6.29	7.56	2.19	

TABLE XXI

SUMMARY OF FARM POWER AND MACHINERY TEACHERS' PERCEIVED COMPETENCE LEVELS FOR HYDRAULICS

		Distribution by Level of Competence											
		Competence None		Competence Limited		Competence Some		Competence Considerable		Competence Great Deal		Average Rating	Rank
Hydraulics	(N)	No.	%	No.	%	No.	%	No.	%	No.	%		
Basic Hydraulics (Pumps, Motors, Controls, Oils)	82	3	3.66	19	23.17	40	48.78	16	19.51	4	4.88	1.98	1
Theory of Operation for Hydraulic Systems	81	3	3.70	27	33.33	29	35.80	18	22.22	4	4.94	1.91	3
Integral Lift Systems (3 Point Hitch Type)	81	3	3.70	22	27.16	36	44.44	16	19.75	4	4.94	1.95	2
Remote Control Cylinders	80	5	6.25	24	30.00	30	37.50	17	21.25	4	5.00	1.88	4
Hydraulic Braking Systems	80	4	5.00	25	31.25	35	43.75	13	16.25	3	3.75	1.82	6
Hydraulic Steering Systems	81	4	4.94	25	30.86	35	43.21	13	16.05	4	4.94	1.85	5
Averages	80.83	3.67	4.54	23.67	29.30	34.17	42.25	15.5	19.17	3.83	4.74	1.90	

competence for teaching hydraulics. All topic areas were about the same in competence rating. They ranged from 1.82 for braking systems to 1.98 for basic hydraulics.

Teachers' Responses to Training Received in Tractor Electrical Systems

Data contained in Table XXII indicates the distribution of the teachers' responses for training received in the tractor electrical system. Four to six, or an average of 5.92 per cent of the teachers, had no training in the selected topics. Of the three types of training, formal, informal, and in-service, the respondents reported they had more in-service type training than formal or informal. A large percentage (33.23) of the teachers' indicated they had received a combination of formal, informal, and in-service training.

Teachers' Responses to Training Received in Diesel Fuel Systems

The data contained in Table XXIII indicates the distribution of the teachers' responses for training received in the diesel fuel system. An average of 15.50 per cent of the teachers indicated no training in topics within the diesel fuel system instructional area. An average of 21.82 per cent of the respondents had training through in-service programs and the combination area of formal, informal, and in-service training had an average of 22.19 per cent. The formal and informal areas had slightly lower percentages with the other combinations having even lower.

TABLE XXII

SUMMARY OF FARM POWER AND MACHINERY TEACHERS' SOURCES OF TRAINING FOR TOPICS IN THE TRACTOR ELECTRICAL SYSTEMS INSTRUCTIONAL AREA

		Type of Training															
		None		Formal Only		Informal Only		In-Service Only		Formal Informal In-Service		Formal Informal		Informal In-Service		Formal In-Service	
Tractor Electrical System	(N)	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Theory of Electricity	84	6	7.14	17	20.24	6	7.14	16	19.05	29	34.52	3	3.57	5	5.96	2	2.38
Storage Battery	83	6	7.23	13	15.56	8	9.64	23	27.71	25	30.12	4	4.82	3	3.61	1	1.22
Charging System	83	4	4.82	14	16.87	7	8.43	19	22.89	27	32.53	4	4.82	6	7.23	2	2.41
Starting System	83	5	6.02	14	16.87	6	7.23	17	20.48	30	36.14	3	3.61	7	8.43	1	1.22
Ignition Systems	84	4	4.76	14	16.67	5	5.95	20	23.82	30	35.71	3	3.57	6	7.14	2	2.38
Lighting and Accessory Systems	81	6	7.41	11	13.58	11	13.58	22	27.16	23	28.40	3	3.70	4	4.94	1	1.23
Use of Testing Equipment	83	4	4.82	10	12.05	10	12.05	20	24.09	27	32.53	4	4.82	6	7.23	2	2.41
Diagnosis of Electrical Systems Problems	78	4	5.12	9	11.54	11	14.10	19	24.36	28	35.90	3	3.85	3	3.85	1	1.28
Averages	82.38	4.88	5.92	12.75	15.42	8	9.77	19.5	23.70	27.38	33.23	3.38	4.09	5	6.04	1.5	1.82

TABLE XXIII

SUMMARY OF FARM POWER AND MACHINERY TEACHERS' SOURCES OF TRAINING FOR TOPICS IN THE DIESEL FUEL SYSTEMS INSTRUCTIONAL AREA

		Type of Training															
		None		Formal Only		Informal Only		In-Service Only		Formal Informal In-Service		Formal Informal		Informal In-Service		Formal In-Service	
Diesel Fuel Systems	(N)	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Diesel Engine Principles	82	12	14.63	14	17.07	10	12.20	17	20.73	18	21.95	3	3.66	4	4.88	4	4.88
Diesel Fuel Tanks (Storage and Handling)	79	10	12.66	12	15.19	12	15.19	19	24.05	21	26.58	2	2.53	2	2.53	1	1.27
Fuel Transfer Pumps	82	14	17.07	16	19.51	14	17.07	15	18.30	16	19.51	2	2.44	4	4.88	1	1.22
Fuel Filters	81	10	12.35	16	19.75	11	13.58	17	20.99	19	23.46	3	3.70	4	4.94	1	1.23
Injection Pumps	83	16	19.28	15	18.07	12	14.46	20	24.10	16	19.20	1	1.20	2	2.41	1	1.20
Injection Nozzles	83	14	16.87	14	16.87	12	14.46	20	24.10	17	20.48	2	2.41	2	2.41	2	2.41
Trouble Shooting the Diesel Fuel System	83	13	15.66	15	18.07	12	14.46	17	20.48	20	24.10	2	2.41	2	2.41	2	2.41
Averages	81.86	12.71	15.50	14.57	17.79	11.86	14.49	17.86	21.82	18.14	22.18	2.14	2.62	2.85	3.49	1.71	2.09

Teachers' Responses to Training Received in Power Trains

The data in Table XXIV indicate the distribution of the teachers' responses for training received in power trains. An average of 11.13 per cent of the teachers indicate no training in topics within the power train instructional area. There was an average of 11.09 per cent of the teachers that had formal training in the field of power trains. An average of 18.94 per cent indicated having training from informal sources. The data shows that an average of 23.65 per cent of the teachers had more in-service type training than the combination group of formal, informal, and in-service with a mean average of 22.40 per cent responding in this category.

Teachers' Responses to Training Received in Hydraulics

Table XXV contains the distribution of the teachers' responses for training received on hydraulic systems. An average of 17.69 per cent indicate no training in topics within the hydraulic system instructional area. An average of 19.11 per cent of the respondents had training through in-service programs. In the population, an average of 15.44 per cent indicated they had received only formal training and 19.72 per cent had received informal training in the field of hydraulics. Only 17.47 per cent indicated training in the combination group of formal, informal, and in-service type training.

TABLE XXIV

SUMMARY OF FARM POWER AND MACHINERY TEACHERS' SOURCES OF TRAINING FOR TOPICS IN THE POWER TRAINS INSTRUCTIONAL AREA

		Type of Training															
		None		Formal Only		Informal Only		In-Service Only		Formal Informal In-Service		Formal Informal		Informal In-Service		Formal In-Service	
Power Trains	(N)	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Theory of Operation and Design	81	11	13.58	9	11.11	13	16.05	18	22.22	19	23.46	4	4.94	4	4.94	3	3.70
Clutch Systems	82	7	8.54	9	10.98	15	18.29	17	20.73	21	25.61	5	6.10	5	6.10	3	3.66
Transmissions	82	9	10.98	9	10.98	15	18.29	21	25.61	17	20.73	5	6.10	3	3.66	3	3.66
Differentials	82	8	9.76	11	13.41	17	20.73	19	23.17	18	21.95	3	3.66	3	3.66	3	3.66
Final Drives	81	8	9.88	10	12.35	17	20.99	20	24.69	17	20.99	3	3.70	3	3.70	3	3.70
Power Take-Offs	82	10	12.19	8	9.76	16	19.51	19	23.17	18	21.95	5	6.10	3	3.66	3	3.66
Special Drives (Belts, Chains, U-Joints)	77	10	12.98	7	9.09	14	18.18	20	25.97	17	22.08	4	5.19	4	5.19	1	1.30
Averages	81	9	11.13	9	11.10	15.29	18.86	19.14	23.15	18.14	22.40	4.14	5.11	3.57	4.42	2.71	3.33

TABLE XXV

SUMMARY OF FARM POWER AND MACHINERY TEACHERS' SOURCES OF TRAINING FOR TOPICS IN THE HYDRAULICS INSTRUCTIONAL AREA

		Type of Training															
		None		Formal Only		Informal Only		In-Service Only		Formal Informal In-Service		Formal Informal		Informal In-Service		Formal In-Service	
Hydraulics	(N)	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Basic Hydraulics (Pumps, Motors, Controls, Oils)	83	13	15.66	13	15.66	13	15.66	15	18.07	18	21.69	3	3.61	6	7.23	2	2.41
Theory of Operation for Hydraulic Systems	82	14	17.07	13	15.85	13	15.85	17	20.73	16	19.51	4	4.88	3	3.66	2	2.44
Integral Lift Systems (3 Point Hitch Type)	82	12	14.63	13	15.85	20	24.39	15	18.29	13	15.85	2	2.44	5	6.10	2	2.44
Remote Control Cylinders	82	16	19.51	13	15.85	17	20.73	14	17.07	13	15.85	2	2.44	5	6.10	2	2.44
Hydraulic Braking Systems	81	16	19.75	11	13.58	17	20.99	16	19.75	13	16.05	3	3.70	4	4.94	1	1.23
Hydraulic Steering Systems	82	16	19.51	13	15.85	17	20.73	17	20.73	13	15.85	3	3.66	2	2.44	1	1.23
Averages	82	14.5	17.69	17.67	15.44	16.67	19.73	15.67	19.11	14.33	17.47	2.83	3.46	4.17	5.08	1.67	2.03

Estimated Total Hours Spent on the Tractor Electrical System

The data in Table XXVI are a summary of the teachers' estimated total time spent in the classroom and shop on the tractor electrical system. It can be noted that in the classroom, 86.91 per cent of the teachers spent from 1-30 hours. Also, a total of 78.58 per cent of the teachers spent from 1-30 hours in the shop. Three teachers indicated spending no time in the classroom, while all the respondents spent time in the shop. A noteworthy finding reported in the table was that six of the teachers spent over 50 hours on electrical systems in the shop.

In this table, it should be observed that 100 per cent taught electrical systems in the shop and 96.43 per cent of the teachers spent time on instruction of electrical systems in the classroom.

Estimated Total Hours Spent on the Diesel Fuel System

Table XXVII is a summary of the teachers' estimated total time spent in the classroom and shop on the diesel fuel system. It can be observed that five or 6.02 per cent indicated they spent no time in the classroom and 14 or 16.86 per cent of the teachers did not teach diesel fuel systems in the shop. There was approximately 86 per cent of the teachers that indicated spending from 0-20 hours in the classroom and approximately 77 per cent spent from 0-20 hours in the shop.

TABLE XXVI

SUMMARY OF THE FARM POWER AND MACHINERY TEACHERS' ESTIMATED TOTAL HOURS SPENT ON THE TRACTOR ELECTRICAL SYSTEMS IN THE CLASSROOM AND SHOP

Total Classroom Hours	Number	Per Cent	Total Shop Hours	Number	Per Cent
0	3	3.57	0	0	0
1-10	31	36.91	1-10	17	20.24
11-20	32	38.09	11-20	29	34.53
21-30	10	11.91	21-30	20	23.81
31-40	4	4.76	31-40	9	10.71
41-50	2	2.38	41-50	3	3.57
Over 50	2	2.38	Over 50	6	7.14
Total	84	100.00	Total	84	100.00

TABLE XXVII

SUMMARY OF THE FARM POWER AND MACHINERY TEACHERS' ESTIMATED TOTAL HOURS SPENT ON THE DIESEL FUEL SYSTEM IN THE CLASSROOM AND SHOP

Total Classroom Hours	Number	Per Cent	Total Shop Hours	Number	Per Cent
0	5	6.02	0	14	16.86
1-10	49	59.04	1-10	25	30.10
11-20	19	22.94	11-20	26	31.34
21-30	6	7.26	21-30	6	7.23
31-40	2	2.41	31-40	4	4.82
41-50	1	1.21	41-50	1	1.21
Over 50	1	1.21	Over 50	7	8.44
Total	83	100.00	Total	83	100.00

Estimated Total Hours Spent on the Power Train

The data in Table XXVIII are a summary of the teachers' estimated total time spent in the classroom and shop on the power train. By observing the data for the classroom, three or 3.61 per cent spent over 50 hours and three or 3.61 per cent indicated no time for instruction of power trains. However, in the 1-20 hour span for instruction, there was a total of 67 or 80.71 per cent. Seventy-one per cent spent from 1-30 hours and there were seven who taught in excess of 50 hours.

Estimated Total Hours Spent on the Hydraulic System

Table XXIX is a summary of the teachers' estimated total time spent in the classroom and shop on hydraulic systems. The data reveals that none of the respondents spent over 30 hours in the classroom for instruction of hydraulics. Six or 7.23 per cent of the teachers indicated they spent from 21-30 hours on hydraulics. Seven or 8.43 per cent responded as spending no time in the classroom. The largest group, 48 or 57.82 per cent, were in the 1-10 hour span.

In the shop, there were six or 7.22 per cent indicating no time and nine or 10.87 per cent that spent over 30 hours on teaching hydraulics. In the combined spans from 1-30 hours, there was a total of 68 or 81.91 per cent of the respondents teaching hydraulics.

TABLE XXVIII

SUMMARY OF THE FARM POWER AND MACHINERY TEACHERS' ESTIMATED TOTAL HOURS SPENT ON POWER TRAINS IN THE CLASSROOM AND SHOP

Total Classroom Hours	Number	Per Cent	Total Shop Hours	Number	Per Cent
0	3	3.61	0	1	1.21
1-10	45	54.20	1-10	24	28.91
11-20	22	26.51	11-20	25	30.11
21-30	8	9.66	21-30	11	13.27
31-40	2	2.42	31-40	9	10.83
41-50	0	0	41-50	6	7.23
Over 50	3	3.61	Over 50	7	8.44
Total	83	100.00	Total	83	100.00

TABLE XXIX

SUMMARY OF THE FARM POWER AND MACHINERY TEACHERS' ESTIMATED TOTAL HOURS SPENT ON HYDRAULICS IN THE CLASSROOM AND SHOP

Total Classroom Hours	Number	Per Cent	Total Shop Hours	Number	Per Cent
0	7	8.43	0	6	7.22
1-10	48	57.82	1-10	47	44.59
11-20	22	26.52	11-20	20	24.08
21-30	6	7.23	21-30	11	13.24
31-40	0	0	31-40	4	4.82
41-50	0	0	41-50	3	3.63
Over 50	0	0	Over 50	2	2.42
Total	83	100.00	Total	83	100.00

Summary of the Suggested Methods of Improving Knowledge and Competence in the Selected Specialized Areas

On the instrument, the teachers were to rank the following suggestions for improving their knowledge and competency in the specialized areas listed on the instrument. The four suggested methods were:

1. Taking courses in Farm Power and Machinery from a college or university.
2. In-service workshops sponsored by industry in the specialized areas of Hydraulics, Diesel Fuel Systems, Power Trains and Electrical Systems.
3. Workshops relating to Farm Power and Machinery sponsored by the Texas Education Agency using university personnel as instructors.
4. On-the-job training (with pay) at a tractor dealership for three or more weeks during the summer.

They were to list other suggestions that are in Appendix C.

The data in Table XXX is a summary of the teachers' responses for improving knowledge and competence in the specialized areas. In the analysis of the data, in-service workshops sponsored by industry ranked first with 52 or 77.61 per cent of the teachers rating in-service first and second. It is interesting to note that the teachers selected on-the-job training (with pay) at a tractor dealershop for three or more weeks during the summer as their second choice. Workshops relating to Farm Power and Machinery sponsored

TABLE XXX

SUMMARY OF THE FARM POWER AND MACHINERY TEACHERS' SUGGESTED METHODS OF IMPROVING KNOWLEDGE AND COMPETENCE IN THE SELECTED SPECIALIZED AREAS

		Distribution by Rank Category											
		1st		2nd		3rd		4th		5th			
	(N)	No.	%	No.	%	No.	%	No.	%	No.	%	Average Rating	Rank
Taking courses in Farm Power and Machinery from a college or university	65	7	10.77	12	18.46	20	30.77	22	33.85	4	6.15	3.06	4
In-service workshops sponsored by industry in the specialized areas of Hydraulics, Diesel Fuel Systems, Power Trains and Electrical Systems	67	31	46.27	21	31.34	11	16.42	4	5.97	0	0	1.82	1
Workshops relating to Farm Power and Machinery by the Texas Education Agency using university personnel as instructors	66	8	12.12	13	19.70	24	36.36	19	28.79	2	3.03	2.91	3

TABLE XXX (Continued)

	Distribution by Rank Category												
		1st		2nd		3rd		4th		5th		Average	
	(N)	No.	%	No.	%	No.	%	No.	%	No.	%	Rating	Rank
On-the-job training (with pay) at a tractor dealership for three or more weeks during the summer	66	19	28.79	19	28.79	8	12.12	19	28.79	1	1.51	2.45	2
Others (Listed in Appendix C)	14												

by the Texas Education Agency using university personnel ranked third. Taking courses in Farm Power and Machinery from a college or university was listed as their fourth choice.

Selected Characteristics of the University Instructors Teaching Farm Power and Machinery Related Courses

The five university instructors teaching farm power and machinery related courses in 1975-1976 had experience as high school vocational agriculture teachers. This experience ranged from 2-12 years. The university instructors indicated they had taught farm power and machinery related courses at the university level from 2-8 years. The university instructors had completed from 4-20 hours of farm power and machinery related courses as part of their training. Four of the five respondents gave the institution from which their course work was completed. Two indicated that they had completed their course work at Texas A&M University, while two indicated that they had received their farm power and machinery training at East Texas State University

University Instructors' Informal Training in Farm Power and Machinery

In response to the statement "check all the types of informal training pertaining to farm power and machinery you have had," two of the instructors indicated they had military training on trucks, heavy equipment service and repair. Four of the instructors responded as having on-farm experience with tractors and equipment repair. There were four that indicated experience related to automobile, truck

service and repair, that included such training as dealerships, parts departments, and garage work. Only one of the five instructors responded as having experience with a tractor dealership in the area of mechanics, parts departments, equipment service and set-up.

The instructors listed four other types of informal training. These were:

1. On-farm maintenance and repair;
2. Dealer schools (hydraulics, electrical power trains, etc.);
3. State highway mechanics helper;
4. Worked in father's welding and machine shop.

University Instructors' Attendance in Non-Credit Workshops Related to Farm Power and Machinery

There were three of the respondents that indicated they had attended the preparatory workshop at Texas A&M University for a farm power and machinery teaching certificate. One of the instructors attended Texas A&I University. The instructors listed four other workshops they had attended sponsored by universities and the Texas Education Agency. They were:

John Deere Hydraulics School

International Harvester Electrical Systems

Mobile Automotive Training Program

Drawns Diesel School

The Texas Vocational Agriculture Teachers Conference each year, incorporates workshops for in-service training of teachers. There was only one of the university instructors indicating attendance at

these workshops on related farm power and machinery subject matter. However, many of these instructors are involved in the presentation of these programs. Four of the instructors attended non-credit workshops sponsored by industry.

Presentation of Data in the Four Instructional Areas by University Instructors

The following section of this chapter gives the number and percentages indicated by the university instructors as they relate to each of the questions in the major categories: importance, classroom hours, shop hours, level of competence, and type of training in the four instructional areas.

Importance Placed on the Four Instructional Areas

The data presented in Table XXXI indicates the amount of importance the university instructors placed on the four instructional areas. The overall mean for importance placed on the tractor electrical system was 4.18 or "Much" importance. The largest rating in any response category was 4.80 for both use of testing equipment and diagnosis of electrical systems problems. These topics fell in the real limits of 4.50 to 5.00 for "Great" importance. Lighting and accessory systems had the lowest overall mean response of 3.00 or "Some" importance. All other topics rated "Much" for average importance.

TABLE XXXI

SUMMARY OF THE PERCEIVED IMPORTANCE PLACED ON TOPICS WITHIN THE FOUR INSTRUCTIONAL AREAS BY UNIVERSITY INSTRUCTORS

		Distribution by Level of Importance										
		No		Little		Some		Much		Great		*Average
Tractor Electrical Systems	(N)	No.	%	No.	%	No.	%	No.	%	No.	%	Importance
Theory of Electricity	5			1	20.00	2	40.00	1	20.00	1	20.00	3.40
Storage Battery	5					2	40.00	2	40.00	1	20.00	3.80
Charging Systems	5					2	40.00	2	40.00	1	20.00	3.80
Starting Systems	5							2	40.00	3	60.00	4.60
Ignition Systems	5					1	20.00	1	20.00	3	60.00	4.40
Lighting and Accessory Systems	5			1	20.00	3	60.00	1	20.00			3.00
Use of Testing Equipment	5							1	20.00	4	80.00	4.80
Diagnosis of Electrical Systems Problems	5							1	20.00	4	80.00	4.80
*Average Importance												4.08

TABLE XXXI (Continued)

Diesel Fuel Systems	(N)	Distribution by Level of Importance										*Average Importance
		No		Little		Some		Much		Great		
		No.	%	No.	%	No.	%	No.	%	No.	%	
Diesel Engine Principles	5			1	20.00	1	20.00	1	20.00	2	40.00	3.80
Diesel Fuel Tanks (Storage and Handling)	5			2	40.00	2	40.00	1	20.00			2.80
Fuel Transfer Pumps	5			1	20.00	4	80.00					3.00
Fuel Filters	5							2	40.00	3	60.00	4.60
Injection Pumps	5					3	60.00	2	40.00			3.40
Injection Nozzles	5							2	40.00	3	60.00	4.60
Trouble Shooting the Diesel Fuel System	4	1	25.00	2	50.00					1	25.00	2.50
*Average Importance												3.53

TABLE XXXI (Continued)

Power Trains	(N)	Distribution by Level of Importance										*Average Importance
		No		Little		Some		Much		Great		
		No.	%	No.	%	No.	%	No.	%	No.	%	
Theory of Operation and Design	5					2	40.00			1	20.00	3.00
Clutch Systems	5					1	20.00	3	60.00	1	20.00	4.00
Transmissions	5					4	80.00			1	20.00	3.40
Differentials	5					4	80.00			1	20.00	3.40
Final Drives	5					4	80.00			1	20.00	3.40
Power Take-Offs	5					3	60.00	1	20.00	1	20.00	3.60
Special Drives (Belts, Chains, U-Joints)	5					2	40.00	2	40.00	1	20.00	3.80
*Average Importance												3.50

TABLE XXXI (Continued)

Hydraulics	(N)	Distribution by Level of Importance										*Average Importance
		No		Little		Some		Much		Great		
		No.	%	No.	%	No.	%	No.	%	No.	%	
Basic Hydraulics (Pumps, Motors, Controls, Oils)	5			1	20.00	1	20.00	2	40.00	1	20.00	3.60
Theory of Operation for Hydraulic Systems	5			2	40.00	1	20.00	1	20.00	1	20.00	3.20
Integral Lift Systems (3 Point Hitch Type)	5			1	20.00	2	40.00	1	20.00	1	20.00	3.40
Remote Control Cylinders	5					4	80.00			1	20.00	3.40
Hydraulic Braking Systems	5			1	20.00	3	60.00			1	20.00	3.40
Hydraulic Steering Systems	5			1	20.00	3	60.00			1	20.00	3.40
*Average Importance												3.40

The data found in Table XXXI also shows the amount of importance placed on instruction of diesel fuel systems by the university instructors. The overall mean average for importance placed on the diesel fuel system was 3.53 hours or "Much" importance. However, individual topic averages ranged from 2.50 to 4.60. The instructors tended to indicate that on the average, little importance should be put on trouble shooting the fuel system and diesel storage tanks. However, one instructor indicated it was of no importance and one indicated great importance. The instruction of fuel filters and injection nozzles rated 4.60 or "Great" for average importance.

The data presented in Table XXXI indicates the amount of importance the university instructors placed on the instruction of power trains. The majority of the instructors placed "Much" importance on the instruction of power trains as indicated by the overall mean average of 3.51 for importance. Only two of the instructors placed any topic in the power train area below "Some" importance. The topic in which this occurred was in the theory of operation and design. Of greatest average importance was clutch systems with 4.00.

The data found in Table XXXI also shows the amount of importance placed on the instruction of hydraulics by the university instructors. The overall mean average for all topics in the hydraulics section was 3.40 or "Some" for importance. All the topics were very close to this overall average. The instructors rated basic hydraulics highest for importance by a close margin.

Classroom Hours Spent on the Four Instructional Areas

Table XXXII contains the summary of the five university instructors' responses to average hours spent in the classroom on the four selected instructional areas used in this study. In the calculation of average hours, the respondents indicating "no" hours were not included, because it was a purpose of the study to determine the number of hours being taught. By observing the data on the tractor electrical system, it can be noted that a majority of the respondents indicated spending from 1-2 hours in the classroom on the topics. The average hours spent on one topic within the tractor electrical system was 3.66 hours. Five of topics had 11 plus hours spent on them by certain instructors.

By observing the data in the table on diesel fuel systems, the instructors spent an average of 3.56 hours on all topics. The majority did indicate teaching from 1-2 hours on the diesel fuel system. There was one respondent that indicated spending "No" time on the instruction of diesel fuel tanks, fuel filters, and injection pumps. It can be noted that certain instructors did indicate spending 11 plus hours on diesel engine principles, injection pumps, injection nozzles and trouble shooting the diesel fuel system.

It can be noted by observing the data found in the table on the power train instructional area, that the majority of the instructors spent from 1-2 hours in the classroom on the topics with the average hours spent on all topics averaging 4.03 hours. However, it should be pointed out that in two instances the average was increased by one

TABLE XXXII

SUMMARY OF THE ESTIMATED CLASSROOM HOURS SPENT ON TOPICS WITHIN THE FOUR INSTRUCTIONAL AREAS BY UNIVERSITY INSTRUCTORS

		Distribution by Hours Spent in the Classroom										
		0 Hours		1-2 Hours		3-5 Hours		6-10 Hours		11+ Hours		*Average Hours
Tractor Electrical System	(N)	No.	%	No.	%	No.	%	No.	%	No.	%	
Theory of Electricity	5	1	20.00	3	60.00					1	20.00	4.13
Storage Battery	5			4	80.00	1	20.00					2.00
Charging Systems	5			4	80.00					1	20.00	3.60
Starting Systems	5			4	80.00			1	20.00			2.80
Ignition Systems	5			4	80.00					1	20.00	3.60
Lighting and Accessory Systems	3	2	66.00			1	33.00					4.00
Use of Testing Equipment	5			2	40.00	2	40.00			1	20.00	4.60
Diagnosis of Electrical Systems Problems	5			2	40.00	2	40.00			1	20.00	3.66
*Average (do not include zero hours spent) Hours												3.66

TABLE XXXII (Continued)

Diesel Fuel Systems	(N)	Distribution by Hours Spent in the Classroom										*Average Hours
		0 Hours		1-2 Hours		3-5 Hours		6-10 Hours		11+ Hours		
		No.	%	No.	%	No.	%	No.	%	No.	%	
Diesel Engine Principles	5			4	80.00					1	20.00	3.60
Diesel Fuel Tanks (Storage, and Handling	5	1	20.00	3	60.00	1	20.00					2.13
Fuel Transfer Pumps	5	2	40.00	2	40.00			1	20.00			3.66
Fuel Filters	5	1	20.00	3	60.00			1	20.00			3.13
Injection Pumps	5	1	20.00	3	60.00					1	20.00	4.13
Injection Nozzles	4			3	75.00					1	25.00	4.13
Trouble Shooting the Diesel Fuel System	4			3	75.00					1	25.00	4.13
*Average Hours (Do not include zero hours spent)												3.56

TABLE XXXII (Continued)

Power Trains	(N)	Distribution by Hours Spent in the Classroom										*Average Hours
		0 Hours		1-2 Hours		3-5 Hours		6-10 Hours		11+ Hours		
		No.	%	No.	%	No.	%	No.	%	No.	%	
Theory of Operation and Design	5	4	80.00							1	20.00	12.00
Clutch Systems	5			4	80.00	1	20.00					2.00
Transmissions	5	1	20.00	3	60.00	1	20.00					2.12
Differentials	5	1	20.00	3	60.00	1	20.00					2.12
Final Drives	5	1	20.00	3	60.00	1	20.00					2.12
Power Take-Offs	5	2	40.00	2	40.00			1	20.00			3.67
Special Drives (Belts, Chains, U-Joints)	5	1	20.00	3	60.00					1	20.00	4.13
*Average Hours (Do not include zero hours spent)												4.02

TABLE XXXII (Continued)

Hydraulics	(N)	Distribution by Hours Spent in the Classroom										*Average Hours
		0 Hours		1-2 Hours		3-5 Hours		6-10 Hours		11+ Hours		
		No.	%	No.	%	No.	%	No.	%	No.	%	
Basic Hydraulics (Pumps, Motors, Controls, Oils)	5			3	60.00	1	20.00			1	20.00	4.10
Theory of Operation for Hydraulic Systems	5			4	80.00					1	20.00	3.60
Integral Lift Systems (3 Point Hitch Type)	5	1	20.00	3	60.00					1	20.00	4.13
Remote Control Cylinders	5	1	20.00	3	60.00	1	20.00					2.12
Hydraulic Braking Systems	5	2	40.00	2	40.00	1	20.00					2.33
Hydraulic Steering Systems	5	3	60.00	1	20.00	1	20.00					2.75
*Average Hours (Do not include zero hours spent)												3.17

instructor indicating 11 plus hours on theory of operation and design, and one instructor indicating 11 plus hours spent on special drives. In comparison to other instructional areas, a greater number of the instructors did not teach certain topics on power trains in the classroom. Four of them did not teach theory of operation and design while one taught it 11 plus hours.

By observing the data in the table concerning the hydraulics instructional area, it can be seen the majority of the instructors spent from 1-2 hours on the topics. The overall average hours spent on instruction of hydraulics was 3.17 hours. The total average hours were increased by one instructor indicating spending 11 plus hours in each of the topics, basic hydraulics, theory of operation and integral lift systems. There were four topics under hydraulics that did not receive any instruction time by certain instructors.

Shop Hours Spent on the Four
Instructional Areas

The data in Table XXXIII contains the summary of the five university instructors' responses to average hours spent in the shop on the four selected instructional areas used in this study.

In the calculation of the average hours, the respondents indicating "No" hours were not included because it was a purpose of the study to determine the number of hours being taught. By observing the data it should be noted that in the shop as in the classroom the instructors tended to indicate spending from 1-2 hours on each of the topics listed under the tractor electrical system. One respondent indicated 11 plus hours on each of the topics. There were four of

TABLE XXXIII

SUMMARY OF THE ESTIMATED SHOP HOURS SPENT ON TOPICS WITHIN THE FOUR INSTRUCTIONAL AREAS BY UNIVERSITY INSTRUCTORS

		Distribution by Hours Spent in the Shop										
		0 Hours		1-2 Hours		3-5 Hours		6-10 Hours		11+ Hours		*Average Hours
Tractor Electrical System	(N)	No.	%	No.	%	No.	%	No.	%	No.	%	
Theory of Electricity	5	3	60.00	1	20.00					1	20.00	6.75
Storage Battery	5	3	60.00	2	40.00					1	20.00	1.50
Charging Systems	5			4	80.00					1	20.00	3.60
Starting Systems	5			4	80.00					1	20.00	3.60
Ignition System	5			4	80.00					1	20.00	3.60
Lighting and Accessory Systems	5	2	40.00	2	40.00					1	20.00	5.00
Use of Testing Equipment	5			2	40.00	2	40.00			1	20.00	4.60
Diagnosis of Electrical Systems Problems	5	1	20.00	2	40.00	1	20.00			1	20.00	4.75
*Average Hours (Do not include zero hours spent)												4.18

TABLE XXXIII (Continued)

Diesel Fuel Systems	(N)	Distribution by Hours Spent in the Shop										*Average Hours
		0 Hours		1-2 Hours		3-5 Hours		6-10 Hours		11+ Hours		
		No.	%	No.	%	No.	%	No.	%	No.	%	
Diesel Engine Principles	5	3	60.00							2	40.00	12.00
Diesel Fuel Tanks (Storage and Handling)	5	4	80.00							1	20.00	12.00
Fuel Transfer Pumps	5	4	80.00							1	20.00	12.00
Fuel Filters	5	2	40.00	2	40.00					1	20.00	5.00
Injection Pumps	5	2	40.00	2	40.00					1	20.00	5.00
Injection Nozzles	5			3	60.00	1	20.00			1	20.00	4.10
Trouble Shooting the Diesel Fuel System	3	1	33.33	2	66.00							1.50
*Average Hours (Do not include zero hours spent)												7.37

TABLE XXXIII (Continued)

		Distribution by Hours Spent in the Shop										
		0 Hours		1-2 Hours		3-5 Hours		6-10 Hours		11+ Hours		*Average Hours
Power Trains	(N)	No.	%	No.	%	No.	%	No.	%	No.	%	
Theory of Operation and Design	5					1	20.00	3	60.00	1	20.00	10.00
Clutch Systems	5			4	80.00					1	20.00	3.60
Transmissions	5			4	80.00					1	20.00	3.60
Differentials	5			4	80.00					1	20.00	3.60
Final Drives	5			4	80.00					1	20.00	3.60
Power Take-Offs	5			4	80.00					1	20.00	3.60
Special Drives (Belts, Chains, U-Joints)	5	2	40.00	1	20.00	1	20.00			1	20.00	5.83
*Average Hours (Do not include zero hours spent)												4.83

TABLE XXXIII (Continued)

		Distribution by Hours Spent in the Shop										
		0 Hours		1-2 Hours		3-5 Hours		6-10 Hours		11+ Hours		*Average Hours
Hydraulics	(N)	No.	%	No.	%	No.	%	No.	%	No.	%	
Basic Hydraulics (Pumps, Motors, Controls, Oils)	5	1	20.00	3	60.00					1	20.00	4.13
Theory of Operation for Hydraulic Systems	5	4	80.00							1	20.00	12.00
Integral Lift Systems (3 Point Hitch Type)	5			3	60.00	1	20.00			1	20.00	4.10
Remote Control Cylinders	5	2	40.00	2	40.00					1	20.00	5.00
Hydraulic Braking Systems	5	3	60.00	1	20.00					1	20.00	6.75
Hydraulic Steering Systems	5	2	40.00	2	40.00					1	20.00	5.00
*Average Hours (Do not include zero hours spent)												6.16

the topics that did not receive any time for instruction in the shop by three instructors; lighting and accessory systems by two; and diagnosis of electrical systems problems by one.

In the analysis of the data on topics within the diesel fuel systems instructional area, a larger number of the respondents indicated they spend "No" time in the shop. In the 1-2 hour range, there were two instructors teaching fuel filters, injection pumps and trouble shooting the fuel system. There were three instructors that indicated spending 1-2 hours on injection nozzles in the shop. There was one of the instructors that spent 11 plus hours in the shop on all topics but trouble shooting the diesel fuel system.

Inspection of the data in the table reveals that all but one of the topics within power trains was taught in the shop. The only area not included in shop instruction was special drives. A majority of the respondents did indicate spending from 1-2 hours of instruction on the topics. The exception was on theory of operation and design and on special drives. It should be noted that one instructor in each group did indicate spending 11 plus hours on each topic.

According to the data presented in the table, the hydraulic system responses were similar to the responses for the diesel fuel system. A large number of the respondents did indicate spending no time in the shop for instruction of certain topics of hydraulics. The next largest group of respondents spent from 1-2 hours on instruction on most topics of hydraulics. Again, it should be noted that in each of the response categories, one instructor indicated spending 11 plus hours on the topics listed under hydraulics.

Summary of the University Instructors Responses for Their Level of Competence

The data in Table XXXIV show the distribution of university instructors' responses for the level of their expressed competence to teach the selected instructional areas on the instrument. The table gives the number and per cent of the responses under the five competence levels in each topic of the tractor electrical system, diesel fuel system, power trains and hydraulics instructional areas.

The data in the table for the tractor electrical system area shows the competence ratings and ranks for the topics. The instructors rated ignition systems 3.6 or first in competence. Their second rating of 3.2 for competence was in the use of testing equipment and the instruction of starting systems. The lowest rating for instructional competence was their instruction of charging systems. The average rating for competence to teach all levels of the tractor electrical system was 2.99 or "Considerable". One instructor did indicate a competence level of "Limited' for charging systems.

The data in the table listed under diesel fuel systems is the distribution of the instructors' responses for their level of expressed competence to teach each of the selected topics. The data shows the instructors' average rating for diesel engine principles, diesel fuel tanks (storage and handling), fuel transfer pumps and fuel filters was 3.2 or "Considerable" for their level of teaching competence. Injection nozzles and trouble shooting the diesel fuel system average rating was 3.0 or "Considerable." Injection pumps average rating for competence was 2.6 for competence and still fell in the set limits

TABLE XXXIV

SUMMARY OF UNIVERSITY INSTRUCTORS' RESPONSES FOR THEIR LEVEL OF PERCEIVED COMPETENCE IN THE FOUR INSTRUCTIONAL AREAS

Tractor Electrical System	(N)	Competence None No.	%	Competence Limited No.	%	Competence Some No.	%	Competence Considerable No.	%	Competence Great Deal No.	%	Average Rating	Rank
Theory of Electricity	5					1	20.00	3	60.00	1	20.00	3.00	3
Storage Battery	5					2	40.00	2	40.00	1	20.00	2.80	4
Charging Systems	5			1	20.00			2	40.00	2	40.00	2.60	6
Starting Systems	5							4	80.00	1	20.00	3.20	2
Ignition Systems	5							2	40.00	3	60.00	3.60	1
Lighting and Accessory Systems	4					1	25.00	3	75.00			2.75	5
Use of Testing Equipment	5							4	80.00	1	20.00	3.20	2
Diagnosis of Electrical Systems Problems	5					2	40.00	2	40.00	1	20.00	2.80	4
Overall Average Competency												2.99	

TABLE XXXIV (Continued)

Diesel Fuel Systems	(N)	Competence None No.	%	Competence Limited No.	%	Competence Some No.	%	Competence Considerable No.	%	Competence Great Deal No.	%	Average Rating	Rank
Diesel Engine Principles	5					1	20.00	2	40.00	2	40.00	3.20	1
Diesel Fuel Tanks (Storage and Handling	5					1	20.00	2	40.00	2	40.00	3.20	1
Fuel Transfer Pumps	5					1	20.00	2	40.00	2	40.00	3.20	1
Fuel Filters	5					1	20.00	2	40.00	2	40.00	3.20	1
Injection Pumps	5			1	20.00	1	20.00	2	40.00	1	20.00	2.60	3
Injection Nozzles	5					1	20.00	3	60.00	1	20.00	3.00	2
Trouble Shooting the Diesel Fuel System	5					1	20.00	3	60.00	1	20.00	3.00	2
Overall Average Competency												3.06	

TABLE XXXIV (Continued)

Power Trains	(N)	Competence Some No.	%	Competence Limited No.	%	Competence Some No.	%	Competence Considerable No.	%	Competence Great Deal No.	%	Average Rating	Rank
Theory of Operation and Design	5					1	20.00	3	60.00	1	20.00	3.00	1
Clutch Systems	5					1	20.00	3	60.00	1	20.00	3.00	1
Transmissions	5					2	40.00	2	40.00	1	20.00	2.80	2
Differentials	5					2	40.00	2	40.00	1	20.00	2.80	2
Final Drives	5					2	40.00	2	40.00	1	20.00	2.80	2
Power Take-Offs	5					1	20.00	3	60.00	1	20.00	3.00	1
Special Drives (Belts, Chains, U-Joints)	5			1	20.00			2	40.00	2	40.00	3.00	1
Overall Average Competency												2.91	

TABLE XXXIV (Continued)

Hydraulics	(N)	Competence None No.	%	Competence Limited No.	%	Competence Some No.	%	Competence Considerable No.	%	Competence Great Deal No.	%	Average Rating	Rank
Basic Hydraulics (Pumps, Motors, Controls, Oils)	5					1	20.00	3	60.00	1	20.00	3.00	1
Theory of Operation for Hydraulic Systems	5					1	20.00	3	60.00	1	20.00	3.00	1
Integral Lift Systems (3 Point Hitch Type)	5					1	20.00	4	80.00			2.80	2
Remote Control Cylinders	5					1	20.00	3	60.00	1	20.00	3.00	1
Hydraulic Braking Systems	5					3	60.00	1	20.00	1	20.00	2.60	3
Hydraulic Steering Systems	5					3	60.00	1	20.00	1	20.00	2.60	3
Overall Average Competency												2.83	

of 2.50 to 3.49 for "Considerable" competence. One instructor indicated a competence level of "Limited" on instruction of injection pumps. The average rating for competence was 3.06.

According to the data contained in the power train instruction area, the instructors' average rating for teaching competence on all topics was 2.91 or "Considerable." The data shows four of the topics tied for a ranking of first and three topics tied for a ranking of second. One instructor indicated a competence level of "Limited" for special drives (betls, chains, U-joints).

Data presented in the section under hydraulics pertain to the instructors' competence level for instruction of the selected topics. The instructors' average rating for competence to teach all topics was 2.83 or "Considerable." The instructors' average rating for basic hydraulics, theory of operation, and remote control cylinders ranked first in teaching competence. Their teafhing competence level for integral lift systems (three point type) ranked second. Hydraulic braking and steering systems were ranked third. None of the instructors rated their competence level to teach any of the topics listed in hydraulics below "Some" competence.

Summary of the Responses for Training Received in the Instructional Areas

The data in Table XXXV show the distribution of the university instructors' responses for the type training they have received on the instructional areas. The greatest amount of training accumulated by the instructors was the combination of formal, informal and in-service. This occurred in the four selected areas. The largest

TABLE XXXV

SUMMARY OF UNIVERSITY INSTRUCTORS' RESPONSES FOR TRAINING RECEIVED IN THE FOUR INSTRUCTIONAL AREAS

Tractor Electrical System	(N)	None No.	%	Formal Only No.	%	Informal Only No.	%	In-Service Only No.	%	Formal Informal In-Service No.	%
Theory of Electricity	5									5	100.00
Storage Battery	5					1	20.00	1	20.00	3	60.00
Charging System	5							1	20.00	4	80.00
Starting System	5					1	20.00	1	20.00	3	60.00
Ignition Systems	5					1	20.00	1	20.00	3	60.00
Lighting and Accessory Systems	5			1	20.00	1	20.00	1	20.00	2	40.00
Use of Testing Equipment	5			1	20.00			2	40.00	2	40.00
Diagnosis of Electrical Systems Problems	5							2	40.00	3	60.00

TABLE XXXV (Continued)

Diesel Fuel Systems	(N)	None No.	None %	Formal Only No.	Formal Only %	Informal Only No.	Informal Only %	In-Service Only No.	In-Service Only %	Formal Informal In-Service No.	Formal Informal In-Service %
Diesel Fuel Principles	5			2	40.00	1	20.00			2	40.00
Diesel Fuel Tanks (Storage and Handling)	5	2	40.00			1	20.00			2	40.00
Fuel Transfer Pumps	5	2	40.00			1	20.00			2	40.00
Fuel Filters	5	1	20.00	1	20.00	1	20.00			2	40.00
Injection Pumps	5	1	20.00	1	20.00	1	20.00			2	40.00
Injection Nozzles	5	1	20.00	1	20.00	1	20.00			2	40.00
Trouble Shooting the Diesel Fuel Systems	5	1	20.00	1	20.00	1	20.00			2	40.00

TABLE XXXV (Continued)

Power Trains	(N)	None No.	%	Formal Only No.	%	Informal Only No.	%	In-Service Only No.	%	Formal Informal In-Service No.	%
Theory of Operation and Design	5			3	60.00					2	40.00
Clutch Systems	5			1	20.00	1	20.00	1	20.00	2	40.00
Transmissions	5			2	40.00	1	20.00			2	40.00
Differentials	5			2	40.00	1	20.00			2	40.00
Power Take-Offs	5			2	40.00	1	20.00			2	40.00
Special Drives (Belts, Chains, U-Joints)	5			1	20.00	1	20.00			3	60.00

TABLE XXXV (Continued)

Hydraulics	(N)	None No.	None %	Formal Only No.	Formal Only %	Informal Only No.	Informal Only %	In-Service Only No.	In-Service Only %	Formal Informal In-Service No.	Formal Informal In-Service %
Basic Hydraulics (Pumps, Motors, Controls, Oils	5			1	20.00			2	40.00	2	40.00
Theory of Operation for Hydraulic Systems	5					1	20.00	2	40.00	2	40.00
Integral Lift Systems (3 Point Hitch Type)	5					1	20.00	1	20.00	3	60.00
Remote Control Cylinders	5					1	20.00	1	20.00	3	60.00
Hydraulic Braking Cylinders	5	2	40.00	1	20.00					2	40.00
Hydraulic Steering Systems	5	2	40.00			1	20.00			2	40.00

response for a single type of training was from formal preparation either from a college or university. The instructors indicated much informal type training from personal work experiences relating to the farm power and machinery industry. It should be noted that some of the instructors indicated they had received "No" training in selected topics of the diesel fuel system and in hydraulics. All instructors had training on electrical systems and power trains.

University Instructors' Estimated Total Hours Spent on the Four Instructional Areas

The data in Table XXXVI show a summary of the instructors' estimated total time for instruction in the classroom and shop on the topics listed under the four instructional areas. The greatest amount of time for any area occurred in the tractor electrical system. One instructor indicated 16-20 hours in the shop for tractor electrical systems. A majority of the instructors did indicate for both the classroom and shop an estimation of from 1-5 hours of instruction on the diesel fuel system, power train and hydraulics.

TABLE XXXVI

SUMMARY OF UNIVERSITY INSTRUCTORS' ESTIMATED TOTAL HOURS SPENT ON THE FOUR INSTRUCTIONAL AREAS

Tractor Electrical System

Total Classroom Hours	Number	Per Cent	Total Shop Hours	Number	Per Cent
0			0		
1-5	2	50.00	1-5		
6-10	1	25.00	6-10	2	50.00
11-15	1	25.00	11-15	1	25.00
16-20			16-20	1	25.00
One did not respond			One did not respond		
Total	4	100.00	Total	4	100.00

Diesel Fuel System

Total Classroom Hours	Number	Per Cent	Total Shop Hours	Number	Per Cent
0			0		
1-5	4	100.00	1-5	3	75.00
6-10			6-10	1	25.00
11-15			11-15		
16-20			16-20		
One did not respond			One did not respond		
Total	4	100.00	Total	4	100.00

TABLE XXXVI (Continued)

Power Train

Total Classroom Hours	Number	Per Cent	Total Shop Hours	Number	Per Cent
0			0		
1-5	3	75.00	1-5	3	100.00
6-10	1	25.00	6-10		
11-15			11-15		
16-20			16-20		
One did not respond			One did not respond		
Total	4	100.00	Total	3	100.00

Hydraulics

Total Classroom Hours	Number	Per Cent	Total Shop Hours	Number	Per Cent
0			0		
1-5	4	100.00	1-5	3	100.00
6-10			6-10		
11-15			11-15		
16-20			16-20		
One did not respond			Two did not respond		
Total	4	100.00	Total	3	100.00

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The purpose of this chapter is to present a summary of the study findings related to the purpose and objectives, to present conclusions derived from the findings and to propose specific recommendations that the author believes are necessary as a result of this study.

Summary of the Study

Purpose

The purpose of this study was to obtain from the Farm Power and Machinery Pre-Employment Laboratory Training teachers and the university instructors of the Farm Power and Machinery Pre-Employment Training Program, the importance placed and time spent on selected areas of instruction. These selected areas were the:

1. Tractor Electrical System
2. Diesel Fuel System
3. Power Trains
4. Hydraulics

Need for the Study

It was hoped that this information could be used in giving direction to curriculum development and/or revision. It was the

intent of this study, that the program be better developed in curriculum content in order to serve the needs of students being trained through the Pre-Employment Training Program. It was not the intent of the researcher to compare instructional qualities of any individuals involved in this study. It was hoped that through the findings of this educational research project that the program of Farm Power and Machinery might be strengthened in its over-all structure.

Specific Objectives

The objectives of the study were as follows:

1. To determine from the instructors of the Farm Power and Machinery Pre-Employment Laboratory Training Program the amount of importance they place on instruction of the Tractor Electrical System, Diesel Fuel System, Power Trains and Hydraulics and the hours spent on each area.
2. To compare the importance to the hours spent in the classroom and in the shop on the four different areas.
3. To determine to what extent teachers of the Farm Power and Machinery Program perceive their level of teaching competence and training received in each area necessary to teach these areas adequately.
4. To determine and compare the perceived importance of selected curriculum areas and hours spent on the curriculum areas by university instructors of the Farm Power and Machinery Pre-Employment Program.

Procedures Used in the Study

Following a review of literature and research pertaining to the study, the following tasks were involved in the collection and analysis of data to satisfy the purpose and objectives of the study:

1. Determine the number of schools and teachers teaching Farm Power and Machinery Pre-Employment Laboratory Training in Texas.
2. Determine the number of universities offering certificates for teachers of Farm Power and Machinery Pre-Employment Training.
3. Develop the instrument for data collection.
4. Develop a procedure for the data collected.
5. Use the proper methods of analyzing the data.

Design and Conduct of the Study

Mailed questionnaires were utilized as the data collecting instruments. A questionnaire was mailed to each of the 93 vocational agriculture teachers in Texas, teaching Farm Power and Machinery Pre-Employment Laboratory Training during the school year 1975-1976. A similar questionnaire was mailed to each of the six university instructors teaching farm power and machinery related courses used for teacher certification of the program.

The respondents in the study included 85 of the 93 Farm Power and Machinery Pre-Employment Laboratory Training teachers in Texas. The respondents included five of six identified university instructors teaching farm power and machinery courses that are used for

certification of Farm Power and Machinery Pre-Employment Laboratory Training teachers.

Findings of the Study

Selected Characteristics of the Teachers and University Instructors Participating in the Study

The 85 responding vocational agriculture teachers who were teaching Farm Power and Machinery Pre-Employment Laboratory Training had from 1-37 years experience teaching vocational agriculture. The average experience was 9.42 years. There were 43 or 50.59 per cent of the teachers that had taught Farm Power and Machinery from one to three years. Three teachers had taught the course nine years. The average years experience teaching Farm Power and Machinery was 3.94 years.

The university instructors had taught vocational agriculture from two to 12 years. The number of years experience teaching Farm Power and Machinery at the university level ranged from two to eight years.

Completion of Course Work

There were 23 or 28.40 per cent of the teachers who had not had any course work relating to farm power and machinery at the university level. There were 14 that had completed from 18-30 semester hours. None of the respondents had completed over 30 semester hours. Thirty-five or 62.50 per cent did indicate completing this course work at Texas A&M University.

The five university instructors had completed from four to 20 semester hours in farm power and machinery related courses.

Informal Training

Sixteen of the teachers had military training, 79 had on-farm training, 41 had automobile/truck service and repair experience and 24 indicated they had worked at tractor dealerships.

There were two university instructors who had received military training, four had on-farm experience and four indicated experience related to automotive training. Only one responded as having experience with a tractor dealership.

Non-Credit Workshop Attendance

There were 73 teachers who indicated they had attended the non-credit workshop at Texas A&M University for teacher certification. There were 46 of the teachers that had attended non-credit workshops sponsored by the Texas Education Agency and industry.

Three of the five university instructors had attended the non-credit teacher preparatory workshop at Texas A&M University. One university instructor attended Texas A&M University. Four of the university instructors attended workshops sponsored by industry.

Presentation of the Data Concerning
the Four Instructional Areas

According to the teachers, the overall mean importance placed on the tractor electrical system for all topics was 3.84 or "Much" importance. The importance ranged from 3.37 for lighting and

accessory systems to 4.19 for diagnosis of electrical system problems.

The university instructors' overall mean for importance placed on the tractor electrical system was 4.18 or "Much" importance. The importance ranged from 3.00 for lighting and accessory systems to 4.80 for use of testing equipment and diagnosis of electrical system problems.

The teachers indicated an overall mean of 3.71 or "Much" importance for all topics in the diesel fuel system. The teachers' importance ranged from 2.69 to 4.02 for selected topics.

The university instructors' overall mean average for importance of the diesel fuel system was 3.53 hours or "Much" importance. Their importance on selected topics showed a wide range from a low of 2.50 for trouble shooting the diesel fuel system to a high of 4.60 for injection nozzles and fuel filters.

The amount of importance the teachers placed on the power train instructional area received an overall mean response of 3.77 for "Much" importance. A narrow range of 3.56 to 3.95 on selected topics was observed.

The university instructors' overall mean average for all topics for the power train section was 3.51 or "Much" for importance. A wider range was observed when university instructors were asked to assess the importance of power trains. A range from 3.0 to 4.0 was noted among the topics within the instructional area of power trains.

The teachers' overall mean response for importance for the hydraulics instructional area was 3.70 or "Much" importance. There was a slight variation among the topics with a range of only 3.55 to 3.80.

The overall mean response for importance on the hydraulics section as indicated by the university instructors was 3.40 or "Some" for importance. The range was from 3.60 for basic hydraulics to 3.20 for theory of operation for hydraulic systems.

Classroom Hours Spent on the Four Instructional Areas

On tractor electrical systems the overall average hours per topic spent in the classroom by the teachers was 3.40 hours. The average hours spent in the classroom ranged from 1.72 hours for lighting and accessory systems to 4.79 hours for diagnosis of electrical system problems.

The university instructors' average hours per topic spent on the tractor electrical system was 3.66 hours. The average hours ranged from 2.00 hours on the storage battery to 4.60 hours for use of testing equipment and diagnosis of electrical system problems. On five selected topics a university instructor did indicate spending more than 11 hours.

A considerable number, from 12.05 per cent to 27.71 per cent of the teachers do not spend any classroom time in instruction of some topics of diesel fuel systems. The average hours spent on topics taught in the classroom was 2.43 hours. The average hours ranged from 1.72 hours spent on fuel transfer pumps to 3.45 hours spent on instruction of diesel engine principles.

The university instructors spent an average of 3.56 hours on all topics in the classroom. The average hours ranged from 2.13 hours for diesel fuel tanks (storage and handling) to 3.14 hours for three topics

which were: injection pumps, injection nozzles and trouble shooting the diesel fuel system. The majority did indicate teaching from one to two hours on the diesel fuel system.

A larger number and per cent of the teachers indicated spending one to two hours in the classroom on power trains. The overall average for classroom time spent on power train topics was 3.25 hours. The average hours ranged from 2.21 hours on instruction of special drives to 3.86 hours spent on teaching transmissions. There were 21 or 25.30 per cent of the teachers that did not teach special drives and theory of operation and design of power trains.

A majority of the university instructors spent from one to two hours in the classroom on power train topics with the average hours spent on all topics being 4.02 hours. The university instructors' average hours spent on power trains ranged from 2.00 hours on clutch systems to 12 hours instruction time allotted to theory of operation and design.

An average of 54.57 per cent of the teachers indicated they spent from one to two hours in the classroom on topics within the hydraulics system. The overall mean average for time spent in the classroom teaching topics on hydraulics was 2.39 hours. The average hours spent on selected topics ranged from 1.87 hours for remote control cylinders to 3.08 hours spent on basic hydraulics. From 8.43 per cent to 20.73 per cent of the teachers indicated they spent no classroom time on instruction of hydraulics.

The university instructors indicated they spent from one to two hours on the instruction of hydraulics in the classroom. The overall average hours spent was 3.17 hours per topic in the classroom. The

average hours ranged from 2.12 hours for remote control cylinders to 4.13 hours spent on instruction of integral lift systems.

Shop Hours Spent on the Four Instructional Areas

On the tractor electrical system, the teachers on the average spent from 2.36 hours on the storage battery to 6.23 hours on instruction of electrical system problems. The overall mean for all topics in the tractor electrical system instructional area was 4.26 hours per topic in the shop.

The university instructors' overall average for hours per topic in the shop was 4.18 hours. The average hours spent ranged from a low of 1.50 for the storage battery to a high of 6.75 for theory of electricity instruction.

The teachers of the program spent an average of 2.76 hours per topic in the shop on all topics in the diesel fuel system instructional area, however, the average hours ranged from 1.91 for diesel fuel tanks (storage and handling) to 3.93 for trouble shooting the diesel fuel system. There were 21.69 per cent to 32.14 per cent of the teachers spending no time on instruction of all the diesel fuel system topics in the shop.

The majority of the university instructors indicated they spent "No" time in the shop on diesel fuel systems. In the one to two hour range, there were two instructors teaching fuel filters, injection pumps, and trouble shooting the diesel fuel system. There was an indication that one instructor in each of the topics spent 11 plus hours in the shop on that topic except trouble shooting the diesel fuel system.

For the power train instructional area, the largest number and per cent of the teachers checked in the three to five hour range with an overall mean of 4.28 hours per topic spent in the shop. The range span was from a low of 3.67 hours for special drives to a high of 5.01 hours for transmissions. On certain topics, from one to five of the teachers did not teach power trains in the shop.

The university instructor's overall mean for shop instruction of power trains was 4.83 hours per topic. It is interesting to observe that the university instructors spent equal time (3.60 hours) on five of the topics within the power train instructional area. One instructor spent a high of ten hours on instruction of theory of operation and design. There were two of the instructors that did not teach power trains in the shop.

There were from 6.10 per cent to 17.50 per cent of the teachers that designated they spent "No" time in the shop on selected topics in the hydraulic systems instructional area. An average of 43.61 per cent wpent one to two hours and an average of 28.56 per cent spent three to four hours in the shop. The overall mean for shop hours on instruction of hydraulics was 3.23 hours. The teachers average hours ranged from 2.75 hours to 3.86 hours on selected topics.

A majority of the university instructors did not teach hydraulics in the shop. One instructor indicated spending 11 plus hours on the topics listed under hydraulics. The overall average hours for instruction of hydraulics was 6.16 hours.

Comparisons of Classroom and Shop Hours to Importance Placed on the Four Instructional Areas

A summary of comparisons was made and analyzed as a result of the teachers' expressed perceptions of importance and estimated hours spent on instruction of topics within the areas for both the classroom and shop.

It would appear that the time teachers spent in the classroom and shop on topics within the tractor electrical systems reflected their average perceived importance on all topics with the exception of the storage battery and lighting and accessory systems. In the shop the average hours spent on topics was greater in all instances than those spent in the classroom except for theory of electricity. Theory of electricity, storage batteries and lighting and accessory systems received less time for instruction as conpared to other topics. Use of testing equipment and diagnosis of electrical systems problems received the greatest amount of time for shop instruction.

For the diesel fuel system instructional area, it appeared that there was more importance indicated than reflected by hours spent in the classroom and shop for all topics except diesel engine principles and trouble shooting the diesel fuel system. In the shop the same was observed.

In the power train instructional area the average time spent in the classroom and shop reflected the average perceived importance the teachers placed on the topics except instruction of final drives and special drives. These two areas had more indicated average importance

than reflected by time spent in classroom instruction. The teachers spent more time on instruction of the selected power train topics in the shop than in the classroom.

In the hydraulics instructional area the teachers average perceived importance for all topics was near the same level. In the classroom the average hours spent among the topics showed a greater variation than those spent in the shop. There was an indication more time was spent on the topics in the shop than in the classroom, and that the shop hours more nearly reflected the importance indicated.

Competence Levels for the Four Instructional Areas

The teachers' competence levels for the tractor electrical system were ranked according to their responses to the topics. The three lowest competence levels were found in teaching theory of electricity, diagnosis of electrical system problems and lighting and accessory systems. These rankings were for both the classroom and the shop. The average rating for competence to teach all topics in the classroom and shop for the tractor electrical system was 2.26. The teachers' levels of competence fell within the set limits of 1.50 to 2.49 for "Some" competence.

The university instructors rated their competence to teach all the topics in the tractor electrical system as 2.99 or "Considerable."

The teachers gave all the topics listed in the diesel fuel system instructional area a mean rating for competence of 2.02 or "Some." The rating for competence ranged from a high of only 2.21 or "Some" for fuel filters to a low of 1.88 or "Some" for instruction of

injection pumps.

The university instructors indicated "Considerable" competence to teach the diesel fuel system. Only one instructor indicated a "Limited" amount of competence on any topic. That topic was instruction of injection pumps. The average response of the university instructors for competence in diesel fuel system topics was 3.06 or "Considerable."

The teachers felt they had an average competence level of "Some" to teach power train topics as indicated by their average response of 2.19 for competence. Of the topics in the power train instructional area, the teachers indicated more ability to teach clutch systems. The lowest rating for competence was on two topics, "the theory of operation and design" and "final drives."

The university instructors average rating for teaching competence on all topics in the power train section was 2.91 or "Considerable." There were four of the topics that tied for a ranking of one and three topics tied for a ranking of two. There was one instructor that indicated "Limited" competence to teach special drives (belts, chains, U-joints).

In the hydraulics instructional area for competence, the teachers indicated a mean response of 1.90 or "Some" competence. The 1.90 mean response was lower than the other three major areas in the study.

The university instructors average rating for competence was 2.83 or "Considerable," also the lowest of the four areas. None of the instructors rated their competence level to teach any of the topics listed in hydraulics below "Some" competence.

Training Received on the Four Instructional Areas

On tractor electrical systems, the teachers reported they had more in-service type training than formal or informal. There was an average of 5.92 per cent of the teachers that had no training in selected topics of the tractor electrical system.

There was an average of 15.50 per cent of the teachers indicating no training among selected topics within the diesel fuel systems instructional area. There were 21.82 per cent that had received their training through in-service programs.

An average of 11.13 per cent of the teachers indicated no training in topics within the power train instructional area. There was a mean average of 23.65 per cent of the teachers that had more in-service type training than the combination group of formal, informal and in-service.

The teachers indicated they had less training in hydraulics than in the three other instructional areas. There were 17.69 per cent with "No" training on selected topics.

The university instructors indicated much informal type training from personal work experiences relating to the farm power and machinery industry. They did attribute that most of their training was from a combination of formal, informal, and in-service training. The instructors all had training on electrical systems and power trains. There were some of the instructors that indicated they had received "No" training in selected topics of the diesel fuel system and hydraulics.

General Summary

Teachers' Perceived Importance Placed on the Four Instructional Areas

The teachers of the Farm Power and Machinery Pre-Employment Laboratory Training Program placed an overall average of "Much" importance on the instruction of topics within the four selected instructional areas. Table XXXVII includes the overall average importance and the low to high importance ranges for topics in the four instructional areas. The overall average importance for all topics fell between the set limits of 3.50 to 4.49 for "Much" importance.

Topics within the tractor electrical system received the greatest overall average importance (3.84). Instruction of power train topics was second in importance with an overall average of 3.77. Diesel fuel system topics (3.71) and hydraulics topics (3.70) were very close for perceived importance. As a group, the farm power and machinery teachers perceived that overall the topics in the four instructional areas were of "Much" importance.

Teachers' Perceived Average Classroom and Average Shop Hours Spent on Individual Topics in the Four Instructional Areas

Table XXXVII includes a summary of the average hours spent on the topics in the classroom and shop for the four selected instructional areas by the teachers. The distribution of the low to high average hour ranges for the topics in each area are listed in the table. The tractor electrical system received the greatest number of

TABLE XXXVII

SUMMARY OF THE FARM POWER AND MACHINERY TEACHERS' PERCEIVED AVERAGE IMPORTANCE, AVERAGE CLASSROOM AND AVERAGE SHOP HOURS AND RANGE AMONG INDIVIDUAL TOPICS IN THE FOUR INSTRUCTIONAL AREAS

Instructional Areas	Average Importance/Topic		Average Hours/Topic			
	Importance	Range Among Topics Low - High	Classroom	Range Among Topics Low - High	Shop	Range Among Topics Low - High
Tractor Electrical System	3.84 (Much)	3.37-4.19	3.40	1.72-4.79	3.26	2.36-6.23
Diesel Fuel System	3.71 (Much)	2.69-4.02	2.43	1.64-3.45	2.75	1.91-3.93
Power Trains	3.77 (Much)	3.56-3.95	3.25	2.12-3.86	4.28	3.67-5.01
Hydraulics	3.70 (Much)	3.55-3.80	2.39	1.87-3.08	3.23	2.75-3.86

hours spent in the classroom. Power trains was very close and rated second. In the shop, power trains received more time for instruction than the other areas.

Comparison of Classroom and Shop Hours Spent on Topics Within the Four Instructional Areas to Perceived Importance

Overall, the time spent in the classroom and shop generally reflected the teachers' perceived importance on topics within the four instructional areas. However, there were some exceptions. Example: The teachers perceived that instruction of the storage battery was of "Much" importance, but required little time for instruction as compared to other topics in the tractor electrical system area. This type situation occurred on some of the topics in the four instructional areas. The teachers did perceive that all areas were of "Much" importance, therefore, these areas should continue to be taught as a part of the Farm Power and Machinery curriculum.

Teachers' Perceived Competence Levels for Teaching the Four Instructional Areas

The teachers perceived themselves on the average to possess "Some" level of competence to teach the four instructional areas adequately.

Teachers' Perceived Training for Teaching the Four Instructional Areas

It did appear the In-Service Training Program in Texas has done a sufficient job in providing training for the Farm Power and Machinery Pre-Employment Laboratory Training Teachers. Formal training at the university level has contributed to the over-all training for many of the teachers. Informal training received from industry and personal experience was valued by many of the teachers as preparing them to teach farm power and machinery. The teachers did attribute much of their training from a combination of formal, informal and in-service type training. There was an average of 5.92 per cent to 17.69 per cent of the teachers that had received "No" training on selected topics within the four instructional areas.

University Instructors' Perceived Importance Placed on the Four Instructional Areas

The five university instructors teaching farm power and machinery related courses placed an average of "Much" importance on the tractor electrical systems, diesel fuel systems, and power trains. Their average importance for topics in the hydraulics section was "Some" importance. Table XXXVIII includes the average importance and the low to high importance ranges for topics in the four instructional areas. Topics within the tractor electrical system received the highest average importance (4.08). The perceived importance of topics in the other three areas were very close (3.40 to 3.53).

TABLE XXXVIII

SUMMARY OF UNIVERSITY INSTRUCTORS' PERCEIVED AVERAGE IMPORTANCE, AVERAGE CLASSROOM, AND AVERAGE SHOP HOURS AND RANGE AMONG INDIVIDUAL TOPICS IN THE FOUR INSTRUCTIONAL AREAS

Instructional Areas	Average Importance/Topic		Average Hours/Topic			
	Importance	Range Among Topics Low - High	Classroom	Range Among Topics Low - High	Shop	Range Among Topics Low - High
Tractor Electrical System	4.08 (Much)	3.00-4.80	3.66	2.00-4.60	4.18	1.50-6.75
Diesel Fuel System	3.53 (Much)	2.50-4.60	3.56	2.13-4.13	7.37	1.50-12.00
Power Trains	3.50 (Much)	3.00-4.00	4.02	2.00-12.00	4.83	3.60-10.00
Hydraulics	3.40 (Some)	3.20-3.60	3.17	2.12-4.13	6.16	4.10-12.00

University Instructors' Perceived Average Classroom and Average Shop Hours Spent on Individual Topics in the Four Instructional Areas

Table XXXVIII includes a summary of the average hours spent on the topics in the classroom and shop for the four selected instructional areas by the five university instructors. The distribution of the low to high average hour ranges for the topics in each area are listed in the table. Power train topics received the greatest number of average hours (4.02) spent in the classroom. The tractor electrical system, diesel fuel systems and hydraulics were very close in average hours spent ranging from 3.17 to 3.66. The university instructors spent a considerable amount of time in the shop on selected topics. More average time for instruction was spent in the shop on all areas by the university instructors. One instructor consistantly checked spending 11 plus hours on selected topics.

University Instructors' Perceived Competence Levels for Teaching the Four Instructional Areas

The five university instructors perceived themselves on the average to possess "Considerable" competence to teach the four instructional areas adequately.

University Instructors' Perceived Training for Teaching the Four Instructional Areas

The greatest amount of training accumulated by the five university instructors was the combination of formal, informal and in-service. The largest response for a single type of training was from formal preparation either from a college or university. The instructors attributed much of their training to personal work experience relating to the farm power and machinery industry.

Conclusions

The analysis of the findings relative to the purpose and objectives of the study, have led the researcher to the following conclusions.

1. Teachers overall, considered all four instructional areas to be of much importance, indicating the four areas surveyed were perceived by the teachers to have a high priority for inclusion in their curriculum.
2. Within instructional areas, individual topics had little variability of perceived importance for power trains and hydraulics indicating all topics were of nearly equal importance for the curriculum. However, in the tractor electrical system and diesel fuel systems, topics varied more. As would appear logical, diagnosis of electrical systems problems, use of testing equipment and ignition systems were viewed as the most important while lighting and accessory systems were viewed least important in tractor electrical systems. Contrary to logic, trouble shooting the diesel fuel

systems was rated of least importance compared to injection nozzles (highest) and other topics within diesel fuel systems. Therefore, within the areas of little variability this would indicate equal priority for including all topics in the curriculum. However, the areas with greater variability, topic priorities might need close examination for curriculum inclusion.

3. In the classroom, the teachers spent more time on instruction of tractor electrical systems and power trains than on instruction of diesel fuel systems and hydraulics. In the shop, the teachers spent more time on instruction of power trains and tractor electrical systems than on instruction of hydraulics and diesel fuel systems. As expected, it would appear that hours spent on selected topics within the four instructional areas were affected by the length of time that was required to teach those topics adequately.
4. In comparisons of importance and classroom and shop hours for topics within the four instructional areas, it appeared the time teachers spent on selected topics reflected their perceived importance.
5. Contrary to earlier findings, the teachers perceived themselves on the average to possess "Some" level of competence to teach the topics in the four instructional areas. This was also indicated by the estimated time spent on topics within these areas in the classroom and shop. However, the "Some" level of competence indicates the teachers recognize the need for further improvement.

6. There was an average of 5.92 per cent to 17.69 per cent of the teachers that had received "No" training on selected topics within the four instructional areas. The In-Service training program in Texas, the formal, the informal type training, and personal experiences were attributed as the major sources of training to prepare teachers to teach the areas adequately. The "Some" rating of competence indicates all training, in-service and pre-service, needs to emphasize these instructional areas more.
7. The five university instructors teaching farm power and machinery related courses placed an average of "Much" importance on the topics within tractor electrical systems, diesel fuel systems, and power trains. Their average importance for topics in the hydraulics section was "Some" importance. By their low importance rating for instruction of hydraulics, the instructors indicated they did not consider hydraulics as high a priority to be included in their curriculum.
8. In the classroom, the university instructors spent more average time on instruction of power trains than the other three areas. Approximately equal time was spent on the tractor electrical system, and diesel fuel systems. Hydraulics received the low average classroom time per topic. The greatest amount of time was spent in the shop on instruction of diesel fuel systems and hydraulics. The time spent in the shop for instruction of hydraulics and diesel fuel systems was contrary to the perceived importance placed

on those areas, indicating that perhaps more time was required for instruction of those areas in the shop.

9. The five university instructors perceived themselves on the average to possess "Considerable" competence to teach the four instructional areas adequately. Perhaps, more emphasis should be placed on these areas in their training programs to attempt to improve the competence of the teachers to teach these areas.

The Farm Power and Machinery Pre-Employment Laboratory Training Program has been very successful since its beginning in Texas High Schools. It has been a definite part of the continued success of the total Vocational Agriculture Program to provide youth with basic knowledge and skills to prepare them for a career definitely related to agriculture.

Recommendations

The following recommendations are made by the researcher as a result of having conducted this study. These recommendations are based on findings and conclusions.

1. The four instructional areas should be continued as an important part of the Farm Power and Machinery curriculum, based on the indicated importance placed on these areas by the teachers and university instructors.
2. The teachers indicated importance on selected topics in the four instructional areas should be used to establish priorities for including them in their instructional program.

3. The time needed to teach selected topics adequately within the four instructional areas should be based on the teachers perceived importance for inclusion of those topics in their curriculum, taking into account different time required for different subject matter.
4. More importance should be placed on the selected topics in these four instructional areas in training prospective teachers and retraining those teachers now teaching Farm Power and Machinery.
5. University instructors should consider the amount of time offered for instruction of the topics within these areas and incorporate more in most areas, as indicated by the findings of this study.

From the list of suggestions from the teachers and university instructors in Appendix C and Appendix D, it is recommended:

1. That, in-service training programs should be <u>greatly</u> increased through close cooperation with industry, universities and the Texas Education Agency. In Table XXX, the high school teachers ranked in-service training <u>First</u> as a desired choice of teaching improvement.
2. That, more practical experience be provided the teachers and instructors through on-the-job work experience in close cooperation with industry, universities and the Texas Education Agency. The high school teachers ranked on-the-job training <u>Second</u>.

3. That, workshops sponsored by the Texas Education Agency using university personnel as instructors be continued. The high school teachers ranked this area Third.
4. That, teachers of these programs should have the combined formal preparation at both the undergraduate and graduate levels. High school teachers ranked this method of improvement Fourth.
5. That, these and other areas of the program be continually evaluated to provide the teachers and graduates of the Farm Power and Machinery Pre-Employment Laboratory Training Program adequate training.

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APPENDIXES

APPENDIX A

OTHER TYPES OF INFORMAL TRAINING

LISTED BY THE TEACHERS

OTHER TYPES OF INFORMAL TRAINING

1. Taught General Agricultural Mechanics one year.
2. General Motors Training Center, Dallas, Texas.
3. Farming with my father all my life.
4. Road construction, equipment repair.
5. Workshops at Texas A&M University.
6. John Deere factory service representative.
7. Individual short courses, electrical, etc.
8. Heavy equipment owner.
9. Articles.
10. Military training in electricity.
11. Heavy equipment operator.
12. Welding and machine shop.
13. High school vocational agriculture.
14. Farming.
15. Body shop, wrecking yard, car sales, and on-farm.
16. Own four diesel tractors.
17. Aircraft mechanic.
18. Vocational agriculture shop-engine repair.
19. Military (helicopter).
20. Aircraft mechanic, five years Air Force.
21. Worked five years as a machinist.
22. Self-interest in power and machinery.
23. Teaching agriculture and working on cars.
24. Auto Diesel College, Nashville, Tennessee.

APPENDIX B

OTHER NON-CREDIT WORKSHOPS SPONSORED BY UNIVERSITIES AND THE TEXAS EDUCATION AGENCY ATTENDED BY THE TEACHERS

OTHER NON-CREDIT WORKSHOPS SPONSORED BY UNIVERSITIES AND THE TEXAS EDUCATION AGENCY

1. Tractor Electrical Systems, General Motors, Dallas, Texas.
2. First workshop for course at Texas A&I University, machinery workshop, Texas A&M University, diesel workshop, Texas A&M University.
3. Farm equipment, Ford Motor Company, Paris, Texas and tractor electric, John Deere, Waterloo, Iowa.
4. Sam Houston State University, tractor workshop.
5. Small engines, Sam Houston State University.
6. John Deere, hydraulics in-service for teachers in Dallas, Texas.
7. Small gas engines, Tarleton State University.
8. Injector pumps, John Deere, Dallas, Texas.
9. Ford Research Center, Paris, Texas.
10. Texas A&M University, injector pumps.
11. Diesel systems, International Harvester, Texas A&M University.
12. General Motors Training Center, distributors, United Delco, Texas State Technical Institute, fuel system, alternators, generators, Perfect Circle Course.
13. Texas A&I University, air-cooled engines.
14. Tractor maintenance short course.
15. General agricultural mechanics training.

Other Workshops Sponsored by Industry

1. Sun Electric Company, Houston, Texas.
2. Outboard Marine Company, Dallas, Texas, on small engines.

APPENDIX C

A LIST OF SUGGESTIONS FROM THE PRE-EMPLOYMENT LABORATORY TRAINING TEACHERS FOR INCREASING KNOWLEDGE AND COMPETENCE IN SPECIALIZED AREAS

A LIST OF SUGGESTIONS FROM THE PRE-EMPLOYMENT LABORATORY TRAINING TEACHERS FOR INCREASING KNOWLEDGE AND COMPETENCE IN SPECIALIZED AREAS

1. More years of experience in shop with students.
2. Actual work in the shop during the summer, work at my own pace, could improve in areas I need improving.
3. Workshops related to Farm Power and Machinery sponsored by Texas Education Agency, using professional personnel.
4. Training yourself during summer, observing professional tractor mechanics.
5. Formal training required of Agricultural Education major and required refresher course after graduation.
6. Workshops taught by a good mechanic on the areas used in this study.
7. Personal experience in teaching Farm Power and Machinery.
8. Work in paint and body refinish shop for one or two weeks during summer.
9. Short courses by tractor companies.
10. Assistance in shop from trained local personnel. Visiting local tractor dealerships and assisting with no pay or observing.
11. Practice on job training.
12. In-service instruction in school, from service representative to local school classes.

13. Visual aides, books, material from material center, free booklets from industry.

14. In-service time should be donated to the shop aspect of training and not so much theory at in-service training.

APPENDIX D

LIST OF UNIVERSITY INSTRUCTORS' SUGGESTIONS FOR IMPROVING THE TRAINING OF TEACHERS

LIST OF UNIVERSITY INSTRUCTORS' SUGGESTIONS FOR IMPROVING THE TRAINING OF TEACHERS FOR THE FARM POWER AND MACHINERY PRE-EMPLOYMENT LABORATORY TRAINING PROGRAM

1. More training in hydraulics and electrical systems.
2. Close cooperation with industry.
3. More technical formal education.
4. Greater time period (hours) assigned to become more of a specialist.
5. More and better equipment.
6. Very much more application of theory.
7. Very much time on test equipment, analysis, trouble shooting, etc.
8. More three-week workshop courses, possibly a two-year sequence.
9. More two-five day workshops over given areas conducted by industry.
10. There is some problem in the renovation of used tractors to teach these skills. A lot of the student's time is spent on scraping, cleaning and repairing items which have accumulated over a period of years. He is not spending his time with the more modern tractors, which have sophisticated hydraulic and diesel systems. Air conditioning is another area that has to be included on the later model, also power and harvesting equipment. It is hard to secure the newer tractors, for it is more efficient for the owners to take them to a shop (dealer) and get them back in a few days. In a Pre-Employment Program, the tractor is needed a full semester.

APPENDIX E

SAMPLE OF TEACHER SURVEY

SAMPLE OF TEACHER SURVEY

Please answer the following statements that apply to your situation.

1. Years experience teaching vocational agriculture _____

2. Years experience teaching Farm Power and Machinery Pre-Employment Laboratory Training Service and Repair _____

3. Number of college semester hours you have completed related to Farm Power and Machinery _____

4. Your formal course work in Farm Power and Machinery was completed at what institution and when _____

5. Check all the types of informal training pertaining to Farm Power and Machinery you have had:

   _____a. Military (trucks, heavy equipment service and repair).

   _____b. On-farm experience with tractors and equipment repair.

   _____c. Experience related to automobile, truck service and repair (dealerships, parts depts., garage work, etc.).

   _____d. Experience at tractor dealerships (mechanic, parts depts., equipment service and set-up).

   _____e. Others please list _____

   _____

Please check Non-credit workshops related to Farm Power and Machinery that you have attended:

   _____1. The preparatory workshop at Texas A&M University for a Farm Power and Machinery teaching certificate.

   _____2. Other workshops sponsored by universities and the Texas Education Agency (Please list) _____

   _____

   _____3. Workshops at the Vocational Agriculture Teachers' Conference (In-Service Training)

   _____4. Workshops sponsored by industry (examples, General Motors Corporation, Electrical Systems, Garland, Texas and Ford Motor Company Equipment, Paris, Texas.

   _____5. Other please list _____

Please Check (✓) in the Appropriate Block the:	Classroom hours you spend on each area					Shop hours you spend on each area					Level of your teaching competence					Training you have had in each area					Importance you feel should be placed on each area				
	0	1-2	3-5	6-10	11+	0	1-2	3-5	6-10	11+	None	Limited	Some	Considerable	Great Deal	None	Formal	In-Formal	In-Service	All Three	No	Little	Some	Much	Great
TRACTOR ELECTRICAL SYSTEM																									
Theory of Electricity																									
Storage Battery																									
Charging Systems																									
Starting Systems																									
Ignition Systems																									
Lighting & Accessory Systems																									
Use of Testing Equipment																									
Diagnosis of Electrical Systems Problems																									
DIESEL FUEL SYSTEMS																									
Diesel Engine Principles																									
Diesel Fuel Tanks (Storage and Handling)																									
Fuel Transfer Pumps																									
Fuel Filters																									
Injection Pumps																									
Injection Nozzles																									
Trouble Shooting the Diesel Fuel System																									
POWER TRAINS																									
Theory of Operation and Design																									
Clutch Systems																									
Transmissions																									
Differentials																									
Final Drives																									
Power Take-Offs																									
Special Drives (Belts, Chains, U-Joints)																									
HYDRAULICS																									
Basic Hydraulics (Pumps, Motors, Controls, Oils)																									
Theory of Operation for Hydraulic Systems																									
Intergal Lift Systems (3 Point Hitch Type)																									
Remote Control Cylinders																									
Hydraulic Braking Systems																									
Hydraulic Steering Systems																									

Please estimate the total hours you spend on each of the following:

	Classroom Hours	Shop Hours
Tractor Electrical Systems	_____	_____
Diesel Fuel Systems	_____	_____
Power Trains	_____	_____
Hydraulics	_____	_____

Your knowledge and competency in specialized areas could be increased by: Rank the following in order 1 through 5 (1=best)

____ Taking courses in Farm Power and Machinery from a college or university

____ In-service workshops sponsored by industry in the specialized areas of Hydraulics, Diesel Fuel Systems, Power Trains and Electrical Systems.

____ Workshops relating to Farm Power and Machinery sponsored by the Texas Education Agency using university personnel as instructors.

____ On-the-job training (with pay) at a tractor dealership for three or more weeks during the summer.

____ Others (please specifiy)_____

APPENDIX F

SAMPLE OF UNIVERSITY INSTRUCTOR SURVEY

SAMPLE OF UNIVERSITY INSTRUCTOR SURVEY

Please answer the following statements that apply to your situation.

1. Years experience teaching vocational agriculture _____

2. Years experience teaching Farm Power and Machinery Pre-Employment Laboratory Training Service and Repair _____

3. Number of college semester hours you have completed related to Farm Power and Machinery _____

4. Your formal course work in Farm Power and Machinery was completed at what institution and when _____

5. Check all the types of informal training pertaining to Farm Power and Machinery you have had:

   _____a. Military (trucks, heavy equipment service and repair).

   _____b. On-farm experience with tractors and equipment repair.

   _____c. Experience related to automobile, truck service and repair (dealerships, parts depts., garage work, etc.)

   _____d. Experience at tractor dealerships (mechanic, parts depts., equipment service and set-up)

   _____e. Others please list _____

   _____

Please check Non-credit workshops related to Farm Power and Machinery that you have attended:

   _____1. The preparatory workshop at Texas A&M University for a Farm Power and Machinery teaching certificate

   _____2. Other workshops sponsored by universities and the Texas Education Agency (Please list) _____

   _____

   _____3. Workshops at the Vocational Agriculture Teachers' Conference (In-Service Training)

   _____4. Workshops sponsored by industry (examples, General Motors Corporation, Electrical Systems, Garland, Texas and Ford Motor Company Equipment, Paris, Texas.

   _____5. Others please list _____

Please Check (✓) in the Appropriate Block the:	Classroom hours you spend on each area					Shop hours you spend on each area					Level of your teaching competence					Training you have had in each area					Importance you feel should be placed on each area				
	0	1-2	3-5	6-10	11+	0	1-2	3-5	6-10	11+	None	Limited	Some	Considerable	Great Deal	None	Formal	In-Formal	In-Service	All Three	No	Little	Some	Much	Great
TRACTOR ELECTRICAL SYSTEM																									
Theory of Electricity																									
Storage Battery																									
Charging Systems																									
Starting Systems																									
Ignition Systems																									
Lighting & Accessory Systems																									
Use of Testing Equipment																									
Diagnosis of Electrical Systems Problems																									
DIESEL FUEL SYSTEMS																									
Diesel Engine Principles																									
Diesel Fuel Tanks (Storage and Handling)																									
Fuel Transfer Pumps																									
Fuel Filters																									
Injection Pumps																									
Injection Nozzles																									
Trouble Shooting the Diesel Fuel System																									
POWER TRAINS																									
Theory of Operation and Design																									
Clutch Systems																									
Transmissions																									
Differentials																									
Final Drives																									
Power Take-Offs																									
Special Drives (Belts, Chains, U-Joints)																									
HYDRAULICS																									
Basic Hydraulics (Pumps, Motors, Controls, Oils)																									
Theory of Operation for Hydraulic Systems																									
Intergal Lift Systems (3 Point Hitch Type)																									
Remote Control Cylinders																									
Hydraulic Braking Systems																									
Hydraulic Steering Systems																									

Please estimate the total hours you spend on each of the following:

	Classroom Hours	Shop Hours
Tractor Electrical Systems	_____	_____
Diesel Fuel Systems	_____	_____
Power Trains	_____	_____
Hydraulics	_____	_____

Please list your suggestions for improving the training of teachers for the Farm Power and Machinery Pre-Employment Laboratory Program.

APPENDIX G

CORRESPONDENCE

2414 N. Park Drive
Stillwater, OK 74074
April 1, 1976

Dear Sir:

Your involvement and expression of ideas are essential to the continued success of the Farm Power and Machinery Pre-Employment Laboratory Program in Texas.

I am currently involved in a study to determine the amount of time and importance that teachers of Farm Power and Machinery place upon specific instructional areas in the program.

Your response to each statement on the enclosed questionnaire would be greatly appreciated. For your convenience, please return the questionnaire in the self-addressed, stamped envelope.

Thank you for the prompt attention given to this request.

Respectfully,

s/ Pat Pruitt
Graduate Assistant
Agricultural Education Department
Oklahoma State University

PP/srg

2414 N. Park Drive
Stillwater, OK 74074
May 1, 1976

Dear Sir:

I recently sent you a questionnaire asking you to express your opinion on the amount of time and importance you place upon specific instructional areas in Farm Power and Machinery.

Without your opinion, the study will be incomplete. I need your questionnaire to have a 100 per cent return.

Enclosed you will find another copy, if you have misplaced the one you received earlier.

Please take time to fill out the questionnaire and return it today, if possible.

Sincerely,

Pat Pruitt
Graduate Assistant
Agricultural Education Department
Oklahoma State University

PP/srg

Enc.

Texas Education Agency

• STATE BOARD OF EDUCATION
• STATE COMMISSIONER OF EDUCATION
• STATE DEPARTMENT OF EDUCATION

201 East Eleventh Street
Austin, Texas
78701

May 12, 1976

Dear Mr.

Recently you received a questionnaire on farm power and machinery from Pat Pruitt who is doing graduate study at Oklahoma State University. Prior to this, he taught vocational agriculture (production agriculture and farm power and machinery) at Crockett High School, Crockett, Texas.

If you have not completed the questionnaire, may we encourage you to take a few minutes from your busy schedule to complete the questionnaire and return it to Pat.

We feel that summary of information from this survey of all the farm power and machinery teachers in Texas will greatly assist in future planning of the needs and desires of the Pre-Employment Laboratory Training Program in Farm Power and Machinery.

We certainly appreciate your interest in this program and solicit your time and cooperation in responding to the questionnaire.

Sincerely,

Raymond L. Holt, Consultant
Agricultural Education

RLH:al

VITA

Albert Pat Pruitt

Candidate for the Degree of

Doctor of Education

Thesis: AN ASSESSMENT OF SELECTED AREAS OF INSTRUCTION RELATED TO THE FARM POWER AND MACHINERY PRE-EMPLOYMENT LABORATORY TRAINING PROGRAM IN TEXAS

Major Field: Agricultural Education

Biographical:

Personal Data: Born in Nacogdoches, Texas, July 6, 1943.

Education: Attended Nacogdoches Public Schools in Nacogdoches County, Texas, graduated from Nacogdoches High School in May, 1961; received the Bachelor of Science degree from Stephen F. Austin State University, Nacogdoches, Texas, with a major in Agricultural Education in May, 1967; received the Master of Education degree from Sam Houston State University, Huntsville, Texas in August, 1971 with a major in Agricultural Education; attended Oklahoma State University, Stillwater, Oklahoma, from August, 1975 to May, 1977; completed requirements for the Doctor of Education degree at Oklahoma State University, Stillwater, Oklahoma, in May, 1977.

Professional Experience: Dairy and row crop farming background; experience in wholesale automobile parts and machine shop from 1963 to 1967; taught vocational agriculture at Latexo, Texas, July 1, 1967 to June 30, 1969; taught vocational agriculture at Crockett, Texas, July 1, 1969 to August, 1975; graduate teaching assistant, Agricultural Engineering Department, Oklahoma State University, August, 1975 to June, 1976; graduate teaching assistant, Agricultural Education Department, Oklahoma State University, with responsibilities in assisting and coordinating student teaching activities from September, 1976 to present.

Professional Organizations: Life member of Texas State Teachers Association; member of Oklahoma and Texas Vocational Agriculture Teachers' Associations and National Vocational Agriculture Teachers' Association; Phi Delta Kappa; Red Red Rose; Church of Christ.