A SELF EVALUATION OF ABILITIES IN FARM MECHANICS BY SHORT COURSE STUDENTS IN AGRICULTURAL COLLEGES WITH IMPLICATIONS FOR INSTRUCTIONAL PROGRAMS

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ABSTRACT

A SELF EVALUATION OF ABILITIES IN FARM MECHANICS BY SHORT COURSE STUDENTS IN AGRICULTURAL COLLEGES WITH IMPLICATIONS FOR INSTRUCTIONAL PROGRAMS

by Lester Paul Bollwahn

Purpose.--The purposes of this study were: (1) to determine the degree in which farm mechanics is used by the farmer, (2) to determine the degree of skill in farm mechanics abilities possessed by students entering agricultural short courses in colleges, (3) to determine what abilities need further instruction at the short course or young farmer level, and (4) to compare the skill of Michigan students in farm mechanics with the skill of students in other states, thus to determine the need for changes in the Michigan farm mechanics program in vocational agriculture.

Methods.--One hundred abilities in farm mechanics were evaluated by 406 short course students who were enrolled in the first course in farm mechanics in seven midwestern states. They were surveyed by means of a questionnaire. The abilities were evaluated in terms of how often they were used on the home farm, who performed them, where they were learned, and how well the respondents felt they could perform them on their home farm. The respondents also indicated on the questionnaire some background information about their farming

and educational experience. The data were analyzed by state, instructional area and individual ability.

Findings and interpretations.--Some of the important findings and interpretations of this study follow.

1. Of the 100 abilities listed on the questionnaire, 35 were performed less than twice per year and 20 were performed more than five times a year on the farm.

2. Abilities more frequently performed on the farm were the ones that young farmers could do with the greatest skill.

3. Respondents indicated that a combination of learning at home and at high school produced the highest level of achievement.

4. Young farmers report that they learn more abilities at home than are used by the farm family on the home farm. Since the respondents felt they learned most abilities at home, this would indicate that students learn the basic information about the ability away from home, but develop it through practice at home.

5. Respondents perform more abilities on the home farm than does the respondents family. Therefore, they introduce new farm mechanics practices on the home farm.

6. Of the 100 abilities listed on the questionnaire, only 18 could be performed adequately on the farm. One was performed unsatisfactorily. The balance were performed in a marginal manner.

7. Fifty-two abilities were found to be important enough for the farmer to perform on the farm. Of these 35 needed

additional instruction at the young farmer level.

8. Specialized courses in shop improved the achievement of the respondents in the farm mechanics instructional area most closely related to it.

9. When respondents had had four years of vocational agriculture, those from Michigan had significantly less skill than those from other states in all instructional areas but soil and water management.

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The Agricultural Engineering Staff of Michigan State University assisted the writer in first securing the cooperation of the other institutions who cooperated in the study and then in the selection of the farm mechanics abilities that appeared on the questionnaire.

The study could not have been conducted if it were not for the Agricultural Engineering Departments in the states cooperating in the study. One person from the staff of the Department in each institution administered the questionnaires to the short course students enrolled in their basic farm mechanics courses.

Mr. Donald Kinsey, Coordinator of Education and Research at Michigan Farm Bureau, reviewed the completed study and gave the writer valuable assistance in editing.

Finally, the writer would like to acknowledge the valuable assistance provided by his family. If it were not for the sacrifices endured by the writer's wife, Carylin, and three sons; the study could not have been conducted. The typing and clerical work performed by Carylin assisted the writer through much of the preliminnary work of the study.

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CHAPTER I

INTRODUCTION

Farming today has become highly mechanized. If a farmer is to compete with other farmers and in a world market, he must keep his mechanical equipment in top working order. He must also understand how equipment he uses in his farming operation functions so when there is a malfunction, he may get it back into working order with the least loss of time. This study is designed to locate abilities a farmer uses on the farm and determine the amount of skill young farmers have in performing them upon graduation from high school. With this information, it would be easier to determine the course content for further instruction in the farm mechanics field.

The Problem

The problem being studied is one that has faced educators for many years. There have been a number of studies dealing with the development of programs in farm mechanics. Many of them are concerned only with the high school student or the education the teacher should receive to teach the abilities that are important in farm mechanics in high school. There are very few studies that determine

what should be taught to young farmers.

Importance of the study.--Young farmers develop some skills in the farm mechanical field before they become involved in farming on their own. They learn these abilities in many ways--high school, at home, 4-H clubs, work away from the farm and other experiences they may take part in. The degree in which the ability is used on the farm should, to some extent, determine the amount of skill a person would develop by the fact that he gets more practice in performing the ability.

The course of instruction offered in the young farmer classes and agricultural short courses in farm mechanics should be based upon what the young farmer already knows about the subject at that time. It should also consider the amount of use the ability receives on the farm so the importance can be determined. From this, a meaningful course in farm mechanics could then be developed.

Statement of the problem.--The problem to be considered becomes: what abilities performed on the farm are important to the farmer and which ones need further instruction at the young farmer and short course level? When this is determined, a course of study could be developed by the teacher for his particular community. An overall study, such as the one being conducted here, could give local teachers a guide in forming their course of study. The results of this study would be of greater value to instructors

in short courses and college because of the diversity of their students.

Purposes of the study.--The purposes of this study as determined by the problem are four fold:

1. To determine the degree in which farm mechanics is used by the farmer.

2. To determine the degree of skill in farm mechanics abilities possessed by students entering agricultural short courses in colleges.

3. To determine what abilities need further instruction at the short course or young farmer level.

4. To compare the skill of Michigan students in farm mechanics with the skill of students in other states, thus to determine the need for changes in the Michigan farm mechanics program in vocational agriculture.

Definition of Terms

Several terms will be used repeatedly in this study. Some of them are used in the terminology of farm mechanics. Some have more than one meaning and will be used in a specific and uniform way throughout this study. One term has been coined for use in this study and will be explained.

Ability.--Ability is defined in this study as those jobs listed on the questionnaire. They usually involve operations that are similar in performance. Many times a

project would require the performance of several abilities.

Skill.--Skill is defined as a level of achievement a respondent has reached in performing an ability. When a respondent has reached a high skill, he is able to perform the ability well.

Farm mechanics.--Farm mechanics is all of the unspecialized mechanical activities that should be performed on the farm and in the home with the kinds of tools and equipment the farmer has available. The Subcommittee on Teacher Training for Vocational Agriculture of the American Society of Agricultural Engineers in 1944 divided the farm mechanics field into five teaching areas and defined each one:

> Farm shop work. Selection, sharpening, care and correct use of shop tools and equipment; woodwork and simple carpentry; sheet metal work; elementary forge work; electric arc and oxyacetylene welding; pipe fitting; simple plumbing repairs; rope work.
>
> Farm power and machinery. Selection, management, adjustment, operation, maintenance and repairing (excluding major repairs requiring specialized equipment and services) of farm gas engines, tractors, trucks and the principal farm machines.
>
> Farm buildings and conveniences. Elementary scale drawing and plan reading; farmstead layout; functional requirements of farm houses, shelters, and storages; water systems; septic tanks and sewage disposal; heating.
>
> Soil and water management. Elementary leveling, land measurement and farm mapping; farm drainage; farm irrigation; terracing; contour farming; strip cropping (emphasis on various phases to be varied in accordance with local or regional needs).
>
> Rural electrification. Utilization of electricity in the home and in the productive farm enterprises;

selection, installation, operation and maintenance of electric equipment.[1]

Skill level.--The skill level is the calculated, self-evaluated skill of the respondents in performing the abilities. It is calculated by assigning a numerical value to the skill the respondent indicated he had in performing the ability. The number of respondents indicating a given skill was multiplied by this value and totaled for each ability. It was then divided by the total number responding for the ability. The formula that was used is

$$\text{Skill level} = \frac{0 \times A + 1 \times B + 2 \times C + 3 \times D + 4 \times E + 5 \times F}{A + B + C + D + E + F}$$

A was the number of respondents indicating they "had not learned," B was the number of respondents that "could not do," C was the number that "could do poorly," D was the number that "could get by," E was the number that "could do well" and F was the number that were "highly skilled." It should be stressed that this is a self-evaluation of the skill the respondents indicated they had in performing the ability.

Skill level when the respondents learned.--The skill level when the respondent learned disregarded all respondents

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[1]American Society of Agricultural Engineers, "Agricultural Engineering Phases of Teacher Training for Vocational Agriculture." A Report of the Subcommittee on Agricultural Teacher Training, with an advisory group of Agricultural Education Specialists, June 22, 1944.

who had not attempted to learn the ability.

Basic Assumptions

In order to draw conclusions in this study, certain facts had to be assumed. These assumptions are rather general in nature and depend upon the integrity of the people involved. The results depend upon human judgement. Three groups of people are involved in this judgement; the Agricultural Engineers who approved the list of abilities, the people who administered the questionnaires in the various states, and the respondents.

1. The abilities selected by the Agricultural Engineers teaching the basic courses in each of the farm mechanics instructional areas at Michigan State University are the ones that young farmers should know.

2. The respondents would answer similarly in each state even though the questionnaires were given at different times and in different places. The administrator in each state was issued a set of instructions to follow in administering the questionnaires.

3. The respondents answered the questions on the questionnaire sincerely and honestly. This entire study is based upon the self-evaluation by the respondent of the skill he had in performing the ability, the number of times he felt the ability was used in his farming business, where he learned the ability, and who performed the ability in his farming business.

CHAPTER II

REVIEW OF LITERATURE

The studies reviewed for this study are more comprehensive than local in scope. It was felt that a more comprehensive area was more consistent with the type of study being conducted here. Many of the early studies were for the purpose of determining the need for and the establishment of a farm mechanics program in a local school. It was felt that this was too specific for the purposes of this study. Though many of the current studies follow this same purpose, a large number deal with training teachers, setting up objectives for farm mechanics in general and in specific areas, or determining the skills that are important in the five instructional areas of farm mechanics.

Surveys of Farmers

Some of the earlier researchers studied the general field of farm mechanics. Sharp,[1] Pollom,[2] Sutherland,[3]

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[1]Marlay Albert Sharp, "A Suggested Course of Study in Farm Mechanics for High Schools Based on the Opinions of Five Hundred Farmers" (unpublished Master's Thesis, Library, Iowa State College, Ames, 1928) (from Summaries of Studies).

[2]Lester Boyd Pollom, "A Study of the Scope and Content of Farm Mechanics Courses and Organization for Teaching Them in the Vocational Agriculture Schools of Kansas" (unpublished Master's thesis, Kansas State Board of Vocational Education, Topeka, Series A-3) (from Summaries of Studies).

Kennedy,[4] Wilkins,[5] Davidson,[6] Bebermeyer[7] and George,[8] all surveyed farmers to determine the content of the farm mechanics courses. These people found that the courses would vary with the community. Walker[9] studied the opinions

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[3]Sidney Samson Sutherland, "Suggested Course of Study in Farm Mechanics, Based on the Opinions of 290 Montana Farmers" (special problem, Department of Agricultural Education, Montana State College, Bozeman, 1929) (from Summaries of Studies).

[4]Arther Chester Kennedy, "A Study of the Needs for Training in Farm Mechanics in Ohio" (unpublished Master's thesis, Department of Agricultural Education, Ohio State University, Columbus, 1927) (from Summaries of Studies).

[5]William Wilson Wilkins, "Farm Mechanics and Home Improvement for South Carolina Public Schools Teaching Vocational Agriculture" (unpublished special problem, Library, State A.& M. College of South Carolina, Orangeburg) (from Summaries of Studies).

[6]Allen Park Davidson, "A Study of Farm Shop and Agricultural Engineering on Kansas Farms: Its Relation to Vocational Agriculture in Kansas High Schools" (unpublished Master's thesis, Library, Kansas State College of Agriculture and Applied Science, Manhattan, 1925) (from Summaries of Studies).

[7]Paul Bebermeyer, "The Teaching of Farm Shop in Missouri High Schools" (unpublished Master's thesis, Department of Agricultural Education, University of Missouri, Columbia, 1923) (from Summaries of Studies).

[8]Chester Jonas George and Walter Wilbur Smith, "A Farm Shop Study" (special study, Department of Agricultural Education, Ohio State University, Columbus, 1932) (from Summaries of Studies).

[9]Clyde Walker, "Determining the Content of Farm-Mechanics Courses of Study for Smith-Hughes Agricultural Departments in High Schools" (unpublished Master's thesis, Library, University of Nebraska, Lincoln, 1931) (from Summaries of Studies).

of 200 Oregon farmers to determine course content in farm mechanics and made the statement "What is important to farmers in one state is important to farmers in another," so he offered his plan to be used as a farm mechanics guide in the entire United States. Graybeal[10] studied the opinions of 205 farmers by the interview method and found that the type of farm mechanics work done varied with the type of farming, size of farm, and between good and poor farmers.

In a study conducted in Pennsylvania, Cross[11] surveyed 64 young farmers from student teaching centers. The objective of the study was to locate farm machinery practices that were recommended by vocational agriculture departments, and practices that manufacturers recommended should not be carried out on the farm. He found that 96 per cent of the respondents had tools to perform these practices, and a large number performed them on the farm. A large number also indicated they had taught themselves to do these practices. His research has a similarity to this study in that he did examine where the

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[10]Henry Clay Graybeal, "Principles Underlying a Course of Farm Shop Work in Vocational Agriculture" (unpublished Master's Thesis, Library, Cornell University, Ithaca, 1923) (from Summaries of Studies).

[11]Albert N. Cross, "Home Farm Shop Practices in Maintenance of Farm Machinery by Graduates of Pennsylvania High Schools" (unpublished Master's thesis, Library, The Pennsylvania State College, State College, 1953), 96 pp.

respondents learned the ability, but he did not survey the amount of learning which took place.

A course of study in rural electrification was developed by Curtis[12] in Louisiana to be used as a guide by other teachers. One hundred twenty-one teachers of vocational agriculture surveyed farmers in their school areas to obtain the data. He found that instruction in the basic principles of electricity, planning the farmstead wiring system, home lighting, farmstead lighting, home appliances, electric motors, farm electrical equipment, farm water systems, and constructing electrical equipment would benefit the farmer.

The need for a program of instruction in farm mechancis for college students was studied by Jacobs.[13] Four hundred twelve graduates from the School of Agriculture in Kansas who were actively engaged in farming were used as the basis for the study. The majority indicated need for instruction in farm power and machinery, farm carpentry,

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[12]Charlie M. Curtis, "A Suggested Course of Study in Farm Electrification for Teachers of Vocational Agriculture in Louisiana" (unpublished Master's thesis, Department of Agricultural Education, Louisiana State University, Baton Rouge, 1952) (from Summaries of Studies).

[13]Clinton Otto Jacobs, "Determining the Need for a Program of Instruction in Farm Mechanics for College Students Based Upon a Survey of Farm-Operator Performance" (unpublished Master's report, Department of Education, Kansas State College, Manhattan, 1953) (from Summaries of Studies).

rural electrification, water supply and sewage disposal, and farm shop work. Soil and water practices tended to be done by hired personnel. Eighty-eight per cent of the respondents indicated a need for doing all of the jobs listed on the questionnaire.

Phipps and Deyoe[14] determined what farmers considered important in farm mechanics in Illinois. They interviewed 197 farmers in five separate areas of the state and found that the most important phase of farm mechanics was the maintenance, repair, and adjustment of farm machinery including tractors. There was some interest in plumbing, electrical work, blacksmithing, motor mechanics, and the construction of large farm buildings. Very little interest was indicated in the areas of soldering, rope work, forge work, and painting.

Thompson[15] surveyed 500 former students of vocational agriculture who were engaged in farming, to determine the content of farm power and machinery courses in Virginia. Fourteen teaching units were developed with the specification

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[14]Lloyd J. Phipps and George P. Deyoe, "Determining Farm Mechanics Content - What Farmers Consider Important" (non-thesis study, Division of Agricultural Education, University of Illinois, Urbana, 1952), 9 pp.

[15]Evans Guy Thompson, "Determining the Content of a Farm Power and Machinery Course for Vocational Agriculture High Schools in Virginia" (unpublished Master's thesis, Library, Virginia Ploytechnic Institute, Blacksburg, 1952) 73 pp.

that local needs should be considered in teaching the units. Schafer[16] also developed teaching units in 14 areas of farm mechanics for Arizona.

An Ohio study by Miller[17] involved 45 young farmers in a survey. It indicated that more emphasis should be placed upon plumbing and rural electrification. The purpose of the study was to determine the present farm shop needs of farmers and the changes that were needed in the present program. The study also surveyed the needs for facilities to meet farm mechanics requirements.

One hundred eighty-two graduates from 17 high schools in Nebraska were surveyed by McCreight.[18] He developed a list of abilities that were learned in school and a list that were learned at home. To be sure that a consistant method of teaching had been followed, the schools selected for the study had the same teacher for at least six years.

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[16]Wallace A. Schafer, "Teaching Units in Farm Mechanics for Courses of Study in Arizona Departments of Vocational Agriculture" (unpublished Master's special study, Library, University of Arizona, Tuscon, 1951) (from Summaries of Studies).

[17]Franklin Dilley Miller, "Changes in Program and Equipment for Farm Shop Work in Central Ohio Based Upon Farming Needs" (unpublished Master's thesis, Library, The Ohio State University, Columbus, 1949), 98 pp.

[18]M. G. McCreight, "A Study of the Use of Acquired Farm Mechanics Abilities by Selected Vocational Agriculture Graduates of Nebraska High Schools" (unpublished Master's thesis, Library, University of Nebraska, Lincoln, 1951) (from Summaries of Studies).

The abilities that were learned at school were in the areas of painting, tool sharpening, glazing, rope work, farm carpentry, forge work, soldering and sheet metal work, arc welding, and oxyacetylene welding. The areas that were learned better at home were tractor maintenance, farm machinery, farm electricity, tractor repair, plumbing and sanitation, heating and ventilation, harness and leather work, and concrete and masonry work. This is similar to the study being conducted here because the place of learning is being considered, but place is not one of the main objectives of this study.

Kindschy[19] obtained opinions about course content, importance of abilities, amount of time needed and the most effective ways of teaching welding, farm machinery, and tractors. He surveyed 246 former students of vocational agriculture in Iowa. Fifteen of the 23 repair abilities listed were considered important by more than 50 per cent of the respondents.

Fifty farmers were surveyed in one community of Oklahoma by Henslee.[20] The farms involved averaged

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[19]Dwight Lewis Kindschy, "Court Content in Welding, Farm Machinery, and Tractors for the Curriculum in Vocational Agriculture" (unpublished Master's thesis, Library, Iowa State College, Ames, 1948) 37 pp.

[20]Earl Dean Henslee, "A Farm Mechanics Training Program in Vocational Agriculture" (unpublished Master's report, Department of Agricultural Education, Oklahoma State University of Agriculture and Applied Science, Stillwater, 1957) (from Summaries of Studies).

210 acres in size. He developed a farm mechanics training program that was based on the requirements of the community. Over three-fourths of the respondents judged the following farm mechanics skills to be important for high school students: (1) the area of plumbing and water systems, (2) planning and constructing small farm buildings, (3) planning and constructing equipment for livestock care and management, (4) farm machinery adjustment, maintenance and minor repair, and (5) tool care and conditioning.

Chilen[21] had 174 veterans evaluate 120 abilities in farm mechanics to ascertain opinions relative to importance, proficiency, and source of training. All but one ability was considered important to farming. A majority of the abilities were rated by the veterans as having inadequate training to perform them properly.

A study started in Michigan by Cook and completed by Byram[22] determined the needs of farmers for training in mechanical activities as a basis for curriculum planning

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[21]Paul Raymond Chilen, "Farm Operator Evaluations of the Farm Mechanics Phases of Agricultural Engineering as Offered in the Department of Agricultural Engineering at Texas College of Arts and Industries, Kingsville, Texas" (unpublished Master's report, Department of Education, Kansas State College, Manhattan, 1952) (from Summaries of Studies).

[22]Glen C. Cook and Harold M. Byram, "Mechanical Activities of Selected Farmers in Michigan" (non-thesis study, Department of Agricultural Education, Michigan State University, East Lansing, 1952) 135 pp.

in farm mechanics. Farmers were questioned by Cook concerning: (1) activities that farmers perform, (2) activities that farmers hire done, and (3) activities that farmers would like to improve their ability to perform. Farmers tended to want to improve their skill in those abilities that they had not performed and did not hire done.

Lechner[23] studied 302 former high school students of vocational agriculture in Colorado and analyzed some selected farm mechanical skills for implications in building a vocational agriculture course. He isolated 12 enterprises that were "Very important" to success in farming: (1) maintaining and repairing tractors and engines, (2) woodworking, glazing and painting, (3) plumbing, (4) arc welding, (5) oxyacetylene welding, (6) concrete work, (7) constructing farm buildings, (8) supplying farm water for domestic use, (9) disposing of sewage, (10) constructing and repairing fences, (11) soil and water management, and (12) rural electrification. Four enterprises showed "some importance:" (1) general shop work, (2) rope work, (3) hot metal work, and (4) soldering and sheet metal work. The study being conducted here is similar to Lechner's study because young farmers are being surveyed in both instances.

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[23]Fred George Lechner, "An Analysis of Farm Mechanical Skills of Colorado Young Farmers with Implications for Course Building in Vocational Agriculture" (unpublished Doctor's thesis, Library, Michigan State University, East Lansing, 1958), 141 pp.

A study conducted in Missouri by Weston[24] of the opinions of 556 farmers showed that of the 90 farm mechanics jobs designated, 59 were performed by over 50 per cent of the farmers. Over 50 per cent of the respondents believed they should perform 86 of the jobs and over 30 per cent desired additional training in 40 of the designated jobs.

The studies reviewed above differ from the study being conducted here in that the respondents were basically older and involved in farming to a greater extent. They would have had more experience in performing farm mechanics abilities. Some of these studies determine where a student learned to perform abilities in farm mechanics, but none of them attempted to determine the amount of skill that the respondent had achieved. This study and those being reviewed used a selected list of abilities or developed a list of abilities in farm mechanics that were taught.

Surveys of Teachers

Teachers of vocational agriculture and agricultural engineers that teach college courses were often surveyed in studies pertaining to farm mechanics. In some of the

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[24]Curtis Ross Weston, "A Study of Mechanical Jobs Performed by Selected Farmers in Missouri" (unpublished Doctor's thesis, Library, University of Missouri, Columbia, 1959), 226 pp.

earlier studies Campbell[25] and Wallace[26] surveyed teachers of vocational agriculture and Gibbs[27] surveyed agricultural engineers to determine the content of the farm mechanics courses to be taught in high schools.

Hutson[28] studying in Arkansas found farm mechanics instruction runs high in farm shop instruction. Two-thirds of the teachers of vocational agriculture surveyed indicated they spent 70 per cent of the time in farm shop work. The projects on which the students worked were predominantly in the wood working field. Rural electrification and soil and water were the areas where the least instruction time was spent. The teachers indicated they needed the most help in farm power and machinery.

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[25]Jesse Lee Campbell, "Universal Shop Problems for Vocational Agriculture" (unpublished Master's thesis, Library, University of Missouri, Columbia, 1926) (from Summaries of Studies).

[26]Harry Moore Wallace, Jr. "Farm Engineering in Agricultural High Schools" (unpublished Master's thesis, Library, Virginia Polytechnic Institute, Blacksburg, 1926) (from Summaries of Studies).

[27]James Thomas Gibbs, Jr., "Basis of Selecting a Farm-Shop Course for Vocational Agriculture" (unpublished Master's thesis, Library, University of Missouri, Columbia, 1925), 71 pp.

[28]Denver B. Hutson, "Instruction in Farm Mechanics as Conducted by Teachers of Vocational Agriculture in Arkansas" (non-thesis study, Department of Agricultural Education, University of Arkansas, Fayetteville, 1955), 26 pp.

Integration of farm mechanics in the high schools of Ohio was studied by McNutt.[29] He recommended a program whereby the activities became more difficult each year. The first year was spent in doing simple jobs to get the student familiar with the use of tools. The second year would be used in learning more skills and the final two years of shop would be for the repair and adjustment of farm machinery.

Information that would be of value in designing a farm mechanics program in Tennessee was assembled by Scarborough.[30] He surveyed 149 teachers of vocational agriculture. He found that 20 per cent of the teaching time in vocational agriculture was spent in farm mechanics. Woodworking, farm carpentry, and rope work received the most teaching time.

Odell[31] found in West Virginia that the area of

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[29]William A. McNutt, "A Study of Farm Mechanics Integration by Ohio Teachers of Vocational Agriculture" (non-thesis study, Department of Agricultural Education, The Ohio State University, Columbus, 1954) (from Summaries of Studies).

[30]J. Fred Scarborough, Jr. "A Survey of the Farm Mechanics Program of Tennessee" (non-thesis study, Department of Agricultural Education, University of Tennessee, Knoxville, 1950) (from Summaries of Studies).

[31]Finley Odell, "The Farm Mechanics Skills Used by Vocational Agriculture Teachers in Forty Vocational Agriculture Departments in West Virginia" (unpublished Master's problem, Library, West Virginia University, Morgantown, 1955), 100 pp.

farm machinery was not used extensively in teaching farm mechanics. Teachers surveyed indicated many of the abilities listed in this area were important. They also listed abilities in electricity, plumbing, and masonry as important, but they were not used to any extent in teaching.

In determining what should be taught in rural electrification in Area VIII of Texas, Berry[32] surveyed 71 teachers in the area. He found that 75 per cent or more of them teach safety rules and precautions, simple repairs, repair or building of electric brooders, electric welding, and wiring small buildings. Seventy-five per cent or more felt that all of the above should be taught along with materials used in wiring, electrical terms, wiring houses and barns, reading meters, figuring cost of electricity, trouble shooting, distribution of electricity, and if the electrician is doing the job correctly.

Larson[33] sent a list of 306 abilities in farm mechanics to 100 teachers of vocational agriculture in South Dakota to determine the technical abilities needed in the

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[32] Melvin T. Berry, "Practices and Opinions of Teachers in Area VIII of Texas Concerning the Teaching of Rural Electrification" (unpublished Master's problem, Department of Agricultural Education, Sam Houston State Teachers College, Huntsville, 1952) 34 pp.

[33] Marvin E. Larson, "A Study to Determine the Technical Abilities Needed in the Farm Mechanics Curriculum of Agricultural Education Majors in Pre-Service Training" (unpublished Master's thesis, Library, South Dakota State College, Brookings, 1959), 165 pp.

farm mechanics curriculum of agricultural education majors. He isolated only 13 that were not important enough to be taught in high schools.

Seventy-one beginning teachers were surveyed by Dougan[34] in Ohio to identify some important skills and abilities in farm mechanics. One hundred selected abilities were used. The respondents indicated if the abilities needed increased instruction, continued instruction, less emphasis, or no emphasis. His work is similar to this study because the teacher training program in farm mechanics is being considered, but the method of arriving at the need for training is determined in different ways.

Carnie[35] studied opinions of University of Idaho trained vocational agriculture teachers to determine the importance of selected farm mechanics abilities. He found six areas that were rated very important by the teachers: arc welding, oxyacetylene welding, farm electricity, tractor maintenance, farm power unit overhaul with the exception of "rebuild a water pump," and all farm machinery repair,

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[34]Riley Shelton Dougan, "Farm Shop Skills and Abilities Needed and Acquired by Beginning Teachers of Vocational Agriculture in Ohio" (unpublished Master's thesis, Library, The Ohio State University, Columbus, 1951), 139 pp.

[35]George Major Carnie, "Evaluation of the Pre-Service Training of Vocational Agriculture Instructors in Farm Mechanics" (unpublished Master's thesis, Library, the University of Idaho, Moscow, 1959) (from Summaries of Studies).

adjustment, and service abilities.

In this section, teachers indicated which abilities are important on the farm. They also indicated which ones in their judgement would need more instruction. The study being conducted here also determines the areas of farm mechanics in which teachers need more instruction, but this is indicated by the skill which students indicated they achieved as a result of the instruction they received in high school.

Surveys of Students

This section of the review of literature is similar to the study being conducted here in that students are being surveyed. A comparison of students having taken vocational agriculture and those not having vocational agriculture was also made in several of the studies. The main difference evident in these studies is that those reviewed, surveyed regular college students while this study surveyed agricultural short course students. All respondents were students in introductory courses in agricultural engineering.

Haltom[36] found in Kansas that boys with a vocational

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[36]Albert Alexander Haltom, "A Comparison of the Machinery Repair Work Done on the Home Farm by Boys With and Without Vocational Agriculture Training" (unpublished Master's thesis, Library, Kansas State College, Manhatten, 1942) (from Summaries of Studies).

agriculture background undertook more machinery repair work on the farm than did boys with no vocational agriculture. This was determined by surveying boys from one to five years after graduation from high school. Walker[37] found in Montana that students are not learning farm mechanics from school, but are learning by "pick up" means on their own. An indication of the place where a student learns will also be determined in the present study.

Four researchers at Iowa State College studied the effects of the vocational agriculture program on the future ability of students. Ball[38] found few significant differences between 119 vocational agriculture graduates and 238 non-vocational agriculture graduates. Fifty-six items on a questionnaire did not yield evidence of differences when no classification of the group was made. Former vocational agriculture students who were classified as having status in farming performed a proportionally greater number of recommended farm mechanics activities in some areas than did

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[37]William Joseph Walker, "The Montana Farm Mechanics Program in Vocational Agriculture" (unpublished Master's thesis, Library, Montana State College, Bozeman, 1941) (from Summaries of Studies).

[38]Wilbur Perry Ball, "Influence of High School Vocational Agriculture on Farm Mechanics Practices Used by Participants in the Veterans Farm Training Program" (unpublished Doctor's thesis, Library, Iowa State College, Ames, 1956) 150 pp.

non-vocational agriculture graduates. Fulton,[39] who studied the opinions of 237 students who had completed either no vocational agriculture or four years of vocational agriculture, found a high correlation between vocational agriculture students and abilities used in farm mechanics prior to the students enrolling in the introductory course in farm mechanics at Iowa State College. High school class size had no effect on the number of skills used. It was found that experience with mechanical repair, tools and equipment, and jobs in the introductory course in agricultural engineering had an effect on achievement in the introductory course regardless of where the experiences had been encountered. High school vocational agriculture students excelled the others because they had had more opportunity to become familiar with these skills.

Stevenson[40] surveyed 371 Iowa students enrolled in the introductory course in Agricultural Engineering at Iowa State College in the 1955-56 school year. The purpose was to determine the influence of high school vocational

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[39]David A. Fulton, "Effect of High School Vocational Agriculture on Achievement in the Introductory Farm Mechanics Course at the Iowa State College" (unpublished Master's thesis, Library, Iowa State College, Ames, 1956) (from Summaries of Studies).

[40]Paul Nelson Stevenson, "Influence of High School Vocational Agriculture on Farm Mechanics Practices Used by Students Previous to Enrolling at Iowa State College" (unpublished Master's thesis, Library, Iowa State College, Ames, 1956), 93 pp.

agriculture on the extent to which farm shop jobs were performed. He found vocational agriculture students performed, on the average, 36 per cent of the 75 jobs listed on the questionnaire while the non-vocational agriculture students performed only 26 per cent of the 75 jobs. He also found vocational agriculture students learned over seven times as many jobs in high school farm mechanics as non-vocational agriculture students learned in industrial arts. A greater number of jobs were hired done on the farms of the non-vocational agriculture students compared to the vocational agriculture students. The study also showed that a relationship existed between the size of the parents farm and the number of farm mechanics jobs done by the boy. Bear[41] studied the relationship of vocational agriculture to the farm mechanics jobs performed by graduates in Iowa. His study did not indicate that farm mechanics instruction as provided in high school vocational agriculture greatly influenced the farm mechanics practices used by graduates.

In another study conducted in Iowa, Rhea[42] determined the suitability of the Owens-Bennett Mechanical

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[41]William Forrest Bear, "Relation of High School Vocational Agriculture to Mechanical Farm Jobs Performed by Graduates" (unpublished Master's thesis, Library, Iowa State College, Ames, 1959) (from Summaries of Studies).

[42]Mark B. Rhea, "Suitability of the Owens-Bennett Mechanical Comprehensive Test for Predicting Farm Shop Manipulative Achievement of College Students" (unpublished Master's thesis, Library, Iowa State College, Ames, 1947) (from Summaries of Studies).

Comprehension Test for predicting farm shop manipulative achievement of college students. He studied the opinions of 254 students in the first course in agricultural engineering at Iowa State College and correlated the final grade with high school marks, background information, the American Council on Education Psychological Examination, and the Owen-Bennett Test. He found that the Owens-Bennett Test was the best of the group in determining achievement.

Surveys of Combined Groups

A number of researchers surveyed the opinions of a variety of classes of people and compared the responses of one group to the others. In this way, a comparison could be made to the thinking of each of the groups and determine if the farm mechanics jobs that were important for one group were the ones that were important to the other groups. In determining which abilities were important in this study, agricultural engineers teaching the basic courses in each area of farm mechanics indicated the ones that they stressed in their courses.

In some of the older studies, Geiger[43] surveyed 100 farmers and 40 teachers in Florida and found that farmers devote most of their farm mechanics work to repair.

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[43]Albert James Geiger, "A Study of Farm Shop Work in Florida" (unpublished Master's thesis, Library, University of Florida, Gainesville, 1932) (from Summaries of Studies).

Teachers devote almost all of their time to teaching construction. Mulligan[44] surveyed farmers, teachers and college students to determine the importance of selected farm mechanics jobs. Davies[45] compared farm shop in Colorado to other states in the Pacific Region. He located repair and construction jobs by surveying farmers and teachers in this region.

In a study in Pennsylvania, Anthony[46] evaluated the current objectives of the farm mechanics phase of vocational agriculture in selected high schools. He surveyed the opinions of teachers of vocational agriculture, farmers, area supervisors, and experts in the field of farm mechanics and found the Pennsylvania State University lagged in the training of teachers in the instructional areas of farm power and machinery, rural electrification, soil and water management and farm buildings and conveniences. He also found

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[44] Clarence William Mulligan, "A Study of the Needs for Training in Farm Mechanics in New York State" (unpublished Master's thesis, Library, Cornell University, Ithaca, 1941) (from Summaries of Studies).

[45] Llewellyn Rhys Davies, "Farm Shop Work in Vocational Education" (unpublished Master's thesis, Library, Colorado Agricultural College, Fort Collins, 1923) (from Summaries of Studies).

[46] Frank Anthony, "An Evaluation of the Current Objectives of the Farm Mechanics Phase of Vocational Agriculture in Selected Pennsylvania High Schools" (unpublished Doctor's thesis, Library, Pennsylvania State University, University Park, 1956) (from Summaries of Studies).

all of the groups agreed that when special tools and skills were needed to perform a job, experts, not farmers, should do the job.

Eighty-six preventative maintenance abilities were rated by farmers, teachers of vocational agriculture, teacher trainers, and agricultural engineers in Ohio to determine the importance of the abilities in farm mechanics. The study was conducted by Ryder.[47] It was recommended that 50 of the 86 abilities should receive emphasis in the teaching of agricultural engineering in high school to boys and farmers. Four of the abilities should be eliminated.

A group of 40 teachers, 40 adult farmers and 40 young farmers were interviewed in Oklahoma by Dugger.[48] They ranked 115 selected competencies in farm mechanics according to the scale: (1) extensive and personal understanding needed, (2) understand when and how to get help, (3) little or no understanding needed, and (4) no comment. A list that a majority rated "1" were the ones recommended be included in a farm mechanics program.

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[47] Gordan J. Ryder, "Skills Needed by Farmers in Selected Areas of Farm Mechanics" (non-thesis study, Department of Agricultural Education, the Ohio State University, Columbus, 1953) (from Summaries of Studies).

[48] Roy Wesley Dugger, "Mechanical Competencies Needed by Vocational Agriculture Teachers in Oklahoma" (unpublished Doctor's Thesis, Library, Oklahoma Agricultural and Mechanical College, Stillwater, 1956), 118 pp.

Hamilton[49] studied the farm shop and farm structures areas of farm mechanics in Michigan. He surveyed teachers of vocational agriculture, advisory council members, teacher educators, and agricultural engineers to establish a basis for instructional planning in the two instructional areas. There was general agreement among the groups in regard to the importance of the 180 farm mechanics abilities. The managerial abilities were rated higher in importance and lower in adequacy of training than were the manipulative types.

Hartzog[50] studied the effect of a survey of farmer opinion on the course of study in farm mechanics. He found teachers indicated farm shop skills were being given greatest emphasis in schools, but farmers indicated much more attention should be given to preventative maintenance.

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[49]James Roland Hamilton, "The Preparation of Michigan Teachers of Vocational Agriculture in Two Areas of Farm Mechanics" (unpublished Doctor's thesis, Library, Michigan State University, East Lansing, 1955), 265 pp.

[50]David H. Hartzog, "A Study of the Effect of a Survey of Farmer Opinion on Course of Study in Farm Mechanics" (unpublished Doctor's thesis, Library, University of Minnesota, Minneapolis, 1959) (from Summaries of Studies).

CHAPTER III

THE INVESTIGATION

This study was conducted in several of the mid-western states by surveying the opinions of agricultural short course students enrolled in the first term agricultural engineering courses. The investigation was so designed that a person in each of the states could collect the data so as to make it uniform and comparable. An instrument was provided to insure this. A system of analyzing the data was then developed to carry through the purposes of the study.

The Instrument

Data were collected by means of a questionnaire administered by a person in each of the Agricultural Engineering Departments cooperating in the study. The questionnaire was planned to provide background information about the respondent that would be helpful in determining the experiences he had received both from a farm and instructional viewpoint. The respondent had only to check the blank that best suited his situation or fill in a number to indicate the number of years of instruction in the various phases of education.

Selection of abilities.--The abilities included on the questionnaire were selected by agricultural engineers from Michigan State University who teach the basic course in each instructional area of farm mechanics. The writer developed a comprehensive list of abilities from other recent studies that had been completed in farm mechanics and submitted it to the agricultural engineers. They selected 20 abilities in each of the five instructional areas which would best indicate what they were teaching in the first course in the area.

Rating scales.--The rating scales following each of the abilities on the questionnaire were developed to give the writer information as to the frequency with which the ability was performed on the farm, who performed the ability, where the ability was learned, and what skill the respondent felt he had achieved in performing the ability.

First, the respondent estimated how often the ability was performed each year in his farming business, whether he owned the farm, worked on his father's farm, or worked on another farm.) Such data would give the writer an opportunity to determine the number of times that ability was used in general in the farming operation. The term "in general" means the total number of times an ability was performed and not the number of times the respondent performed the ability. The respondent should make one check for each ability.

The second decision he made was whether the ability was hired done, done by the farm family or done by the respondent. In some cases, any of the groups listed could have performed the ability. Thus, the data would indicate whether the respondent performed the ability or the ability was performed on the farm by some member of the farm family as a part of their farming operation.

It was also felt that it would be helpful in the study to determine where the respondent judged that he learned to perform the ability. He was asked to check the column of the space which best indicated where he learned the ability. He was not to check the column if he had not learned to perform the ability.

A numerical scale followed each ability with a guide at the top of each page to give the respondent an opportunity to indicate how well he estimated he could perform the ability. This part was a self-evaluation of his skill. The respondent would place his value upon the ability using his own value judgement.

Trial run of questionnaire.--The questionnaire was submitted to 11 students enrolled in a short course during the previous term. After analyzing the data, only minor changes to some of the background questions were necessary to clarify them. It was determined that the questionnaire would serve adequately as a device for collecting the data to meet the requirements of this study.

Administering the Questionnaire

Each of the Agricultural Engineering Departments cooperating in the study designated one person from its staff to administer the questionnaire. This person was sent sufficient questionnaires for respondents in his state.

A set of instructions was sent to each administrator. He was asked to read the instructions on the questionnaire to the respondents carefully, and to point out to them the importance of checking the columns following the abilities in the prescribed way. This would provide for the writer uniform and fairly comparable data. The respondent was asked to take the questionnaire home with him so as to allow needed time in filling it out, and to return it at the next class session.

The instructions to the administrator were as follows:

> Read the instructions on the first page of the questionnaire to all of the respondents.
>
> Clarify questions five and six by pointing out that this means vocational agriculture in high school.
>
> Go over the examples on the second page of the questionnaire and point out that in the first column after the abilities they should check once for <u>each</u> ability. Column two should be checked one, two or three times for <u>each</u> ability depending upon who performed this ability. Column three should be checked no more than once--only that place where they feel they have learned the most about this ability. They do not check if they have not learned. In column four, they are to circle one number for <u>each</u> ability that <u>best</u> indicates how well they can perform the ability.
>
> They may take the questionnaires with them to be returned at the next class session.

Selection of the Population

It was felt that a study of this type would be of greatest value if students from several state education institutions could be included. If only one state were studied, there would be little on which to base any conclusions bearing on the teaching of farm mechanics to high school students. Most of the teachers in a given state would have received their education from one institution, and the training they received would be quite similar. Therefore, the specific things taught would be quite similar. It was with this in mind that a number of states were selected.

States included.--The states in the midwest region of the United States have a similar type of agriculture in many ways. Many of them have a similar type of agricultural short course offered in the Agricultural Colleges. All of the midwest states were invited to participate in this study. Some do not have a short course program and others reported that the courses offered or the students involved would not be compatible in the study. Still others indicated they had a time problem, and would not be able to participate. In the final analysis, seven states took part in the study: Illinois, Michigan, Minnesota, North Dakota, Ohio, South Dakota, and Wisconsin.

Selection of respondents.--First year short course students were selected to take part in this study for four reasons. First, the students enrolled in a short course

in agriculture would give a cross section of the state in which they were enrolled. They were likely to be students interested in farming and would probably return to the farm. This would provide the study with data from commercial farms, and be more representative of farming in the several states. Second, these students would be out of high school for only a few years for the most part, and could provide a better indication of the instruction they had received in high school. Third, a quantity of young farmers would be available in one place to whom to administer the questionnaires. Fourth, they would not have had an opportunity to learn the abilities in previous courses in the Short Course program.

It is realized that the respondents are a select group. They are the ones that are interested in learning more about farming and will probably return to the farm. This is compatible with the purposes of this study.

Collecting the Data

After the Agricultural Engineering Departments had indicated that they would cooperate in the study, contact was made with the person from each state who would administer the questionnaires. He estimated the number of questionnaires that he would need and this number was sent to him.

Issuing the questionnaires.--The questionnaires were mailed to each administrator in bulk and returned the same way. By this procedure, only the writer and the administrator would handle the questionnaires after the respondent had

completed his copy. This would reduce the handling and therefore the possibility of loss.) Since the questionnaire was administered as a part of class work, 100 per cent of the students surveyed returned the questionnaires.

Processing the questionnaires.--When the questionnaires were returned, they were coded and the data were placed on IBM cards for analysis. Each instructional area of farm mechanics on the questionnaire was placed on a separate card with the background information on each card. This required five cards for each questionnaire. In this way, each instructional area could be analyzed separately and compared to the background information.

Analyzing the Data

The data, after they were tabulated, were analyzed statistically by the Chi Square method using border totals. The data were tabulated for each factor and the formula $\text{Chi Square} = \frac{(O - E)^2}{E}$ was used as a test of homogeneity of the data. In the formula, O is the observed frequency of the responses and E is the expected frequency computed from border totals.

Kinds of Analyses

The data allowed three types of comparisons and it was felt that each comparison could contribute significant findings to the study. The data were analyzed by states, by skill level, and by skill level for those that learned for each ability.

State.--The general information was analyzed by comparing Michigan to the total of the other states. This is a Michigan study and one of the purposes is to improve the Michigan farm mechanics program. Therefore, the greatest value could be received from this type of comparison.

Skill level of instructional areas of farm mechanics.--The average estimated skill level of each instructional area of farm mechanics could tell us in general terms how the areas were affected by the background information. This would be valuable in determining what factors affected the skill of the respondents in the instructional areas.

Skill level of each ability.--The effect of the number of times an ability was done on the farm, who performed the ability on the farm and where the respondent learned the ability could best be indicated by analyzing each ability according to the skill level of those who learned the ability. In this way, each ability could be more completely analyzed. This would indicate which abilities being taught need additional instruction.

CHAPTER IV

ANALYSIS OF DATA

Introduction

The data presented in this study were analyzed in three different ways: (1) by state, (2) by skill level, and (3) by ability. Those dealing with the general background of the population were analyzed on a state by state basis. Since the Michigan farm mechanics program should come under the most scrutiny, all of the data from other states were pooled, the Michigan figures compared to them and reported in this study. The general data concerning the population also were analyzed by the skill level of the respondents in each area of farm mechanics. This gave some background of the population that would be of value in interpreting the data.

Each of the 100 abilities were then analyzed in detail so that certain factors affecting the skill level of the respondents could be determined.

Purposes of the study.--Only those analyses that directly affect the purposes of the study will be reported in detail. The stated purposes of this study are: (1) to determine the degree in which farm mechanics is used by the farmer, (2) to determine the degree of skill in farm

mechanics abilities possessed by students entering the short course, (3) to determine what abilities need further instruction at the short course or young farmer level, and (4) to determine the skill of Michigan students in farm mechanics in relation to the skill of students in other states, thus to determine the need for changes in the Michigan farm mechanics program in vocational agriculture.

Number of questionnaires obtained and used.--The criterion used in sending questionnaires to the states was based on the estimated number of students to be enrolled in agricultural engineering short courses for the first time. Table I shows the number of questionnaires returned and the number used in the study.

Table I - Number of Questionnaires Returned and Used

State	Returned	Used
Illinois	63	56
Michigan	95	85
Minnesota	20	18
North Dakota	76	73
Ohio	33	28
South Dakota	36	33
Wisconsin	123	113
Total	446	406

Four hundred forty-six questionnaires were returned to the writer and 406 of them were used. The 40 questionnaires not used were discarded for several reasons. In most of the questionnaires which were not used there was either insufficient information reported on the questionnaire or obvious indications that respondents did not follow the instructions as they were given. Two of the respondents were over 40 years of age, and had many more years of experience than the rest of the respondents. Two were residents of a state not included in this study, and it was felt the difference would be too great in the state programs to have these questionnaires included. One of the students that filled out a questionnaire was from a foreign land, and it was felt his responses would not be comparable with the results from the state in which he was enrolled. One respondent indicated he lived in a city and had no farm experience.

The Population

Age.--Table II indicates that Michigan respondents were younger than those of other states. Michigan has 77.6 per cent of its respondents in the age group 16 to 19 while the other states show only 64.4 per cent of respondents in this group. This difference was significant at the five per cent level.

Table II - Age of Respondents

State	16 to 19	20 and over
Michigan	66	19
Other states	203	112
Total	269	131

Number of men on the farm.--The number of men working full time on the farm, rather than the number of acres, was used to indicate the size of business. Due to the variety in types of farming in the states studied, a ten acre farm in the intensive fruit and vegetable or poultry area may be as large in terms of the amount of labor and farm mechanics involved as several hundred acres in the wheat and ranch areas. Part time farming is also prevalent in some parts of the area being studied, and it was felt that in all cases where there was less than one full time man on the farm, this would be true.

Only about 20 per cent of the total respondents were from Michigan, yet Michigan had 36.3 per cent of all farms in this study that had less than one man working full time on the farm as indicated in Table III. Michigan also had 26.9 per cent of the farms with one full time man, and 18.1 per cent of the farms with two full time workers. Michigan is represented in these results with only 14.3 per cent

Table III - Number of Men Working Full Time on the Farm

State	0	1	2	3 plus
Michigan	4	32	37	9
Other states	7	86	167	54
Total	11	118	204	63

of the farms having three or more full time men on the farm. These data indicate that Michigan had a higher per cent of farms in what would be classed as a family operation, inasmuch as the short course student in most cases is working on the home farm. Even the two-man operation would consist of the respondent's father and himself. It is quite evident that respondents from Michigan came from smaller farms than was typical for the other states resported in the study. These results were highly significant.

Years of vocational agriculture.--The number of years of training in vocational agriculture should affect the skill of the respondent in the farm mechanics abilities he performs. Much farm mechanics is taught along with other agricultural subjects that make up the vocational agriculture program. Table IV compares the amount of vocational agriculture taken by Michigan respondents to that taken by respondents in other states. There was no difference between the two groups in the number of respondents having four years

Table IV - Years of Vocational Agriculture Taken

State	0	1	2	3	4	Total
Michigan	8	3	13	13	47	84
Other States	82	28	13	19	175	317
Total	90	31	26	32	222	401

of vocational agriculture. The Michigan respondents indicated 55.9 per cent had four years of vocational agriculture, while the other states showed 55.2 per cent had four years in the program. There is a difference when you consider those that had no vocational agriculture, however. About nine per cent of the Michigan respondents indicated no vocational agriculture while 25.8 per cent of the others indicated none. From an overall view, Michigan respondents had more vocational agriculture than the other respondents.

Separate courses in farm shop.--In most of the states, schools have the option of teaching farm mechanics as a part of the vocational agriculture program or teaching it one or more years as a separate course. When it is taught as a separate course, it is usually taught in the second, third or fourth year of school. In Michigan it is usually taught in the second year of high school, while in the Dakotas the separate class usually comes in the senior year.

As indicated in Table V, 51.3 per cent of the Michigan respondents had a separate course in farm mechanics, while respondents from other states had 57.8 per cent in a separate course in farm mechanics. There is no significant difference in these figures.

Table V - Separate Courses in Farm Mechanics Taken

State	Yes	No
Michigan	41	39
Other states	184	134
Total	225	173

Other shop courses.--Other shop courses taken by the respondents while in high school also could affect the amount of skill they had acquired before they entered the college short course classes in farm mechanics. Table VI shows the comparison of Michigan respondents to other respondents in each type of shop course listed on the questionnaire. These shop courses include general shop, wood shop, metal shop, auto mechanics, electrical shop and mechanical drawing. Table VI indicates there is no significant difference between the respondents in classes in wood shop, metal shop, auto mechanics and mechanical drawing. In the area of general shop, however, it is highly significant that more Michigan respondents had enrolled. Forty-six and two-tenths

Table VI - Other Shop Courses Taken

Shop Course	Michigan Yes	Michigan No	Other States Yes	Other States No
General shop	55	30	148	173
Wood shop	43	42	157	164
Metal shop	23	62	101	220
Auto mechanics	5	80	33	288
Electrical shop	5	80	55	266
Mechanical drawing	30	55	89	232
Total	161	349	583	1343
Average number taken	1.9		1.8	

per cent of the other state respondents had taken at least one year of general shop while 64.7 per cent of the Michigan respondents had taken some general shop. Students from other states had about 11 per cent more electrical shop classes than Michigan students. This figure is significant at the five per cent level.

When all of the shop areas are considered, there is no difference between Michigan and the combination of other states in other shop courses taken in high school.

Farm mechanics 4-H clubs.--Some 4-H clubs are based upon a farm mechanics emphasis. To the people involved, they should be considered as a means of learning. In the

states considered in this study, programs universally show electrical, tractor maintenance, handicraft, and soil and water management 4-H clubs. Table VII points out that there is no difference between states in the number of respondents having enrolled in these clubs with the exception of the handicraft clubs.

Table VII - Participation in Farm Mechanics 4-H Clubs

4-H Club	Michigan		Other States	
	Yes	No	Yes	No
Electrical	21	64	60	261
Tractor maintenance	25	60	128	193
Handicraft	33	52	56	265
Soil and Water	8	77	37	284
Total	87	253	281	1003
Average number taken	1.0		0.9	

Approximately 39 per cent of the Michigan respondents indicated they had enrolled in the 4-H handicraft club, while only about 17 per cent from other states so indicated. This difference was highly significant. It would appear then, the Michigan respondents would be more highly skilled in the farm shop area of farm mechanics if the 4-H club program played a role in the learning of these farm mechanics abilities.

When the totals were considered, however there was

no difference in the 4-H participation in farm mechanics clubs between respondents from Michigan and other states.

Skill level in each area of farm mechanics.--The skill level of all respondents in each instructional area of farm mechanics was determined to give a comparison of Michigan respondents with those of other states. The data were then grouped into three areas to indicate the skill the respondents felt they had in a given area of farm mechanics. The responses for each ability in the area were compiled to get this figure.

Table VIII shows a comparison of Michigan and other states in the skill level of respondents in the low, medium and high skill groups in each instructional area of farm mechanics. The low skill group included all of the responses with a skill level up to 2.49. This would include those who checked their skill in the ability as "never done," "can't do," and "do poorly." The medium group included anyone who checked their skill level from 2.50 to 3.49 or the ones that indicated they "can get by." The high group included those who checked anywhere above 3.50 or in the "can do well" or "highly skilled" group.

The only instructional area of farm mechanics that does not show a significant difference between Michigan respondents and other respondents is in soil and water management. All other areas showed Michigan significantly lower in skill. The farm structures instructional area showed the

Table VIII - A Comparison of Michigan and Other States in Skill Level

Farm Mechanics Area	Michigan			Other States		
	Low	Med.	High	Low	Med.	High
Farm shop	51	31	3	118	186	15
Farm structures	45	36	4	78	203	35
Rural electrification	67	14	3	187	104	23
Farm power and machinery	40	37	8	68	194	55
Soil and Water	76	6	0	282	35	1
Total	280	124	18	743	722	129

greatest difference. Michigan had only 4.7 per cent of the respondents in the high group, while the other states had 11.1 per cent in this category. On the other hand, Michigan had almost 53 per cent of the respondents indicating they were in the low group, while the other states had only 24.6 per cent in the low group. This does not support the hypothesis that 4-H handicraft clubs and wood shop would increase the skill of the respondent. Michigan respondents had more handicraft clubs, the same amount of wood shop in high school, and a greater number of general shop courses than did respondents from other states.

The instructional area of farm power and machinery was next most highly significant in the farm mechanics program. Here, Michigan had only 9.4 per cent of the

respondents as compared to 16.8 per cent for other states in the high skill group. In the low skill group, Michigan had 47 per cent and the other states had only half as many with 23.5 per cent. There was no difference in the percentage of respondents from Michigan and other states that had enrolled in auto mechanics and 4-H tractor maintenance. There was a difference in general shop as reported in the preceeding paragraph.

The instructional area of farm shop was next to be considered for significant differences. The percentage of respondents from both groups were about equal in the high skill class. However, Michigan respondents indicated that a larger number fell into the low skill group than did respondents from other states.

Rural electrification showed the same trend as the other instructional areas of farm mechanics mentioned. Michigan had a smaller percentage in the high skill group and a larger percentage in the low skill group. Michigan had only 3.6 per cent in the high skill group as compared with 7.3 per cent in this group from other states. Seventy-nine and seven-tenths per cent of the Michigan respondents indicated they were in the low skill group while 59.3 per cent of the other states' respondents indicated they were in the low group.

In farm mechanics as a whole, Michigan respondents indicated a lower skill level than did respondents from other states, even though they had more participation in

both 4-H club activity in the farm mechanics clubs and in other shop work taken in high school. There was no significant difference in the amount of vocational agriculture or farm mechanics taken by the respondents.

Average skill level in each area of farm mechanics.-- The average skill level in each instructional area of farm mechanics was calculated for Michigan and other states. Michigan ranks lower in average skill level in all instructional areas of farm mechanics as shown in Table IX. The difference was very small in the soil and water management instructional area and largest in the farm structures and farm power and machinery areas. Soil and water

Table IX - The Average Skill Level in Each Area of Farm Mechanics

Area of Farm Mechanics	Michigan	Other States	Total
Farm shop	2.12	2.37	2.32
Farm structures	2.24	2.78	2.66
Rural electrification	1.52	2.02	1.91
Farm power and machinery	2.40	2.94	2.82
Soil and water management	1.08	1.14	1.13

management shows only a difference of .06 in the amount of skill while farm structures and farm power and machinery

show a difference of .54 in the skill level. Rural electrification shows a difference of .50 and farm shop shows a .25 difference.

Table IX also shows that on the average, all respondents are below the "can get by" level. The soil and water instructional area of farm mechanics appears to show the least development of skill in the respondent. The skill level for all of the respondents if 1.13. Rural electrificiation is next lowest with 1.91. The remaining three instructional areas are all above the "can't do" level with farm shop at 2.32, farm structures at 2.66 and farm power and machinery at the 2.82 level.

Population Evaluated by Skill Level

The skill level of the entire population was computed in each instructional area of farm mechanics. Comparisons with general information about the population point out some very interesting facts. Some of them would serve as good background material.

Age.--Age had no affect on the skill level in any of the instructional areas of farm mechanics when the group was divided into two age groups. The younger age group included all of those respondents nineteen years and younger while the older age group included those twenty years and older. Figure 1 compares the age groups in each skill level for all farm mechanics instructional areas.

Number of men on the farm.--There was no significant difference in the skill level of the respondents when the

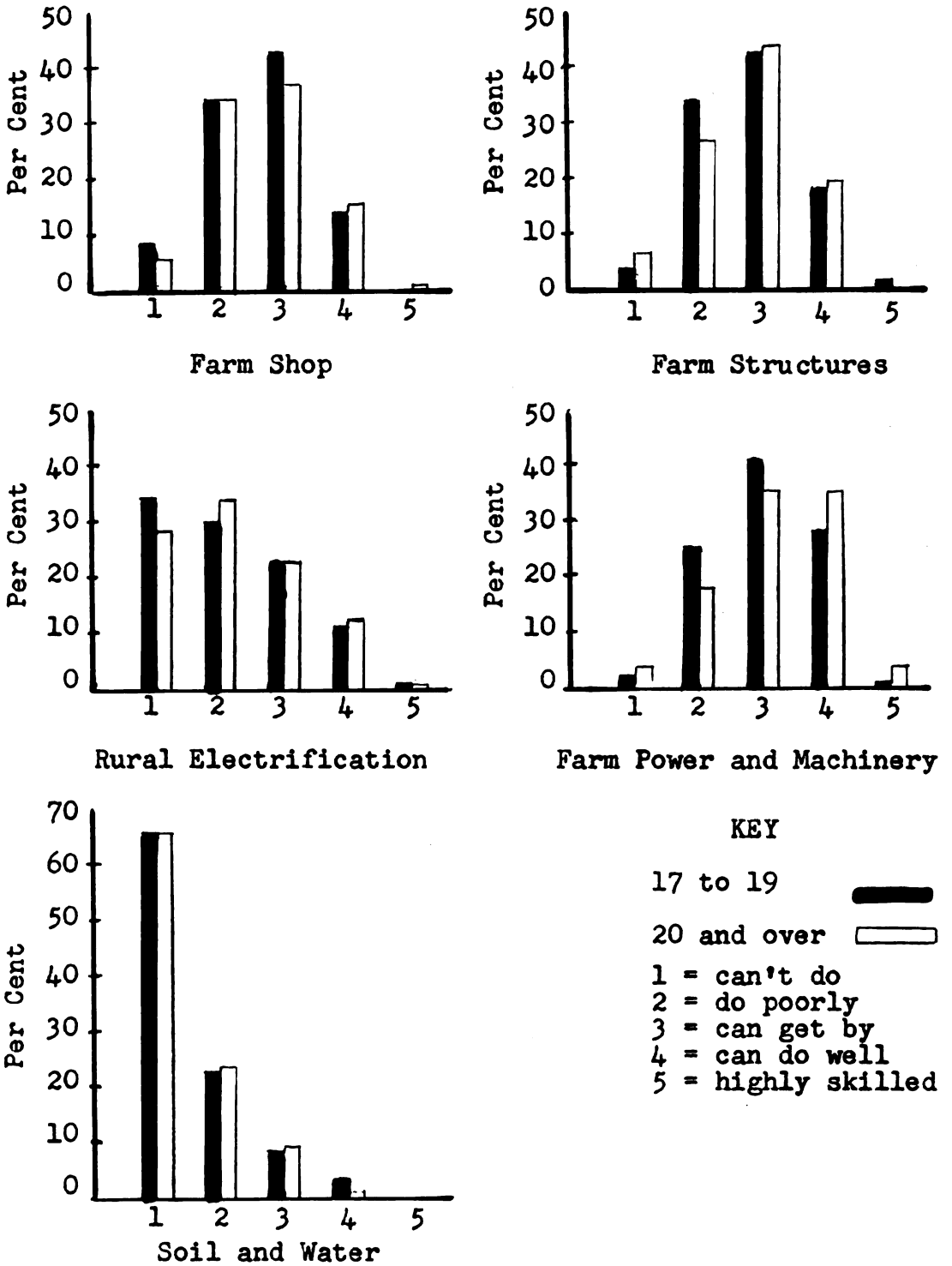

Figure 1 - A comparison of the skill level of the 17 to 19 age group with the 20 and over age group.

size of farm was small or large as indicated by the number of men working on the farm. The respondents from farms that had one or two men working full time were no different than those that had three or more men working full time. This was true in each instructional area of farm mechanics as indicated in Figure 2.

Vocational agriculture.--Whether or not the respondents had vocational agriculture in high school made no significant difference in the skill level. Each instructional area of farm mechanics bore this out. Figure 3 shows this graphically.

Separate course in farm mechanics.--Only the farm shop instructional area of farm mechanics showed any significant difference in skill level when the respondent had a separate course in farm mechanics in high school. This would seem to indicate that the high school farm mechanics courses were aimed primarily toward farm shop abilities and not toward farm mechanics as a whole. Figure 4 shows the percentage of respondents in each of the skill levels for both those who had separate courses in farm mechanics in high school and those who did not. The respondents who had separate farm mechanics courses in high school had a larger percentage in the higher skill levels in farm shop; while those that had not had such courses, placed more in the lower skill levels (if one takes their own judgements of skill levels as a basis of actual differences in skills).

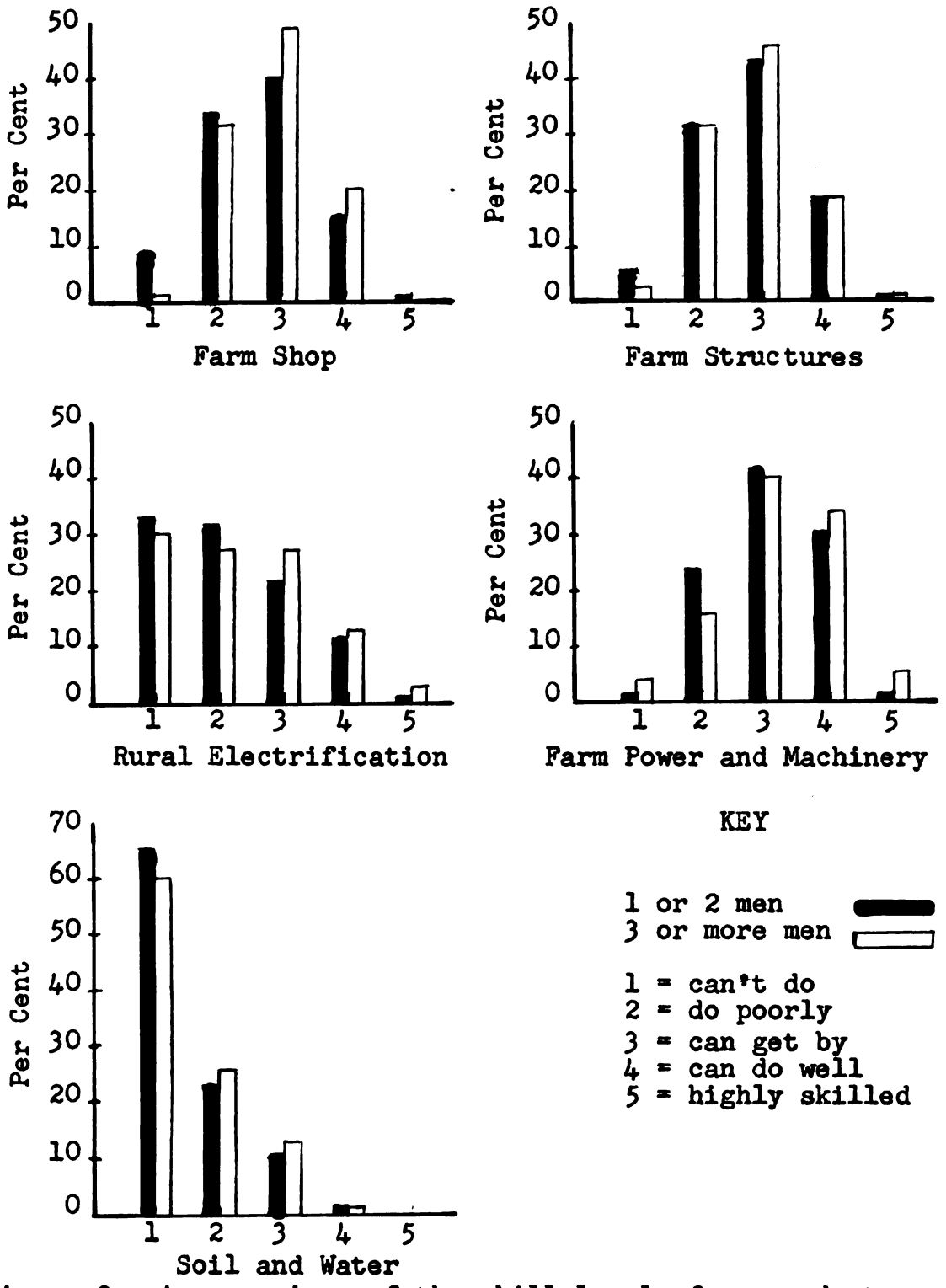

Figure 2 - A comparison of the skill level of respondents coming from farms where one or two men work full time and three or more men work full time.

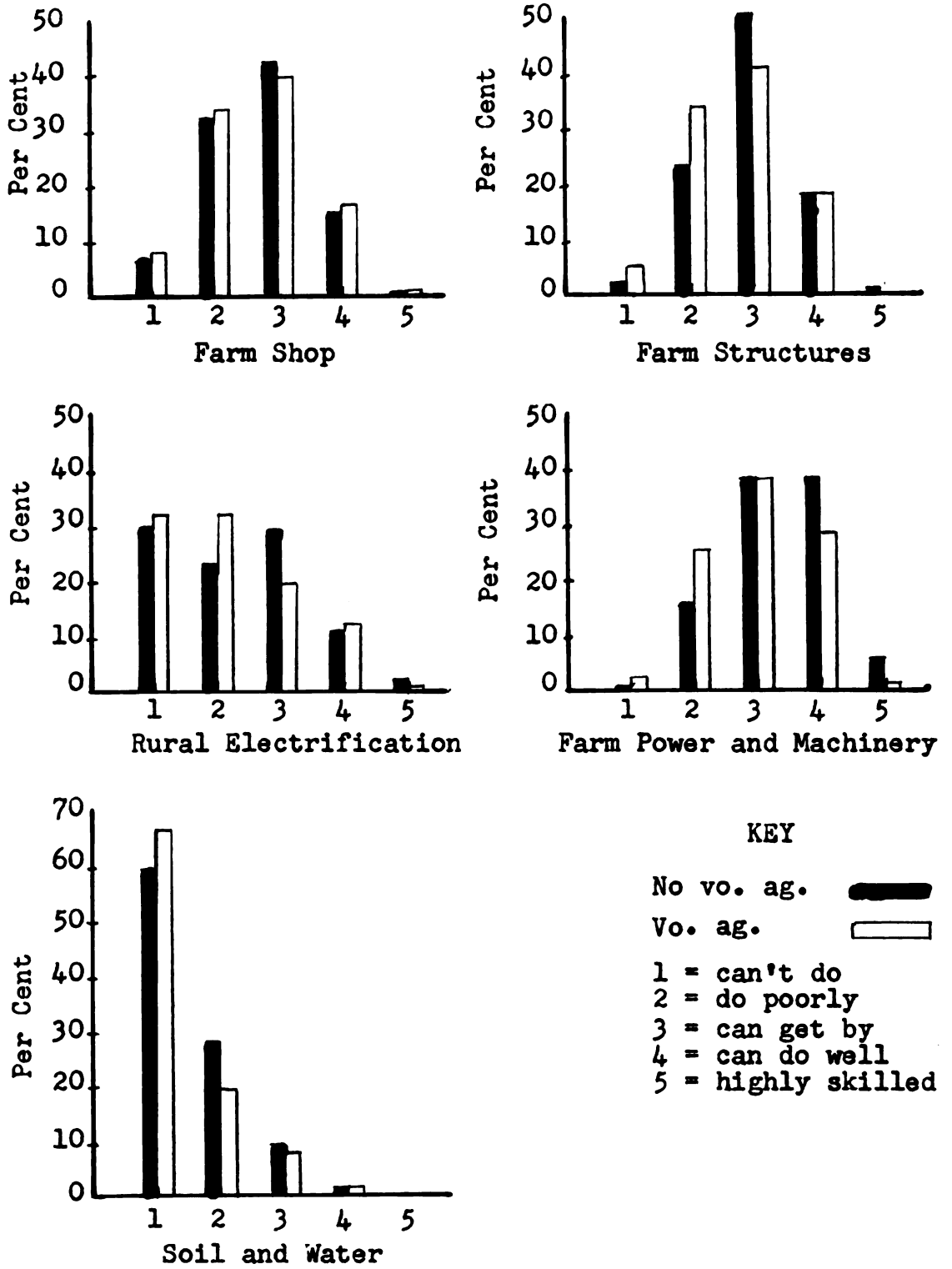

Figure 3 - A comparison of the skill level of respondents having and not having vocational agriculture.

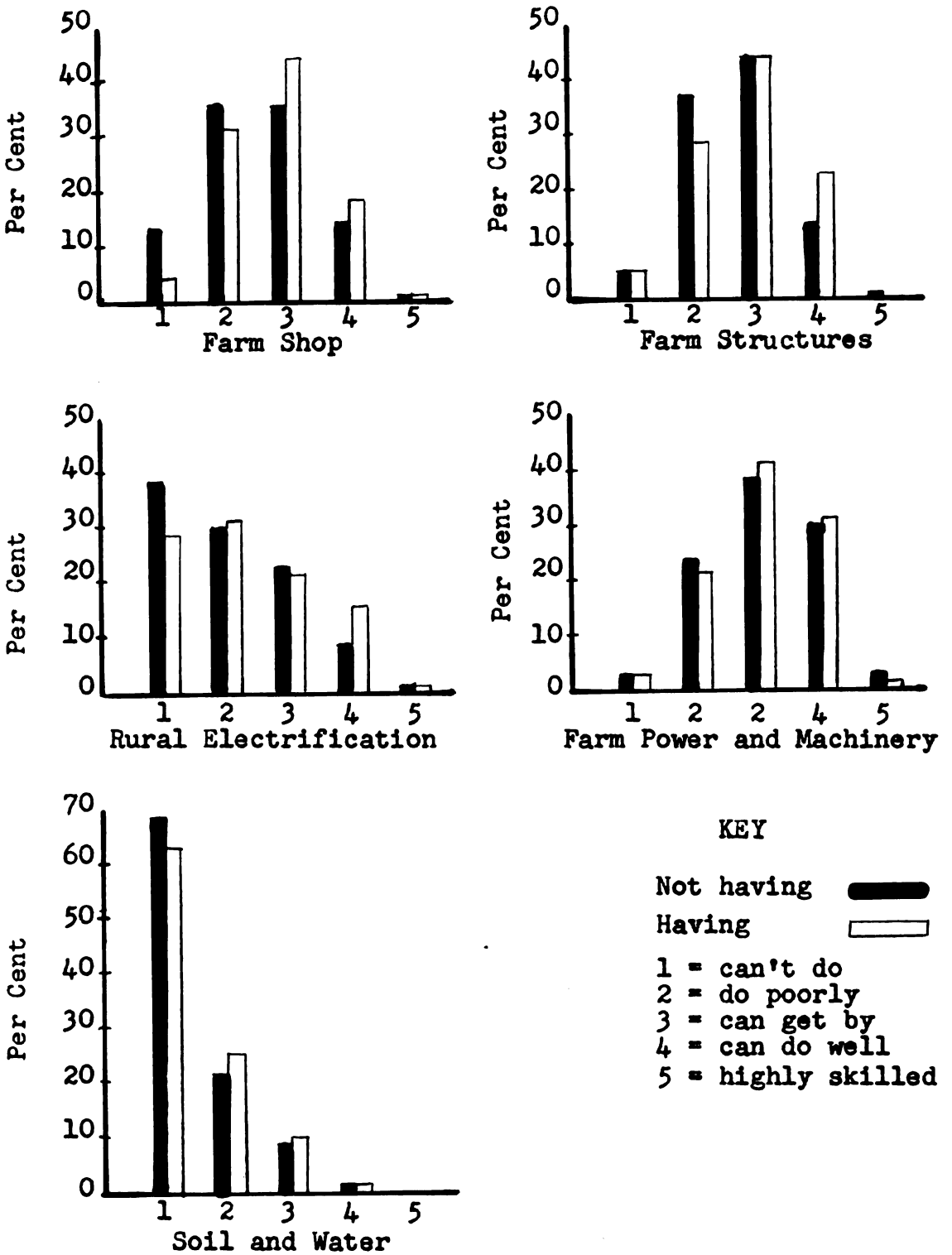

Figure 4 - A comparison of the skill level of respondents having and not having separate courses in farm mechanics.

All other areas show no significant difference.

Other shop in high school.--Shop courses in high school can be classified as general and specialized. Many schools teach a course known as general shop that is supposed to give the student a general background in all instructional areas of shop work before he takes some of the specialized courses. With this in mind, the general shop courses were evaluated in terms of four of the farm mechanics areas. It was felt that general shop would have little affect on soil and water management, so this instructional area was omitted from this section of the study.

Only the instructional area of rural electrification showed any significant difference on the skill of the respondents when general shop was taken. This was at the one per cent level. The other instructional areas of farm mechanics showed no significant difference when general shop was taken. This is shown graphically in Figure 5.

When we get into the instructional area of specialized shop, we find a much greater difference in the skill estimated by the respondents. Those that had taken metal shop in high school showed a higher skill level in the instructional area of farm shop than those that did not. Twenty-seven per cent of the respondents that had metal shop in high school were in the "can do well" category of skill, while only 13 per cent of those not having metal shop in high school were in this skill judgement group. Those not taking metal shop

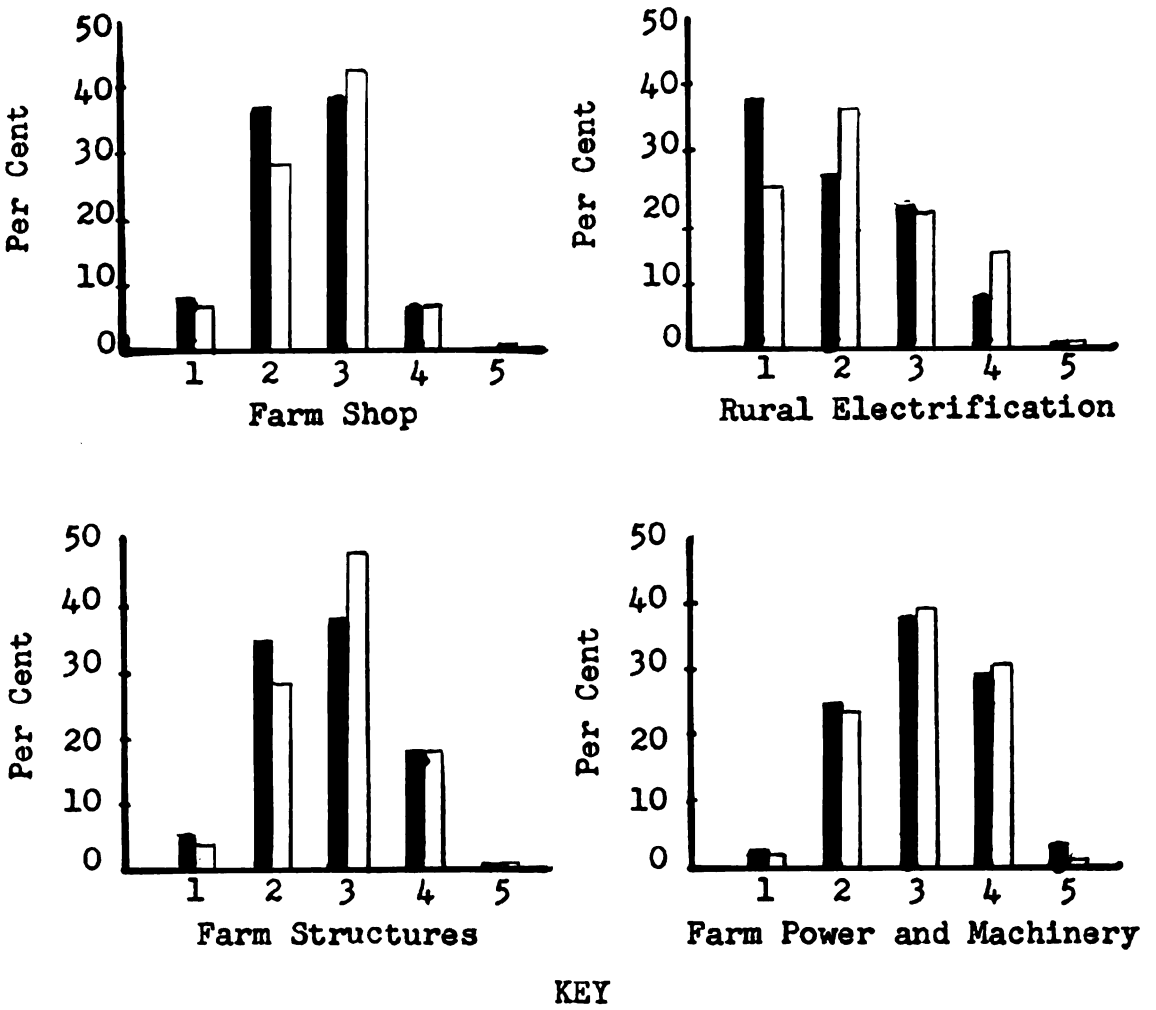

Figure 5 - A comparison of the skill level of respondents having and not having general shop in high school.

in high school had a higher percentage of respondents in the lower skill groups than did the metal shop group.

The differences in estimated skill in rural electrification between those taking electrical shop and those not taking it is highly significant. Figure 6 shows there is little difference in the percentage of respondents in the three middle skill groups for those that took electrical shop, but those that did not had 35 per cent in the lowest level and only ten per cent in the "can do well" group as compared to 15 per cent and 27 per cent respectively for those who had electrical shop.

Wood shop had no effect on the skill of the respondents in the instruction area of farm structures. Figure 6 indicates that about the same percentage of respondents were in a given skill group whether they had wood shop or not.

Auto mechanics affected the instructional area of farm power and machinery favorably in raising the level of estimated skill of the respondents as can be seen in Figure 6. Those having had a course in auto mechanics showed significantly more estimated skill than those that did not.

Other General Findings

A copy of the questionnaire can be found in Appendix A. It is pertinent at this time to point out that some of the data were not used in their entirety in this study. Some of them did not appear to be pertinent to the purposes of

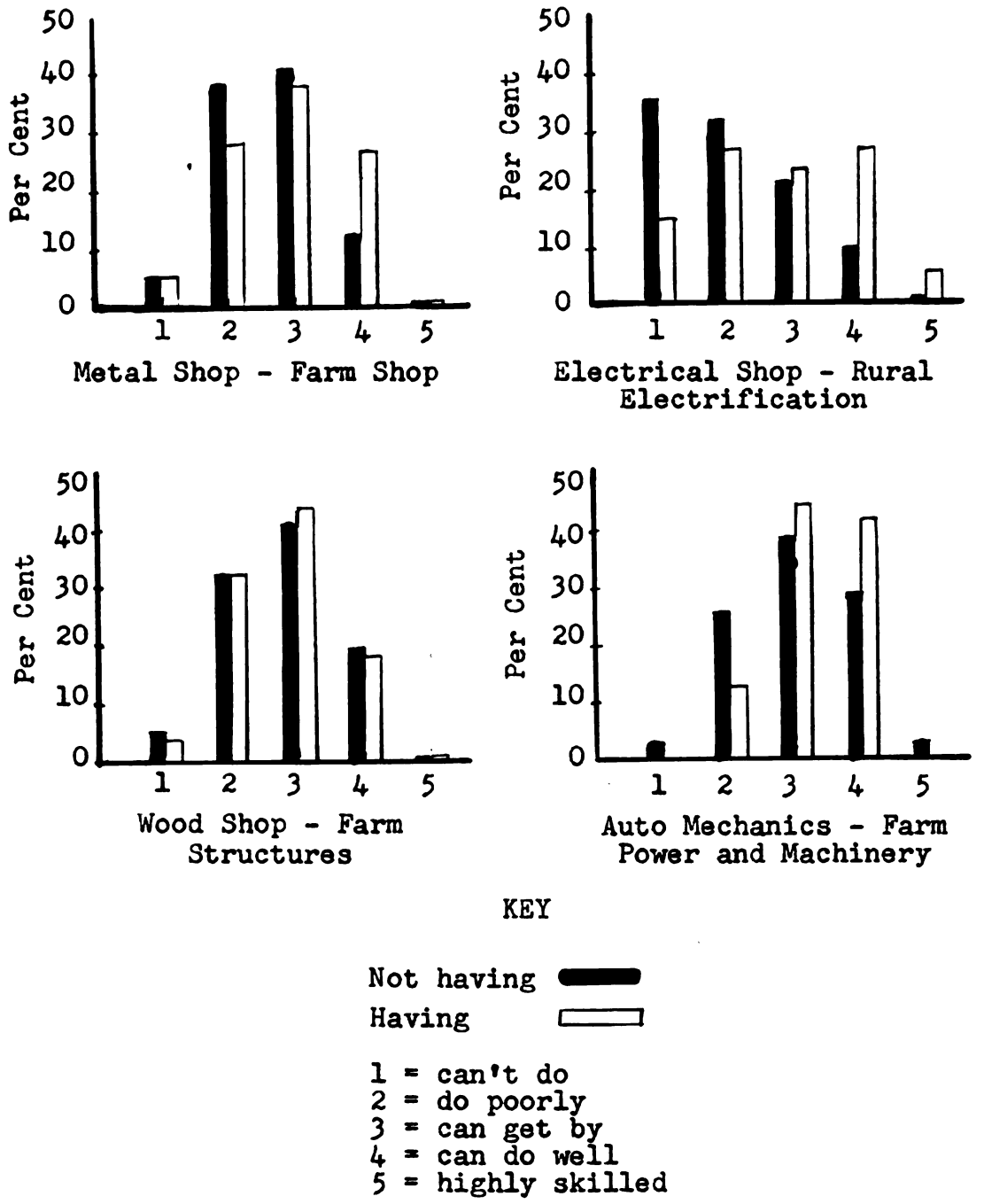

Figure 6 - A comparison of the skill level of respondents having and not having specialized shop courses in high school.

the study while others were incomplete and of little value in making comparisons.

The type of farm from which the respondent came was not directly associated with the skill of the respondents. The type of farming varied greatly with the state or section of the midwest. The Dakotas predominated in the production of livestock and cash crops, while the other states tended more toward dairy and general farming.

The size of farm in acres also appeared to have little value in the analysis of data. The farm in the western part of the region tended to be much larger where a similar number of men worked the farms. For this reason, the number of men working on the farm was used as the criterion for determining the size of the farming operation rather than acreage.

Question nine on the questionnaire in which the respondents indicated whether they had had any young farmer courses in farm mechanics and how many, did not appear to be of enough value to be included in the study. Only 40 had any class work in this area and 28 of them had only one year of young farmer instruction.

Performance of Abilities on the Farm

There appeared to be a relationship between the number of times an ability was performed on the farm and the number of times that respondents indicated they performed it. An inverse relationship would therefore be expected

between the number of times the ability was performed on the farm and the number of respondents that indicated they had never performed the ability. This is presented in Appendix B in its entirety.

Table X lists 35 abilities that were done less than twice a year on the farm. Twelve of the abilities were done less than once per year. Ten of the abilities performed less than once a year are in the instructional area of soil and water management. All four of the abilities that deal with irrigation were done the least number of times. They were also the ones that the least number of respondents performed on the farm and the greatest number of respondents indicated they had never performed. Over 90 per cent of the respondents had never performed the irrigation abilities. Only two abilities outside of the soil and water area were performed less than once a year. They are "Build laminated rafters" and "Wire with non-metalic cable."

Only three abilities done less than two times a year on the farm were performed by more than 50 per cent of the respondents as a part of their farming business. These were "Install an electrical ground," "Build a small building" and "Build a saw horse." On the other hand, there were 22 abilities that more than half of the respondents had never performed.

Table X - Abilities Performed Less Than Twice a Year on the Farm

Ability	Number of times ability is done each year	% of respondents doing ability on the farm	% of respondents never doing the ability
Farm Shop			
Temper tool steel	1.32	29.5	55.1
Farm Structures			
Build a small building	1.61	65.7	24.8
Build laminated rafters	.63	16.9	68.0
Build wood trusses	1.13	32.8	48.1
Build a saw horse	1.63	65.4	19.8
Spray paint a building	1.73	40.3	41.2
Rural Electrification			
Plan a wiring system	1.09	28.1	42.2
Select material used in wiring	1.59	34.4	34.0
Determine size of wire to use	1.68	34.7	33.1
Determine kind of wire to use	1.64	33.9	32.4
Install two way switches	1.79	43.5	29.4
Make a rat tail splice	1.76	37.9	39.8
Tie an Underwriter's knot	1.41	26.4	53.2
Wire a branch circuit	1.26	25.6	44.6
Install a ground	1.79	50.3	23.3
Wire with nonmetalic cable	.92	21.3	57.4
Change direction of rotation of electric motors	1.85	45.2	38.7
Farm Power and Machinery			
Overhaul a sprayer pump	1.79	3.03	52.5
Soil and Water Management			
Install tile drainage	1.26	27.5	51.1
Repair broken tile drains	1.58	35.5	50.0
Determine slope for tile line	.87	19.6	59.9
Determine slope for open ditch	.84	19.5	64.9
Select quality drain tile	1.03	18.3	57.6

Table X - Continued

Ability	Number of times ability is done each year	% of respondents doing ability on the farm	% of respondents never doing the ability
Remove sediment from ditches	1.31	30.3	58.0
Remove vegetation from ditches	1.58	33.2	54.2
Lay out terraces	.56	10.0	81.1
Construct sod waterways	1.60	33.7	51.7
Lay out contour lines	.85	14.5	76.2
Construct a farm pond	.31	10.3	80.2
Make a profile map	.70	23.7	70.0
Irrigate crops	.22	4.2	94.5
Select an irrigation system	.15	2.2	95.9
Determine when to irrigate	.27	4.2	94.7
Determine the amount of water to apply	.20	3.0	94.2

Those abilities performed more than five times a year appear in all of the instructional areas of farm mechanics with the exception of soil and water management. Table XI lists 20 abilities that were performed more than five times a year. Five of them are in the instructional area of farm shop, four in farm structures, three in rural electrification, and eight in the area of farm power and machinery. In all of the cases listed, more than 60 per cent of the respondents indicated they performed the ability on the farm. There are some abilities, however, done less than five times a year that more than 60 per cent of the

Table XI - Abilities Performed More Than Five Times a Year on the Farm

Ability	Number of times ability is done each year.	% of respondents doing ability on the farm	% of respondents never doing the ability
Farm Shop			
Sharpen edged tools	7.45	82.2	1.0
Select shop tools	5.42	68.9	3.4
Use shop tools properly	8.66	81.2	0.5
Replace handles in tools	5.09	80.0	2.9
Operate an arc welder	6.07	65.5	19.3
Farm Structures			
Identify common lumber	6.15	80.1	6.1
Saw a board to dimension	8.79	91.5	0.7
Use carpentry tools correctly	8.50	88.6	0.3
Set a corner post	6.04	85.3	3.5
Rural Electrification			
Lubricate electric motors	5.17	78.1	7.3
Read an electric meter	5.24	61.1	18.3
Know safety rules and precautions	6.14	71.9	9.2
Farm Power and Machinery			
Make tractor engine adjustments	6.43	82.4	4.2
Do simple repairs on tractor	7.34	87.7	0.7
Regap spark plugs	5.92	77.7	7.4
Service air cleaners	7.91	86.8	1.9
Service batteries	7.25	83.4	3.0
Maintain small engines	5.02	73.0	8.0
Make mower adjustments	5.29	77.9	7.5
Make operational adjustments on farm machinery	7.67	82.9	3.2

respondents performed on the farm as can be seen in Appendix B.

In two abilities which wer performed five or more times on the farm each year, more than ten per cent of the respondents had never performed them. These abilities were "Operate an arc welder" and "Read an electric meter." Appendix B indicates that there are some abilities that were done less than five times a year but have less than ten per cent of the respondents not doing the ability. There are only three of these however: "Maintain power tools," "Mix, place and finish concrete," and "Brush paint a building."

Abilities Usually Not Performed by Respondents

There were a number of abilities that a large portion of the young farmers did not perform in their farming business. It was felt that if less than half of the respondents performed an ability in their farming business, the ability should be identified and the question raised as to whether the ability was of sufficient importance to develop skill. The respondent may receive only enough instruction to understand the ability. If the ability was performed more than twice a year on the farm, it was felt the respondents should develop some skill in the ability. Appendix B shows all of the abilities with the number of times performed and the percentage of respondents doing the ability in the farming business.

Table XII - Abilities Performed by Less Than Fifty Per Cent of the Respondents and Performed More Than Twice Yearly on the Farm

Ability	% of respondents doing ability on the farm	Number of times ability is done each year
Farm Shop		
Sharpen shearing tools	36.4	2.58
Sharpen twist drills	48.7	3.75
Measure, cut and install fittings on copper pipe	37.6	2.14
Operate an oxyacetylene welder	34.7	2.32
Apply hard facing materials	30.0	2.11
Farm Structures		
Lay concrete blocks	39.6	2.12
Rural Electrification		
Use a test lamp	47.2	2.76
Inspect equipment for UL label	45.5	2.87
Farm Power and Machinery		
Time an engine	46.4	2.52
Adjust combine cylinder speed	49.6	3.55
Adjust valves	40.2	2.58
Soil and Water Management		
Maintain sod waterways	41.0	2.19
Use a farm level	43.7	3.06

Table XII shows those abilities that were done by less than 50 per cent of the respondents but performed more than twice a year on the farm. Of the 13 abilities

listed in Table XII, more than half of them would require special equipment to perform. This may help to indicate why the ability was not performed by the respondent in his farming business. Eight of the abilities are performed by 40 per cent or more of the respondents. The ability which the lowest percentage of respondents normally perform would require, in most cases, oxyacetylene welding equipment as would the next to the lowest ability listed.

The balance of the abilities that are performed by less than 50 per cent of the respondents are listed in Table XIII. All but five of the 32 abilities listed were in either the rural electrification or soil and water management instructional areas of farm mechanics. Only one ability is in the farm shop area, one in the farm power and machinery area, three in the farm structures area and eleven and sixteen in the rural electrification and soil and water management instructional areas respectively. Ten of the abilities in the soil and water instructional area are done less than one time per year on the farm.

When all of the abilities are considered, the instructional area of soil and water management has the greatest number of abilities which less than 50 per cent of the respondents perform on the farm. There are 18 of the 20 respondents in this category. This indicates that either they are not receiving enough instruction to perform the abilities or that these abilities are not needed

Table XIII - Abilities Performed by Less Than Fifty Per Cent of the Respondents and Performed Less than Twice Yearly on the Farm

Ability	% of respondents doing ability on the farm	Number of times ability is done each year
Farm Shop		
Temper tool steel	29.5	1.32
Farm Structures		
Build laminated rafters	19.9	.63
Build wood trusses	32.8	1.13
Spray paint a building	40.3	1.73
Rural Electrification		
Plan a wiring system	28.1	1.09
Select material used in wiring	34.4	1.59
Determine size of wire to use	34.7	1.68
Determine kind of wire to use	33.9	1.64
Install two way switches	43.5	1.79
Make a rat tail splice	37.9	1.76
Tie an Underwriter's knot	26.4	1.41
Wire a branch circuit	25.6	1.26
Wire with nonmetalic cable	21.3	.92
Change direction of rotation of electric motors	45.2	1.85
Change voltage of motors	20.1	1.28
Farm Power and Machinery		
Overhaul a sprayer pump	30.3	1.79
Soil and Water Management		
Install tile drainage	27.5	1.26
Repair broken tile drains	35.5	1.58
Determine slope for tile lines	19.6	.87
Determine slope for ditch	19.5	.84
Select quality drain tile	18.3	1.03

Table XIII - Continued

Ability	% of respondents doing ability on the farm	Number of times ability is done each year
Remove sediment from ditches	30.3	1.31
Remove vegetation from ditches	33.2	1.58
Lay out terraces	10.0	.56
Construct sod waterways	33.7	1.60
Lay out contour lines	14.5	.85
Construct a farm pond	10.3	.31
Make a profile map	23.7	.70
Irrigate crops	4.2	.22
Select an irrigation system	2.2	.15
Determine when to irrigate	4.2	.27
Determine the amount of water to apply	3.0	.20

by the respondents to as great a degree. The latter appears to be the best answer, in that the abilities are used much less than the other instructional area abilities.

Skill Level by Ability

The skill level of respondents in all 100 abilities is between 2.30 and 3.95 for everyone that has at least tried to perform the ability. The lowest score came in the instruction area of soil and water management with the highest score in the instructional area of farm power and machinery. "Select an irrigation system" had a score of 2.30 while "Service air cleaners" had the score of 3.95. The value for all 100 abilities can be found in Appendix C.

If we consider a score of from 2.50 to 3.49 as the "can-get-by" group, there are only eighteen abilities where the respondents indicated their skill was above this level. These abilities are listed in Table XIV. There are four in the farm shop instructional area, four in the farm structures area, three in the rural electrification area, and seven in the farm power and machinery area. There were no abilities that showed a skill level above "can-get-by" in the soil and water management instructional area of farm mechanics.

There is only one ability that showed a skill level below "can-get-by" when the respondents indicated they had at least tried to learn. This ability is "Select an irrigation system" in the soil and water management area of farm mechanics with a level of 2.30.

Where the Respondent Learned

The respondents indicated they learned many more abilities at home than they did at high school. Only in the instructional area of farm-shop did the respondents indicate they learned a larger share of the abilities listed on the questionnaire in high school. In the instructional areas of farm structures, rural electrification and soil and water management, all but two or three of the abilities were learned at home. All of the abilities in the farm power and machinery instructional area were

Table XIV - Abilities with a Skill Level Above 3.49

Ability	Skill level
Farm Shop	
Sharpen edged tools	3.58
Select shop tools	3.56
Use shop tools properly	3.66
Replace handles in tools	3.54
Farm Structures	
Saw a board to dimension	3.75
Use carpentry tools correctly	3.58
Brush paint a building	3.70
Set a corner post	3.90
Rural Electrification	
Lubricate electric motors	3.55
Read electric meter	3.62
Inspect equipment for UL label	3.55
Farm Power and Machinery	
Do simple repairs on tractor	3.66
Regap spark plugs	3.77
Service air cleaners	3.95
Service batteries	3.66
Lay engines up for winter	3.55
Make mower adjustments	3.55
Make operational adjustments on farm machinery	3.53

learned at home as indicated by the respondents. Table XV shows a summary of the abilities in the instructional areas of farm mechanics that were learned at home and at high school.

Appendix C lists the skill level of all the abilities for those who indicated they learned at home, high school

Table XV - Where Abilities were Learned

	Number learned at home	Number learned at school
Farm shop	9	11
Farm structures	17	3
Rural electrification	18	2
Farm power and machinery	20	0
Soil and water management	17	3
Total	81	19

or a combination of both. It also lists the average skill level for the abilities of all of the respondents. Many respondents could not decide whether they learned to perform an ability at home or high school. They checked both on the questionnaire, so a separate tabulation was made of them. In most cases, the combination of learning at home and at school provided the highest skill level of any means of learning. In some instances, the average skill level is either above or below all of the skill levels from home or school. This was brought about by some respondents signifying a skill in the ability, but then indicating they had not learned to perform the ability. These respondents usually indicated a rather low skill for the performance of the ability.

Each instructional area of farm mechanics seems to have its own peculiarities in this section of the study. Therefore, it will be presented by farm mechanics instructional areas.

Farm shop.--All but seven of the abilities in this instructional area follow the same pattern as far as the skill level and "Where learned" are concerned: the combination of high school and home was the highest and high school alone was the lowest. In six abilities, learning at home brought about the highest skill level. The ability "Apply hard facing material" showed a higher skill level when learned in high school than when learned at home. Table XVI shows this relationship for those abilities that do not follow the previously mentioned pattern.

Table XVI - Farm Shop Abilities Not Following the Regular Skill Level Pattern

Ability	Skill level when the respondent learned at: High School	Home	Both
Measure, cut and threat iron pipe	3.22	3.53	3.46
Measure, cut and install fittings on copper pipe	3.14	3.24	3.15
Temper tool steel	2.90	3.05	3.00
Apply hard facing material	2.94	2.81	3.07
Care for the arc welder	3.21	3.45	3.36
Sketch project plans	3.16	3.32	3.31

Farm structures.--The farm strcutures instructional area follows a pattern similar to that of the farm shop area. The combination of learning at home and at high school proved to reveal the highest skill level for the respondents in all but five cases. In four cases, the home proved to be better than the combination. These were the abilities to "Use carpentry tools correctly," "Brush paint a building," "Build a saw horse," and "Mix, place and finish concrete." In one case, the home and the combination were equal. This was "Select and use wood glue." "Use carpentry tools correctly" and "Brush paint a building" showed a higher skill level when learned in high school than the combination. In every case, the home facilities proved to be as good or better than any other to learn the farm structures abilities. Table XVII shows the relationship for those abilities not showing the combination as the highest skill level.

Table XVII - Farm Structures Abilities Not Following Regular Skill Level Pattern

Ability	Skill level when the respondent learned at: High School	Home	Both
Use carpentry tools correctly	3.55	3.62	3.51
Select and use wood glue	3.14	3.16	3.16
Build a saw horse	3.39	3.48	3.43
Mix, place and finish concrete	3.40	3.54	3.41
Brush paint a building	3.53	3.75	3.39

Rural electrification.--Only eight of the abilities in the rural electrification instructional area of farm mechanics showed the combination of learning at home and high school as providing the highest skill level. The home alone developed the highest skill level in the respondents for seven abilities and high school alone for five. Table XVIII shows that "Select material used in

Table XVIII - Rural Electrification Abilities Learned Better at Home or High School

Ability	Skill level when the respondent learned at: High School	Home	Both
Plan a wiring system	3.11	3.05	3.10
Select materials used in wiring	3.00	3.20	2.95
Determine size of wire to use	3.08	3.10	2.89
Determine kind of wire to use	3.14	3.05	3.06
Install a ground	3.30	3.28	3.14
Ground a machine	3.36	3.25	3.33
Read an electric meter	3.40	3.88	3.52
Know safety rules and precautions	3.32	3.56	3.50
Understand electrical terms	3.19	3.00	3.00
Use a test lamp	3.23	3.51	3.47
Inspect equipment for UL label	3.42	3.68	3.62
Know how electricity is made and distributed	3.18	3.33	3.12

wiring," "Determine size of wire to use," "Read an electric meter," "Know safety rules and precautions," "Use a test lamp," "Inspect equipment for UL label," and "Know how electricity is made and distributed" have the highest skill level when the respondents learned at home. "Plan a wiring system," "Determine kind of wire to use," "Install a ground," "Ground a machine," and "Understand electrical terms" were best learned in high school as indicated by the highest skill level. Five abilities showed a higher skill level when learned at high school or home than those indicating the combination.

Farm power and machinery.--The home was favored as the better place to learn farm power and machinery abilities. Ten of the abilities showed that the home was better than the combination of home and high school. Nine showed that the combination was the best and one, "Maintain small engines," had the same skill level for both home and the combination. When the combination was disregarded, only two abilities indicate more favorable learning at school. They were "Adjust carburetors" and "Calibrate seeding tools." Three abilities have a higher skill level when learned at home or high school individually than the combination. This relationship can be seen in Table XIX for those abilities that do not show the combination with the highest skill level.

Soil and water management.--The home is the best place to learn the soil and water abilities as indicated

Table XIX - Farm Power and Machinery Abilities Learned Better at Home or High School

Ability	Skill level when the respondent learned at: High School	Home	Both
Regap spark plugs	3.43	3.83	3.81
Time an engine	3.33	3.69	3.47
Adjust valves	3.13	3.55	3.50
Service air cleaners	3.91	3.98	3.24
Service batteries	3.69	3.92	3.68
Maintain small engines	3.38	3.48	3.48
Determine line of draft on plow	3.15	3.41	3.31
Make adjustments on the plow hitch	3.31	3.53	3.20
Adjust combine cylinder speed	3.09	3.62	3.40
Overhaul a sprayer pump	3.00	3.46	3.45
Determine size of belts	3.14	3.32	3.19

by the respondents skill level when they said they learned the ability at a given place. Fifteen of the abilities showed an equal or higher skill level when learned at home as compared to either the high school or a combination of home and high school. Two were learned better at high school and two were learned better by the combination. Table XX shows the skill level for the entire soil and water management area.

"Determine slope for tile line," "Determine slope for open ditch," and "Select quality drain tile" were the abilities that have the highest skill level when learned

Table XX - Skill Level for Soil and Water Management Abilities

Ability	Skill level when the respondent learned at: High School	Home	Both
Install tile drainage	3.25	3.26	3.10
Repair broken tile lines	2.75	3.47	3.20
Determine slope for tile lines	3.29	3.03	3.00
Determine slope for open ditch	3.28	3.17	3.00
Select quality drain tile	3.27	3.20	3.00
Remove sediment from ditches	3.20	3.39	3.25
Remove vegetation from ditches	3.00	3.48	3.29
Lay out terraces	3.00	3.22	3.33
Construct sod waterways	3.12	3.35	3.31
Lay out contour lines	3.03	3.32	3.00
Construct a farm pond	3.10	3.25	3.00
Maintain sod waterways	3.41	3.45	3.33
Use a farm level	3.11	3.59	3.69
Make a profile map	3.07	3.61	3.44
Make a map of the farm	3.35	3.44	3.44
Determine acreage of a field	3.27	3.50	3.44
Irrigate crops	3.13	3.50	--
Select an irrigation system	2.75	3.43	--
Determine when to irrigate	3.20	3.60	--
Determine the amount of water to apply	3.25	3.44	--

at school. "Lay out terraces" and "Use a farm level" show the highest skill level when learned in the combination of home and high school. All other abilities had an equal or

higher skill level when learned at home. The four irrigation abilities had no respondent indicating they learned by the combination means.

Summary.--It appears that the home is the better place to learn farm mechanics abilities when a choice of only home and high school is given. If all of the respondents would have chosen to indicate a combination, perhaps a much larger percentage would have chosen this answer. The question arises as to whether the practical experience a person receives when he does an ability along with his father or someone else on the farm is the most important thing in his mind, or if the background information that one receives in school to be put to work on the farm is important but forgotten when he is asked to recall where he first learned an ability. In any event, the respondents indicated that the home was the better place to learn most abilities by the skill they said they had in performing the ability and by indicating where they learned the ability.

Performing the Abilities

In every case, the respondents indicated they hired the ability done far more than it was done by either the farm family or the respondent. It appeared that this information would not be of much value in the analysis of data. Many times an ability is hired done as a part of a

major enterprise being carried through on the farm or is a minute item that is done incidentally along with another ability. In any event, the information received concerning the abilities that were hired done did not prove to be of much value.

A comparison of the abilities done by the farm family and those done by the respondent proved very interesting in some instances. Appendix D shows a comparison of the percentage that indicated the farm family performed the ability and the percentage that indicated that the respondent performed the ability in the farming business. The respondent could indicate that the ability was performed by either the farm family or the respondent or both. In many cases, both the respondent and the farm family performed the ability as a part of the farming business. Some important differences did appear however, that indicated that the respondent either had more skill in performing the ability than did the farm family, or this became one of the jobs that the respondent took over on the farm to free the farm family for other duties.

The most significant figures in Appendix D is the difference between the percentage figures of an ability. It was arrived at by subtracting the percentage of respondents who indicated that they performed the ability on the farm from the percentage who indicated the farm family performed the ability. When the difference is a plus value, the respondent performed the ability more in the farming

Table XXI - Abilities That Respondents Perform More Frequently Than the Farm Family

Ability	Difference
Operate an arc welder	+26.6
Recognize welding errors	+25.9
Make a map of the farm	+21.8
Care for arc welder	+18.5
Sketch project plans	+16.6
Regap spark plugs	+16.4
Make tractor engine adjustments	+16.2
Know how electricity is made and distributed	+14.1
Service air cleaners	+13.2
Build a small building	+13.0
Temper tool steel	+12.4
Select and use wood glue	+11.7
Do simple repairs on tractor	+11.2
Build a saw horse	+10.9
Lubricate electric motors	+10.5

operation than the farm family did. The opposite is true with the negative figure. It was found that the differences ran from -20.2 for "Select quality drain tile" to +26.6 for "Operate an arc welder." Table XXI lists the abilities that have a plus value of ten or more. There are 15 that fall into this group. Five of them are in the instructional area of farm shop, four in farm structures, two in rural electrification, four in farm power and machinery, and one in soil and water management. The three that deal with arc welding run almost 20 per cent higher for the respondent

than for the farm family. "Make a map of the farm" is also over 20 per cent higher at +21.8.

There are also several in which the farm family perform ten per cent or over more frequently than the respondent. These abilities are listed in Table XXII. There are six in this category with only one more than 20 per cent different. Three of the abilities are in the farm structures instructional area with one each in the instructional areas of farm shop, farm power and machinery and soil and water management.

Table XXII - Abilities That the Farm Family Perform More Frequently Than the Respondent

Ability	Difference
Select quality drain tile	-20.2
Lay out foundation lines	-15.5
Calibrate seeding tools	-14.1
Select shop tools	-13.9
Replace rotted sills and joists	-12.7
Lay concrete blocks	-10.2

When all of the positive figures were compared with the negative figures, we find there are 59 positive, 39 negative, and two even. This indicates that respondents perform more abilities more often than does the farm family.

Abilities Needing Further Instruction

It has been assumed that the abilities selected by

the agricultural engineers teaching the basic courses in each of the farm mechanics instructional areas at Michigan State University are the ones that young farmers should know. If this is the situation, those abilities having a low skill level are the ones that need further instruction. It should also be pointed out that some abilities would be taught not to develop skill, but that an understanding of the ability would be made by the student.

Three factors were used in determining what abilities need further instruction in either the agricultural short courses or the young farmer classes. They are the number of times the ability was performed on the farm, the percentage of respondents or farm families that performed the ability on the farm, and the skill level of the respondents when they indicated they had learned the ability. The first two factors would isolate the abilities that farmers should be able to perform. The third would indicate which would require more instruction.

Performance on the farm.--Not all of the 100 abilities were performed on the farm to any significant degree. Those performed less than twice a year would not necessarily have to be learned by the farmer. He may choose to have some of these abilities hired done.

The abilities were separated into two groups with those performed twice a year and more being included in the group that should receive instruction. The instructional

areas of farm shop and farm power and machinery had 19 abilities each that were performed more than twice a year. Farm structures had 15, rural electrification had eight, and soil and water management had four in this category.

Abilities performed by the farm family.--The group of abilities performed more than twice a year were analyzed further to determine if the abilities were performed by the farm family or the respondent, or if they were hired done. Those abilities that were performed on the farm by over half of the farm families or the respondents should be recognized as the abilities the young farmer should be able to perform.

Of the 19 abilities in the farm shop instructional area, 14 were done on the farm by over 50 per cent of the respondents or farm families. Fourteen of the 15 in the farm structures area were in this category, as were six of the eight in rural electrification, 17 of the 19 in farm power and machinery, and two of the four in soil and water management. App. E lists all abilities that should be taught.

Skill level of the respondents.--The young farmers should be able to perform the abilities on the farm well if they are to make this a part of their farming business. Therefore, any of the abilities performed on the farm frequently enough to warrant the farmer learning the ability, should be developed so that the farmer could do the ability well. This would mean that the ability should show an

Table XXIII - Farm Mechanics Abilities Needing Additional Instruction at the Young Farmer Level

Farm Shop
Maintain power tools
Cut and form sheet metal
Solder sheet metal used on the farm
Measure, cut and thread iron pipe
Cut and thread steel rods
Identify kinds of iron and steel
Operate an arc welder
Recognize welding errors
Care for an arc welder
Sketch project plans
Farm Structures
Identify common lumber
Read building plans
Construct common wood joints
Select and use wood glue
Use wood connectors and fasteners
Lay out foundation lines
Cut and erect rafters
Replace rotted joists and sills
Mix, place and finish concrete
Construct forms for concrete
Rural Electrification
Ground a machine
Know safety rules and precautions
Understand electrical terms
Know how electricity is made and distributed
Farm Power and Machinery
Make tractor engine adjustments
Adjust carburetors
Maintain small engines
Determine line of draft of a plow
Make adjustments on a plow hitch
Adjust combine cylinder speed
Calibrate seeding tools
Fit bearings to farm machinery
Determine size of pulleys
Determine size of belts
Soil and Water Management
Determine acreage of a field

average skill level of at least 3.5. Table XXIII shows the abilities that require additional instruction. They were performed at least twice per year on the farm, by at least half of the respondents or the farm families, and have a skill level below 3.5. There were ten abilities in each of the instructional areas of farm power and machinery, farm shop, and farm structures. There were only four in rural electrification and one in soil and water management.

Skill with Four Years of Vocational Agriculture

In order to evaluate the Michigan program of farm mechanics in vocational agriculture, it was felt that only those respondents who had taken all of the vocational agriculture available in high school should be considered. Those students who had four years of vocational agriculture were isolated and their skill level was determined for each farm mechanics instructional area. Those data may be seen in Figure 7. As reported earlier in this chapter, there was no significant difference in the percentage of respondents taking four years of vocational agriculture in Michigan and other states.

There was no significant difference in the responses from Michigan and other states in the instructional areas of farm structures and soil and water management. There was a difference that was highly significant in the instructional areas of farm shop, rural electrification, and

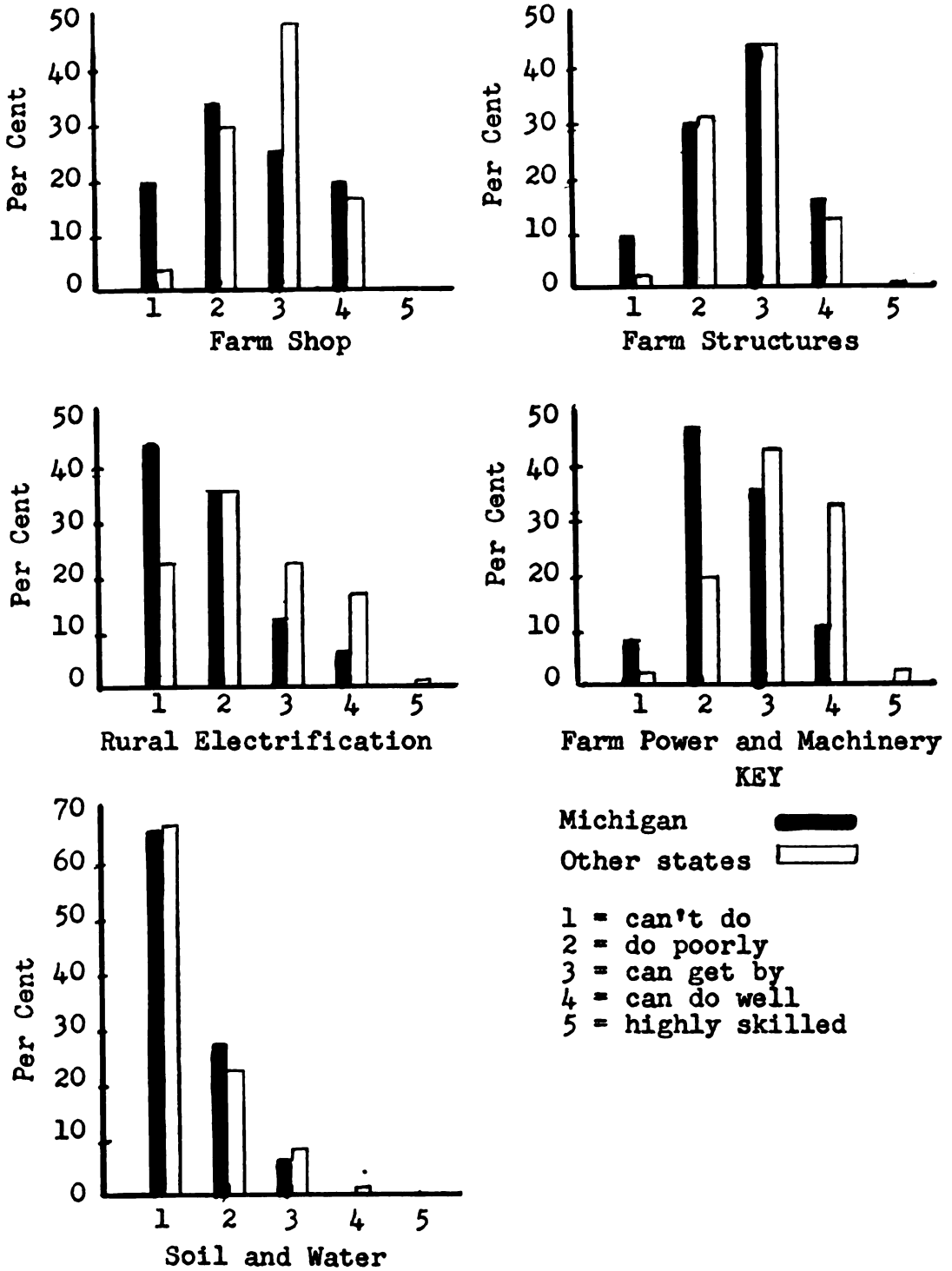

Figure 7 - A comparison of the skill level of respondents from Michigan and other states that had four years of vocational agriculture.

farm power and machinery. In each of the instructional areas where there was a difference, Michigan had more students in the lower skill levels and fewer in the higher skill levels than did the other states. In the farm power and machinery instructional area, the differences were the greatest. Michigan had 44.7 per cent of respondents in the "do poorly" level while the other states had only 20.2 per cent. On the other hand, Michigan had only 10.6 per cent in the "can do well" level and the other states had 32.9 per cent.

Rural electrification was the next to be considered for significance. Michigan had 44.7 per cent of its responses in the "can't do" level of skill and 36.2 per cent in the "do poorly" group. This leaves only 19.1 per cent in and above the "can get by" group. On the other hand, the other states had 39.9 per cent in the "can get by" and above group. Only 23.5 per cent of the respondents indicated they were in the "can't do" group.

The major differences appearing in the farm shop instructional area were in the "can't do" and the "can get by" categories. Michigan respondents indicated 19.6 per cent and 26.0 per cent in the respective groups while the other states had 4.0 per cent and 49.1 per cent respectively.

In all but the farm structures instructional area, Michigan respondents indicated that their skill level was predominantly below the "can get by" level. Fifty per cent

or more of the respondents indicated that their skill level was in the "can't do" or "do poorly" classification in the instructional areas of farm power and machinery, farm shop, soil and water management, and rural electrification. For the other states, this was true for only the soil and water management and the rural electrification instructional areas.

Summary of Important Findings

1. The Michigan respondents were younger and came from smaller farms than did the respondents from other states. They also had more vocational agriculture and the same amount of separate courses in farm mechanics, other shop, and 4-H farm mechanics clubs. The Michigan respondents had a lower skill level than the other states.

2. The skill level of the respondents was not affected by age, number of men on the farm or vocational agriculture. Only the instructional area of farm shop was affected by a separate course in farm mechanics. Specialized courses in shop affected the skill level of the respondents in the farm mechanics instructional area that was closely related.

3. Thirty-five abilities were performed less than twice a year on the farm with 12 of them being done less than once per year. Twenty abilities were performed more than five times a year. Twenty-two abilities that were

performed less than twice a year had never been performed by more than half of the respondents, while all of the abilities that were done more than five times a year were done by over 60 per cent of the respondents on the farm. Forty-five abilities are performed on the farm by less than 50 per cent of the respondents.

4. The skill level of the respondents in the 100 abilities is between 2.30 and 3.95. Eighteen abilities are in the "can do well" level and above, while only one is in the "do poorly" and below level.

5. The respondents indicated that a combination of learning at home and high school produced the highest skill level in the greatest number of abilities. Learning at home produced a higher skill level in more abilities than did learning at high school.

6. The respondents indicated they performed 59 abilities more frequently than the farm family did on the farm while the farm family performed 39 more frequently than the respondents did. Two abilities were performed equally by both groups.

7. Fifty-two of the 100 abilities were found to be important for the farmer to perform on the farm. Thirty-five of the 52 need more instruction if the respondent is to perform them well.

8. The Michigan respondents had significantly less ability than the other states in all areas but soil and water management when they had four years of vocational agriculture.

CHAPTER V

SUMMARY, GENERALIZATIONS AND IMPLICATIONS

This study surveyed the opinions of 406 young farmers enrolled in the basic courses in Agricultural Engineering in seven midwestern states. The respondents were enrolled in agricultural short courses in agricultural colleges. The survey was made with a questionnaire administered by an instructor in each of the institutions. The data were tabulated by machine process.

The purposes of the study were (1) to determine the degree in which farm mechanics is used by the farmers, (2) to determine the degree of skill in farm mechanics abilities that students entering short course have, (3) to determine what abilities need further instruction at the short course or young farmer level, and (4) to compare the skill of Michigan students in farm mechanics with the skill of students in other states, thus to determine the need for changes in the Michigan farm mechanics program in vocational agriculture.

Summary of Findings

1. Frequency of performance on the farm varied with the abilities:

a. Thirty-five of the 100 abilities were performed less than twice a year on the farm with 12 of them being done less than once per year. Twenty-two of these had not been performed by over half of the respondents.

b. Twenty abilities were performed more than five times per year. All of these were done by over 60 per cent of the respondents on the farm.

c. Forty-five of the 100 abilities were performed between two and five times per year on the farm.

2. The respondents indicated a combination of learning at home and at high school resulted in the highest skill level in the greatest number of abilities. In a majority of cases, abilities learned mostly at home resulted in a higher level of skill than learning the same ability at school. One of the studies reviewed also indicated that students learned more from a so-called "pick-up" method at home than they did at school.

3. Respondents indicated they learned 81 of the 100 abilities at home while 19 were learned at school.

4. Respondents indicated they performed 59 of the 100 abilities more frequently than the farm family did on the farm, while the farm family performed 39 more frequently than the respondents did. Two abilities were performed equally by both groups.

5. The skill level of the respondents in the 100 abilities is between 2.30 and 3.95. Eighteen abilities can be performed adequately while only one is performed unsatisfactorily.

6. Thirty-five of the 52 abilities that were found important needed further instruction at the young farmer and short course level. There were ten each in the instructional areas of farm shop, farm structures, and farm power and machinery, four in rural electrification, and one in soil and water management. These were computed on the basis of frequency of use on the farm, the percentage of farmers performing them and the skill level of the respondents. Other studies reviewed indicated many abilities should be taught, but many at the high school level.

7. The skill level of the respondents was not affected by age, number of men on the farm or courses in vocational agriculture. Only the skill level of the farm shop instructional area was associated with separate courses in farm mechanics. Specialized courses in shop affected the skill level of the respondents in the instructional area most closely related to the course.

8. The Michigan respondents were younger and came from farms utilizing fewer farm workers than did the respondents from other states. They also had more courses in vocational agriculture. The two groups were similar

in the number of separate courses in farm mechanics and other shop courses, 4-H farm mechanics clubs, and the number of students taking four years of vocational agriculture.

9. When respondents had had four years of vocational agriculture, those from Michigan had significantly less skill than those from other states in all instructional areas but soil and water management.

Generalizations

The findings of this study and the studies reviewed in Chapter II seem to point to some general conclusions for which implications for educational programs will be based. These generalizations are true for this population and likely to be true for other youth who are enrolling in short courses in our agricultural colleges. Such young farmers may be a select group since they are seeking to improve themselves in these educational programs.

1. The abilities more frequently performed on the home farm were those that young farmers could do with greater skill. The abilities not commonly done, but included in the survey, are low in skill level.

2. Learning at home develops a higher skill in the students for performing the abilities. This may be a result of more practice on the part of the student when he

can perform the ability at home. There is an indication that the student may get the basic information about the ability some where else. But when he reports where he had learned the ability, the home was the most important item.

3. Farmers perform many farm mechanics abilities on the farm, but young farmers enrolled in short courses in college perform more abilities than other members of their farm families. Young farmers report they learned more abilities at home than they did at high school, but the data indicate they performed more abilities than are used by the farm family. This would indicate young farmers receive instruction somewhere else and complete their learning by practicing on the home farm. It may also indicate that once the young farmer learns some abilities, it becomes his responsibility to perform them on the home farm.

4. Young farmers perform, at a low level of skill, most of the farm mechanics abilities that are important in terms of use on the farm. This would indicate they are learning something about the abilities before they are ready for agricultural short courses or young farmer classes. They could use more instruction in many of them if they are to do them adequately.

5. Specialized courses in shop develop more skill in the performance of abilities than the more generalized courses.

6. Michigan high school graduates who have completed four years of vocational agriculture do not have the skill to perform abilities in farm mechanics that similar graduates from other states have. This is an indication they are not learning as much from the farm mechanics program in vocational agriculture as students from other states.

Implications for Instructional Program

The conclusions of this study indicate some implications for instructional programs in farm mechanics. Some of these are substantiated by other studies as reviewed in Chapter II.

1. Use of abilities on the farm is related to skill level. Courses in farm mechanics should reflect the needs of students in their farming business. The abilities in farm mechanics that are used most by farmers should be taught so farmers can do them well. This may require that farm mechanics being taught to young farmers, either in short course or young farmer classes, be based upon the needs of young farmers. These abilities should then be developed so that the young farmer can do them well. An evaluation of instructional methods used in classes where young farmers learn farm mechanics may be desirable to see if their needs are being met. Since the initial skill of the class members would vary along with the importance of

abilities for young farmer, young farmer classes should be taught on more of an individual basis.

Respondents indicated they learned more abilities and achieved a higher skill level when they learned on the home farm. This would also indicate that the teacher of young farmer classes should work more closely with the young farmer on the home farm so the young farmer could develop his skill under the direction of the teacher.

2. Since the young farmer performs more abilities on the farm than the farm family does, young farmers have introduced new abilities to the farm family. This would indicate that new practices in farm mechanics should be taught to both high school and young farmer students. This does not concur with the above implication, but abilities appearing to be future approved farm mechanics practices should be introduced and, in some cases, developed to the degree so the student can perform them well.

It also appears, since the respondent performs more abilities than the farm family does, that when the young farmer learns to perform an ability; he takes over the practice of it on the farm to relieve the farm family for other duties. In this case, he must develop enough skill so the ability can be performed well.

3. The level of skill of young farmers surveyed in this study is low. Therefore, improved techniques should

be considered in instructional programs so that the student may develop enough skill for the adequate performance of the ability. This would require that the student get more experience in the performance of the ability. This may be provided in the classroom or on the farm under the supervision of a well qualified vocational agriculture teacher. It may also require that the number of abilities now being taught in farm mechanics courses be reduced so that the student can develop a higher degree of skill. Of the 52 abilities found to be important for the farmer to perform, 35 needed additional instruction at the young farmer level.

4. Since students who had specialized courses in shop developed a higher degree of skill, specialized instruction with more time devoted to it will be necessary if higher levels of skill are desired. This may require teachers to limit the number of abilities they teach and provide the student with more instruction and practice time. Thus, students may develop more skill in the performance of the abilities they learn.

5. Michigan respondents had a lower skill level in all areas of farm mechanics but soil and water management, when compared to the other states. It may be desirable to study the programs offered in the other states to determine what differences exist between them and the Michigan program. An evaluation of these differences may

prove beneficial to the Michigan program of farm mechanics in vocational agriculture.

Areas where additional studies are needed:

1. Methods used by teachers of vocational agriculture in teaching farm mechanics.

2. Content of separate courses in farm mechanics.

3. The amount of practice time needed by students to perform farm mechanics abilities adequately.

4. How students learn farm mechanics abilities.

5. A comparison of the Michigan program of farm mechanics with those from other midwestern states.

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APPENDIX

State _____

1. Name _____ Age _____

2. What is the major source of income from your farming business? (Check one) Dairy ___ Livestock ___ Poultry ___ Cash crops ___

3. What is the size of the farm? _____ Acres

4. How many men work full time on the farm where you work? ___

5. What grades did you enroll in vocational agriculture? (Check those that apply) None ___ 9th ___ 10th ___ 11th ___ 12th ___

6. What grades did you have farm mechanics taught by the vocational agriculture teacher? (Check those that apply) None ___ 9th ___ 10th ___ 11th ___ 12th ___

7. How many years of each of these shop courses have you had in high school? General shop ___ Wood shop ___ Metal shop ___ Auto mechanics ___ Electrical shop ___ Farm shop ___ Mechanical drawing ___ Other (Specify) _____

8. How many years have you been active in the following 4-H Clubs? Electrical ___ Tractor maintenance ___ Handicraft ___ Soil and water ___

9. Have you ever enrolled in a young farmer class where farm mechanics was taught? No ___ Yes ___ Number of years ___

10. Have you ever taken any agricultural engineering in short course before this term? No ___ Yes ___ Number of courses ___

INSTRUCTIONS:

Please complete the following three pages of abilities using your best judgement. Check column 1 showing how often <u>each</u> ability is used in your farming business whether you own the farm, work on your father's farm, or work on another farm. In column 2, check who does <u>each</u> ability. Some of the abilities may be done by you and the farm family, you and hired done, the farm family and hired done, or by all three groups of people. Check column 3 only if you have learned to use the ability; check <u>only once</u> where you have learned the most about the ability. In column 4, circle the number that best indicates how well you can perform <u>each</u> ability. The key is at the top of the column.

ABILITIES	How often each year is this done in your farming business? (Check one for each ability) Over 10	6 to 10	1 to 5	Less than 1	Never	Who does this in your farming business? (Check 1 or more for each ability) No one	Hired done	Farm family	You	Where did you learn to do this? (Check no more than once for each ability) Non-farm work	Short course	High school	Home	How well can you do this? 0=never tried 1=can't do 2=do poorly 3=can get by 4=can do well 5=highly skilled
EXAMPLES:														
1. Saw a board to dimension. . .		✓						✓	✓				✓	0-1-2-(3)-4-5
2. Overhaul a tractor.				✓			✓							(0)-1-2-3-4-5
3. Weld iron castings.			✓					✓				✓		0-1-(2)-3-4-5
4. Drill holes in metal.	✓								✓			✓		0-1-2-3-(4)-5
5. Build a farm pond					✓	✓								(0)-1-2-3-4-5
FARM SHOP														
1. Sharpen edged tools (knives,ax)														0-1-2-3-4-5
2. Sharpen shearing tools. . . .														0-1-2-3-4-5
3. Select shop tools														0-1-2-3-4-5
4. Use shop tools properly . . .														0-1-2-3-4-5
5. Sharpen twist drills.														0-1-2-3-4-5
6. Maintain power tools.														0-1-2-3-4-5
7. Cut and form sheet metal. . .														0-1-2-3-4-5
8. Solder sheet metal used on farm														0-1-2-3-4-5
9. Replace handles in tools. . .														0-1-2-3-4-5
10. Measure,cut & thread iron pipe														0-1-2-3-4-5
11. Measure, cut & install fittings on copper pipe . .														0-1-2-3-4-5
12. Cut & thread steel rods . . .														0-1-2-3-4-5
13. Temper tool steel														0-1-2-3-4-5
14. Identify kinds of iron & steel														0-1-2-3-4-5
15. Operate an arc welder														0-1-2-3-4-5
16. Operate an oxyacetylene welder														0-1-2-3-4-5
17. Apply hard facing materials .														0-1-2-3-4-5
18. Recognize welding errors. . .														0-1-2-3-4-5
19. Care for the arc welder . . .														0-1-2-3-4-5
20. Sketch project plans.														0-1-2-3-4-5

ABILITIES	1 How often? Over 10	6 to 10	1 to 5	Less than 1	Never	2 Who does? No one	Hired done	Farm family	You	3 Where learned? Non-farm work	Short course	High school	Home	4 How well done 0=never tried 1=can't do 2=do poorly 3=can get by 4=can do well 5=highly skilled
FARM STRUCTURES														
1. Identify common lumber. . . .														0-1-2-3-4-5
2. Saw a board to dimension. . .														0-1-2-3-4-5
3. Use carpentry tools correctly														0-1-2-3-4-5
4. Read building plans														0-1-2-3-4-5
5. Construct common wood joints.														0-1-2-3-4-5
6. Select and use wood glue. . .														0-1-2-3-4-5
7. Use wood connectors and fasteners														0-1-2-3-4-5
8. Lay out foundation lines. . .														0-1-2-3-4-5
9. Cut & erect rafters														0-1-2-3-4-5
10. Build a small building. . . .														0-1-2-3-4-5
11. Build laminated rafters . . .														0-1-2-3-4-5
12. Build wood trusses.														0-1-2-3-4-5
13. Build a saw horse														0-1-2-3-4-5
14. Replace rotted joists & sills														0-1-2-3-4-5
15. Mix, place & finish concrete.														0-1-2-3-4-5
16. Lay concrete blocks														0-1-2-3-4-5
17. Construct forms for concrete.														0-1-2-3-4-5
18. Spray paint a building. . . .														0-1-2-3-4-5
19. Brush paint a building. . . .														0-1-2-3-4-5
20. Set a corner fence post . . .														0-1-2-3-4-5
RURAL ELECTRIFICATION														
1. Plan a wiring system.														0-1-2-3-4-5
2. Select material used in wiring														0-1-2-3-4-5
3. Determine size of wire to use														0-1-2-3-4-5
4. Determine kind of wire to use														0-1-2-3-4-5
5. Install two way switches. . .														0-1-2-3-4-5
6. Make a rat tail splice. . . .														0-1-2-3-4-5
7. Tie an Underwriter's knot . .														0-1-2-3-4-5
8. Wire a branch circuit														0-1-2-3-4-5
9. Install a ground.														0-1-2-3-4-5
10. Wire with nonmetalic cable. .														0-1-2-3-4-5
11. Ground a machine.														0-1-2-3-4-5
12. Lubricate electric motors . .														0-1-2-3-4-5
13. Change direction of rotation of electric motors.														0-1-2-3-4-5
14. Change voltage of motors. . .														0-1-2-3-4-5
15. Read an electric meter. . . .														0-1-2-3-4-5
16. Know safety rules and precautions														0-1-2-3-4-5
17. Understand electrical terms .														0-1-2-3-4-5
18. Use a test lamp														0-1-2-3-4-5
19. Inspect equipment for UL label														0-1-2-3-4-5
20. Know how electricity is made and distributed														0-1-2-3-4-5

ABILITIES	1 How often? Over 10	6 to 10	1 to 5	Less than 1	Never	2 Who does? No one	Hired done	Farm family	You	3 Where learned? Non-farm work	Short course	High school	Home	4 How well done? 0=never tried 1=can't do 2=do poorly 3=can get by 4=can do well 5=highly skilled
FARM POWER AND MACHINERY														
1. Make tractor engine adjustment														0-1-2-3-4-5
2. Do simple repairs on tractor.														0-1-2-3-4-5
3. Regap spark plugs														0-1-2-3-4-5
4. Time an engine.														0-1-2-3-4-5
5. Adjust carburetors.														0-1-2-3-4-5
6. Adjust valves														0-1-2-3-4-5
7. Service air cleaners.														0-1-2-3-4-5
8. Service batteries														0-1-2-3-4-5
9. Maintain small engines. . . .														0-1-2-3-4-5
10. Lay engines up for winter . .														0-1-2-3-4-5
11. Determine line of draft on plow														0-1-2-3-4-5
12. Make adjustments on the plow hitch														0-1-2-3-4-5
13. Make mower adjustments. . . .														0-1-2-3-4-5
14. Adjust combine cylinder speed														0-1-2-3-4-5
15. Overhaul a sprayer pump . . .														0-1-2-3-4-5
16. Make operational adjustments on farm machinery														0-1-2-3-4-5
17. Calibrate seeding tools . . .														0-1-2-3-4-5
18. Fit bearings to farm machinery														0-1-2-3-4-5
19. Determine size of pulleys . .														0-1-2-3-4-5
20. Determine size of belts . . .														0-1-2-3-4-5
SOIL AND WATER MANAGEMENT														
1. Install tile drainage														0-1-2-3-4-5
2. Repair broken tile drains . .														0-1-2-3-4-5
3. Determine slope for tile line														0-1-2-3-4-5
4. Determine slope for open ditch														0-1-2-3-4-5
5. Select quality drain tile . .														0-1-2-3-4-5
6. Remove sediment from ditches.														0-1-2-3-4-5
7. Remove vegetation from ditches														0-1-2-3-4-5
8. Lay out terraces.														0-1-2-3-4-5
9. Construct sod waterways . . .														0-1-2-3-4-5
10. Lay out contour lines														0-1-2-3-4-5
11. Construct a farm pond														0-1-2-3-4-5
12. Maintain sod waterways. . . .														0-1-2-3-4-5
13. Use a farm level.														0-1-2-3-4-5
14. Make a profile map.														0-1-2-3-4-5
15. Make a map of the farm. . . .														0-1-2-3-4-5
16. Determine acreage of a field.														0-1-2-3-4-5
17. Irrigate crops.														0-1-2-3-4-5
18. Select an irrigation system .														0-1-2-3-4-5
19. Determine when to irrigate. .														0-1-2-3-4-5
20. Determine the amount of water to apply.														0-1-2-3-4-5

APPENDIX B

A Comparison of the Number of Times the Abilities Were Done on the Farm with the Percentage of Respondents who had Never Done the Ability and the Percentage of Respondents Who had Indicated They Performed the Ability on the Farm.

	% of respondents doing ability on the farm	% of respondents never doing the ability	Number of times ability is done each year.
Farm Shop Abilities			
Sharpen edged tools	82.3	.99	7.45
Sharpen shearing tools	36.4	36.45	2.58
Select shop tools	68.9	3.45	5.42
Use shop tools properly	81.3	.49	8.66
Sharpen twist drills	48.8	27.59	3.75
Maintain power tools	68.5	7.14	4.95
Cut and form sheet metal	53.0	27.34	2.73
Solder sheet metal used on the farm	54.3	25.86	2.76
Replace handles in tools	80.1	2.96	5.09
Measure, cut and thread iron pipe	58.1	18.76	4.16
Measure, cut and install fittings on copper pipe	37.7	36.45	2.14
Cut and thread steel rods	54.9	24.88	3.61
Temper tool steel	29.6	55.17	1.32
Identify kinds of iron and steel	57.4	23.65	3.54
Operate an arc welder	65.5	19.31	6.07
Operate an oxyacetylene welder	34.7	40.15	2.32
Apply hard facing material	30.0	48.28	2.11
Recognize welding errors	66.7	19.95	4.55
Care for arc welder	50.5	35.35	3.55
Sketch project plans	64.3	17.77	3.52
Farm Structures Abilities			
Identify common lumber	80.1	4.75	6.15
Saw a board to dimension	91.5	.72	8.79
Use carpentry tools correctly	88.6	.25	8.50
Read building plans	64.2	16.71	3.18
Construct common wood joints	69.4	12.97	4.71
Select and use wood glue	58.7	18.47	2.88
Use wood connectors and fasteners	59.0	20.00	3.87

APPENDIX B - Continued

	% of respondents doing ability on the farm	% of respondents never doing the ability	Number of times ability is done each year
Lay out foundation lines	51.7	19.65	2.05
Cut and erect rafters	50.7	22.02	2.36
Build a small building	65.7	24.87	1.61
Build laminated rafters	16.9	68.02	.63
Build wood trusses	32.8	48.21	1.13
Build a saw horse	65.4	19.84	1.63
Replace rotted joists and sills	52.0	23.61	2.16
Mix, place and finish concrete	71.6	9.00	3.41
Lay concrete blocks	39.6	35.09	2.12
Construct forms for concrete	64.4	13.81	2.68
Spray paint a building	40.3	41.21	1.73
Brush paint a building	80.8	4.52	3.51
Set a corner post	85.3	3.50	6.04
Rural Electrification Abilities			
Plan a wiring system	28.1	42.21	1.09
Select material used in wiring	34.4	34.08	1.59
Determine size of wire to use	34.7	33.17	1.68
Determine kind of wire to use	33.9	32.49	1.64
Install two way switches	43.5	29.47	1.79
Make a rat tail splice	37.9	39.80	1.76
Tie an Underwriter's knot	26.4	53.20	1.41
Wire a branch circuit	25.6	44.67	1.26
Install a ground	50.3	23.35	1.79
Wire with non-metalic cable	21.3	57.40	.92
Ground a machine	52.0	25.06	2.08
Lubricate electric motors	78.1	7.38	5.17
Change direction of rotation of electric motors	45.2	38.73	1.85
Change voltage of motors	20.1	65.65	1.28
Read an electric meter	61.1	18.34	5.24
Know safety rules and precautions	71.9	9.28	6.14
Understand electrical terms	60.6	23.39	3.48
Use a test lamp	47.2	38.78	2.76
Inspect equipment for UL label	45.5	40.15	2.87
Know how electricity is made and distributed	60.3	23.65	2.38

Appendix B - Continued

	% of respondents doing ability on the farm	% of respondents never doing the ability	Number of times ability is done each year
Farm Power and Machinery Abilities			
Make tractor engine adjustments	82.4	4.24	6.43
Do simple repairs on tractor	87.6	.75	7.34
Regap spark plugs	77.7	7.46	5.92
Time an engine	46.4	26.50	2.52
Adjust carburetors	74.9	5.47	4.55
Adjust valves	40.2	28.36	2.58
Service air cleaners	86.8	1.99	7.91
Service batteries	83.4	3.00	7.25
Maintain small engines	73.0	8.02	5.02
Lay engines up for winter	65.4	16.37	3.61
Determine line of draft on plow	63.5	19.70	3.11
Make adjustments on the plow hitch	80.1	5.75	4.64
Make mower adjustments	77.9	7.50	5.29
Adjust combine cylinder speed	49.6	29.00	3.55
Overhaul a sprayer pump	30.3	52.55	1.79
Make operational adjustments on farm machinery	82.9	3.26	7.67
Calibrate seeding tools	58.6	16.58	4.27
Fit bearings to farm machinery	62.0	15.01	3.88
Determine size of pulleys	60.8	20.15	3.16
Determine size of belts	61.3	19.90	3.06
Soil and Water Abilities			
Install tile drainage	27.5	51.12	1.26
Repair broken tile drains	35.5	50.00	1.58
Determine slope for tile lines	19.6	59.95	.87
Determine slope for open ditch	19.5	64.98	.84
Select quality drain tile	18.3	57.64	1.03
Remove sediment from ditches	30.3	58.08	1.31
Remove vegetation from ditches	33.2	54.29	1.58
Lay out terraces	10.0	81.16	.56
Construct sod waterways	33.7	51.77	1.60
Lay out contour lines	14.5	76.20	.85
Construct a farm pond	10.3	80.20	.31
Maintain sod waterways	41.0	46.56	2.19

Appendix B - Continued

	% of respondents doing ability on the farm	% of respondents never doing the ability	Number of times ability is done each year
Use a farm level	43.7	44.19	3.06
Make a profile map	23.7	70.03	.70
Make a map of the farm	60.0	25.70	2.01
Determine acreage of a field	64.2	15.15	4.11
Irrigate crops	4.2	94.50	.22
Select an irrigation system	2.2	95.99	.15
Determine when to irrigate	4.2	94.74	.27
Determine the amount of water to apply	3.0	94.23	.20

APPENDIX C

The Skill Level of Those Who Tried to Learn the Ability

Ability	Ave.	H.S.	Home	Both
Farm Shop				
Sharpen edged tools	3.58	3.30	3.42	3.64
Sharpen shearing tools	3.01	2.98	3.05	3.09
Select shop tools	3.56	3.43	3.60	3.74
Use shop tools properly	3.66	3.57	3.68	3.79
Sharpen twist drills	3.04	2.98	3.13	3.50
Maintain power tools	3.33	2.37	3.46	3.50
Cut and form sheet metal	2.99	3.00	2.86	3.29
Solder sheet metal used on the farm	3.04	3.26	2.97	3.41
Replace handles in tools	3.54	3.53	3.54	3.88
Measure, cut and thread iron pipe	3.41	3.22	3.53	3.46
Measure, cut and install fittings on copper pipe	3.11	3.14	3.24	3.15
Cut and thread steel rods	3.47	3.33	3.52	3.67
Temper tool steel	2.87	2.90	3.05	3.00
Identify kinds of iron and steel	2.80	2.65	2.91	2.95
Operate an arc welder	3.36	3.25	3.45	3.67
Operate an oxyacetylene welder	3.13	3.15	2.91	3.20
Apply hard facing material	2.86	2.94	2.81	3.07
Recognize welding errors	3.12	3.07	3.25	3.23
Care for arc welder	3.29	3.21	3.45	3.36
Sketch project plans	3.22	3.16	3.32	3.31
Farm Structures				
Identify common lumber	3.09	3.09	3.15	3.18
Saw a board to dimension	3.75	3.60	3.75	3.77
Use carpentry tools correctly	3.58	3.55	3.62	3.51
Read building plans	3.12	3.09	3.09	3.36
Construct common wood joints	3.12	3.06	3.17	3.24
Select and use wood glue	3.15	3.14	3.16	3.16
Use wood connectors and fasteners	3.21	3.09	3.32	3.39
Lay out foundation lines	3.09	2.92	3.14	3.18
Cut and erect rafters	3.31	3.15	3.25	3.28
Build a small building	3.24	3.16	3.22	3.31
Build laminated rafters	3.10	2.92	3.19	3.50
Build wood trusses	3.14	3.15	3.19	3.40

Appendix C - Continued

Ability	Ave.	H.S.	Home	Both
Build a saw horse	3.41	3.39	3.48	3.43
Replace rotted joists and sills	3.35	2.73	3.30	3.41
Mix, place and finish concrete	3.42	3.40	3.54	3.41
Lay concrete blocks	3.15	2.90	3.27	3.29
Construct forms for concrete	3.29	3.11	3.34	3.43
Spray paint a building	3.48	3.18	3.54	3.86
Brush paint a building	3.70	3.53	3.75	3.39
Set a corner post	3.90	3.50	3.91	4.00
Rural Electrification				
Plan a wiring system	3.15	3.11	3.05	3.10
Select materials used in wiring	3.12	3.00	3.20	2.95
Determine size of wire to use	3.14	3.08	3.10	2.89
Determine kind of wire to use	3.10	3.14	3.05	3.06
Install two way switches	3.27	3.22	3.14	3.31
Make a rat tail splice	3.17	3.10	3.27	3.80
Tie an Underwriter's knot	3.13	3.14	3.28	3.33
Wire a branch circuit	3.13	2.89	3.16	3.67
Install a ground	3.26	3.30	3.28	3.14
Wire with nonmetalic cable	3.05	2.96	3.26	4.00
Ground a machine	3.34	3.36	3.25	3.33
Lubricate electric motors	3.55	3.22	3.34	3.52
Change direction of rotation of electric motors	3.47	3.25	3.55	3.69
Change voltage of motors	3.31	3.26	3.53	4.17
Read an electric meter	3.62	3.40	3.88	3.52
Know safety rules and precautions	3.45	3.32	3.56	3.50
Understand electrical terms	2.98	3.19	3.00	3.00
Use a test lamp	3.36	3.23	3.51	3.47
Inspect equipment for UL label	3.55	3.42	3.68	3.62
Know how electricity is made and distributed	3.19	3.18	3.33	3.12
Farm Power and Machinery				
Make tractor engine adjustments	3.41	3.38	3.40	3.47
Do simple repairs on tractor	3.66	3.51	3.57	3.59

Appendix C - Continued

Ability	Ave.	H.S.	Home	Both
Regap spark plugs	3.77	3.43	3.83	3.81
Time an engine	3.35	3.33	3.69	3.47
Adjust carburetors	3.33	3.35	3.33	3.46
Adjust valves	3.41	3.13	3.55	3.50
Service air cleaners	3.95	3.91	3.98	3.24
Service batteries	3.66	3.69	3.92	3.68
Maintain small engines	3.44	3.38	3.48	3.48
Lay engines up for winter	3.55	3.31	3.56	3.71
Determine line of draft on plow	3.32	3.15	3.41	3.31
Make adjustments on the plow hitch	3.46	3.31	3.53	3.20
Make mower adjustments	3.55	3.36	3.53	3.77
Adjust combine cylinder speed	3.48	3.09	3.62	3.40
Overhaul a sprayer pump	3.49	3.00	3.46	3.45
Make operational adjustments on farm machinery	3.54	3.43	3.53	3.74
Calibrate seeding tools	3.37	3.40	3.37	3.52
Fit bearings to farm machinery	3.41	3.21	3.40	3.50
Determine size of pulleys	3.25	3.19	3.30	3.61
Determine size of belts	3.23	3.14	3.32	3.19
Soil and Water				
Install tile drainage	3.26	3.25	3.26	3.10
Repair broken tile lines	3.25	2.75	3.47	3.20
Determine slope for tile line	3.09	3.29	3.03	3.00
Determine slope for open ditch	3.17	3.28	3.17	3.00
Select quality drain tile	3.20	3.27	3.20	3.00
Remove sediment from ditches	3.38	3.20	3.39	3.25
Remove vegetation from ditches	3.40	3.00	3.48	3.29
Lay out terraces	3.05	3.00	3.22	3.33
Construct sod waterways	3.33	3.12	3.35	3.31
Lay out contour lines	3.06	3.03	3.32	3.00
Construct a farm pond	3.21	3.10	3.25	3.00
Maintain sod waterways	3.55	3.41	3.45	3.33
Use a farm level	3.45	3.11	3.59	3.69

Appendix C - Continued

Ability	Ave.	H.S.	Home	Both
Make a profile map	3.14	3.07	3.61	3.44
Make a map of the farm	3.26	3.35	3.44	3.44
Determine acreage of a field	3.42	3.27	3.50	3.44
Irrigate crops	3.21	3.13	3.50	--
Select an irrigation system	2.30	2.75	3.43	--
Determine when to irrigate	3.21	3.20	3.60	--
Determine the amount of water to apply	3.00	3.25	3.44	--

Appendix D

The Per Cent of Farm Families and Respondents Performing the Abilities as a Part of the Farming Business

Ability	Farm Family	Respondent	Difference Farm Family-Respondent
Farm Shop			
Sharpen edged tools	81.5	82.3	+ .8
Sharpen shearing tools	44.1	36.4	- 7.7
Select shop tools	82.8	68.9	-13.9
Use shop tools properly	80.5	81.3	+ .8
Sharpen twist drills	44.3	48.8	+ 4.5
Maintain power tools	67.5	68.5	+ 1.0
Cut and form sheet metal	50.7	53.0	+ 2.3
Solder sheet metal used on the farm	52.2	54.3	+ 2.1
Replace handles in tools	73.4	80.1	+ 6.7
Measure, cut and thread iron pipe	67.2	58.1	- 9.1
Measure, cut and install fittings on copper pipe	45.8	37.7	- 8.1
Cut and thread steel rods	50.5	54.9	+ 4.4
Temper tool steel	17.2	29.6	+12.4
Identify kinds of iron and steel	54.7	57.4	+ 2.7
Operate an arc welder	38.9	65.5	+26.6
Operate an oxyacetylene welder	28.6	34.7	+ 6.1
Apply hard facing materials	20.4	30.0	+ 9.6
Recognize welding errors	41.8	66.7	+25.9
Care for arc welder	32.0	50.5	+18.5
Sketch project plans	47.7	64.3	+16.6
Farm Structures			
Identify common lumber	81.3	80.1	- 1.2
Saw a board to dimension	82.9	91.5	+ 8.6
Use carpentry tools correctly	83.3	88.6	+ 5.5
Read building plans	67.9	64.2	- 3.7
Construct common wood joints	63.2	69.4	+ 6.2
Select and use wood glue	47.0	58.7	+11.7
Use wood connectors and fasteners	58.2	59.0	+ .8

Appendix D - Continued

Ability	Farm Family	Respondent	Difference Farm Family-Respondent
Lay out foundation lines	67.2	51.7	-15.5
Cut and erect rafters	57.2	50.7	- 6.5
Build a small building	52.7	65.7	+13.0
Build laminated rafters	23.9	16.9	- 7.0
Build wood trusses	39.6	32.8	- 6.8
Build a saw horse	54.5	65.4	+10.9
Replace rotted joists and sills	64.7	52.0	-12.7
Mix, place and finish concrete	73.6	71.6	- 2.0
Lay concrete blocks	49.8	39.6	-10.2
Construct forms for concrete	69.4	64.4	- 5.0
Spray paint a building	37.3	40.3	+ 3.0
Brush paint a building	71.4	80.8	+ 9.4
Set a corner post	81.3	85.3	+ 4.0
Rural Electrification			
Plan a wiring system	35.4	28.1	- 7.3
Select materials used in wiring	43.5	34.4	- 9.1
Determine size of wire to use	41.5	34.7	- 6.2
Determine kind of wire to use	40.5	33.9	- 6.6
Install two way switches	41.2	43.5	+ 2.3
Make a rat tail splice	34.7	37.9	+ 3.2
Tie an Underwriter's knot	23.6	26.4	+ 2.8
Wire a branch circuit	30.7	25.6	- 5.1
Install a ground	50.0	50.3	+ .3
Wire with nonmetalic cable	23.1	21.3	- 1.8
Ground a machine	51.8	52.0	+ .2
Lubricate electric motors	69.6	78.1	+10.5
Change direction of rotation of electric motors	39.9	45.2	+ 5.3
Change voltage of motors	27.9	20.1	- 7.8
Read an electric meter	57.3	61.1	+ 3.8
Know safety rules and precautions	70.1	71.9	+ 1.8
Understand electrical terms	50.8	60.6	+ 9.8
Use a test lamp	41.2	47.2	+ 8.0
Inspect equipment for UL label	36.2	45.5	+ 9.3
Know how electricity is made and distributed	46.2	60.3	+14.1

Appendix D - Continued

Ability	Farm Family	Respondent	Difference Farm Family-Respondent
Farm Power and Machinery			
Make tractor engine adjustments	46.2	82.4	+16.2
Do simple repairs on tractor	76.4	87.6	+11.2
Regap spark plugs	61.3	77.7	+16.4
Time an engine	38.7	46.4	+ 7.7
Adjust carburetors	67.7	74.9	+ 7.2
Adjust valves	40.7	40.2	- .5
Service air cleaners	73.7	86.9	+13.2
Service batteries	74.4	83.4	+ 9.0
Maintain small engines	68.7	73.0	+ 4.3
Lay engines up for winter	65.3	65.4	- .1
Determine line of draft on plow	63.3	63.5	+ .2
Make adjustments on the plow hitch	71.7	80.1	+ 8.4
Make mower adjustments	73.4	77.9	+ 4.5
Adjust combine cylinder speed	59.3	49.6	- 9.7
Overhaul a sprayer pump	37.5	30.3	- 7.2
Make operational adjustments on farm machinery	81.6	82.9	+ 1.3
Calibrate seeding tools	72.7	58.6	-14.1
Fit bearings to farm machinery	69.0	62.0	- 7.0
Determine size of pulleys	62.3	60.8	- 1.5
Determine size of belts	61.3	61.3	0.0
Soil and Water			
Install tile drainage	35.0	27.5	- 7.5
Repair broken tile drains	45.0	35.5	- 9.5
Determine slope for tile lines	25.5	19.6	- 5.9
Determine slope for open ditch	23.5	19.5	- 4.0
Select quality drain tile	38.5	18.3	-20.2
Remove sediment from ditches	30.0	30.3	+ .3
Remove vegetation from ditches	34.2	33.2	- 1.0
Lay out terraces	11.3	10.0	- 1.3
Construct sod waterways	36.5	33.7	- 2.8
Lay out contour lines	15.3	14.5	- .8
Construct a farm pond	9.8	10.3	+ .4

Appendix D - Continued

Abilities	Farm Family	Respondent	Difference Farm Family-Respondent
Maintain sod waterways	41.0	41.0	0.0
Use a farm level	39.7	43.7	+ 4.0
Make a profile map	14.5	23.7	+ 8.8
Make a map of the farm	38.2	60.0	+21.8
Determine acreage of a field	61.0	64.2	+ 3.2
Irrigate crops	3.5	4.2	+ .7
Select an irrigation system	3.5	2.2	- 1.3
Determine when to irrigate	3.5	4.2	+ .7
Determine the amount of water to apply	3.5	3.0	- .5

APPENDIX E

Farm Mechanics Abilities That Should be Learned by Young Farmers

Farm Shop

Sharpen edged tools
Select shop tools
Use shop tools properly
Maintain power tools
Cut and form sheet metal
Solder sheet metal used on the farm
Replace handles in tools
Measure, cut and thread iron pipe
Cut and thread steel rods
Identify kinds of iron and steel
Operate an arc welder
Recognize welding errors
Care for the arc welder
Sketch project plans

Farm Structures

Identify common lumber
Saw a board to dimension
Use carpentry tools correctly
Read building plans
Construct common wood joints
Select and use wood glue
Use wood connectors and fasteners
Lay out foundation lines
Cut and erect rafters
Replace rotted joists and sills
Mix, place and finish concrete
Construct forms for concrete
Brush paint a building
Set a corner fence post

Rural Electrification

Ground a machine
Lubricate electric motors
Read an electric meter
Know safety rules and precautions
Understand electrical terms
Know how electricity is made and distributed

Farm Power and Machinery

Make tractor engine adjustments
Do simple repairs on tractor
Regap spark plugs
Adjust carburetors
Service air cleaners
Service batteries
Maintain small engines
Lay engines up for winter
Determine line of draft on plow
Make adjustments on a plow hitch
Make mower adjustments
Adjust combine cylinder speed
Make operational adjustments on farm machinery
Calibrate seeding tools
Fit bearings to farm machinery
Determine size of pulleys
Determine size of belts.

Soil and Water Management

Make a map of the farm
Determine acreage of a field