

ANALYSIS OF FARM-MECHANICAL SKILLS OF
COLORADO YOUNG FARMERS WITH
IMPLICATIONS FOR COURSE BUILDING
IN VOCATIONAL AGRICULTURE

THESIS FOR DEGREE OF
DOCTOR OF EDUCATION
MICHIGAN STATE UNIVERSITY
FRED GEORGE LECHNER

1958

This is to certify that the

thesis entitled

ANALYSIS OF PSYCHOLOGICAL SKILLS OF
COLORADO YOUNG MEN WITH LIMITATIONS
FOR CARRIERS BUILDING IN
VOCATIONAL AERONAUTICS

presented by

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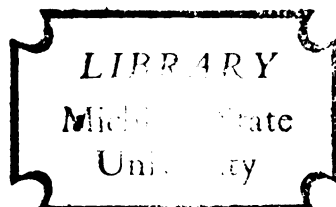
has been accepted towards fulfillment
of the requirements for

Ed.D. degree in Education

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Date December 1, 1958

O-169



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By

FRED GEORGE LECHNER

AN ABSTRACT

Submitted to the School for Advanced Graduate Studies of
Michigan State University of Agriculture and
Applied Science in partial fulfillment of
the requirements for the degree of

DOCTOR OF EDUCATION

Department of Teacher Education

1958

Approved



Purpose. The primary purpose of this study was to evaluate programs of farm-mechanical training taught as an integral part of vocational agriculture courses in Colorado high schools. It was also a purpose to discover usable data for the revision of courses.

Methods. Three hundred and two young farmers responded to a check list which was specifically compiled and tested for reliability for this study. Each respondent qualified by the criteria: (1) Must have been enrolled in the full program of vocational agriculture if only two years were offered, or must have been enrolled in at least three years of a three or four year program; (2) Must have been engaged for a minimum of two years in at least one of several farming statuses to the extent that a major portion of his working time was thus expended; and (3) Was 19 to 29 years of age. The respondents were recruited by vocational agriculture teachers in 36 selected school communities.

Each respondent exercised judgment in checking the data-gathering device to indicate for each of 98 selected manipulative kinds of farm-mechanical skills the relationship (1) of its importance for success in farming, (2) his success in using it in farm practice, and (3) the training received in high school in vocational agriculture courses. Each three-check response was used as a single one in order to maintain the relationship which was indicated when it was interpreted for its meaning.

Findings and Interpretations. Only two of the 98 farm-mechanical skills were indicated as ones for which training should not be

offered in high school. Seventy-four of the skills were considered to be "very important" for success in farming. Training had been adequately provided for 33 of them. For 11 "very important" skills training had not been provided for students who probably should have received it. (Training was also not provided for 30 more "very important" skills, however, in their case the responses did not unquestionably indicate a desirability for such training. For these it was, therefore, concluded that a careful study of the local situation was needed to reach a decision relative to their inclusion in a revised program.) It was, however, recommended that training should be provided for all of the other "very important" skills.

Twenty-two skills were rated to be of only "some" importance for success in farming. Training had been provided for 14 of these. It was concluded that this training was justified only if training for more important skills was not slighted. A lack of training was indicated for the remaining eight of the skills of "some" importance. Providing training for these 22 skills in revised programs was recommended only if it could be scheduled in a well balanced vocational agriculture program so that training for other more important skills would not be ignored.

(Nineteen enterprises were represented by the 98 farm-mechanical skills studied. For only three, namely; tool fitting, cold metalworking, and operating and repairing farm machinery was the relationship of importance to use and to training relatively satisfactory. Twelve enterprises were rated "very important", but training had not been adequately provided. They are: (1) maintaining and repairing

tractors and engines; (2) woodworking, glazing, and painting; (3) plumbing; (4) arc welding; (5) oxyacetylene welding; (6) concrete working; (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, namely; general planning, ropeworking, hot metalworking, and soldering and sheet metalworking were rated of only "some" importance, however, training for these had been provided.

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5-12-59
G-8457

ACKNOWLEDGMENTS

Sincere appreciation is felt by the author for the excellent guidance he received from his Graduate Study Guidance Committee, members of which are Professors Harold M. Byram, Chairman, H. Paul Sweany, Merle L. Esmay, and Buford Steffle.

Sincere appreciation is expressed to Professors R. W. Canada, James E. Woodhull and W. Paul Gray, all of Colorado State University, for their inspiration and encouragement in carrying on with this study and for their help in gathering the data.

The author wishes to express thanks to Dr. William D. Baten for his untiring efforts in exploring statistical analyses. Thanks are also expressed to Marvin G. Linson, State Supervisor of Agricultural Education in Colorado, to his assistants, and to the vocational agriculture teachers who cooperated in gathering the data for this study. Special expression of thanks is offered to Irving Cross for his excellent cooperation in conducting the reliability test of the check list with young farmers in his community.

The author is indebted to the young farmers in Colorado who cooperated in the study. Without their response this study could not have been made.

Further appreciation is expressed to Dr. Willard M. Brown, Teacher of Literature, Fred C. Nelles School, Whittier, California, for editing the manuscript and to Frankie D. Lechner, the author's wife for her patience, understanding, and assistance in making the study.

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CHAPTER I

INTRODUCTION

With the ever-changing complexion of the modern farmer's need for farm-mechanical training, it is indeed a challenge to those who undertake to offer such training to attempt to keep abreast of, or, more desirably to keep ahead of the changes that are occurring. Any prediction of what the future will bring is subject to the element of error in human judgment. In searching for information that is likely to help make sound decisions possible when planning farm-mechanical training programs for high school students, an evaluation of the program already in operation should prove to be helpful.

The primary purpose of this study was to evaluate former programs of farm-mechanical training that were taught as an integral part of vocational agriculture courses in high schools. It was also a purpose of this study to ferret out information that could be used with confidence in planning future training programs in farm mechanics.

With the assistance of young farmers in Colorado who met arbitrarily defined qualifications, data were gathered to evaluate the farm-mechanical training program in vocational agriculture courses in which these young farmers had been enrolled as high school students. The evaluation consisted primarily of studying aspects of importance, use, and training relating to the skills involved as they applied to the young farmers who cooperated in this study.

There is presented in this chapter a statement of the problem, an analysis of the problem, justification for the study, statements

concerning the scope and the limitations of the study and of assumptions held, and definitions for some of the terms used.

+ Problem Analysis

The problem of this study was to determine for selected farm-mechanical skills the relationship of (1) their importance for success in farming, (2) the success of young farmers in using the skills in farm practice, and (3) the degree of training received in high school — in vocational agriculture courses.

Problem analysis involved:

1. Discovering those skills for which evaluation of the importance, use, and training relationships are most suitable.
2. Discovering "very important" skills for which the three-way relationship stated in the problem may not have been the best possible, but for which it is nevertheless still highly acceptable.
3. Discovering other "very important" skills, that young farmers have used with at least some success in farm practice, training for which has been neglected in high school.
4. Discovering additional skills for which the three-way relationship indicates training should be offered to high school students if there is time in a well-balanced program to permit this to be done.
5. Ascertaining skills that should not be taught in high school to vocational agriculture students.

Justification for This Study

Hollenberg, in the United States Office of Education, states that "there had been more progress in farm mechanization during the past 25 years than during the previous 5000."¹ In all probability rapid changes will continue to be made in years to come. Vocational educators will need to bend every effort to keep up-to-date with, and better yet, ahead of these changes. Along with this challenging problem educators are also faced with the problem of finding enough time in a school schedule to teach all the farm-mechanical skills that appear to be important in conjunction with modern mechanized farming.

All leaders, no doubt, will agree that it is not necessary to teach every kind of a farm-mechanical skill, but it is questionable if they will agree on which of the multitudinous number of skills should be taught to high school students studying vocational agriculture. From a review of the literature on this subject one soon realizes that this topic is one in respect to which continuous searching for the best answers must not be abated.

With a vocational agriculture student's time in high school being divided among many other interests while he is trying to learn enough to make a beginning in today's highly scientific farming, it is highly important that his farm-mechanical skill training be concentrated in the learning of the skills that are likely to be very

¹A. H. Hollenberg, Instruction in Farm Mechanics, United States Department of Health, Education, and Welfare, Vocational Division, Bulletin No. 267, Agricultural Series No. 70 (Washington: Government Printing Office, 1957), p. 1.

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important for his success in farming and which he is most likely to use in farm practice. Even within such a framework of qualifying limitations many choices will still have to be made concerning which skills can or should be included in the training program.

Kinds of changes in modern mechanized farming that will change the farmer's need for farm-mechanical skill training are exemplified in the discussion that follows.

In farm power and machinery each new machine is becoming more complicated than its predecessor, with many adjustments needing the attention of a skilled operator. Many farmers are taking advantage of new developments in electronics and hydraulic systems to obtain greater use, flexibility, and economy of operation from their power equipment. To stay in business farmers are being forced to use a higher proportion of their investment in farming for machines and equipment. Consequently, as the farmer becomes the owner of a greater number and more complicated machines, it becomes necessary for him to devote an increasingly greater portion of his total working hours to preventive maintenance and repair of his farm power and machinery. Increasingly he needs to be trained to do this kind of work.

Many farm buildings are now obsolete. "Today farm buildings must be truly production tools that will pay their own way. They have become more than just shelters—they're the working tools of the farm unit and are used for everything from machinery storage to milking parlors."² The farmer is being forced to renovate these buildings

²Centennial of Farm Mechanization, 1855-1955 (Exposition Souvenir Booklet, East Lansing, Michigan: Michigan State University, 1955), p. 35.

or to construct new ones to meet his present-day needs in farming. If he is to keep up-to-date, he must learn the use of new types of building materials; new construction designed for improving sanitation, ventilation, heating, cooling, and lighting; and the use of automation in new and old buildings. The farmer must be trained to use properly skills that represent practical procedure and efficient use of his time in maintaining, servicing, and, in some instances, constructing modern service buildings.

The rapid increase in farm electrification has also motivated the farmer to learn new skills formerly not used on the farm. Even though electrical power is now available to 95 per cent of the nation's farmers, the trend toward more electrification will continue as new uses are found for it. "The age of electricity has arrived and the meters turned faster as motors were added for burning, lifting, cooling, and pumping. And with the possible utilization of electrical energy, tomorrow promises to be even better."³ This rapid development has created many problems pertaining to the safe use of electricity. One leading danger concerns the fact that many circuits are being overloaded. Both for correcting presently undesirable electrical wiring and for adding new circuits the farmer will need new kinds of skill training.

Approved soil and water conservation practices are being accepted at a steady pace by modern farmers. To adapt these practices to their farms and to maintain them, farmers have needed to and will, in the future, need to continue to learn skills not formerly used by them.

³Ibid., p. 32.

Farm shop work has changed and will continue to change coincident with the changes in farm power and machinery, farm buildings, farm electrification, and soil and water management. The need for replacing out-dated farm-mechanical skills with new skills is continuous. There is increasing need for ability to make skillful use of power tools. Farmers will need to learn what farm-mechanical jobs they can best and most economically do for themselves and what jobs they can most profitably have done by hired specialists.

The large number of studies that have been conducted in the farm-mechanical phase of vocational agriculture indicates that much research has been needed in the past. There is no evidence to show that this need has diminished. It is obvious that an increasing number of studies need to be made if farm-mechanical training programs that are taught as an integral part of vocational agriculture in our high schools are to be evaluated and modified so that they will meet adequately the needs of modern mechanized farming. Vocational agriculture teachers need up-to-date data from research to assist them in planning their programs. There should be little need for them to waste valuable teaching time floundering around with trial and error methods in an effort to discover what kind of training should be offered.

Scope of This Study

This study is concerned only with the need for vocational agriculture training in high school in respect to manipulative kinds of farm-mechanical skills. This does not imply any ranking of manipulative farm-mechanical skills versus those that are more managerial

in nature. While studying both managerial and manipulative farm-mechanical skills or abilities, Hamilton⁴ found that nothing in his study tended to minimize the importance of manipulative skills or abilities. Managerial abilities are an essential requirement in farm mechanics training in vocational agriculture, but to have included both types of skills in this study would extend its scope beyond practical limitations.

Ninety-eight skills were selected to represent the numerous kinds of manipulative farm-mechanical skills that can be taught in high school in vocational agriculture courses. There is no intent to imply that manipulative skills be included in courses in vocational agriculture for the sake of skill learning only. However as Hollenberg states, "Some skills will need to be perfected before they are used on actual jobs."⁵ If the basic, manipulative farm-mechanical skills are related to the student's total farm mechanics program in vocational agriculture, they can strengthen it.

Data were gathered from 302 former students who had studied vocational agriculture in 36 Colorado high schools. The schools included represent approximately 50 per cent of the total vocational agriculture departments in Colorado. The criteria for the selection of the schools, as well as the former students from each school, are discussed in detail in Chapter III, Methods and Materials.

⁴J. R. Hamilton, "Managerial Abilities Are Important in Teaching Farm Mechanics," The Agricultural Education Magazine, 28:7, January, 1956.

⁵Hollenberg, op. cit., p. 61.

Limitations of This Study

As in any study involving recall and judgment, this study was subject to a certain amount of error depending on the ability and the sincerity of each of the respondents. The discussion in Chapter III, Methods and Materials, presents evidence that this kind of error has been held to a minimal level.

Restriction of the skills selected for inclusion in this study may possibly be a limiting factor. Although they were selected with the benefit of many years of experience, and with much advice that represents the seasoned judgment of leaders in agricultural education, they may not be equally applicable in every respect in each of the school communities selected for this study. Consistent effort was exerted, however, to make the skills chosen as representative and as practical as possible.

The amount and quality of farm-mechanical training offered in the 36 schools naturally varies to some extent. A young farmer's judgment of the degree of his success in using a farm-mechanical skill in farm practice is undoubtedly affected more or less by the kind of training he receives in the use of the skill. His rating of success in its use may, therefore, be influenced by the kind of workmanship to which he has become accustomed in his training program. However, even though differences in training may affect, to some extent, the validity of some individual responses as to their use in farm practice, it is assumed that the effect on the pooled judgment of all the responses is not serious because of the large number of respondents.

The amount and kind of the respondent's post-high school training in farm-mechanical skills may affect his judgment as to the amount of training he has received in high school. It is possible that accuracy of checking for the training part of the three-check response that undertakes to indicate the relationship of importance to use and to training may vary somewhat depending on the willingness of the respondent to want to spend enough time to recall his actual training experiences in high school. All evidence that was obtained from personal contact with young farmers, however, indicates that they have tried to report their high school training experiences as fully and accurately as possible.

Individual difference among the respondents as to their aggressiveness, interest, health, financial ability, as well as the kind of opportunities they had to use a skill, may have influenced their use of the skills in farm practice with the result, in some cases admittedly, like training does not always result in like results in use.

Although the several limitations that have been presented are recognized, there is very little evidence to indicate that the validity of the data for this study has been unduly impaired.

Assumptions

1. It was assumed that data for the evaluation and/or planning of farm-mechanical courses taught in high school as an integral part of vocational agriculture would be meaningful if it were gathered to discover, for the farm-mechanical skills taught, the relationship of (1) importance to general success in farming, (2) to success in use in particular aspects of farm

practice, and (3) to training received in high school.

This would entail a judgment response for each of the three parts of the relationship. It was further assumed that this three-check response obtained from each respondent for each skill studied would be best used in the analysis of data as a single response interpreted for its meaning.

2. It was assumed that the young farmer's judgment as to the degree of importance of any selected farm-mechanical skill to his success in farming was a valid measure of its true importance. It was further assumed that accepting his judgment of success in farming was a satisfactory criterion for measuring such success, and that his response as to the importance of a skill pooled together with the responses of the other respondents would be a valid indication of the degree of its importance to success in farming.
3. It was assumed that the young farmer's judgment as to his success in using a selected farm-mechanical skill in farm practice was a valid measure of such use. This assumption was based on the fact that a young farmer, as a student of vocational agriculture in high school, had been given opportunity during his training to gain an understanding of quality, good workmanship, durability, and satisfactory service from the use of farm-mechanical skills. In this connection it was further assumed that he had also been engaged in farming enterprises for a period long enough to encounter opportunities for the use of the skills studied, since to qualify as a respondent he must have spent most

of his working time for at least two years engaged in one or more status of farming.

4. It was assumed that the young farmer's judgment as to the amount of training he had received in any selected farm-mechanical skill while enrolled in vocational agriculture in high school was a valid measure of such training. Since, to qualify as a respondent, he must have been graduated within 10 years, it was further assumed that he was better able than older farmers to recall his training experiences.
5. It was assumed that enough basic training in the use of any selected, manipulative farm-mechanical skill could be given while the student was in high school to enable him to use it in farm practice.
6. It was assumed that if any of the manipulative farm-mechanical skills studied, were to be included in courses of study, they would be included because they enhanced the performance of a practical farm-mechanical maintenance and/or construction job or project.
7. It was assumed that any farm-mechanical skill that may be needed by a future farmer to make a beginning in farming that has not been learned prior to his enrolling in high school can best be taught to him in vocational agriculture.
8. It was assumed that the pooled judgment of a representative sampling of qualified young farmers is a valid form of evaluation for farm mechanics courses of study as taught in high school.

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Definition of Terms

Farm mechanics. This term is used to indicate all of the practical application phases of agricultural engineering used in farm practice by farmers such as farm power and machinery, farm structures, farm electrification, soil and water management, and farm shop functions.

Selected farm-mechanical skill. For this study a selected farm-mechanical skill is an ability that has been accepted by competent authorities in agricultural education as one that may be used in the performance of farm-mechanical activities in agriculture, and one that was selected to be representative of the skills that are used to perform such activities.

Amount of training. This term is used to represent the extent of the training that was received by the young farmer in any selected farm-mechanical skill during his vocational agriculture courses while enrolled in high school. For example the amount might be "enough", "some", or "none".

Success in using. The measure of achievement used in obtaining durable results, good workmanship, and satisfactory service from the job performed with the use of a selected farm-mechanical skill is designated by this term. The degree of success attained in the use of such a skill by the young farmer in farm practice are indicated as; "successful almost every time", "sometimes successful", "not successful", or "not used".

Importance of the skill. This term is used to indicate the degree of effect that the use of any selected farm-mechanical skill by the young farmer had on his success in farming. The degree of importance may be, namely; "very important", "somewhat important", or "not important or not used".

Enterprise. The term enterprise is used as a subdivision of any of the five areas of farm mechanics as defined by the American Society of Agricultural Engineers and included several closely related, selected farm-mechanical skills. For example the skills, drill holes in metal, cut threads on bolts or rods, and bend cold metal are skills in the enterprise of cold metal working; and this enterprise is a subdivision of the farm shop area of farm mechanics.

Response pattern. This term is used in this study to designate any one of the 36 possible relationship combinations of the three degrees of importance to the four degrees of use and to three degrees of training as indicated by a respondent for a farm-mechanical skill.

Category. This term is used to designate a group of responses, as patterns, for a farm-mechanical skill, or enterprise that were similar enough to be considered as alike in the analysis of data.

Class of skills. This term designates a group of farm-mechanical skills or enterprises on the basis of the per cent of respondents who, by their responses, placed these skills in each of the categories used in the analysis of data.



CHAPTER II

REVIEW OF LITERATURE

Since the inception of the program of teaching vocational agriculture in the secondary schools of our nation research has been considered to be an important aspect of development in this field. Much of this research has been an effort to find and to interpret data that could be used both to plan and to evaluate courses of study in farm mechanics that were being taught as an integral part of the total vocational agriculture program. A variety of approaches has been used to attack the many problems that have been studied.

This chapter was organized to present a review of the research that was conducted for both of these two basic purposes, that is, course planning and course evaluating. This kind of organization was chosen inasmuch as the present study was designed, basically, to evaluate courses in farm mechanics as taught in high school as an integral part of vocational agriculture. As a result of this evaluation, however, applications for improving the courses evaluated were also evident in the data. The review is concluded with a section devoted to a summary of the data that was examined.

+ Because of the voluminous amount of research that has been done in the area of farm-mechanical instruction in high school, it was decided to limit the review to data that would relate pertinently to the present study. No other reports were found, however, to closely resemble this study in design. To present a reasonably practical review, only those studies whose scope was larger than that of a

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school community or district were reviewed, and, from most of these, only brief statements were adduced to present the significant findings and the plan and procedure used. A more extensive review, however, is presented for those relatively few studies that were most similar to the present one.

Most of the research was organized on a normative basis by using a relatively simple plan that usually consisted of asking one or more of various types of persons to give their opinions, or in their best judgment to rate or rank certain selected items listed in a check list or questionnaire. These persons may have been vocational agriculture students, former vocational agriculture students, fathers of vocational agriculture students, any young farmer whether a former student or not, adult farmers other than fathers of students, instructors of vocational agriculture, teacher trainers and supervisors in agricultural education, and agricultural engineers.

Although all studies served a useful purpose, it was not possible to detect any close relationship of any one to another. Apparently each one was associated with a need for data separate and apart from any other. Also, the data of one study usually did not complement closely that of another because they were not sufficiently alike in their purposes, the types of resource persons who were asked to participate, or in the methods and materials used.

Studies Designed to Obtain Data for Course Planning

Some of the early studies were made by Struck¹, Bebermeyer², Davies³, Davidson⁴, Kennedy⁵, Pollom⁶, Walker⁷, Flowers⁸, White⁹, Thompson¹⁰, Geiger¹¹, and Wright¹². All of these men except Geiger and Wright asked farmers their opinion relative to what they thought ought to be taught in farm mechanics as an integral part of vocational agriculture in high school. Farmers expressed a need to know how to use many of the farm-mechanical skills studied, and they indicated that much of the repair work on the farm was done by themselves. Units of instruction were planned on the basis of the findings. The

¹Theodore F. Struck, Farm Shop Work in Pennsylvania, (Rural Life Department, Special Bulletin No. 1. State College: Pennsylvania State College, 1920).

²Paul Bebermeyer, "The Teaching of Farm Shop in Missouri High Schools" (unpublished Master's thesis, University of Missouri, Columbia, 1925), 90 pp.

³L. R. Davies, "Farm Shop Work in Vocational Education" (unpublished Master's thesis, Colorado Agricultural College, Fort Collins, 1923), 94 pp.

⁴Allen P. Davidson, "A Study of Farm Shop and Agricultural Engineering of Kansas Farms: Its Relation to Vocational Agriculture in Kansas High Schools" (unpublished Master's thesis, Kansas State College of Agriculture, Manhattan, 1925), 40 pp.

⁵Arthur C. Kennedy, "A Study of the Need for Training in Farm Mechanics in Ohio" (unpublished Master's thesis, Ohio State University, Columbus, 1927), 57 pp.

⁶Lester B. Pollum, "A Study of the Scope and Content of Farm Mechanics Courses and Organization for Teaching Them in Vocational Agriculture Schools of Kansas" (unpublished Master's thesis, Kansas State College, Manhattan, 1927), 88 pp.

⁷Clyde Walker, "Determining the Content of Farm Mechanics Courses of Study for Smith-Hughes Agricultural Departments in High Schools" (unpublished Master's thesis, The University of Nebraska, Lincoln, 1931), 80 pp.

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data obtained by Geiger and Wright were based on the actual farm-mechanical activities carried on by farmers on their farms. An early bulletin published by the University of California¹³ contains facts supported by data indicating the actual mechanical situation found on farms. Armstrong¹⁴, at the University of Minnesota, also used data obtained from farmers to publish a monograph. He found that farmers did most of the repair work that was done on farms. For the purpose of course building Sharp¹⁵, in an early study, asked 500 farmers to

⁸Walter A. Flowers, "An Analysis of the Recommendations of Teachers and Farmers as to What Should Be Taught in Farm Mechanics Courses in the Negro Schools of Mississippi" (unpublished Master's thesis, Iowa State College, Ames, 1937), 97 pp.

⁹Chris White, "Farm Mechanics as a Part of the Instruction in Vocational Agriculture in Oklahoma High Schools" (unpublished Master's thesis, Oklahoma Agricultural and Mechanical College, Stillwater, 1938), 115 pp.

¹⁰C. T. Thompson, "Farm Shop Jobs for Louisiana" (unpublished Master's thesis, Louisiana State University, University, 1938), 217 pp.

¹¹Albert J. Geiger, "A Study of Farm Shop Work in Florida" (unpublished Master's thesis, University of Florida, Gainesville, 1932), 106 pp.

¹²Carlton E. Wright, "A Study of the Needs for Training in Farm Shop in High School Departments of Vocational Agriculture in the State of Vermont" (unpublished Master's thesis, Cornell University, Ithaca, 1938), 120 pp.

¹³Farm Mechanics for California Schools (Agricultural Education Series, No. 2, Division Bulletin, No. 11. Berkley: University of California, 1922), 45 pp.

¹⁴Fred E. Armstrong, Farm Repair and Construction Work, (Educational Monograph No. 4. Minneapolis: University of Minnesota, 1923), 38 pp.

¹⁵Marlay A. Sharp, "A Suggested Course in Farm Mechanics for High Schools Based on the Opinion of Five Hundred Farmers" (unpublished Master's thesis, Iowa State College, Ames, 1928), 37 pp.

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check whether they thought a farm-mechanical skill was "important"; "of little value"; "average", or "should not be taught". They indicated that only skills of practical value should be taught. Repair work was considered more important than construction work. Sutherland¹⁶ developed a suggested course of study in farm mechanics based on the opinion of 290 Montana farmers. Most of them were fathers of boys studying vocational agriculture. These farmers were asked to rate farm-mechanical jobs as to importance and to the frequency with which they were used in farming. Many skills that are currently considered to be obsolete in farm practice were indicated to be important at the time of study.

Early investigators soon began gathering data from persons other than farmers. Gibbs¹⁷ queried engineers, students, and teachers as well as farmers. He found a wide divergence of opinion relative to the content that should be included in farm mechanics courses in vocational agriculture. Salmon¹⁸ asked both farmers and teachers of vocational agriculture their opinion on what shop jobs they considered most important on the farm. He found that farmers wanted jobs

¹⁶Sidney 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), 22 pp. (Mimeographed.)

¹⁷James Thomas Gibbs, Jr., "Basis of Selecting a Farm Shop Course for Vo-Ag" (Unpublished Master's thesis, University of Missouri, Columbia, 1925), 71 pp.

¹⁸Ray John Salmon, "A Study of Certain Factors in the Waterford Area Pertaining to the Building of Farm Shop Curricula in Secondary Schools of Pennsylvania and New York" (unpublished Master's thesis, Cornell University, Ithaca, 1939), 112 pp.

taught representing experiences for which their boys had a practical need in their farming activities, and the teachers indicated a lack of facilities for the teaching of farm machinery repair jobs.

Mulligan¹⁹ two years later asked farmers, teachers of vocational agriculture, and college students to check their rating of the importance of farm-mechanical skills. His respondents agreed quite well as to what skills they thought should be taught in high school to vocational agriculture students. The skills he listed in his study as important were essentially the same kinds of skills that Sutherland²⁰ listed as important.

The trend to use respondents other than established farmers was continued in studies of succeeding years. In a study conducted by Bartlett²¹, part-time farmers, full-time farmers, and veterans checked farm-mechanical skills: (1) needed on the farm; (2) not needed; and (3) needed but should be purchased ready made or hired done. The kinds of farm-mechanical work indicated to be important and for which training was needed were, at this later date, still very similar to those listed by Sutherland.²² Miller²³ interviewed

¹⁹Clarence W. Mulligan, "A Study of the Needs for Training in Farm Mechanics in New York State" (unpublished Master's thesis, Cornell University, Ithaca, 1941), 155 pp.

²⁰Sutherland, loc. cit.

²¹Lawrence Farrell Bartlett, "A Farm Shop Study" (unpublished Master's thesis, West Virginia University, Morgantown, 1948, 102 pp.

²²Sutherland, loc. cit.

²³Franklin Diley Miller, "Changes in Program and Equipment for Farm Shop Work in Central Ohio Based upon Farming Needs" (unpublished Master's thesis, The Ohio State University, Columbus, 1949), 98 pp.

young farmers in three communities to determine their farm shop needs. As a result of these interviews he was able to indicate what changes were needed in local farm-shop programs of instruction and what physical facilities were necessary to carry out these revised programs. He discovered a need for instruction in the areas of farm plumbing and electricity that was relatively new in the usual farm-mechanical training program at the time his study was made. He recommended that prospective teachers of vocational agriculture be given more extensive training in these areas. With a survey using questionnaires, Smith²⁴ obtained data from 131 institutional-on-farm veterans and 69 farmers to determine their farm-mechanical instruction needs. His findings indicated a need for the teaching of skills that would help vocational agriculture students to become established in farming. Suzui²⁵ had the same objective in mind as Smith when he queried institutional-on-farm veterans; however, he also consulted their instructors. His study showed that the various phases of maintenance and repair of farm power and machinery as well as the area of construction and estimation of costs of farm buildings ranked high among the farm-mechanical instruction needs.

In studies of more recent years, the opinion of farmers was still used as the primary source of data upon which to base the

²⁴W. J. Smith, "Building a Program of Work in Farm Mechanics" (non-thesis study, University of Tennessee, Knoxville, 1950), 65 pp.

²⁵Richard S. Suzui, "Needs for Instruction in Farm Mechanics Hawaii" (unpublished Master's thesis, Iowa State College, Ames, 1952), 160 pp.

planning of a program of instruction in farm mechanics taught as an integral part of vocational agriculture in high school. Ramay and Walker²⁶ interviewed 50 farmers to: (1) determine the need for farm-mechanical jobs and skills; (2) analyze instructional areas into skills; and (3) determine the skills in doing certain jobs, projects, or exercises. The findings emphasized that the jobs, projects, and exercises used for instruction should be practical.

A study started by Cook and completed by Byram²⁷ somewhat parallels one part of the data gathering techniques used in the present study. Cook questioned farmers concerning: (1) activities that farmers perform; (2) activities that farmers hire done; and (3) activities that farmers would like to improve their ability in performing. The findings showed that farmers performed a larger number of the skills listed than the number of them in which they wanted to improve their ability. Those farmers who wanted to improve their ability in an activity tended to be those who had not performed it or who had not hired it done.

With a questionnaire Howell²⁸ asked farmers to indicate what farm-mechanical jobs they were performing on the farm, what tools and

²⁶A. O. Ramay, and Howard B. Walker, "Building a Course of Study in Farm Mechanics for All-Day Students" (non-thesis study, University of Tennessee, Knoxville, 1951), 48 pp.

²⁷G. C. Cook, and H. M. Byram, "Mechanical Activities of Selected Farmers in Michigan" (research project in agricultural education, Michigan State College, East Lansing, 1952), 136 pp.

²⁸Ezra Lewis Howell, "Farm Mechanics Jobs Performed on Farms in an Agricultural Department Patronage Area in North Carolina, Including Those Jobs Which Should Be Performed" (unpublished Master's thesis, North Carolina State College, Raleigh, 1952), 101 pp.

equipment the farmer owned, what farm-mechanical jobs should be, but were not, being done, and what tools and equipment the farmer needed but did not have. The analysis of his data permitted him to recommend that more instructional time in high school should be devoted to the area of farm mechanics in vocational agriculture and that:

1. The instruction should be based on the needs of the community.
2. The value of farm machinery and buildings should be stressed.
3. Emphasis should be placed on the building and equipping of a home farm shop.

In a study made by Phipps and Deyoe²⁹ 197 farmers were interviewed with the help of five teachers of vocational agriculture to determine farmers' farm-mechanical needs, and to obtain the judgment of farmers as to the relative importance of various areas of these. The results of the study indicated that the most important areas of instruction in farm mechanics for these farmers was the maintenance, repair, and adjustment of farm machinery and tractors. Farmers indicated little interest in being expertly trained in plumbing, electrical work, blacksmithing, engine mechanics, and the construction of large farm buildings.

Still further variations were employed in more recent studies in both the kind of respondent used and the kind of delimitation

²⁹Lloyd J. Phipps, and George P. Deyoe, "Determining Farm Mechanics Content--What Farmers Consider Important" (non-thesis study, University of Illinois, Urbana, 1952), 92 pp.

decided upon. Ryder³⁰ limited his study to skills in preventive maintenance in farm machinery and equipment that were checked for importance by vocational agriculture teachers, farmers, agricultural education specialists, and agricultural engineers. The farmers' rating as to importance were generally lower than those of the other three groups, however, those skills rated high by the farmers were, for the most part, the same as those rated high by other groups. Fathers of vocational agriculture students expressed their opinion as to the importance of 72 activities in farm mechanics in a study conducted by the Wyoming State Department of Education.³¹

Hamilton³² studied two areas of farm mechanics, namely, farm shop, and farm buildings and conveniences, to determine the training needs of teachers in farm-mechanical abilities. He asked the opinion of selected farmers, vocational agriculture teachers, and agricultural engineers. Units of abilities in farm mechanics rated highest in importance were general principles, use and care of tools, arc welding, and concrete masonry work. Importance was scored lowest in forge work, sheet metalworking, ropeworking, painting, and related woodworking. The managerial abilities were rated highest in importance and lower in adequacy of training than were the manipulative ones.

³⁰Gordon J. Ryder, "Skills Needed by Farmers in Selected Areas of Farm Mechanics" (non-thesis study, The Ohio State University, Columbus, 1953), 24 pp.

³¹Farm Mechanics Instruction That Farmers Want Their Boys to Have (Special Bulletin, Vocational Division, Laramie: The Wyoming State Department of Education, 1954), 10 pp.

³²James Roland Hamilton, "The Preparation of Michigan Teachers of Vocational Agriculture in Two Areas of Farm Mechanics" (unpublished Doctoral thesis, Michigan State University of Agriculture and Applied Science, East Lansing, 1955), 265 pp.

Dugger³³ held individual interviews with forty selected, vocational agriculture teachers, forty selected young farmers, and forty selected adult farmers for the purpose of obtaining data to prescribe the mechanical competencies needed by vocational agriculture teachers in Oklahoma. The interviewees were asked to express their opinion as to the degree of understanding that was needed by farmers in the mechanical competencies. The areas of farm power and machinery, farm buildings and conveniences, farm electrification, soil and water management, and farm shop were studied.

Dugger's data indicated that farmers needed an extensive and personal understanding in most of the competencies he had listed in farm power and machinery, farm buildings and conveniences, farm electrification and farm shop. This meant that they needed sufficient understanding to be able to perform the normally thought of functions involved in the competencies. Only a little less than half of the competencies in soil and water management were classified as being essential for the farmer. In his recommendations for further studies Dugger stressed the need for research to ascertain the farm-mechanics practices actually used by successful farmers. This statement supports the data gathering method used in the present study wherein each respondent was asked to check not only the degree of importance for his success in farming, but also his success in using them in farm practice. The respondents in the present study, however, were also

³³Roy Wesley Dugger, "Mechanical Competencies Needed by Vocational Agriculture Teachers in Oklahoma" (unpublished Doctoral thesis, Oklahoma Agricultural and Mechanical College, Stillwater, 1956), 118 pp.

asked to check the degree of training they had received in the skills.

Several investigators used as respondents those young farmers who were former high school students in vocational agriculture. In this respect these studies resemble the present one, although, there is much dissimilarity in other respects. Kindschy³⁴ made such a study in Iowa. He assumed that reasonably accurate information concerning farmers' need for abilities in welding, farm machinery, and farm engines and tractors could be obtained from former students of vocational agriculture. Another assumption he made was that former students engaged in farming were in a favorable position to determine for what abilities training should be included in a course of vocational agriculture. These two assumptions support the thinking used in this study in selecting, as the source of data, former students of vocational agriculture who had attained a specified amount of farm experience since their graduation from high school.

Kindschy's study is similar to this study in another respect in that he solicited the cooperation of instructors of vocational agriculture to contact the young farmers. He analyzed data from 246 questionnaires by computing the percentage of respondents who indicated several degrees of importance of the farm-mechanical skills and abilities he studied. Kindschy decided that if 50 per cent or more of the respondents rated an item as important, it should be

³⁴Dwight Lewis Kindschy, "Course Content in Welding, Farm Machinery, and Tractors for the Curriculum in Vocational Agriculture" (unpublished Master's thesis, Iowa State College, Ames, 1948), 37 pp.

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given much consideration as course content for farm-mechanics instruction in a vocational agriculture program in high school. He, however, also pointed out that certain skills and abilities that were not important for most of the former students may have been very important to some of the other students.

From his data Kindschy concluded that it was important to include instruction in welding in vocational agriculture courses in Iowa. He indicated welding was important as a part of course content because it developed the ability: (1) to determine what pieces can be satisfactorily welded; (2) to recognize a good weld when the work is done by a tradesman; and (3) to arc weld to the extent that the student can weld cast and malleable iron for average farm repair and construction. He concluded that oxyacetylene welding should be touched on only briefly, if at all, and this was dependent on local conditions.

In farm-implement repair abilities rated important by more than 50 per cent of Kindschy's respondents were: (1) maintain and adjust farm implements; (2) inspect machinery for needed repair; (3) replace parts, gears, and castings; (4) repair and adjust corn pickers, mowers, seeders, plows, cultivators, combines, and grain binders; (5) replace and adjust machine gears; (6) adjust chains and vee and flat belts; (7) adjust roller and ball bearings; (8) make a repair list and order parts; (9) replace studs, pins, keys, and other fastenings.

Abilities in farm engine and tractor work rated important by more than 50 per cent of the respondents were: (1) care for and maintain farm engines; (2) test, clean, and adjust ignition systems;

(3) test, clean, and adjust fuel systems; (4) select an engine for a given job; (5) remove the head from an engine; (6) adjust tappets; (7) time an engine; and (8) service connecting rods and bearings.

Other abilities ranked important by a majority of the respondents were: (1) select the proper tool for a given job; (2) woodwork and carpentry; (3) sharpen and fit hand tools; (4) do cold metal work; and (5) do simple installation and maintenance of electrical equipment.

McCreight³⁵ asked 182 farmers who had studied vocational agriculture in high school to indicate the extent of their use of farm-mechanical abilities. They were selected in schools where the instructor had a tenure of six or more years. In this respect his data are similar to that for this study. Young farmers who had studied two to four years of vocational agriculture in high school, in one part of their response for each skill, were asked to indicate how often they used each skill in farm practice. Along with this response they were asked to indicate whether their source of learning the skill was in high school, or at home. These young farmers, as well as those used in the present study, must have had a time lapse of at least two years since studying vocational agriculture in high school.

However, in other respects the qualifications of the young farmers used by McCreight were different. His young farmers were, at the time of the survey, to have lived on a farm either with their parents, as a renter, or as an owner of a farm. No age limit was

³⁵M. G. McCreight, "Study of the Use of Acquired Farm Mechanics Abilities by Selected Vocational Agriculture Graduates of Nebraska Public Schools" (unpublished Master's thesis, University of Nebraska, Lincoln, 1951), 111 pp.

specified in qualifying his young farmers. The young farmers in the present study must have had at least two years of experience in some farming status since studying vocational agriculture, and an age limit of 19 to 29 years was specified. He assumed that former students of vocational agriculture who were, at the time of the study, engaged in farming would give serious consideration to a questionnaire and could answer it competently. This assumption supports the data-gathering method used in the present study.

McCreight's findings showed that many farm-mechanical abilities were learned by farmers in farm practice after graduation from high school. Those areas or enterprises in which the farmers learned more in than out of school were painting, tool sharpening, glazing, rope-work, farm carpentry, forge work, soldering and sheet metal work, and arc and oxyacetylene welding. Out of school these farmers were developing their ability in tractor maintenance and repair, farm machinery servicing and repair, farm electrification, plumbing and sanitation, heating and ventilation, harness and leather work, and concrete and masonry work.

Mercer³⁶ also used farmers who had studied vocational agriculture in high school with the added qualification that they had also been awarded the State Farmer degree. One hundred and three such farmers indicated which farm-mechanical skills they considered important, and their response also showed they needed tools, equipment, and supplies to use the skills that they thought were important.

³⁶F. Robert Mercer, "A Procedure in Determining the Scope and Content of Farm Shop Courses on the Basis of What Farmers Consider Important" (unpublished Master's thesis, University of Delaware, Newark, 1953), 116 pp.

Studies Designed to Evaluate Courses of Study

Since the present study was primarily evaluative in design, other studies of a similar design were reviewed. Studies of this type were not nearly as numerous as those designed to obtain data for course planning. They were confined primarily to an evaluation of the units of instruction taught in relation to their use. Sources of data for the studies have been so broad as to include opinions of teachers of vocational agriculture and contemporary vocational agriculture students, as well as of farmers who may, or may not, have had training in farm mechanics taught as an integral part of the total vocational agriculture program in high school.

Rogers³⁷ conducted an evaluative study using former high school students of vocational agriculture who had had two or more years of farm mechanics instruction not longer than 11 years previous to the time of his study, and who were, at the time they were queried, engaged in farming. He assumed that data gathered from young farmers who had received farm-mechanical instruction could be used for meaningful evaluation. The questionnaires were either mailed directly or delivered by all-day students to the respondents. From his 85 completed returns he discovered to what extent farm mechanics training had been helpful to former students of vocational agriculture in their performance of various farm-mechanical jobs. The study also contained data that indicated what instruction had been received in

³⁷Earl Stanley Rogers, "An Evaluation of the Farm Mechanics Program in Wake County, North Carolina, by Former Students of Vo-Ag, Including Recommendations for Improvement" (unpublished Master's thesis, North Carolina State College, Raleigh, 1951), 66 pp.

each of the five major areas of farm mechanics. Approximately 92 per cent of the former students felt that the training they had received in high school had proved to be either very, or somewhat helpful to them.

Also as a part of the study he asked the respondents to rate the importance of the jobs he listed. He found that construction and repair jobs connected with the student's supervised farming program and those farm-mechanical jobs that needed to be done on the home farm rated high on his degree of importance scale. The five areas of farm mechanics were ranked in the following order as to their importance in farm practice: (1) farm shop work; (2) farm power and machinery; (3) soil and water management; (4) farm buildings and conveniences; and (5) farm electrification. He concluded that too much instruction had been given in unimportant farm-mechanical jobs.

Although the study made by Canada³⁸ did not deal with farm mechanics, the structure of it was comparable to that of the present one. His data showed the degree of relationship of the participating experiences of student teachers in agricultural education to the performance of these student teachers as teachers. Coupled with participating experiences he included a rating of the importance of the training received by the respondents, and coupled with performance in actual practice he included a rating of the importance of each

³⁸R. W. Canada, "The Relationship of Participating Experiences in Student Teaching to Comparable Experiences in Teaching Vocational Agriculture" (unpublished Doctoral thesis, Pennsylvania State College, State College, 1954), 130 pp.

practice as used by the teachers. His analysis of data was unlike that of this study in that it lent itself well to the computing of coefficients of correlation.

One purpose of Anthony's³⁹ study was to determine the requirements of the farm mechanics phase of the vocational agriculture curriculum to meet present needs of farm mechanics. It was also an evaluation of the teacher-training program in farm mechanics on both the undergraduate and graduate level. A third part of the study was designed to obtain suggestions for a solution for a change of emphasis in the program of farm mechanics to more adequately meet the then current needs. He also gathered data to determine what important farm-mechanical abilities were needed by successful farmers.

He discovered that the instruction in both the undergraduate and graduate courses for training teachers of vocational agriculture was lagging behind the trends in farm power and machinery, farm electrification, soil and water management, and farm buildings and conveniences. His respondents agreed that jobs which required expert skill and special tools should not be included in a farm mechanics program in vocational agriculture.

Anthony's study is somewhat similar to the present one in that he anticipated using his evaluation data to make valid recommendations for the improvement of farm mechanics instruction in high school. He obtained data from vocational agriculture teachers, farmers, farm advisors, and experts.

³⁹ Frank Anthony, "An Evaluation of the Current Objectives of the Farm Mechanics Phase of Vo-Ag in Selected Pennsylvania High Schools" (unpublished doctoral thesis, Pennsylvania State College, State College, 1956), 126 pp.

+ Summary

The review of literature indicates that considerable effort has been applied to research by the leaders in agricultural education since the beginning of the vocational agriculture program in an effort to find valid criteria to plan courses in farm-mechanical training taught as an integral part of the program in high school. A lack of evaluative studies, however, is strikingly indicated by the proportionally small number of them.

In general the recommendations of the studies indicated that training in farm mechanics should be of a practical nature with actual farm jobs used as teaching situations. A trend to want to include an ever-increasing amount of subject matter to be taught in the farm mechanics phase of vocational agriculture was indicated by respondents for the studies. This emphasizes the changing and increasing needs in farm-mechanical skill training for farmers.

Reviewing these studies left the impression that a fairly accurate way to decide what to teach in farm mechanics would be to follow accurately the changes in farm mechanization and include, in the program, training for those simpler skills which will be needed most by farmers. However, using the findings of research was very helpful in making the decisions. In any event it has been, and it is now a constant challenge to keep abreast and, if possible, ahead of the changes of the modern farmer's needs in mechanized farming. The review of former research impresses one with the fact that there has been, and there will continue to be, a need for sound research in order to make wise decisions in evaluating and/or planning farm-mechanical training in high school as taught in vocational agriculture.

CHAPTER III

METHODS AND MATERIALS

This chapter is devoted to a discussion of the methods and materials that were used to gather and analyze data for the study. Discussed are the procedures used to: (1) compile; (2) test run; and (3) test the reliability of the check list which was used to gather the data. The method used to select both the schools to be included in the study and the young farmers who had studied vocational agriculture in these schools and who were asked to complete the check list is explained. The ways and means used to gather the data are discussed.

+ Check List Development

— The data-gathering check list used was prepared specifically for this study. Inasmuch as both reliability and validity were sought, a rather extensive procedure for preparing and testing the check list was planned and executed.

+ Since young farmers were to be asked to complete the check list, — two major factors had to be considered. One of these dealt with making the check list comprehensive enough so that the data would lend themselves well to meaningful analysis, and the other, counteracting factor was keeping the check list short enough so that young farmers would + give their best attention to the completion of it. + As an aid in obtaining the young farmer's best efforts for the completion of the

check list, it was considered important that the directions, instructions, and/or explanations be clear and easily understood.

→ The manipulative farm-mechanical skills that were listed in the check list were selected from several of the most recently published sources of reference, from several of the latest studies in farm-mechanical course planning, and from the author's courses of study for vocational agriculture. (Only those skills that in the opinion of leaders in agricultural education, best represent each of the farm-mechanical enterprises studied, were included as a part of the check list.) This list of skills was revised several times with the assistance of members of the guidance committee for this study. (The final revised form, which was prepared for a trial run with qualified young farmers in several Michigan communities, contained a list of 98 skills.)

A total of thirteen young farmers residing in the Williamston, Onsted, and Owosso, Michigan communities completed the check list for the trial run of the check list. The vocational agriculture teacher in each community was instructed in the same way in which it was hoped the instructors who would be cooperating in gathering the data for the study would be instructed. They were also asked to make notations of comments and suggestions offered by the young farmers. To obtain information relative to problems that may be encountered in using the check list the author personally accompanied the vocational agriculture instructor at Onsted in contacting young farmers who completed the check list.

After careful consideration of the suggestions and comments that were offered by both the young farmers and their vocational agriculture instructors, and after a brief analysis of the data gathered had been made, it was considered desirable to reword several of the skill listings. Directions, instructions and/or explanations were restated for greater clarification, and the format of the check list was simplified.

Check List Reliability Test

To test further the revised form of the check list, arrangements were made with Irving Cross, instructor of vocational agriculture in Sterling, Colorado, to run a reliability test with 20 young farmers participating.

The community of Sterling, Colorado was chosen because, there, at least 20 qualified young farmers who were willing to cooperate could be selected. Also the instructor, Irving Cross, had taught farm mechanics as an integral part of vocational agriculture in high school for eight years, and he was, therefore, considered to be well qualified to select 20 qualified young farmers and to conduct the reliability test.

A dittoed copy of the check list was completed by each of the 20 young farmers. Approximately one week later ten of these 20 young farmers were asked to complete for a second time the checking of the first half of the check list while the remaining ten young farmers were asked to complete again the second half of the check list. At the time of their first completion of the check list, none of the young farmers knew that they would be asked to complete half of the check list for a second time.

The purpose of the double checking was to determine whether or not reliable data could be gathered with it. Table I in the Appendix gives the totals for the double completion by categories of each of the two groups of 10 young farmers for each of the 98 farm-mechanical skills in the check list. Chapter IV, Analysis and Discussion of Data, includes an explanation telling how the checking completed by the young farmers was converted into a response for each skill identifiable in one of the categories given in the table.

The responses by categories from the second completion of the check list are not exactly the same as those from the first. It was noted, however, that a change in response by one young farmer in his second completion of the check list was occasionally counterbalanced by the changed response of another young farmer. The data to be gathered, it could be assumed, would be similarly affected in that one young farmer's response would in some cases be cancelled by the incorrect response of another respondent. In any event, such an unreliable response made by one young farmer would not be made worse by the divergent response of another young farmer.

It was decided to analyze the difference between the first and second responses by comparing them by both the individual respondent and the group of ten respondents bases. The differences were compared by response categories using responses in categories 6, 7, 8, and 9 as alike. This grouping of response categories is consistent with that used in the analysis and discussion of data as they are presented in Chapter IV. The comparison of the double responses on the group response basis is probably most appropriate because the

data for the study are analyzed on the basis of returns from a group of 302 respondents. The differences between the first and second completion of the check list are not as great when they are compared as a group response from the two 10 young farmer groups. It was noted that the per cent of no change, (agreement), in the individual responses in the two completions ranged from 30 to 100. Compared to this, when the responses were compared on the group of ten response basis, the per cent of no change ranged from 40 to 100. The average per cent of no change in response for the entire check list between its first and second completion is 62.0 when the responses are compared on the individual basis and 77.1 when they are compared on the group basis. Table I, page 101 in the Appendix, contains a comparison of the double response to each of the 98 farm-mechanical skills included in this study. A percentage figure is given for both of the methods of comparison discussed above.

Based on these data from the reliability test it was concluded that the check list, to the degree indicated, is a reliable data-gathering instrument.

Final Form of the Check List

In preparing the final form of the check list a few minor changes in the wording of some of the skill were made. Some improvements in the explanations and directions the need for which was discovered during the reliability test were also made as well as several changes in the listing of the farming statuses to be checked. The letter to the young farmer, which was a part of the check list, was also slightly modified.

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† The final revised form of the check list still contained a listing of 98 manipulative farm-mechanical skills. For each skill listed, space was provided for the young farmer to check the degree of: (1) importance of the skill for his success in farming during the past three to five years, whether used by himself or for himself; (2) his success in using the skill in farm practice; and (3) the amount of training he had received in the skill while enrolled in a high school course in vocational agriculture. These three sections of the check list were designated by the letters A, B, and C respectively. (For reasons given later in this chapter the three to five years stipulated with respect to importance were changed so that at least two years became the requirement when the revised check lists were distributed for final use. The vocational agriculture teachers and other persons who contacted the young farmer respondents informed them of this change.) Space was provided for the selective checking of one of three degrees of importance that were designated: ((1) very important; (2) somewhat important; and (3) not important or not used by the young farmer or for him.) The degrees of success in using the skill were provided spaces that were designated: ((1) successful almost every time; (2) sometimes successful; (3) not successful; and (4) not used by the young farmer.) The degrees of the amount of training received were to be checked in columns designated: ((1) enough for successful use when enrolled; (2) some; and (3) none.) The three and four point scale in judgment was used because it was assumed that it would be difficult for the young farmers to discriminate more accurately.

Sample check list

Nineteen farm-mechanical enterprises were represented by the 98 skills finally listed in the check list. Its final form was printed by the photo off-set process and consisted of eight pages 7" x 8 1/2" in size. To produce this size and number of pages two sheets 8 1/2" x 14" were stapled together and folded. A copy of the printed form of the check list is included in the Appendix.

Selection of Schools to Be Included in This Study

+ On the basis of determined criteria the state supervisor of agricultural education in Colorado was requested to select the rural school communities wherein the qualified young farmers who were to cooperate in this study resided. (Communities containing less than 10 young farmers were not included in his selection because this number was considered to be the most practical working minimum. This number, however, was not adhered to in the gathering of the data in the communities selected. A very limited number of communities were not included although the desired number of respondents could probably have been found in them. But, because the teacher in the local school had only recently assumed his duties, it was considered impractical to ask him to cooperate.) Forty-seven schools were selected which are representative of all the major agricultural sections and of the various sized vocational agriculture departments in the state. They comprised approximately 70 per cent of the total number of vocational agriculture departments in the state in 1957.

Qualifications of Young Farmers Who Cooperated in This Study

+ Each of the young farmers who cooperated in the study had either been enrolled in two years of vocational agriculture of which farm-mechanical training was an integral part if only two years were offered in the high school he attended, or if three or four years were offered, he had taken at least three years. (It was considered important to the

study to get the judgment of only young farmers who had availed themselves of the opportunity to enroll in a relatively complete program of vocational agriculture in high school. It was also considered important that the vocational agriculture program had included, as an integral part of it, training in farm-mechanical skills.

It was at first planned to accept only young farmers who had had three to five years of farm or ranch experience since their enrollment in the above prescribed number of years of vocational agriculture. It, however, soon became evident that the number of returns would be considerably smaller if this requirement were not modified. It was decided that a minimum of two years of farm or ranch experience in one or more of the statuses listed in the check list would be a sufficient amount of experience to qualify a young farmer to use good judgment in evaluating the importance and his use of the farm-mechanical skills in farm practice as well as his training in each of them while enrolled in high school. It was not required that he be engaged in any status of farming or ranching at the time of his completion of the check list.

It was assumed that a young farmer's ability to recall his training experiences in vocational agriculture would decrease proportionately with the lapse of time since such training. It was also improbable that any young farmer under the age of 19 could have had at least two years of farm or ranch experience since studying vocational agriculture. The ages, of 19 to 29 years were, therefore, arbitrarily selected for qualifying the young farmers as to age.

The Gathering of Data

The vocational agriculture instructor in each of the selected schools was asked by means of a mimeographed letter to contact 10 to 15 qualified young farmers and to solicit their cooperation in applying their best judgment to the completion of the check list. To help motivate each vocational agriculture instructor, the State Supervisor of Agricultural Education sent him a dittoed cover letter in which he was asked for his fullest cooperation in the gathering of the data from the young farmers in his community. (A list of the instructors who cooperated and their location is included in the Appendix.)

As was anticipated, the gathering of the data proved to be a prolonged task. A year elapsed before all 302 returns were collected. Many of the vocational agriculture instructors were contacted several times. Several kinds of contacts were necessary to get the 302 usable returns (which were analyzed and discussed in Chapter IV.) In numerous instances the author contacted young farmers personally, by phone, or by mail. Some were contacted by a student who was majoring in agricultural education at Colorado State University and who was hired to do this job. Table II in the Appendix is a summation of the data gathering contacts which were made.

All evidence from the contacts made with the vocational agriculture teachers who cooperated as well as with some of the young farmers indicated that the data were carefully and accurately gathered and that the young farmers were sincerely interested in providing data for the improvement of the farm-mechanical training phase of vocational agriculture as taught in the high school in their community as well as in their state.

CHAPTER IV

ANALYSIS AND DISCUSSION OF DATA

The form in which the data were gathered, the method that was used to summarize them, the kind of analysis that was used to develop organization of the data, use of the data in evaluating courses in farm mechanics to which they apply, and their application to future course planning are discussed in this chapter. These data indicate a three-way relationship (1) of importance for success in farming, (2) to success in use in farm practice, and (3) to training received in high school in vocational agriculture courses for 98 selected farm-mechanical skills. These data also show the same kind of relationship for the 19 farm-mechanical enterprises which are represented by these skills. Additional data are also discussed in order to amplify and to describe in more detail some of the qualifications of the respondents.

Source of Data

Data were obtained from each of 302 young farmers who had studied vocational agriculture in one of 36 participating high schools in the State of Colorado. Chapter III, Methods and Materials, contains a detailed discussion of the selection of the respondents, their qualifications, the selection of the high schools, and the methods and materials that were used to gather the data.

To establish certainty that several of the qualifying characteristics of the respondents were in actuality those planned for,

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the participating young farmers were asked to respond to questions pertaining to the number of years they had studied vocational agriculture in high school, their status of farm or ranch experience, and whether or not they worked more hours in farm or ranch enterprises than in any other kind of work at the time they completed the check list for this study.

Check list question three is, "Did you complete all courses of vocational agriculture in which farm-mechanics training was offered in your high school?". This question was answered, Yes, by 271 of the three hundred and two respondents. Twenty-seven answered, No; and four did not respond to this question. All young farmers who were selected to complete the check list must have either completed both full year courses in a two-year or at least three years of a three or four-year vocational agriculture program. These findings simply indicate that the 27 young farmers who answered, No, to check list question three completed three of four years in a four-year program.

Check list question five is, "Do you work more hours in farm or ranch enterprises than in any other type of work?". This question was answered, Yes, by 260 of all the respondents while thirty-two answered, No. Ten did not respond to it. Table III contains a summary of the responses made to both this and the above discussed question.

The respondents from 29 of the schools indicated an average of more than one farming status per respondent. This means that many of the young farmers were, or had been, engaged in more than one farming status. Two of the statuses listed in the check list were indicated by a considerably greater percentage of the respondents than

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TABLE III

SUMMARY OF RESPONSES TO CHECK-LIST QUESTIONS THREE AND FIVE BY YOUNG FARMERS FROM EACH OF 36 SCHOOLS INCLUDED IN THIS STUDY AND TOTALS OF ALL SCHOOLS BY QUESTION ASKED

Schools	Total number of respondents from each school	Question 3. Did you complete all courses of vocational agriculture in which farm-mechanics training was offered in your high school?			Question 5. Do you work more hours in farm or ranch enterprises than in any other type of work?		
		Yes	No	Did not respond	Yes	No	Did not respond
Arvada	10	8	2	0	9	1	0
Berthoud	7	7	0	0	6	1	0
Brighton	37	35	2	0	29	8	0
Burlington	5	5	0	0	5	0	0
Center	4	2	2	0	4	0	0
Collbran	4	4	0	0	2	2	0
Cortez	9	8	0	1	9	0	0
Crook	7	5	2	0	7	0	0
Del Norte	4	3	1	0	3	1	0
Delta	5	5	0	0	5	0	0
Eaton	9	9	0	0	9	0	0
Fleming	7	7	0	0	7	0	0
Fort Collins	16	15	1	0	8	7	1
Fort Morgan	2	2	0	0	2	0	0
Fruita	9	6	3	0	7	2	0
Greeley	10	10	0	0	9	1	0
Gunnison	6	6	0	0	6	0	0
Haxtun	4	4	0	0	4	0	0
Holly	5	3	1	1	4	0	1
Holyoke	10	8	2	0	10	0	0
Julesburg	4	4	0	0	2	2	0
Longmont	13	11	2	0	11	1	1
Loveland	11	8	3	0	9	2	0
Meeker	8	7	1	0	8	0	0
Montrose	5	5	0	0	3	0	2
Olathe	4	4	0	0	4	0	0
Palisade	6	6	0	0	6	0	0
Prospect Valley	4	4	0	0	3	0	1
Rifle	9	4	4	1	5	3	1
Rocky Ford	7	7	0	0	7	0	0
Sargent	2	2	0	0	2	0	0
Springfield	10	10	0	0	10	0	0
Steamboat Springs	6	6	0	0	6	0	0
Sterling	20	20	0	0	20	0	0
Wiggins	15	15	0	0	15	0	0
Windsor	8	6	1	1	4	1	3
Totals	302	271	27	4	260	32	10

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were the others. They were; (1) at home owning or sharing in one or more farm enterprise, and (2) at home, sharing in total farm business. The first of these was indicated by 28.8 per cent and the second by 24.8 per cent of the young farmers. Only 9.6 per cent of the respondents were not engaged in any farm or ranch enterprise at the time they completed the check list for this study. The vocational agriculture teachers who selected these young farmers to complete the check list, however, had done so because the respondents in question had had at least two years of experience in one or more of the farming statuses listed in the check list, and they were, therefore, qualified to complete it. The status, farm worker, was written in by one per cent of the respondents. Since it was not printed in the check list, it may have also been an additional status for others who indicated their statuses from among those which were printed. Table IV is a summary of the farming statuses of the 302 respondents. The number of young farmers from each school who completed check lists is recorded in both Tables III and IV.

Method Used to Organize Data for Analysis

A detailed discussion of the check list which was used to gather data for this study is included in Chapter III, Methods and Materials. A three-check response was obtained from the 302 young farmer respondents for each of 98 selected farm-mechanical skills. (As is explained in detail in Chapter III, each respondent presumably exercised his best judgment and checked each skill for one of three degrees of importance for success in farming, one of four degrees of success in use in farm practice, and one of three degrees of training

TABLE IV

FARMING STATUSES OF YOUNG FARMER RESPONDENTS FOR EACH
OF THE 36 SCHOOLS INCLUDED IN THIS STUDY

Schools	Total number of young farmers from each school	At home, owning or sharing in one or more farm enterprises	At home, owning or sharing in one or more farm enterprises and renting additional land for yourself	At home, sharing in total farm business	At home, sharing in total farm business and renting additional land for yourself	Living at home and renting land for yourself	Partner in farming either at home or away from home	Living on and operating farm for yourself	Living on and operating your own farm	Living on and operating your own farm and renting additional land for yourself	Farm manager	Not engaged in any farm or ranch enterprise	Farm worker	Did not respond
Arvada	10	2	4	3		1	4		2		1			1
Berthoud	7	2	1	1	1	1	2				1	1		
Brighton	37	15	4	10		2	8	4	2	2	2	5		
Burlington	5	2	3	2	1	1		1			1			
Center	4						2	1				1		
Collbran	4	3		1			1	1	1		2	1		
Cortez	9	1	1	4	2		3					3		
Crook	7	2	1	1			1	2				1		
Del Norte	4	1		3			1					1		
Delta	5	1		2		1	2			1				
Eaton	9	4			1			2			1		1	
Fleming	7	1	1	2				2	1	2				
Fort Collins	16	5	2	1	1		3	2		1		6		1

TABLE IV (continued)

Schools	Total number of young farmers from each school	At home, owning or sharing in one or more farm enterprises	At home, owning or sharing in one or more farm enterprises and renting additional land for yourself	At home, sharing in total farm business	At home, sharing in total farm business and renting additional land for yourself	Living at home and renting land for yourself	Partner in farming either at home or away from home	Living on and operating farm for yourself	Living on and operating your own farm	Living on and operating your own farm and renting additional land for yourself	Farm manager	Not engaged in any farm or ranch enterprise	Farm worker	Did not respond
Port Morgan	2			2										
Fruita	9	4		1			2		1		1	2	1	
Greeley	10	5	1	2	1		1	1				1		
Gunnison	6	2	1	3			1				1	1		
Haxtun	4	2	2	2	1	1		3			1			
Holly	5	1	2			1	1				1			1
Holyoke	10	1			1	1		5			2	1		
Julesburg	4	2	1									3		
Longmont	13	2	2	2	3		2	4			1			
Loveland	11	1		1	1		2	4				1	1	
Meeker	8	1		5			5				3			
Montrose	5	2		3			1	2						1

TABLE IV (continued)

Schools	Total number of young farmers from each school	At home, owning or sharing in one or more farm enterprises	At home, owning or sharing in one or more farm enterprises and renting additional land for yourself	At home, sharing in total farm business	At home, sharing in total farm business and renting additional land for yourself	Living at home and renting land for yourself	Partner in farming either at home or away from home	Living on and operating farm for yourself	Living on and operating your own farm	Living on and operating your own farm and renting additional land for yourself	Farm manager	Not engaged in any farm or ranch enterprise	Farm worker	Did not respond
Olathe	4			1	2	2			3	1				1
Palisade	6	1	1	2	1		1							
Prospect Valley	4	1	1	2	1		1		5		1			1
Rifle	9	6	1	4	2	4	1	1	1		1			
Rocky Ford	7		1	1	1			3	1	1	1			
Sargent	2			1	1				1					
Springfield	10	3	1	3	1	1	5	2	1	3	2			
Steamboat Springs	6	3		3				1	1		1			
Sterling	20	7	2	5	2	1	8	2	1	2	2			
Wiggins	15	4	3	4	1	1		2						
Windsor	8		2				1	2			1	1		2
Totals	302	87	40	75	24	18	57	46	18	14	26	29	3	8
Percentages*		28.8	13.2	24.8	7.9	6.0	18.9	15.2	6.0	4.6	8.6	9.6	1.0	2.6

*Since many young farmers indicated that they had attained experience in more than one farming status, the total of the percentages for all of the farming statuses does not equal 100 per cent.

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received in high school in vocational agriculture courses. Theoretically, therefore, 36 combinations were possible.

As it was stated in Chapter I, Introduction, the problem of this study was to determine for selected farm-mechanical skills the relationship of importance for success in farming, to success in use in farm practice, and to training received in high school in vocational agriculture courses. Since this three-way relationship was indicated by the young farmer respondents for the skills, it had to be used as one of the 36 possible response patterns in order to maintain the relationship that was indicated. In other words a response could not be divided into its three parts for analysis.

In order to simplify the discussion as to how the 36 response patterns were organized for the analysis of data, the same letters and numbers that were used to designate the three importance, four use, and three training columns in the check list were used. Since the letters A, B, and C were used in the check list to indicate importance, use, and training respectively, they were used in a like manner in this discussion. In section A (importance) of the check list number one (1) column is headed "very important", and number two (2) and three (3) columns are headed "somewhat important" and "not important, or not used by the young farmer or for him" respectively. In section B (use) of the check list number one (1) column is headed "successful almost every time", and number two (2), three (3), and four (4) columns are headed "sometimes successful", "not successful" and "not used by the young farmer" respectively. In section C (training) of the check list number one (1) column is

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headed "enough for successful use when enrolled in high school", and number two (2) and three (3) columns are headed "some" and "none" respectively.

Each of the 36 response patterns can be designated by using combinations of the letters and numbers discussed above. For example, a three-way response consisting of a check for importance (A) in column one "very important", for use (B) in column one "successful almost every time", and for training (C) in column one "enough for successful use when enrolled in high school" can be designated with the combination of letters and numbers, $A_1B_1C_1$. To simplify the analysis of the data an arbitrary regrouping of the 36 response patterns into nine groups, now to be called categories, appeared to be quite logical. Any of the response patterns which are enough similar to one another so that the same analysis can be made of any one, or all of them together, can be placed in the same category. For identification the categories are designated by the numbers one (1) through nine (9). It is not intended that these numbers imply any arbitrary ranking of the categories, however, to facilitate the analysis of the data an arbitrary decision was made as to which of the nine numbers to assign to each of the categories.

Below is a listing of the nine categories of response patterns with a justification for each grouping.

Key to letters and numbers of response patterns

Importance of skill (A)	Success in using skill (B)	Training in high school (C)
A ₁ Very important	B ₁ Successful almost every time	C ₁ Enough for successful use when enrolled
A ₂ Somewhat important	B ₂ Sometimes successful	C ₂ Some
A ₃ Not important, or Not used by respondent or for him	B ₃ Not successful	C ₃ None
	B ₄ Not used by respondent	

Categories	Patterns	Justification for the Grouping
1	A ₁ B ₁ C ₁	This pattern of the three-way relationship of importance (A), to use (B), and to training (C) is the best possible. Since this is the ultimate goal of the three-way relationship, it was left to comprise category one (1) by itself to allow for a more complete analysis of data.
2	A ₁ B ₁ C ₂ , A ₁ B ₂ C ₁ , A ₁ B ₂ C ₂	A response with one of these patterns indicates a skill to be "very important", (A ₁). In this way they are the same as the pattern in category one (1). They fall short, however, of a best possible three-way relationship of importance (A), to use (B),

Categories	Patterns	Justification for the Grouping
		and to training (C) because use and training are both not rated one (B_1C_1).
3	$A_2B_1C_1$, $A_2B_2C_1$, $A_2B_1C_2$, $A_2B_2C_2$	Although the rating of use (B) and training (C) of responses with these patterns are quite similar to those placed in category two (2), skills in these patterns are rated to be of less importance (A_2) than those in categories one (1) and two (2).
4	$A_1B_1C_3$, $A_1B_2C_3$, $A_2B_1C_3$, $A_2B_2C_3$	Although the importance (A) and use (B) of responses with these patterns have a two (2) or one (1) rating and in this respect they could be placed in one of the first three categories, they do not qualify for them because training (C) was not offered.
5	$A_1B_3C_3$, $A_1B_4C_3$, $A_2B_3C_3$, $A_2B_4C_3$	The patterns in this category differ from those in category four (4) in use (B) which in these patterns is rated either three (3) or four (4).
6	$A_1B_3C_1$, $A_1B_3C_2$, $A_2B_3C_1$, $A_2B_3C_2$	These patterns indicate that even though some or more training (C_2 or C_1) was offered, the responses for skills in this category indicate that the skills were "not used with any success" (B_3).

Categories	Patterns	Justification for the Grouping
		Responses for skills with these patterns, however, are rated two (2) or one (1) as to importance (A_2 or A_1).
7	$A_1B_4C_1$, $A_1B_4C_2$, $A_2B_4C_1$, $A_2B_4C_2$	These patterns are like those in category six (6) except, in these, use (B) is indicated "not used by the respondent" (B_4) instead of "not used with any success" (B_3).
8	$A_3B_1C_1$, $A_3B_2C_1$, $A_3B_3C_1$, $A_3B_4C_1$, $A_3B_1C_2$, $A_3B_2C_2$, $A_3B_3C_2$, $A_3B_4C_2$	Responses for skills with these patterns are all "not important or not used by the respondent or for him" (A_3). However, since some or more training (C_2 or C_1) was offered, these patterns indicate an undesirable relationship between importance (A) and training (C). In responses with these patterns the use (B) of the skills is of no consequence in the analysis of data.
9	$A_3B_1C_3$, $A_3B_2C_3$, $A_3B_3C_3$, $A_3B_4C_3$	The characteristic difference between the patterns in this category and those in the previous category (8) is that no training was offered (C_3). Again in these response patterns, as in those of the previous category, use (B) is of no consequence in the analysis of the data because the skills to which they apply are rated three (3) as to importance (A_3).

With the above nine categories arbitrarily established, the summarization of data was done in four steps. First, each young farmer's three-check response for each of the 98 farm-mechanical skills was transposed to its category number. Second, the number of responses in each category made by the respondents were totaled by schools for each skill. This step was used only for convenience since an analysis of a comparison among schools did not promise enough added value to justify such a procedure. Also in most instances the number of responding young farmers from the schools was not large enough to adequately represent their respective schools. In the third step the responses in each category by schools were added to determine the grand total number of respondents who placed each skill in each of the categories. In the fourth step the grand total number of responses in each category for each skill were reduced to percentages.

Table V in the Appendix contains the grand total number of responses in each of the categories for each skill and their corresponding percentage of the total number of responses per skill. It will be noted that the total of all the percentages for a skill may not add to exactly 100 per cent. This is the result of rounding fractions to whole percentages. As an aid in interpreting the data contained in Table V bar graphs are used in the discussion that follows to show the distribution of the responses in the categories for each of the 98 farm-mechanical skills as well as for each of the farm-mechanical enterprises they represent. Since, as, is discussed later, the responses in categories six (6), seven (7), eight (8), and nine (9) were always added together in interpreting the data, the

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percentages in each of these categories are shown as the sum of them in the bar graphs.

Analysis of the Data

Since a majority of any significant number of respondents is usually considered to be a large enough group so that their response can be considered to be meaningful, a 50 or greater per cent response was used to determine what could be said with some degree of conclusiveness about each skill. However, for only seven skills was there a 50 or greater per cent response in any of the nine categories.

The next logical step in the analysis of the data was to make a further regrouping of the nine-category responses and still preserve the information that was available from the nine-category grouping. It was decided to regroup the nine categories into six groups that would be designated as classes of skills. With this procedure it becomes possible to make an evaluative analysis of the training that had been offered in the skills in high school courses of vocational agriculture as well as to make recommendations pertaining to the future needs for such training. A listing of the six classes by Roman numbers I to VI and a brief explanation of the basis on which the classifications were made is given below. A more detailed explanation is given in the discussion that follows later.

Class	Basis on which Classification Was Made
I	Category one (1) with a 50 or greater per cent majority response alone, comprises class I. The importance (A), to use (B), and to training (C) relationship is the best possible, ($A_1B_1C_1$).

Class	Basis on which Classification Was Made
II	Category one (1) responses, when not placed in class I, were added to those in category two (2) for a 50 or greater per cent majority to comprise this class. Skills listed in Class II are "very important" (A_1), were rated at least "sometimes successful" in use (B_1 or 2), and "some" or more training (C_1 or 2) had been received.
III	When the responses in categories one (1) and two (2) were high but did not add to a 50 or greater per cent majority, they were added to a portion of the category four (4) and five (5) responses, and if the desired majority was obtained by this combination of categories, the skills involved were placed in class III. These skills were indicated to be as important as those in class II, but some of the respondents had not received training (C_3). All degrees of use ($B_1, 2, 3$, or B_4) are included for these skills.
IV	When the sum of the responses in categories one (1) and two (2) did not equal a 50 or greater per cent majority and the responses in categories four (4) and five (5) were relatively low, categories one (1), two (2), and three (3) were added together. If the desired majority was obtained by this procedure, the skills involved were listed in class IV. Skills in this class are less important (A_1 or 2) than those listed in the first three classes, while their use and training resembles those in class II, (B_1 or 2 and C_1 or 2) respectively.

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Class	Basis on which Classification Was Made
V	In class V were listed those skills for which categories one (1), two (2), three (3), and four (4), and five (5) were added together to get a 50 or greater per cent majority response. These skills were at least "somewhat important" (A_1 or 2), however, all degrees of <u>use</u> (B_1 , 2, 3, or 4) and <u>training</u> (C_1 , 2 or 3) were indicated.
VI	When a majority, (50 per cent or more), of the responses were in categories six (6), seven (7), eight (8), and nine (9), the skills involved were placed in class VI. A high proportion of the respondents indicated these skills to be unimportant or not used (A_3). Others indicated them to be at least "somewhat important" (A_2 or 1), but they were not successful in using them or they were not used by themselves even though at least "some" (C_1 or 2) training had been received.

Class I skills. The discussion that follows treats in detail, by use of the six classification groups just described, the analysis of the three-way responses made by the 302 young farmers to the 98 farm-mechanical skills. The first group of skills, seven in number, that are pictured by bar graph in Figure 1, qualify to be placed in class I. In each case 50 per cent or more of the young farmers indicated a category (1) response that, as will be recalled from the discussion of the grouping of categories into classes, makes up class I.

Skills	Categories						Key to Categories
	1	2	3	4	5	6,7,8,9	
TOOL FITTING	.51						Cate- gor- ies
1. Replace broken handles in tools		.20	.23				
				.03	0	.01	1
	.50						A ₁ B ₁ C ₁
2. Sharpen edged tools, such as chisels, plane blades or knives		.34					2
			.13				A ₁ B ₁ or 2
				.01	0	.02	C ₁ or 2
ARC WELDING	.50						3
3. Weld iron or steel		.32					A ₂ B ₁ or 2
				.06	.04	.01	C ₁ or 2
						.06	4
							A ₁ or 2
							B ₁ or 2 C ₃
OXACETYLENE WELDING	.56						5
4. Use the cutting torch to cut metal		.17					A ₁ or 2
			.07	.04	.03		B ₃ or 4 C ₃
							6
COLD METALWORKING	.59						A ₁ or 2 B ₃
5. Drill holes in metal		.20	.16				C ₁ or 2
				.03	.01	.01	7
							A ₁ or 2 B ₄
							C ₁ or 2
6. Cut metal using tools such as, hacksaws, metal shears or chisels	.51						8
		.22	.22				A ₃
				.03	0	.01	B _{1,2,3, or 4}
	.50						C ₁
7. Cut threads on bolts or rods		.22	.18				9
				.07	.01	.04	A ₃
							B _{1,2,3, or 4}
							C ₃

FIGURE 1. FARM-MECHANICAL SKILLS IN CLASS I

For these seven skills, then, it can be said that the three-way relationship of importance to success in farming, to use, and to training was the best possible. The number of respondents who indicated these skills to be "very important" to their success in farming but who had not received at least some training in high school is obviously insignificant since the per cent of responses in both categories four (4) and five (5) is quite low. These skills were indicated to be "very important" (A_1) by a very high percentage of the respondents since the total responses in categories one (1) and two (2) was 73 per cent or higher. It will be recalled that a category two (2) response also indicates a skill to be "very important" (A_1).

It is logical to conclude that for these seven skills, Colorado vocational agriculture programs satisfactorily met the needs of vocational agriculture students who responded to the check list. Although it is difficult to predict the future training needs of vocational agriculture students, it is probably correct to assume that training in these seven skills should be continued in high school courses of vocational agriculture if the students have not already acquired proficiency in their use before enrolling. This assumption is supported by the fact that these skills were also rated one (1) as to use (B_1) by a greater than 50 per cent majority of the respondents.

Class II skills. The 26 skills listed in Figure 2 below have been placed in class II. It will be noted that, although the category-response distributions of these skills are not all closely similar, they all include 50 per cent or more of the responses in categories one (1) and two (2). This kind of response indicates them to be

Skills	Categories						Key to Categories
	1	2	3	4	5	6,7,8,9	
WOODWORKING, GLAZING AND PAINTING	.45						Categories Combined response patterns
1. Cut lumber to size with saws		.27	.25	.01	0	.02	1 A ₁ B ₁ C ₁
2. Bore or drill holes in wood	.45		.36	.03	.01	.01	2 A ₁ B ₁ or 2 C ₁ or 2
3. Measure lumber to construct buildings and equipment which are correctly plumbed and squared	.34	.34	.18	.05	.02	.06	3 A ₂ B ₁ or 2 C ₁ or 2
4. Fasten boards with nails	.47		.35				4 A ₁ or 2 B ₁ or 2 C ₃
5. Fasten boards with screws and/or bolts	.43	.20	.33	.03	0	.01	5 A ₁ or 2 B ₃ or 4 C ₃
6. Paint equipment or buildings constructed of lumber	.38	.18	.32	.07	.01	.04	6 A ₁ or 2 B ₃
TOOL FITTING	.30	.40	.18	.04	.01	.03	7 C ₁ or 2
7. Sharpen drilling and boring tools	.33	.25	.33	.03	0	.07	8 A ₃ B ₁ , 2, 3 or 4 C ₁
SOLDERING AND SHEET METALWORKING							9 A ₃ B ₁ , 2, 3, or 4 C ₃
8. Solder metals used on the farm							

FIGURE 2. FARM MECHANICAL SKILLS IN CLASS II

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Skills	Categories					
	1	2	3	4	5	6,7, 8,9
ARC WELDING						
9. Weld iron castings	.23	.29	.13	.09	.10	.16
ARC WELDING						
10. Use the arc welder to cut metal	.39	.17	.16	.12	.05	.17
OXYACETYLENE WELDING						
11. Use steel rod to weld iron or steel	.32	.22	.14	.05	.06	.20
12. Use bronze rod to weld iron or steel	.32	.23	.10	.06	.05	.23
OPERATING AND REPAIRING FARM MACHINERY						
13. Sharpen cutting parts of farm machinery	.31	.29	.11	.18	.03	.08
14. Replace broken or worn parts on farm machinery	.37	.37	.05	.20	0	.01
15. Fit bearings on farm machinery	.23	.33	.08	.27	.04	.06
16. Make operational adjustments on farm machinery	.26	.34	.04	.34	.01	.01

Figure 2. (continued)

Skills	Categories					
	1	2	3	4	5	6,7, 8,9
17. Calibrate farm machinery. Example: Adjust a grain drill so it will plant the correct amount of seed per acre	.21	.30	.43	.38	.02	.06
18. Make adjustment in hitches and alignments on farm machinery	.22	.32	.04	.40	.01	0
OPERATING AND REPAIRING FARM MACHINERY	.41	.31		.25	0	0
19. Lubricate farm machinery			.03			
20. Paint farm machinery	.33	.20	.26	.09	.02	.09
MAINTAINING AND REPAIRING TRACTORS AND ENGINES	.33	.27		.30		
21. Service battery			.09		0	.01
22. Tune-up or replace spark plugs	.36	.26	.09	.38	0	0
23. Service air cleaner	.39	.24	.04	.31	.01	.01
24. Tune-up carburetor or fuel system	.20	.34	.04	.29	.07	.05

FIGURE 2. (continued)

Skills	Categories					
	1	2	3	4	5	6,7, 8,9
25. Service tires	.32	.21	.11	.32	.01	.02
RURAL ELECTRIFICATION						
26. Repair electrical cord	.26	.26	.20	.20	.03	.06

FIGURE 2. (concluded)

"very important" (A_1). The three-way relationship of importance (A), to use (B), and to training (C) is, however, not as desirable as that for the seven skills discussed above. The responses do indicate that, for these skills, a fairly satisfactory program of instruction was offered in Colorado vocational agriculture departments to high school students.

However, some noticeable differences can be observed by comparing the bar graphs of these 26 skills. In several instances the skills are rated only "somewhat" important (A_2) by a relatively high proportion of the respondents since they placed their responses in category three (3). The skills so indicated are numbers 2, 4, 5, 6, 8, and 20. These skills can probably be considered to be less important to success in farming than those where a higher proportion of the responses were in categories one (1) and two (2).

The significance of the "very important" (A_1) rating was deemphasized a noticeable amount for four skills, numbers, 9, 10, 11, and 12. This is indicated by a 16 or greater per cent response in categories six (6), seven (7), eight (8), and nine (9). From a review of the category classification discussion it can be stated

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that a response in these categories is an indication that training (C) should not be offered for the skills to which they apply. This kind of response for the four skills listed above is, however, not great enough to justify such a recommendation. This distribution of the responses, however, warrants the giving of considerable thought to deciding whether or not training should be offered, especially, when not enough time is available to include all of the "very important" (A_1) skills in the courses of vocational agriculture.

The respondents also indicated that a considerable number of them did not receive training for skill numbers 9, 10, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, 24, 25, and 26. More consideration should have been given to training high school students in vocational agriculture in these skills.

For all 26 of these skills, it is probably correct to assume that training should be offered in high school even though use of the skills by a sizeable proportion of the young farmers was only a two (B_2) rating.

Class III skills. The 11 skills included in Figure 3 qualify to be placed in class III. The category-response distribution for each of these skills is characterized by a high proportion of the responses in category four (4). This kind of response indicates a complete lack of training in high school for these skills for those young farmers who indicated such a response.

For none of these skills is there a 50 per cent majority response in categories one (1) and two (2) although the proportion of such responses is higher than are those in categories three (3), six (6), seven (7), eight (8), and nine (9) combined. It is, of course, not possible to know how many of those young farmers who indicated that they had no training, by category four (4) and five (5) responses, would have indicated a category (1) or (2) response if they had had training. It must also be kept in mind that some of the responses were in category three (3), and those who had not received training might have indicated in category three (3) response had they received training. It is logical to assume, however, that some of the

Skills	Categories						Key to Categories	
	1	2	3	4	5	6,7,8,9		
PLUMBING				.38			Cate- gor- ies	Combined response patterns
1. Repair leaky valves or faucets	.16	.16	.19		.07	.03		
OPERATING AND REPAIRING FARM MACHINERY				.30			1	A ₁ B ₁ C ₁
2. Assemble farm machinery	.23	.26	.10		.03	.09	2	A ₁ B ₁ or 2 C ₁ or 2
MAINTAINING AND REPAIR- ING TRACTORS AND ENGINE				.29			3	A ₂ B ₁ or 2 C ₁ or 2
3. Tune-up magneto or distributor	.10	.31	.06		.14	.11	4	A ₁ or 2 B ₁ or 2 C ₃
4. Repair or replace electrical wiring	.17	.31	.09	.26	.07	.10	5	A ₁ or 2 B ₃ or 4 C ₃
5. Tune-up tractor timing	.16	.24	.07	.30	.10	.12	6	A ₁ or 2 B ₃ C ₁ or 2
6. Tune-up cooling system	.19	.28	.07	.33	.08	.06	7	A ₁ or 2 B ₄ C ₁ or 2
17. Tune-up brakes	.18	.26	.08	.37	.05	.06	8	A ₃ B _{1,2,3, or 4} C ₁
SUPPLYING FARM WATER FOR DOMESTIC USE				.39			9	A ₃ B _{1,2,3, or 4} C ₃
8. Repair water pumps	.09	.19	.10		.13	.10		

FIGURE 3. FARM MECHANICAL SKILLS IN CLASS III

11

Skills	Categories					
	1	2	3	4	5	6,7, 8,9
CONSTRUCTING AND REPAIR- ING FENCE				.39		
9. Set fence posts	.23	.23	.11		0	.03
10. Stretch fence	.25	.23	.09	.40	0	.03
11. Install farm gates	.21	.30	.11	.35	.01	.03

FIGURE 3. (concluded)

category four (4) and five (5) respondents would probably have indicated a category one (1) or two (2) response had they received training. To arrive at an estimate of how many would have responded in this manner it was decided to use a proportion equal to

$$\frac{\text{category one (1) plus two (2)}}{\text{category one (1) plus two (2) plus three (3) plus four (4) plus five (5) responses}}$$

of the category four (4) responses. By using the above formula it is possible to estimate whether or not a 50 or greater per cent majority of the responses would have been in categories one (1) and two (2) if those who did not receive training had received it. It was by this method that the 11 skills in Figure 3 were selected. Inasmuch as a high portion of the responses indicated the skills to be "very important" (A_1), and since a large portion of the respondents had used the skills successfully at least some of the time, it is probably correct to

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assume that training in them should be offered to high school students studying vocational agriculture in Colorado. It is also logical to state that such training should have been offered to more of the respondents while they were students of vocational agriculture in high school.

The 30 skills listed in Figure 4 also qualify for placement in class III but the category-response distribution of these is more scattered than those of the skills in the former list. For these skills the young farmers also indicated a lack of training in high school, but when the percentage of those who indicated a lack of training was viewed with respect to the other kinds of category-responses for any of these skills, it is not as well defined as it is for the skills listed in Figure 3.

Seventeen of the 30 skills had a 14 or greater per cent response in categories six (6), seven (7), eight (8), and nine (9). This characteristic tends to deemphasize a need to offer training. This pattern of category-response distribution was not found in the former list of skills. Eight of the skills had a 21 or greater per cent response in category three (3). This kind of response also deemphasizes a need to offer training because it indicates an importance rating of two (A_2) for these skills by those young farmers who responded in this manner.

By applying the formula which was used to determine the former list, however, it is possible to assume that a 50 or greater per cent response for these 30 skills would have been in categories one (1) and two (2) if those who did not receive training had received it.

Skills	Categories						Key to Categories
	1	2	3	4	5	6,7,8,9	
WOODWORKING, GLAZING, AND PAINTING							Cate- gor- ies
1. Cut rafters	.19	.29	.24	.06	.04	.16	
2. Replace a broken window pane	.21	.16	.32	.18	.06	.08	1 A ₁ B ₁ C ₁
PLUMBING							2 A ₁ B ₁ or 2 C ₁ or 2
3. Cut pipe used in plumbing to desired length	.21	.16	.26	.22	.04	.09	3 A ₂ B ₁ or 2 C ₁ or 2
4. Thread pipe	.23	.18	.28	.21	.03	.07	4 A ₁ or 2 B ₁ or 2 C ₃
5. Assemble pipe and fittings so that joints are properly sealed	.20	.24	.21	.26	.04	.05	5 A ₁ or 2 B ₃ or 4 C ₃
ROPEWORKING							6 A ₁ or 2 B ₃ C ₁ or 2
6. Tie common knots	.27	.19	.34	.10	.02	.09	7 A ₁ or 2 B ₄ C ₁ or 2
ARC WELDING							8 A ₃ B _{1,2,3} , or 4 C ₁
7. Apply hard-facing material	.15	.16	.10	.19	.18	.23	9 A ₃ B _{1,2,3} , or 4 C ₃
OXYACETYLENE WELDING							
8. Weld iron castings	.17	.23	.13	.07	.10	.29	

FIGURE 4. ADDITIONAL FARM-MECHANICAL SKILLS IN CLASS III

Skills	Categories						
	1	2	3	4	5	6,7, 8,9	
9. Apply hard-facing materials							
	.14	.14	.12	.14	.22	.24	
CONCRETE WORKING							
10. Build concrete forms	.22	.26	.16	.23			
					.04	.09	
11. Reinforce concrete							
	.16	.21	.18	.27			
					.05	.14	
12. Pour concrete							
	.25	.22	.21	.23			
					.02	.07	
MAINTAINING AND REPAIR- ING TRACTORS AND ENGINES							
13. Tune-up tractor generator		.20		.27			
	.11		.09	.18	.15		
14. Adjust tappets							
	.13	.18		.25			
			.06	.17	.15		
15 Tune-up clutch							
	.10	.20		.35			
			.09	.13	.14		
16. Grind and/or replace valves							
	.07	.15		.17	.27	.29	
			.05				

FIGURE 4. (continued)

Skills	Categories						
	1	2	3	4	5	6,7, 8,9	
17. Overhaul engine	.14	.18	.07	.17	.18	.27	
18. Repair or overhaul any part of tractor other than the engine	.14	.32	.12	.29	.05	.09	
CONSTRUCTING BUILDINGS							
19. Lay out foundation lines and set grade stakes for buildings	.14	.20	.16	.20	.11	.19	
20. Construct the framework for farm buildings	.15	.25	.21	.15	.06	.17	
21. Apply roofing material	.18	.24	.19	.28	.04	.07	
SUPPLYING FARM WATER FOR DOMESTIC USE							
22. Install water-pressure system	.07	.11	.09	.37	.15	.20	
DISPOSING OF SEWAGE							
23. Install sewage-disposal system	.08	.15	.09	.26	.18	.24	
CONSTRUCTING AND REPAIRING FENCE							
24. Construct electric fence	.19	.23	.15	.32	0	.11	

FIGURE 4. (continued)

Skills	Categories					
	1	2	3	4	5	6,7, 8,9
SOIL AND WATER MANAGEMENT						
25. Measure fields to determine acreage	.21	.23	.14	.22	.05	.14
26. Lay out contour or grade lines for drainage or irrigation ditches	.17	.24	.09	.19	.08	.23
27. Lay out field drainage system	.09	.19	.09	.14	.15	.34
RURAL ELECTRIFICATION						
28. Repair an electrical circuit	.17	.30	.16	.16	.08	.14
29. Install an electrical circuit	.15	.26	.15	.17	.08	.18
30. Install overload-protection devices for electrical motor	.03	.16	.07	.16	.29	.29

FIGURE 4. (concluded)

It may, therefore, be recommended that training should be offered for these skills in vocational agriculture in high school. Since this recommendation must be made with more reservations than those previously made, it is suggested that careful study be made in any local situation before accepting it. The same kind of an evaluative statement can be made for the training program for these skills as was made for the former 11 skills, and that is, again, that more of the respondents should have had the opportunity to receive training for these 30 skills in high school.

Class IV skills. Fourteen skills are included in class IV, Figure 5. They are of less importance to success in farming than those in the first three classes since class IV contains the responses in categories one (1), two (2), and three (3). It will be recalled that a category three (3) response rates a skill "somewhat" important (A_2). The responses in categories four (4) and five (5) are relatively low for these skills. This indicates that training, generally, was offered. Whether or not it can be stated that this is desirable in evaluating a school's program will depend on how well the skills in question fit into a well balanced farm-mechanical training program designed to meet the needs of the students involved. If, because training was offered for these skills, it was not offered for other skills which were rated more important by the respondents from the school, then the training which was offered for any of these 14 skills was not justified.

It can be noted from Figure 5 that for several skills, namely numbers 3, 4, 5, 6, 7, 9, and 10, there was a rather marked tendency

Skills	Categories						Key to Categories	
	1	2	3	4	5	6,7, 8,9	Cate- gor- ies	Combined response patterns
GENERAL			.92					
1. Sketch plans for the construction of farm-mechanical jobs	.11	.21		.07	.05	.15	1	A ₁ B ₁ C ₁
WOODWORKING, GLAZING, AND PAINTING			.97				2	A ₁ B ₁ or 2 C ₁ or 2
2. Use hand tools other than saws to cut and shape lumber	.20	.19		.04	.01	.08	3	A ₂ B ₁ or 2 C ₁ or 2
3. Remove paint or varnish	.05	.06	.41	.14		.31	4	A ₁ or 2 B ₁ or 2 C ₃
4. Cut glass to desired size	.14	.11	.28	.11	.08	.28	5	A ₁ or 2 B ₃ or 4 C ₃
TOOL FITTING							6	A ₁ or 2 B ₃ C ₁ or 2
5. Sharpen saws	.17	.20	.26	.04	.13	.20	7	A ₁ or 2 B ₄ C ₁ or 2
ROPEWORKING			.36				8	A ₃ B _{1,2,3, or 4} C ₁
6. Make rope splices	.16	.13		.07	.04	.23	9	A ₃ B _{1,2,3, or 4} C ₃
7. Finish ends of rope	.18	.13	.37	.08	.04	.20		
HOT METALWORKING			.36					
8. Shape hot metal	.22	.22		.03	.01	.15		

FIGURE 5. FARM-MECHANICAL SKILLS IN CLASS IV

Skills	Categories					
	1	2	3	4	5	6,7, 8,9
9. Draw out tillage tools to a sharp edge	.15	.17	.21	.09	.14	.24
HOT METALWORKING						
10. Temper tools, such as chisels or punches	.22	.23	.27	.02	.03	.24
SOLDERING AND SHEET METALWORKING						
11. Cut and shape any kind of sheet metal	.11	.20	.40	.09	.07	.14
12. Fasten together any kind of sheet metal with rivets or self-tapping screws	.08	.14	.36	.17	.06	.19
COLD METALWORKING						
13. Fasten metal together with rivets	.21	.14	.28	.13	.07	.18
14. Bend cold metal	.20	.10	.34	.16	.03	.09

FIGURE 5. (concluded)

for the respondents to indicate a category six (6), seven (7), eight (8), or nine (9) response. Since a response in these categories is an indication that training for a skill should not be offered in high school, the fairly high proportion of responses in these categories emphasizes the fact that the seven skills mentioned above are even less important than the other seven of the total 14 in class IV.

Because these skills are not as highly important as any of those listed in classes I through III, it must be concluded that training in high school for them should probably be offered only if time is available in the schedule after other more important skill training has been offered.

Class V skills. The eight skills listed in Figure 6 are included in class V. As it will be recalled, a skill was placed in this class when it was necessary to add together the responses in categories one (1) through five (5) to get a 50 or greater per cent majority. Importance wise these skills are obviously not significantly different than those in class IV, since, in both cases, the skills were rated either "very" (A_1) or "somewhat" (A_2) important.

Except for skill number 1, (Anneal steel), the respondents indicated a greater lack of training for these skills than they did for those in the previously discussed class. If, in the local school program, this lack of training resulted because all the time available in the school schedule was used to provide training for more important skills, then the lack of training for these eight skills was well justified. Obviously no general statement can be made about the desirability of the lack of training indicated for the eight skills

Skills	Categories						Key to Categories	
	1	2	3	4	5	6,7,8,9		
HOT METALWORKING						.43	Cate- gor- ies	Combined response patterns
1. Anneal steel	.09	.13	.21	.04	.10			
ARC WELDING						.31	1	A ₁ B ₁ C ₁
2. Use the carbon arc to make a bronze weld	.13	.18	.15	.11	.12		2	A ₁ B ₁ or 2 C ₁ or 2
CONCRETE WORKING						.24	3	A ₂ B ₁ or 2 C ₁ or 2
3. Waterproof concrete, or concrete block walls	.10	.10	.12	.23	.21		4	A ₁ or 2 B ₁ or 2 C ₃
4. Lay block or bricks	.06	.06	.10	.26	.21	.31	5	A ₁ or 2 B ₃ or 4 C ₃
OPERATING AND REPAIRING FARM MACHINERY						.25	6	A ₁ or 2 B ₃ C ₁ or 2
1. Splice belts	.10	.08	.21	.24	.12		7	A ₁ or 2 B ₄ C ₁ or 2
CONSTRUCTING FARM BUILDINGS						.21	8	A ₃ B _{1,2,3, or 4} C ₁
6. Install insulating materials	.10	.11	.13	.28	.16		9	A ₃ B _{1,2,3, or 4} C ₃
CONSTRUCTING AND REPAIRING FENCE						.33		
7. Treat fence posts	.07	.11	.15	.13	.21			
RURAL ELECTRIFICATION						.31		
8. Tune-up an electrical motor	.05	.13	.11	.17	.24			

FIGURE 6. FARM-MECHANICAL SKILLS IN CLASS V



in question. It is probably also quite debatable whether or not training should be offered to current students in vocational agriculture. The total amount of time available for farm-mechanical skill training is the major limiting factor.

From a more detailed look at the bar graph for these eight skills, some rather outstanding differences can be noted in the response distributions. The number 1 skill, (Anneal steel), has a high proportion, 43 per cent, of the responses in categories six (6), seven (7), eight (8), and nine (9) which means, of course, that this skill is getting quite near to being rated one for which training should not be offered in high school. The lack of training for both skill numbers 1 and 2, (Anneal steel and Use the carbon arc to make a bronze weld respectively), was indicated proportionately considerably less often than it was for the rest of the skills in this class.

Class VI skills. Only two of the 98 farm-mechanical skills were placed in class VI by the respondents. They are listed in Figure 7 and are namely, weld aluminum and tune-up diesel-fuel-injection system. Since this class consists of skills for which the total of the responses in categories six (6) through nine (9) is equal to a 50 or greater per cent majority, training should not be offered for this class of skills in high school. For the two skills involved a fairly high proportion of the responses are in category five (5) which indicates lack of training. Since the responses in categories six (6) through nine (9) were 50 per cent or more, the fairly high lack of training indicated by category five (5) responses

Skills	Categories					
	1	2	3	4	5	6,7, 8,9
OXYACETYLENE WELDING						.54
1. Weld aluminum					.23	
	.01	.03	.12	.08		
MAINTAINING AND REPAIR- ING TRACTORS AND ENGINES						.50
2. Tune-up diesel-fuel- injection system					.31	
	.02	.03	.03	.12		

FIGURE 7. MECHANICAL SKILLS IN CLASS VI

is highly justified. Colorado vocational agriculture teachers, in other words, planned well in not offering training in these two skills to high school students. For the present, at least, they should continue to not offer training for these skills.

Enterprise classification. The data were analyzed further on the basis of the 19 farm mechanical enterprises which are represented by the skills studied. This analysis consisted of determining into which of the six classes, as used for the skills, each of the enterprises qualified. To summarize the data for this purpose, the method for determining the percentage of response by categories for each farm-mechanical enterprise consisted simply of obtaining an average of the percentages by categories of all the skills included. A review of the check list for this study will serve to recall what skills were included in each enterprise. A copy of it is included in the Appendix. Table VI in the Appendix contains these percentage figures.

Whether or not the offering of training can be recommended for any of these enterprises will, of course, depend on what skills are to be included in the various enterprises, since actually any discussion of any analysis of the enterprises is based on an average of the skills involved. The discussion which follows will, therefore, be brief and will be presented only to give a general overview of the discussion that has preceded. It should be kept in mind, however, that better answers for course planning can be found in the analysis of the data by individual skills.

It was noted that none of the enterprises was indicated by a category one (1) response by a 50 or greater per cent majority of the young farmers. This means that for no enterprise was the importance, use, and training relationships the best possible. Therefore, none of them qualified for placement in a I classification.

Three enterprises qualify to be placed in class II. As will be noted from Figure 8, they are; (1) tool fitting; (2) cold metalworking; and (3) operating and repairing farm machinery. These enterprises were rated "very important" (A_1) to success in farming. The young farmer respondents used the skills included at least "sometimes successfully" (B_1 or 2), and they had received "some" or more training (C_1 or 2) in their use.

A fairly high proportion of the respondents, 30 per cent of them, indicated that they had not received any training in the enterprise, operating and repairing farm machinery. For skills in this enterprise, then, it appears that more Colorado high school students studying vocational agriculture should be receiving training, since

Enterprises	Categories					
	1	2	3	4	5	6,7, 8,9
1. TOOL FITTING	.37	.29	.20	.03	.04	.08
2. COLD METALWORKING	.40	.19	.24	.08	.02	.07
3. OPERATING AND REPAIR- ING FARM MACHINERY	.27	.28	.10	.27	.03	.06

FIGURE 8. FARM-MECHANICAL ENTERPRISES IN CLASS II

a large majority of the young farmers were using the skills. For the other two enterprises a fairly satisfactory training program had evidently been in operation. With perhaps some slight improvements to make sure that all the boys who need the training get it, the present program should be continued.

Only one enterprise, maintaining and repairing tractors and engines, qualified to be placed in the more important of the two class III listings of enterprises. It is included in Figure 9. Less than seven per cent of the respondents indicated a category three (3) response for this enterprise. Or, in other words, it was indicated to be only "somewhat important" (A_2) by these respondents. Eleven other enterprises also qualified for a class III listing, Figure 10, but for these more than seven per cent of the respondents indicated

Enterprises	Categories					
	1	2	3	4	5	6,7, 8,9
1. MAINTAINING AND REPAIRING TRACTORS AND ENGINES	.19	.23	.07	.27	.11	.12

FIGURE 9. FARM-MECHANICAL ENTERPRISE IN CLASS III

a category three (3) response. The category-response distribution of these 11 enterprises were also different in other respects from that of the enterprise listed in Figure 9. When the category three (3) response was not much higher than seven per cent, it was accompanied by a fairly high response in categories six (6), seven (7), eight (8), and nine (9). For every one of the 11 enterprises the total of the category three (3), six (6), seven (7), eight (8) and nine (9) responses were greater than were the total responses in these categories for the enterprise, maintaining and repairing tractors and engines, listed in Figure 9.

In any event, when the same formula was used to estimate how many of those respondents who had not received training would have indicated a category one (1) or two (2) response, the enterprises listed in both Figures 9 and 10 qualify as "very important" (A_1) enterprises. Since the skills in these were used at least with some success by the respondents, it is probably correct to state that Colorado programs were, but should not have been, lacking in training for skills in these enterprises. One enterprise, woodworking, glazing, and painting, however, can be considered a border line case since 49 per cent of the responses were in categories one (1) and two (2).

Enterprises	Categories					
	1	2	3	4	5	6,7, 8,9
1. WOODWORKING, GLAZING AND PAINTING	.30	.19	.32	.07	.01	.10
2. PLUMBING	.20	.19	.24	.27	.05	.06
3. ARC WELDING	.27	.22	.12	.11	.09	.19
4. OXYACETYLENE WELDING	.25	.27	.11	.07	.12	.28
5. CONCRETE WORKING	.16	.17	.15	.24	.11	.17
6. CONSTRUCTING FARM BUILDINGS	.14	.20	.17	.23	.09	.17
7. SUPPLYING FARM WATER FOR DOMESTIC USE	.08	.15	.10	.38	.14	.16
8. DISPOSING OF SEWAGE	.08	.15	.09	.26	.18	.24

FIGURE 10. ADDITIONAL FARM-MECHANICAL ENTERPRISES IN CLASS III

Enterprises	Categories					
	1	2	3	4	5	6,7, 8,9
9. CONSTRUCTING AND REPAIRING FENCE	 .19	 .22	 .12	 .32	 .04	 .10
10. SOIL AND WATER MANAGEMENT	 .16	 .22	 .11	 .18	 .09	 .24
11. RURAL ELECTRIFICA- TION	 .13	 .22	 .14	 .17	 .14	 .21

FIGURE 10. (concluded)

With only a one per cent greater response in these two categories this enterprise would have qualified for a class II listing. The training offered in this enterprise was, as can be noted in Figure 10, not markedly lacking.

These data show that Colorado vocational agriculture teachers should be encouraged to offer training to more of their high school students in the skills in the 12 enterprises just discussed.

The remaining four enterprises qualify to be placed in class IV. Their category-response distributions are pictured by the bar graphs in Figure 11. As it will be recalled from the discussion of the class IV skills, the category-response patterns in this class indicate a lesser degree of importance to success in farming. For the four enterprises shown in Figure 11 this is indicated by the rather high proportion of

Enterprises	Categories					
	1	2	3	4	5	6,7, 8,9
1. GENERAL			.42			
	.11	.21		.07	.05	.15
2. ROPEWORKING			.36			
	.20	.15		.08	.03	.17
3. HOT METALWORKING			.27			
	.17	.19		.05	.07	.27
4. SOLDERING AND SHEET METALWORKING			.36			
	.17	.20		.10	.03	.13

FIGURE 11. FARM-MECHANICAL ENTERPRISE IN CLASS IV

the category responses having been placed in category three (3). Enterprise number 3, hot metalworking, may be considered to be the least important of the four listed even though its category three (3) responses total to less than that of the other enterprises because, for it, a fairly high proportion, 27 per cent, of the respondents indicated category six (6), seven (7), eight (8), or nine (9) responses. These latter responses, as will be recalled, are an indication that the enterprises should probably not be taught to high school students. However, even though this trend is somewhat indicated for enterprise number 3, this enterprise and the other three

in class IV qualify to be included in a vocational agriculture program in high school if, by so doing, training for other more important enterprises is not sacrificed. Since the category four (4) and five (5) responses are fairly low for these enterprises, past programs in Colorado for these enterprises were fairly satisfactory provided adequate training was given for all enterprises that are more important to the students in the local situation.

No enterprises were placed in classes V and VI by the respondents. Since no enterprise was placed in the latter class none were considered unimportant to the extent that any one of them should not be included in a high school program in vocational agriculture if the time distribution schedule will allow it.

Summary

+ The data for this study indicate that the farm-mechanical skill training that was included as an integral part of a total vocational agriculture program in Colorado high schools was, as a whole, fairly well planned and executed. However, along with pointing out certain strong points in Colorado's programs, the data also unveiled certain weaknesses.

Only two of the 98 farm-mechanical skills were considered by the 302 respondents to be ones for which training should not be offered in high school. Of the remaining 96 seventy-four were considered by a 50 or greater per cent majority of the responding young farmers to be "very important" (A_1) for their success in farming. Twenty-two, were rated of lesser importance ranging from "very to somewhat" (A_1 or 2) important. For 33 of the seventy-four "very

important" (A_1) skills the vocational agriculture teachers in Colorado satisfactorily provided for the training needs of their former students who responded for this study. These data show that the providing of training should be continued for these 33 skills. For 11 other "very important" (A_1) skills these data show that training had not been provided for many of the students for whom it probably should have been provided. Future students should be given training in these skills. For 30 more skills that were also rated "very important" (A_1), training was also not provided for many of the students in high school. For these, however, it is more debatable whether or not more students should have received training. Their category-response distributions did not as definitely indicate a desirability for offering training as did those of the other "very important" (A_1) skills. Probably it should be concluded that local situations should be studied carefully before a decision is made to offer training in these skills, especially when program-scheduling time is a limiting factor.

Training has been provided for 14 of the twenty-two less important skills. A Colorado teacher was justified in offering training for these skills only if training for other skills more important to the boys in his community were not slighted and if best use was thereby made of curriculum time assigned to the teaching of vocational agriculture. The same recommendation can be made for future programs. A lack of training was indicated for the remaining of the twenty-two less important skills. If this lack of training existed because of a time limitation in the schedule, and if training was not offered for unimportant skills, then this lack of training was justified. The same statement for future programs can be made for these eight

skills as was made for the 14 skills already discussed.

A general analysis of the data relating to farm-mechanical enterprises is also presented in this chapter. Three of the 19 enterprises studied are rated "very important", and it is shown that training has been provided for the skills associated with these enterprises. Such training should also be provided for future students in these enterprises. These enterprises are, namely; tool fitting, cold metalworking, and operating and repairing farm machinery.

For one "very important" (A_1) enterprise, namely, maintaining and repairing tractors and engines, training was lacking when it should have been provided. It can also be recommended that more students be provided the opportunity to receive training in this enterprise.

Eleven other enterprises were also rated "very important" (A_1), but training was lacking. For many of these, local studies would probably reveal that more students should have been, and in the future should be, receiving training in the skills involved. The enterprises are the following: woodworking, glazing, and painting; plumbing; arc welding; oxyacetylene welding; concrete working; constructing farm buildings; supplying farm water for domestic use; disposing of sewage; constructing and repairing fences; soil and water management; and rural electrification.

The remaining four enterprises were rated less important, but still important enough to be included in a skill-training program if time is available to allow training to be offered for the

skills involved. Training has been fairly satisfactorily provided for the skills in these enterprises. These enterprises are, namely; general, (Sketch plans for the construction of farm-mechanical jobs), ropeworking, hot metalworking, and soldering and sheet metalworking.

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CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

It is the purpose of this study, first of all, to evaluate vocational agriculture programs in representative high schools in the state of Colorado with respect to the training that had been provided in manipulative farm-mechanical skills. Programs offered during the period of school years of 1947 to 1955 were included. The data that were gathered for the evaluation purpose also were adaptable to serve a secondary purpose of the study, that of providing information for use in the planning of future programs.

In conducting this study the problem was to evaluate, for selected farm mechanical skills, the interrelationships (1) of importance for success in farming, (2) success in use in farm practice, and (3) of training received in high school in vocational agriculture courses. In gathering the data it was considered most desirable to maintain the three-way relationship that was stated in the problem. Each respondent's three-check response was, therefore, not divided into its three parts in the analysis of the data.

Data were gathered from 302 former high school students of vocational agriculture who had had a specified amount of training in and experience in using the 98 farm-mechanical skills that were included in the study. These young farmers were distributed in all major agricultural areas in the state of Colorado, and they represent the various sizes of vocational agriculture departments

in 36 high school communities. The vocational agriculture instructors in each of the schools cooperated in this study by contacting qualified young farmers in their area.

The data-gathering check list was compiled and tested for reliability specifically for this study. The selected skills that were included were intended to be an adequate representation of any manipulative farm-mechanical skill for which training may be provided in high school. It was, of course, not practical to try to compile a complete list.

The reliability test was conducted in the Sterling, Colorado school with 20 young farmers cooperating. They completed the check list twice without knowing at the time of the first completion that they would be asked to complete it a second time. Data from this test indicated the check list to be a reliable data-gathering device.

The review of literature left no doubt that considerable research had been done to obtain information for course planning, but it was quite evident that evaluative studies were lacking. The procedure, involving a three-way relationship of importance for success in farming, as well as success in use in farm practice, and to training for a farm-mechanical skill, was not used in any of the previously conducted studies. Young-farmer respondents who had been students in vocational agriculture in high school were used in only a relatively small number of the studies. In one study use was studied in relation to training received, and in another importance, use, and training were studied not as a three-way relationship but each independently from the other. It was therefore, not

possible to make any direct comparisons of the data from this study with that of any previously conducted study in farm mechanics.

Data from this study indicated that training for those manipulative farm-mechanical skills, which were needed by boys studying vocational agriculture in Colorado high schools was, on the whole, fairly well provided. The strength and weakness of the programs in the State are exemplified in the following brief statements concerning the farm-mechanical enterprises that were included in the study.

For none of the 19 farm-mechanical enterprises was the relationship of importance to use and to training the best possible, although this relationship was satisfactory for three of the enterprises. These enterprises were, namely, tool fitting, cold metal-working, and operating and repairing farm machinery. They were rated by the respondents to be "very important" to their success in farming. Some could not use the skills included successfully every time they used them irrespective of training and some had not had quite enough training in high school to use the skills. However, to the extent that the sample used in the study is representative of the state as a whole, the high school training program was found to have been good for the skills in these enterprises, and it was recommended that such training be continued with a higher percentage of the students studying vocational agriculture in Colorado high schools being given the opportunity to receive this training.

Twelve enterprises were rated to be "very important" to success in farming, but, for these, more boys should have received training in the skills included. Colorado vocational agriculture programs in

farm-mechanical training should be reviewed to find ways of providing, for more boys, the opportunity to receive training in the skills involved. The 12 enterprises are, namely; maintaining and repairing tractors and engines; woodworking, glazing, and painting; plumbing; arc welding; oxyacetylene welding; concrete working; constructing farm buildings; supplying farm water for domestic use; disposing of sewage; constructing and repairing fences; soil and water management; and rural electrification.

The four remaining enterprises were rated to be less important to success in farming since a larger proportion of the respondents rated the skills involved to be only of "some" importance. These enterprises are, namely; general, ropeworking, hot metalworking, and soldering and sheet metalworking. The training program for skills in these enterprises over the State was satisfactory, and it was justified in local situations only if other more-needed training was also provided. Training for skills in these enterprises was recommended for inclusion in future high school programs of vocational agriculture if curriculum time is to be available, and if such training will best help meet the total vocational agriculture training needs of the students in local situations.

Conclusions

There was no evidence to indicate that the data from this study are not both reliable and valid. They can, therefore, be used with confidence as a guide to evaluate present and plan future programs of farm-mechanical training in vocational agriculture as

taught in high school, provided it is used as it applies in local situations. The data were gathered on a state-wide basis, but it must be remembered that individual differences as to the need for training in the kinds of manipulative farm-mechanical skills studied must be recognized. Any community differences should also not be overlooked in planning a training program.

It can be noted from examining the data, for example, that even though a high proportion of the respondents may have rated a skill "very important" to success in farming, there were others for whom this same skill may have been only of "some" or of no importance. Individual differences in training needs should be allowed for on a basis commensurate with the providing of a well balanced program of group instruction.

+ The needs of the students in the local high school community should be studied to obtain information that is more specific than state-wide data. This statement is not meant to minimize the value of the data from this study. Local studies could also be conducted in much the same way as was this one.

As was stated earlier, it is extremely difficult to predict accurately what the future farm-mechanical training needs of high school students will be. This statement, however, is not intended to imply that research does not help solve the problem. Actually it emphasizes the need for more and better research, especially of an evaluative type. A study of human nature will support this statement. If asked what he thinks is important, a farmer may base his

response not on actual experience, or lack of it, but on what he hopes to do in the future. Consequently, this farmer, if asked to predict his future needs, may be influenced somewhat by his fondest dreams with the result that the data will, to this extent, be inaccurate. Any research that can discover the actual facts in an evaluative approach may come nearer to the correct information. In using valid research findings, however, it is highly desirable that good judgment be exercised to use them in conjunction with the best facts that are available in predicting future trends. In other words instructors of vocational agriculture will need to find ways of stepping ahead with their training programs in an effort to prepare their students to meet future needs satisfactorily.

+ With the trend of allowing less time for high school study of vocational agriculture together with the trend for the farmer to need training in an increasingly greater number of farm-mechanical skills, both manipulative and managerial, it is impossible to provide training for all of the skills in high school. Research is needed to determine which of all the skills most need to be taught in high school and which could be learned by some other means as in junior high shop classes, young and/or adult farmer classes, and activities — sponsored by other agencies, or by the pick-up method. —

A further precaution in the use of the research findings from this study must be emphasized. These findings deal only with manipulative farm-mechanical skills. To plan a program in farm mechanics which consists of training in these kinds of skills only would be highly undesirable. Students will need training in managerial types

of farm-mechanical skills. The use of these skills could, in many instances, be much more important to a farmer's success in farming than the manipulative skills. The amount of emphasis to be placed on each kind of skill, manipulative or managerial, is a question that needs to be answered in each local school situation. In any event it is highly desirable that a well balanced program including both kinds of skill training be planned and conducted. It must also be emphasized that the total farm-mechanical training program should be in balance with other kinds of vocational agricultural training needs.

+ The problems of providing training for farmers engaged in today's rapidly-changing mechanized farming must be faced, and it is indeed a challenge for leaders in agricultural education to promote and conduct more studies that will look further into the future. Findings from such studies are needed along with the pooled judgment of recognized leaders in both agricultural education and agricultural engineering to insure wise decisions in future planning.

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APPENDIX

TABLE I

COMPARISON OF RESPONSES BY CATEGORIES FOR EACH OF THE 98 FARM-MECHANICAL SKILLS LISTED IN THE CHECK LIST
 USED TO GATHER DATA FOR THIS STUDY, EACH HALF OF WHICH WAS COMPLETED TWICE BY A DIFFERENT
 GROUP OF THE YOUNG FARMERS IN THE STERLING, COLORADO COMMUNITY

Skills	Young farmers who responded to first half of check list										Per cent no change between first and second responses	
	1	2	3	4	5	6	7	8	9	10	Individual respondents by categories	Respondents as a group by grouping of categories used in analysis
GENERAL	1	2	3	4	5	6	7	8	9	10	%	%
	3*	2	3	3	3	7	9	3	1	3	50	80
1. Sketch plans for the construction of farm-mechanical jobs	4	2	8	9	3	2	3	3	1	3		
WOODWORKING, GLAZING, AND PAINTING	2	1	9	1	2	2	2	2	1	1	50	60
	3	1	3	2	2	2	3	3	1	1		
1. Cut lumber to size with saw												
2. Use hand tools other than saws to cut and shape lumber	3	3	3	2	5	7	3	2	1	1	50	80
	4	3	9	3	5	3	3	3	1	1		
3. Bore or drill holes in wood	1	1	1	3	2	1	3	2	1	1	40	90
	3	1	2	1	1	2	3	3	1	1		

TABLE I (continued)

Skills	Young farmers who responded to first half of check list										Per cent no change between first and second response	
	1	2	3	4	5	6	7	8	9	10	Individual respondents by categories	Respondents as a group by grouping of categories used in analysis
4. Measure lumber to construct buildings and equipment which are correctly plumbed and squared	4 3	2 1	9 8	2 3	1 1	1 2	3 2	2 3	1 1	1 1	% 30	% 80
5. Cut rafters	2 3	2 4	3 8	2 3	7 3	2 2	8 8	4 4	7 5	1 1	40	60
6. Fasten boards with nails	2 3	1 1	1 2	3 3	2 1	1 1	3 3	3 3	1 1	1 1	70	90
7. Fasten boards with screws and/or bolts	3 3	1 1	2 2	7 3	2 2	2 1	3 3	3 3	1 1	1 1	80	80
8. Paint equipment or buildings constructed of lumber	3 3	2 1	3 3	3 3	1 1	1 2	2 3	3 3	1 1	1 1	70	90
9. Remove paint or varnish	9 9	6 3	9 9	9 9	5 4	9 5	3 3	3 4	9 5	2 4	40	60

TABLE I (continued)

Skills	Young farmers who responded to first half of check list										Per cent no change between first and second response	
	1	2	3	4	5	6	7	8	9	10	Individual respondents by categories	Respondents as a group by grouping of categories used in analysis
10. Cut glass to desired size	9 9	2 2	9 9	9 8	9 4	2 5	4 5	3 4	9 5	2 2	% 40	% 60
11. Replace a broken window pane	5 9	2 4	9 3	9 9	- 4	2 4	4 4	3 4	9 5	2 2	40	70
TOOL FITTING												
1. Replace broken handles in tools	3 3	2 1	1 2	3 3	1 1	2 5	1 3	2 3	1 1	3 1	40	80
2. Sharpen edged tools, such as chisels, plane blades, or knives	3 3	1 1	2 -	3 2	1 1	1 2	2 3	2 3	1 1	2 1	50	90
3. Sharpen drilling and boring tools	3 3	2 2	3 3	1 2	6 2	2 2	2 3	2 3	2 1	1 1	50	80
4. Sharpen saws	3 3	2 1	9 8	9 9	7 7	7 2	5 5	2 3	9 5	- 1	50	70

TABLE I (continued)

Skills	Young farmers who responded to first half of check list										Per cent no change between first and second response	
	1	2	3	4	5	6	7	8	9	10	Individual respondents by categories	Respondents as a group by grouping of categories used in analysis
PLUMBING	3	2	9	9	4	7	4	2	1	2	60	70
	9	4	9	9	4	4	4	4	1	2		
2. Thread pipe	3	2	9	9	4	2	4	2	1	2	60	60
	9	4	9	9	4	5	4	4	1	2		
3. Assemble pipe and fittings so that joints are properly sealed	3	2	3	9	4	7	4	2	2	1	40	60
	9	-	9	9	4	9	4	4	5	2		
4. Repair leaky valves or faucets	9	4	4	9	4	4	4	4	9	2	80	90
	9	4	4	9	4	9	4	4	5	2		

TABLE I (continued)

Skills	Young farmers who responded to first half of check list										Per cent no change between first and second response	
	1	2	3	4	5	6	7	8	9	10	Individual respondents by categories	Respondents as a group by grouping of categories used in analysis
ROPEWORKING											%	%
1. Tie common knots	3 3	2 1	3 3	6 6	3 3	2 4	4 4	3 3	2 5	3 2	60	70
2. Make rope splices	9 9	3 3	9 9	6 6	8 3	5 5	9 5	3 3	2 5	3 3	70	70
3. Finish ends of rope	9 9	3 3	9 9	6 6	3 2	4 5	4 5	3 3	5 5	3 3	70	70
HOT METALWORKING												
1. Shape hot metal	3 3	2 2	2 3	1 2	2 1	2 2	3 3	3 3	1 1	1 1	70	90
2. Draw out tillage tools to sharp edge	9 3	2 2	3 8	9 9	5 5	7 4	5 5	5 5	5 1	2 2	60	80

TABLE I (continued)

Skills	Young farmers who responded to first half of check list										Per cent no change between first and second responses	
	1	2	3	4	5	6	7	8	9	10	Individual respondents by categories	Respondents as a group by grouping of categories used in analysis
3. Temper tools, such as, chisels or punches	3 3	6 2	2 3	3 3	2 2	2 2	3 3	2 3	1 1	1 1	% 70	% 80
4. Anneal steel	3 3	6 3	3 -	9 3	- -	5 5	5 5	3 3	1 -	2 2	80	80
SOLDERING AND SHEET METAL- WORKING												
1. Solder metal used on the farm	3 3	1 1	2 3	3 2	3 1	6 9	3 3	3 4	2 5	2 3	30	70
2. Cut and shape any kind of sheet metal	9 -	2 2	3 9	3 6	3 3	5 9	3 4	3 4	2 5	2 1	30	40
3. Fasten together any kind of sheet metal with rivets or self-tapping screws	9 9	9 8	7 9	9 9	3 2	- 9	4 4	4 4	1 5	3 1	50	80

TABLE I (continued)

Skills	Young farmers who responded to first half of check list										Per cent no change between first and second responses		
	1	2	3	4	5	6	7	8	9	10	Individual respondents by categories	%	Respondents as a group by grouping of categories used in analysis
ARC WELDING	1	4	1	1	4	2	4	5	1	1	80	80	
	1	4	2	2	4	2	4	5	1	1			
	3	4	1	1	5	2	5	5	2	2	50	90	
	1	4	3	2	5	6	5	5	1	2			
	1	4	1	9	5	6	5	5	1	1	60	60	
	1	4	2	9	4	2	5	5	5				
3. Use the carbon arc to make a bronze weld	1	4	1	9	5	6	5	5	1	1	60	60	
	1	4	2	9	4	2	5	5	5				
4. Use the arc welder to cut metal	4	4	1	8	4	3	4	5	1	9	70	100	
	1	4	4	6	4	3	4	5	1	9			
5. Apply hard-facing material	4	4	2	9	5	5	5	5	4	9	60	70	
	4	4	4	9	9	9	5	5	1	9			
OXYACETYLENE WELDING													
1. Use steel rod to weld iron or steel	1	4	1	3	7	3	5	5	1	1	40	70	
	3	4	3	2	2	5	5	4	1	1			

TABLE I (continued)

Skills	Young farmers who responded to first half of check list										Per cent no change between first and second responses	
	1	2	3	4	5	6	7	8	9	10	Individual respondents by categories	Respondents as a group by grouping of categories used in analysis
2. Use bronze rod to weld iron or steel	3 3	4 4	1 3	1 2	7 2	5 5	5 5	5 4	1 1	1 1	% 60	% 60
3. Weld iron castings	4 3	4 4	3 4	3 2	7 2	3 4	5 5	5 5	4 1	2 2	40	70
4. Weld aluminum	9 9	5 9	9 9	9 9	9 9	5 5	5 5	5 5	9 5	9 9	80	100
5. Use the cutting torch to cut metal	3 -	4 4	1 2	1 2	7 2	2 2	3 3	5 5	1 1	1 1	70	70
6. Apply hard-facing material	4 4	4 4	3 -	2 2	4 9	5 5	5 5	5 5	4 1	9 9	80	80
CONCRETE WORKING												
1. Building concrete forms	4 4	2 2	3 4	8 9	4 4	2 2	3 3	4 4	2 1	2 2	70	80

4

TABLE I (continued)

Skills	Young farmers who responded to first half of check list										Per cent no change between first and second responses	
	1	2	3	4	5	6	7	8	9	10	Individual respondents by categories	Respondents as a group by grouping of categories used in analysis
2. Reinforce concrete	9 9	4 4	8 9	8 9	4 4	2 5	3 4	4 4	2 5	2 2	% 50	% 70
3. Pour. concrete	4 3	2 4	3 4	8 9	4 4	3 1	3 3	4 4	1 1	2 2	50	80
4. Waterproof concrete, or concrete block walls	9 9	5 5	9 9	9 9	9 9	5 3	5 5	4 5	9 4	2 2	70	90
5. Lay blocks or bricks	9 9	4 4	9 9	8 9	4 4	5 5	5 5	4 5	9 5	2 2	70	80
COLD METALWORKING												
1. Drill holes in metal	3 3	1 1	1 2	1 2	1 1	2 1	4 3	3 3	1 1	1 1	60	80
2. Cut metal using tools, such as, hacksaw, metal shears, or chisel	4 3	1 1	2 3	2 2	1 1	2 3	3 3	3 3	1 1	2 2	70	70

4

TABLE I (continued)

Skills	Young farmers who responded to first half of check list										Per cent no change between first and second responses	
	1	2	3	4	5	6	7	8	9	10	Individual respondents by categories	Respondents as a group by grouping of categories used in analysis
3. Cut threads on bolts or rods	3	1	2	3	1	1	3	3	1	1	%	%
	3	1	3	2	1	1	4	3	1	1	70	90
4. Fasten metal together with rivets	9	2	8	9	4	5	4	3	1	1	60	90
	4	2	9	9	1	5	4	3	5	1		
5. Bend cold metal	4	4	3	3	4	4	4	3	1	2	40	60
	3	4	9	2	1	3	3	3	1	2		

TABLE I (continued)

Skills	Young farmers who responded to second half of check list										Per cent no change between first and second responses	
	11	12	13	14	15	16	17	18	19	20	Individual respondents by categories	Respondents as a group by grouping of categories used in analysis
OPERATING AND REPAIRING FARM MACHINERY											%	%
	4 4	1 1	2 3	4 3	7 5	2 2	4 4	4 3	4 4	1 1	60	60
1. Splice belts												
	2 7	1 1	3 3	2 1	2 2	1 2	1 1	2 2	2 3	1 1	60	80
2. Sharpen cutting parts of farm machinery												
	2 1	1 1	1 1	2 3	2 1	1 1	- 2	2 2	2 2	1 1	70	70
3. Replace broken or worn parts on farm machinery												
	2 3	1 1	2 3	2 2	4 4	2 2	1 2	2 2	2 2	1 1	70	80
4. Fit bearings on farm machinery												
	9 9	1 1	2 1	1 -	5 5	3 3	2 4	3 4	4 4	1 1	70	70
5. Assemble farm machinery												
	2 4	1 1	2 2	1 3	2 2	2 2	4 4	2 4	4 4	1 1	70	70
6. Make operational adjustments on farm machinery												
	2 4	1 1	2 2	1 3	2 2	2 2	4 4	2 4	4 4	1 1	70	70

TABLE I (continued)

Skills	Young farmers who responded to second half of check list										Per cent no change between first and second responses	
	11	12	13	14	15	16	17	18	19	20	Individual respondents by categories	Respondents as a group by grouping of categories used in analysis
7. Calibrate farm machinery, Example: Adjust a grain drill so it will plant the correct amount of seed per acre	5	1	3	2	3	4	4	3	4	2	%	%
	8	1	4	3	3	4	4	9	4	2	60	70
8. Make adjustment in hitches and alignments on farm machinery	4	1	2	1	1	4	4	4	2	1	50	90
	2	1	4	-	2	4	4	3	4	1		
9. Lubricate farm machinery	4	1	1	4	1	4	1	1	2	1	50	70
	2	1	4	1	1	4	2	2	2	1		
10. Paint farm machinery	3	1	1	3	3	4	1	3	3	1	100	100
	3	1	1	3	3	4	1	3	3	1		
MAINTAINING AND REPAIRING TRACTORS AND ENGINES 1. Service battery	2	1	1	2	2	4	1	2	2	1	70	90
	1	1	2	1	2	4	1	2	2	1		

TABLE I (continued)

Skills	Young farmers who responded to second half of check list										Per cent no change between first and second responses	
	11	12	13	14	15	16	17	18	19	20	Individual respondents by categories	Respondents as a group by grouping of categories used in analysis
2. Tune-up magneto or distributor	2 3	1 1	2 2	1 1	4 4	4 4	1 -	2 3	4 4	2 2	% 80	% 80
3. Repair or replace electrical wiring	3 3	2 1	2 3	- 2	5 5	1 2	1 1	3 3	1 1	1 1	70	90
4. Tune-up tractor timing	7 7	1 1	2 1	1 1	3 7	2 6	2 4	4 3	2 2	1 1	50	60
5. Tune-up tractor generator	7 7	1 1	3 5	1 1	3 7	6 2	5 5	4 3	2 4	1 1	50	90
6. Tune-up or replace spark plugs	2 3	1 1	1 1	1 1	1 1	1 1	1 2	2 3	2 2	1 1	70	80
7. Service air cleaner	2 2	1 1	1 2	1 1	2 1	4 4	2 1	1 2	2 2	1 1	60	100

TABLE I (continued)

Skills	Young farmers who responded to second half of check list										Per cent no change between first and second responses	
	11	12	13	14	15	16	17	18	19	20	Individual respondents by categories	Respondents as a group by grouping of categories used in analysis
8. Tune-up carburetor or fuel system	2 7	1 1	2 2	1 1	1 2	4 5	4 4	2 2	2 2	1 1	% 70	% 80
9. Adjust tappets	7 7	2 2	7 5	2 1	3 3	5 5	5 4	3 3	2 4	1 1	60	70
10. Tune-up cooling system	7 3	2 2	2 4	2 -	2 2	5 5	4 5	2 2	4 2	1 1	60	80
11. Service tires	2 3	2 1	1 1	2 3	3 1	4 4	1 1	3 3	2 2	1 1	60	70
12. Tune-up diesel-fuel-injection system	9 9	7 7	8 5	4 4	5 5	5 5	5 5	3 3	9 9	2 2	90	90
13. Tune-up clutch	2 3	1 1	3 3	4 1	5 5	6 6	4 4	3 3	4 2	1 1	70	80
14. Tune-up brakes	2 3	1 1	1 2	1 1	5 5	2 2	2 4	2 3	2 2	1 1	60	70

1

TABLE I (continued)

Skills	Young farmers who responded to second half of check list										Per cent no change between first and second responses	
	11	12	13	14	15	16	17	18	19	20	Individual respondents by categories	Respondents as a group by grouping of categories used in analysis
15. Grind and/or replace valves	7 5	7 7	7 5	2 2	2 2	5 5	7 4	2 3	4 4	2 2	% 60	% 60
16. Overhaul engine	7 5	1 1	3 2	2 2	1 2	5 5	1 2	2 2	4 4	2 2	60	60
17. Repair or overhaul any part of tractor other than the engine	2 4	1 1	2 4	2 2	7 3	4 5	2 2	2 2	2 4	1 1	50	60
CONSTRUCT FARM BUILDINGS												
1. Lay out foundation lines and set grade stakes for buildings	8 8	1 1	3 7	2 2	2 3	7 7	1 1	2 3	2 -	2 2	70	80
2. Construct the framework for buildings	8 8	7 7	3 7	2 2	9 5	8 8	1 1	2 3	2 2	2 2	70	90
3. Apply roofing materials	8 8	3 7	2 1	2 2	3 3	2 2	1 1	2 3	4 2	1 1	60	80

TABLE I (continued)

Skills	Young farmers who responded to second half of check list										Per cent no change between first and second response	
	11	12	13	14	15	16	17	18	19	20	Individual respondents by categories	Respondents as a group by grouping of categories used in analysis
4. Install insulating materials	8 8	7 7	7 5	9 2	3 3	9 9	2 4	3 3	4 4	2 2	% 70	% 80
SUPPLYING FARM WATER FOR DOMESTIC USE												
1. Repair water pumps	3 3	1 1	2 2	2 2	5 5	4 4	5 5	4 4	4 2	1 1	90	90
2. Install water-pressure system	8 9	1 1	7 5	2 2	- 7	5 5	4 4	4 4	2 4	2 2	70	80
DISPOSING OF SEWAGE												
1. Install sewage-disposal system	9 9	1 1	7 5	- 2	4 3	5 5	2 4	2 3	4 4	2 2	60	70

TABLE I (continued)

Skills	Young farmers who responded to second half of check list										Per cent no change between first and second response	
	11	12	13	14	15	16	17	18	19	20	Individual respondents by categories	Respondents as a group by grouping of categories used in analysis
CONSTRUCTING AND REPAIRING FENCE												
1. Treat fence posts	9	7	7	3	9	4	2	2	4	1	80	80
	9	7	7	5	9	4	4	2	4	1		
2. Set fence post	4	1	1	2	3	4	1	4	4	1	90	90
	4	1	1	1	3	4	1	4	4	1		
3. Stretch fence	4	1	1	-	3	4	1	4	4	1	100	100
	4	1	1	1	3	4	1	4	4	1		
4. Install farm gates	4	1	1	2	3	4	1	2	2	1	90	90
	4	1	1	2	3	4	1	3	2	1		
5. Construct electric fence	4	2	1	1	3	4	1	4	3	1	80	100
	4	2	1	1	3	4	1	3	4	1		

TABLE I (continued)

Skills	Young farmers who responded to second half of check list										Per cent no change between first and second response	
	11	12	13	14	15	16	17	18	19	20	Individual respondents by categories	Respondents as a group by grouping of categories used in analysis
SOIL AND WATER MANAGEMENT											%	%
	3	1	7	2	1	4	1	2	3	2	50	90
	2	1	1	2	2	7	1	3	3	2		
2. Lay out contour or grade lines for drainage or irrigation ditches	2	1	7	2	5	5	-	2	8	2	50	50
	4	1	7	6	7	7	1	3	8	2		
3. Lay out field drainage system	8	2	7	5	5	5	1	8	8	2	40	70
	9	1	7	2	5	2	2	3	8	2		
RURAL ELECTRIFICATION												
	8	1	2	2	5	6	2	3	1	2	70	80
	8	1	2	3	5	2	2	3	2	2		
1. Repair on electrical circuit	8	1	2	3	5	6	1	3	1	2	80	80
	8	1	2	3	5	2	2	3	2	2		
2. Install an electrical circuit	8	1	2	3	5	6	1	3	1	2	80	80
	8	1	2	3	5	6	2	3	2	2		

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TABLE I (continued)

Skills	Young farmers who responded to second half of check list										Per cent no change between first and second responses	
	11	12	13	14	15	16	17	18	19	20	Individual respondents by categories	Respondents as a group by grouping of categories used in analysis
3. Repair electrical cords	8	-	2	6	5	2	1	3	1	2	%	%
	3	-	2	3	5	2	2	3	1	2	70	70
4. Tune-up an electrical motor	6	7	8	9	5	5	1	3	3	2		
	8	7	3	4	5	5	2	3	3	2	60	70
5. Install overload protection devices for electrical motors	6	7	8	9	5	7	2	2	2	2		
	8	7	7	5	5	7	2	3	2	2	60	80

*The upper numbers are the category responses from the first completion and the lower numbers are the corresponding responses from the second completion.

**A hyphen (-) in the table indicates that the young farmer missed completing his response for the skill involved.

TABLE II
SUMMARY OF DATA-GATHERING CONTACTS MADE

Number of contacts	Kind of contacts
4	Letter by author preliminary to mailing check list
39	Mimeographed letter by author, January 16, 1957, asking for data
39	Check list mailed January 22, 1957
39	Dittoed letter by Colorado State Supervisor of Agricultural Education, January 28, 1957, sent to vocational agriculture teachers asking for data.
98	Follow-up letter to vocational agriculture teachers and state agricultural education personnel by author
1	Mimeographed letter by author, February 25, 1957, asking for data
1	Dittoed letter by Colorado State Supervisor of Agricultural Education, February 28, 1957, sent to vocational agriculture teacher asking for data
39	Personal contact or letter by agricultural education personnel at Colorado State University
65	Follow-up postal card to vocational agriculture teachers by author
16	Follow-up phone call to vocational agricultural teachers or state agricultural education personnel by author
9	Sent additional check list on request

TABLE II (Continued)

Number of contacts	Kind of contacts
6	Personal contact made by author with vocational agriculture teachers, young farmers, or both
10	Letter sent to young farmers by author
11	Follow-up postal card sent to young farmers by author
15	Phone calls to young farmers by author
2	Personal contact with state agricultural education personnel by author
6	Letter by author, September 30, 1957, asking for data
6	Dittoed letter by Colorado State Supervisor of Agricultural Education, October 7, 1957, sent to vocational agriculture teachers asking for data
9	Follow-up letter to vocational agriculture teachers by author's wife
6	Letter to young farmers by Brighton Schools Superintendent
15	Longhand reminder memo to vocational agriculture teachers by author
42	Personal contact with young farmers by hired employee
8	Letter by hired employee to young farmers asking for data

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TABLE V

NUMBER AND PER CENT OF 302 YOUNG FARMERS WHO INDICATED EACH OF THE NINE CATEGORIES AFFECTING THE RELATIONSHIP (1) OF THE IMPORTANCE FOR SUCCESS IN FARMING, (2) TO SUCCESS IN USE IN FARM PRACTICE AND, (3) TO THE AMOUNT OF TRAINING RECEIVED IN HIGH SCHOOL FOR EACH OF 98 FARM-MECHANICAL SKILLS

Skills	Number failing to respond	Number representing categories								
		1	2	3	4	5	6	7	8	9
GENERAL										
1. Sketch plans for the construction of farm-mechanical jobs	36	29 11%	57 21%	111 42%	19 7%	12 5%	6 2%	12 5%	10 4%	10 4%
WOODWORKING, GLAZING, AND PAINTING										
1. Cut lumber to size with saws	8	132 45	79 27	74 25	3 1	0 0	2 1	0 0	3 1	1 0
2. Use hand tools other than saws to cut and shape lumber.	11	58 20	55 19	137 47	11 4	3 1	4 1	4 1	15 5	4 1
3. Bore or drill holes in wood	12	130 45	39 13	105 36	10 3	2 1	1 0	1 0	2 1	0 0
4. Measure lumber to construct buildings and equipment which are correctly plumbed and squared	13	98 34	97 34	51 18	15 5	7 2	4 1	4 1	10 3	3 1

TABLE V (continued)

Skills	Number failing to re-spond	Number representing categories								
		1	2	3	4	5	6	7	8	9
5. Cut rafters	12	56 19	85 29	70 24	18 6	12 4	13 4	12 4	20 7	4 1
6. Fasten boards with nails	5	141 47	34 11	105 35	17 6	0 0	0 0	0 0	0 0	0 0
7. Fasten boards with screws and/or bolts	7	126 43	58 20	98 33	8 3	0 0	0 0	1 0	1 0	3 1
8. Paint equipment or buildings constructed of lumber	4	114 38	55 18	96 32	20 7	3 1	1 0	2 1	5 2	2 1
9. Remove paint or varnish	9	16 5	17 6	119 41	42 14	10 3	3 1	8 3	31 11	47 16
10. Cut glass to desired size	8	42 14	32 11	82 28	32 11	24 8	2 1	9 3	20 7	51 17
11. Replace a broken window pane	8	62 21	46 16	95 32	52 18	17 6	2 1	3 1	5 2	12 4
TOOL FITTING										
1. Replace broken handles in tools	4	153 51	61 20	69 23	10 3	1 0	2 1	1 0	1 0	0 0

TABLE V (continued)

Skills	Number failing to respond	Number representing categories								
		1	2	3	4	5	6	7	8	9
2. Sharpen edged tools, such as chisels, plane blades, or knives	3	149 50	101 34	38 13	4 1	0 0	1 0	3 1	3 1	0 0
3. Sharpen drilling and boring tools	5	90 30	118 40	52 18	12 4	4 1	9 3	2 1	5 2	5 2
4. Sharpen saws	6	49 17	58 20	76 26	13 4	37 13	10 3	19 6	19 6	15 5
PLUMBING										
1. Cut pipe used in plumbing to desired length	10	61 21	48 16	77 26	65 22	13 4	1 0	5 2	10 3	12 4
2. Thread Pipe	9	68 23	53 18	81 28	62 21	9 3	1 0	5 2	6 2	8 3
3. Assemble pipe and fittings so that joints are properly sealed	6	60 20	72 24	63 21	77 26	11 4	2 1	4 1	2 1	5 2
4. Repair leaky valves or faucets	9	47 16	46 16	57 19	112 38	21 7	0 0	0 0	1 0	9 3
ROPEWORKING										
1. Tie common knots	2	82 27	56 19	102 34	31 10	5 2	5 2	2 1	9 3	8 3

TABLE V (continued)

Skills	Number failing to re-spond	Number representing categories								
		1	2	3	4	5	6	7	8	9
2. Make rope splices	6	47 16	38 13	107 36	22 7	13 4	14 5	7 2	24 8	24 8
3. Finish ends of rope	6	54 18	38 13	110 37	25 8	11 4	8 3	5 2	24 8	21 7
HOT METALWORKING										
1. Shape hot metal	4	67 22	67 22	106 36	8 3	4 1	3 1	10 3	18 6	15 5
2. Draw out tillage tools to a sharp edge	8	43 15	49 17	62 21	26 9	41 14	6 2	16 5	22 7	29 10
3. Temper tools, such as, chisels or punches	5	65 22	68 23	79 27	7 2	9 3	8 3	17 6	24 8	20 7
4. Anneal steel	20	26 9	36 13	62 22	11 4	27 10	13 5	19 7	31 11	57 20
SOLDERING AND SHEET METALWORKING										
1. Solder metals used on the farm	5	99 33	73 25	97 33	8 3	0 0	9 3	3 1	8 3	0 0

Table V (continued)

Skills	Number failing to respond	Numbers representing categories								
		1	2	3	4	5	6	7	8	9
2. Cut and shape any kind of sheet metal	11	31 11	59 20	116 40	25 9	19 7	6 2	8 3	10 3	17 6
3. Fasten together any kind of sheet metal with rivets or self-tapping screws	7	25 8	40 14	106 36	49 17	17 6	4 1	7 2	12 4	35 12
ARC WELDING										
1. Weld iron or steel	6	148 50	94 32	17 6	12 4	4 1	0 0	16 5	4 1	1 0
2. Weld iron castings	10	67 23	85 29	38 13	26 9	30 10	10 3	19 7	6 2	11 4
3. Use the carbon arc to make a bronze weld	4	38 13	55 18	45 15	32 11	36 12	14 5	24 8	11 4	43 14
4. Use the arc welder to cut metal	9	99 34	49 17	46 16	35 12	15 5	3 1	20 7	11 4	15 5
5. Apply hard-facing material	6	43 15	48 16	30 10	55 19	52 18	7 2	21 7	8 3	32 11

TABLE V (continued)

Skills	Number failing to respond	Numbers representing categories								
		1	2	3	4	5	6	7	8	9
OXYACETYLENE WELDING										
1. Use steel rod to weld iron or steel	7	93 32	66 22	42 14	14 5	18 6	9 3	22 7	22 7	9 3
2. Use bronze rod to weld iron or steel	9	94 32	67 23	30 10	18 6	16 5	7 2	31 11	21 7	9 3
3. Weld iron castings	11	50 17	67 23	38 13	20 7	30 10	13 4	32 11	23 8	18 6
4. Weld aluminum	11	4 1	9 3	34 12	23 8	66 23	9 3	19 7	14 5	113 39
5. Use the cutting torch to cut metal	11	163 56	50 17	21 7	13 4	8 3	2 1	20 7	11 4	3 1
6. Apply hard-facing materials	15	40 14	41 14	34 12	40 14	63 22	8 3	16 6	10 3	35 12
CONCRETE WORKING										
1. Build concrete forms	9	64 22	76 26	47 16	66 23	12 4	4 1	7 2	9 3	8 3
2. Reinforce concrete	8	47 16	61 21	53 18	78 27	14 5	3 1	11 4	10 3	17 6

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TABLE V (continued)

Skills	Number failing to respond	Numbers representing categories								
		1	2	3	4	5	6	7	8	9
3. Pour concrete	10	72 25	65 22	60 21	68 23	5 2	1 0	6 2	8 3	7 2
4. Waterproof concrete or concrete block walls	9	30 10	29 10	35 12	67 23	61 21	3 1	13 4	8 3	47 16
5. Lay blocks or bricks	6	17 6	18 6	31 10	76 26	62 21	4 1	9 3	12 4	67 23
COLD METALWORKING										
1. Drill holes in metal	8	172 59	58 20	48 16	9 3	3 1	1 0	1 0	2 1	0 0
2. Cut metal using tools such as, hacksaws, metal shears or chisels	1	154 51	66 22	66 22	10 3	0 0	1 0	1 0	0 0	3 1
3. Cut threads on bolts or rods	2	150 50	65 22	54 18	20 7	2 1	2 1	2 1	5 2	0 0
4. Fasten metal together with rivets	6	63 21	40 14	82 28	38 13	20 7	3 1	7 2	11 4	32 11
5. Bend cold metal	9	58 20	52 18	99 34	48 16	10 3	4 1	2 1	5 2	15 5

4

TABLE V (continued)

Skills	Number failing to re-spond	Numbers representing categories								
		1	2	3	4	5	6	7	8	9
OPERATING AND REPAIRING FARM MACHINERY										
1. Splice belts	10	28 10	24 8	62 21	69 24	34 12	1 0	9 3	13 4	52 18
2. Sharpen cutting parts of farm machinery	12	90 31	85 29	32 11	51 18	9 3	2 1	3 1	7 2	11 4
3. Replace broken or worn parts on farm machinery	7	108 37	110 37	14 5	59 20	0 0	0 0	0 0	3 1	1 0
4. Fit bearings on farm machinery	9	66 23	97 33	23 8	78 27	13 4	2 1	0 0	6 2	8 3
5. Assemble farm machinery	6	67 23	76 26	31 10	88 30	10 3	2 1	2 1	3 1	17 6
6. Make operational adjustments on farm machinery	5	77 26	100 34	12 4	101 34	2 1	1 0	1 0	1 0	2 1
7. Calibrate farm machinery. Example: Adjust a grain drill so it will plant the correct amount of seed per acre	3	63 21	91 30	8 3	115 38	5 2	3 1	2 1	2 1	10 3

TABLE V (continued)

Skills	Number failing to respond	Numbers representing categories								
		1	2	3	4	5	6	7	8	9
8. Make adjustment in hitches and alignments on farm machinery	4	65 22	95 32	13 4	119 40	2 1	1 0	1 0	1 0	1 0
9. Lubricate farm machinery	3	123 41	92 31	8 3	74 25	0 0	1 0	0 0	0 0	1 0
10. Paint farm machinery	4	97 33	59 20	78 26	27 9	7 2	1 0	16 5	10 3	3 1
MAINTAINING AND REPAIRING TRACTORS AND ENGINES										
1. Service battery	5	99 33	80 27	25 8	90 30	0 0	0 0	1 0	0 0	2 1
2. Tune-up magneto or distributor	7	29 10	90 31	19 6	85 29	42 14	8 3	6 2	2 1	14 5
3. Repair or replace electrical wiring	4	52 17	93 31	27 9	78 26	21 7	5 2	9 3	2 1	11 4
4. Tune-up tractor timing	6	48 16	72 24	22 7	88 30	31 10	8 3	14 5	3 1	10 3
5. Tune-up tractor generator	9	32 11	60 20	25 9	79 27	52 18	9 3	12 4	1 0	23 8

TABLE V (continued)

Skills	Number failing to respond	Numbers representing categories								
		1	2	3	4	5	6	7	8	9
6. Tune-up or replace spark plugs	8	105 36	76 26	26 9	82 28	1 0	1 0	1 0	1 0	1 0
7. Service air cleaner	5	116 39	71 24	13 4	91 31	2 1	0 0	1 0	2 1	1 0
8. Tune-up carburetor or fuel system	5	60 20	101 34	11 4	87 29	20 7	6 2	4 1	1 0	7 2
9. Adjust tappets	6	53 18	52 18	19 6	75 25	51 17	7 2	16 5	3 1	20 7
10. Tune-up cooling system	8	52 18	83 28	20 7	96 33	23 8	2 1	7 2	1 0	10 3
11. Service tires	11	92 32	62 21	31 11	94 32	3 1	1 0	3 1	1 0	4 1
12. Tune-up diesel-fuel-injection system	15	6 2	8 3	8 3	34 12	90 31	2 1	9 3	8 3	122 43
13. Tune-up clutch	5	29 10	59 20	26 9	105 35	39 13	5 2	8 3	2 1	24 8

4
1

TABLE V (continued)

Skills	Number failing to respond	Numbers representing categories								
		1	2	3	4	5	6	7	8	9
14. Tune-up brakes	12	51 18	76 26	24 8	107 37	15 5	1 0	6 2	2 1	8 3
15. Grind and/or replace valves	8	22 7	45 15	15 5	50 17	76 27	1 0	28 10	9 3	46 16
16. Overhaul engine	11	41 14	51 18	19 7	50 17	51 18	7 2	25 9	9 3	38 13
17. Repair or overhaul any part of tractor other than the engine	7	41 14	94 32	34 12	86 29	14 5	5 2	7 2	3 1	11 4
CONSTRUCTING FARM BUILDINGS										
1. Lay out foundation lines and set grade stakes for buildings	7	40 14	58 20	46 16	60 20	33 11	3 1	23 8	10 3	22 7
2. Construct the framework for farm buildings	6	45 15	73 25	63 21	44 15	19 6	3 1	22 7	8 3	19 6
3. Apply roofing materials	7	52 18	71 24	55 19	82 28	12 4	1 0	9 3	4 1	9 3
4. Install insulating materials	14	29 10	32 11	37 13	82 28	45 16	4 1	11 4	7 2	41 14

TABLE V (continued)

Skills	Number failing to respond	Numbers representing categories								
		1	2	3	4	5	6	7	8	9
SUPPLYING FARM WATER FOR DOMESTIC USE										
1. Repair water pumps	6	26 9	56 19	30 10	116 39	37 13	1 0	6 2	3 1	21 7
2. Install water pressure system	9	21 7	32 11	26 9	109 37	45 15	2 1	12 4	7 2	39 13
DISPOSING OF SEWAGE										
1. Install sewage disposal system	5	23 8	45 15	28 9	78 26	52 18	3 1	15 5	5 2	48 16
CONSTRUCTING AND REPAIRING FENCE										
1. Treat fence posts	5	21 7	33 11	45 15	39 13	62 21	0 0	18 6	12 4	67 23
2. Set fence posts	3	70 23	70 23	32 11	118 39	1 0	0 0	2 1	2 1	4 1
3. Stretch fence	2	76 25	69 23	28 9	119 40	1 0	0 0	2 1	2 1	3 1
4. Install farm gates	4	62 21	88 30	32 11	103 35	4 1	0 0	2 1	3 1	4 1
5. Construct electric fence	6	55 19	68 23	44 15	95 32	1 0	0 0	3 1	12 4	18 6

TABLE V (continued)

Skills	Number failing to re- spond	Numbers representing categories								
		1	2	3	4	5	6	7	8	9
SOIL AND WATER MANAGEMENT										
1. Measure fields to determine acreage	11	61 21	68 23	41 14	63 22	15 5	5 2	16 5	6 2	16 5
2. Lay out contour or grade lines for drainage or irrigation ditches	4	50 17	73 24	26 9	56 19	24 8	3 1	15 5	12 4	39 13
3. Lay out field drainage system	9	26 9	57 19	25 9	40 14	45 15	5 2	14 5	16 5	65 22
RURAL ELECTRIFICATION										
1. Repair an electrical circuit	6	51 17	90 30	46 16	46 16	24 8	8 3	8 3	6 2	17 6
2. Install an electrical circuit	7	44 15	77 26	45 15	50 17	25 8	10 3	14 5	10 3	20 7
3. Repair electrical cord	10	75 26	76 26	59 20	57 20	8 3	3 1	5 2	4 1	5 2
4. Tune-up an electrical motor	8	15 5	37 13	33 11	49 17	70 24	13 4	17 6	14 5	46 5
5. Install overload protection devices for electrical motor	4	8 3	49 16	21 7	48 16	86 29	7 2	23 8	6 2	50 17

Note: Number of respondents is given in upper and the per cent in the lower line for each skill. The percentages were computed on the basis of those who responded.

TABLE VI

PER CENT OF 302 YOUNG FARMERS WHO INDICATED EACH OF NINE CATEGORIES OF THE RELATIONSHIP (1) OF THE IMPORTANCE FOR SUCCESS IN FARMING, (2) TO SUCCESS IN USE IN FARM PRACTICE, AND (3) TO THE AMOUNT OF TRAINING RECEIVED IN HIGH SCHOOL FOR EACH OF 19 FARM-MECHANICAL ENTERPRISES

Enterprises	Numbers representing categories								
	1	2	3	4	5	6	7	8	9
	%*	%	%	%	%	%	%	%	%
1. General	11	21	42	7	5	2	5	4	4
2. Woodworking, glazing, and painting	30	19	32	7	2	1	1	4	4
3. Tool fitting	37	29	20	3	4	2	2	2	2
4. Plumbing	20	19	24	27	5	0	1	2	3
5. Ropeworking	20	15	36	8	3	3	2	6	6
6. Hot metalworking	17	19	27	5	7	3	5	8	11
7. Soldering and sheet metalworking	17	20	36	10	3	2	2	3	6
8. Arc welding	27	22	12	11	9	2	7	3	7
9. Oxyacetylene welding	25	17	11	7	12	3	8	6	11
10. Concrete working	16	17	15	24	11	1	3	3	10
11. Cold metalworking	40	19	24	8	2	1	1	2	3
12. Operating and repairing farm machinery	27	28	10	27	3	0	1	1	4
13. Maintaining and repairing tractors and engines	19	23	7	27	11	1	3	1	7
14. Constructing farm buildings	14	20	17	23	9	1	6	2	8
15. Supplying farm water for domestic use	8	15	10	38	14	1	3	2	10
16. Disposing of sewage	8	15	9	26	18	1	5	2	16
17. Constructing and repairing fence	19	22	12	32	4	0	2	2	6
18. Soil and water management	16	22	11	18	9	2	5	4	13
19. Rural electrification	13	22	14	17	14	3	5	3	10

*Note: The percentages were computed on the basis of the number of those who responded in each respective case.

APPENDIX A

List of Vocational Agriculture Instructors Who
Cooperated in This Study and Their Locations

Instructor	School	City
Adams, Melvin	Greeley High School	Greeley
Bailey, J. H.	Rifle Union High School	Rifle
Ball, Wayne	Prospect Valley High School	Keenesburg
Britton, John P.	Fruita Union High School	Fruita
Butterfield, Paul G.	Windsor High School	Windsor
Carpenter, David	Center High School	Center
Clark, Devon M.	Montrose County High School	Montrose
Cockroft, Donald	Eaton High School	Eaton
Cross, Irving	Sterling High School	Sterling
Daise, Eugene	Phillips County High School	Holyoke
Davis, Rex	Wiggins High School	Wiggins
Daxton, James	Crook Branch County High School	Crook
Hanna, Dale	Fort Morgan High School	Fort Morgan
Harvey, J. L.	Loveland High School	Loveland
Howerton, Feyle K.	Sargent Consolidated High School	Monte Vista
Jones, Mack	Steamboat Springs High School	Steamboat Springs
Kemper, Dale	Burlington Conselidated High Scheel	Burlington
Lutz, Harold	Olathe Branch County High School	Olathe
Mariano, Elmond	Springfield High School	Springfield
Mattoon, Philip	Longmont High School	Longmont

APPENDIX A (continued)

Instructor	School	City
McCormick, Floyd	Berthoud High School	Berthoud
Mecham, Alta	Fort Collins High School	Fort Collins
Nation, Willard	Plateau Valley High School	Collbran
Pasquin, August	Montezuma County High School	Cortez
Peters, Bill	Holly Union High School	Holly
Pepjoy, George	Fleming Branch County High School	Fleming
Reed, Floyd	Haxtun High School	Haxtun
Reynolds, Ralph	Delta High School	Delta
Sowder, Glen E.	Sedgwick County High School	Julesburg
Stalert, Paul	Del Norte Consolidated High School	Del Norte
Starbuck, Gordon	Rocky Ford High School	Rocky Ford
Starbuck, Paul	Rio Blanco County High School	Meeker
Talley, Curtis	Palisade High School	Palisade
Taylor, Walter	Brighton High School	Brighton
Towles, John	Gunnison County High School	Gunnison
Vance, Wendell	Arvada High School	Arvada

APPENDIX B

Check List

Dear

As a former student of vocational agriculture you are in a position to give valuable assistance for the improvement of the vocational agriculture program both in your community and in Colorado.

It is important that we teach in high school vocational agriculture those farm-mechanical skills which are both important to success in farming and are used by the farmer. The check list which accompanies this letter was developed for you to help us discover those farm-mechanical skills in which high school vocational agriculture students should receive training. To accomplish this goal we need to know to what degree the farm-mechanical training you received in high school vocational agriculture is actually needed in your farming operations. If the training is needed in farm practice, we need to know if the training you received in high school was sufficient. We also need to know how important the skills listed have been to you in your farming operations since the completion of your vocational agriculture training in high school.

Your cooperation and good judgment in completing this check list will be very helpful and much appreciated. Approximately 30 minutes of your time will be needed to complete it.

Please complete the check list and return it to me within a few days. Thank you.

Sincerely yours,

VOCATIONAL AGRICULTURAL TRAINING IN FARM-MECHANICAL SKILLS, THEIR
USE IN FARM PRACTICE AND THEIR IMPORTANCE TO SUCCESS IN FARMING

1. Name _____ Age _____
2. Address _____
3. Did you complete all courses of vocational agriculture
in which farm mechanics training was offered in your
high school? Yes _____ No _____
4. Check one, or more of the following which best
describes your present farming status.
 - a. At home, owning or sharing in one or more farm
enterprises _____
 - b. At home, owning or sharing in one or more farm
enterprises and renting additional land for your-
self _____
 - c. At home, sharing in total farm business _____
 - d. At home, sharing in total farm business and
renting additional land for yourself _____
 - e. Living at home and renting land for yourself _____
 - f. Partner in farming either at home or away from home _____
 - g. Living on and operating rented farm for yourself _____
 - h. Living on and operating your own farm _____
 - i. Living on and operating your own farm and renting
additional land for yourself _____
 - j. Farm manager _____
 - k. Not engaged in any farm or ranch enterprise _____
5. Do you work more hours in farm or ranch enterprises
than in any other type of work? Yes _____ No _____

After careful consideration please check the most appropriate column in each of the sections A, B, and C for each skill. Please do not skip any skills.

	A	B	C
	IMPORTANCE OF SKILL to your success in farming during the past three to five years, whether used by you or for you	YOUR SUCCESS IN USING THE SKILL IN FARM PRACTICE	AMOUNT OF TRAINING you received in the skill in high school agriculture course
	1 Vary import- ant	2 Some- what import- ant	3 Not used by you
	2 Some- what import- ant	1 Success- ful most of time	1 Enough for succe- ssful use when en- rolled
	3 Not import- ant or not used by you or for you	2 Some- times succe- ssful	2 Some
		3 Not succe- ssful	3 None
SKILLS			
1. Cut metal using tools, such as, hacksaw, metal shears or chisel			
2. Cut threads on bolts or rods			
3. Fasten metal together with rivets			
4. Bend cold metal			
FARM POWER AND MACHINERY			
OPERATING AND REPAIRING FARM MACHINERY			
1. Splice belts			
2. Sharpen cutting parts of farm machinery			
3. Replace broken or worn parts on farm machinery			
4. Fit bearings on farm machinery			
5. Assemble farm machinery			
6. Make operational adjustments on farm machinery			
7. Calibrate farm machinery. Example: Ad- just a grain drill so it will plant the correct amount of seed per acre			
8. Make adjustments in hitches and alignments on farm machinery			
9. Lubricate farm machinery			
10. Paint farm machinery			

1. The common knowledge

2. Make rope splices

3. Finnish ends of rope

HOT METALWORKING

1. Shape hot metal

2. Draw out tillage tools to a sharp edge

3. Temper tools, such as, chisels or punches

4. Anneal steel

SOLDERING AND SHEET METALWORKING

1. Solder metals used on the farm

2. Cut and shape any kind of sheet metal

3. Fasten together any kind of sheet metal with rivets or self tapping screws

ARC WELDING

1. Weld iron or steel

2. Weld iron castings

3. Use the carbon arc to make a bronze weld

4. Use the arc welder to cut metal

5. Apply hard-facing material

OXYACETYLENE WELDING

1. Use steel rod to weld iron or steel

2. Use bronze rod to weld iron or steel

3. Weld iron castings

4. Weld aluminum

5. Use the cutting torch to cut metal

6. Apply hard-facing material

CONCRETE WORKING

1. Build concrete forms

2. Reinforce concrete

3. Pour concrete

4. Waterproof concrete, or concrete block walls

5. Lay blocks or bricks

COLD METALWORKING

1. Drill holes in metal

After careful consideration please check the most appropriate column in each of the sections A, B, and C for each skill. Please do not skip any skills.

SKILLS

A			B				C		
IMPORTANCE OF SKILL to your success in farming during the past three to five years, whether used by you or for you			YOUR SUCCESS IN USING the skill in farm practice				AMOUNT OF TRAINING you received in the skill in high school agriculture course		
1	2	3	1	2	3	4	1	2	3
Very important	Some- import- ant	Not import- ant or by you or for you	Success- ful al- most every time	Some- times success- ful	Not success- ful	Not used by you	Enough for success- ful use when enrolled	Some	None

6. Fasten boards with nails
7. Fasten boards with screws and/or bolts
8. Paint equipment or buildings constructed of lumber
9. Remove paint or varnish
10. Cut glass to desired size
11. Replace a broken window pane

TOOL FITTING

1. Replace broken handles in tools
2. Sharpen edged tools, such as chisels, plane blades, or knives
3. Sharpen drilling and boring tools
4. Sharpen saws

PLUMBING

1. Cut pipe used in plumbing to desired length
2. Thread pipe
3. Assemble pipe and fittings so that joints are properly sealed
4. Repair leaky valves or faucets

ROPEWORKING

1. Tie common knots

5. SHARPENING
6. PAINTING
7. WELDING
8. RIVETING
9. BENDING METAL
10. DRILLING
11. SAWING
12. NAILING
13. SCREWDRIVING
14. BRASSWORK
15. OTHER

After careful consideration please check the most appropriate column in each of the sections A, B, and C for each skill. Please do not skip any skills.

A	B			C		
	YOUR SUCCESS IN USING THE SKILL IN FARM PRACTICE			AMOUNT OF TRAINING YOU RECEIVED IN THE SKILL IN HIGH SCHOOL AGRICULTURE COURSE		
1	2	3	1	2	3	
Very Important	Some-what important	Not Important or Not used by you or for you	Successful at most times	Not Successful	Not used by you	1 Enough for successful use when enrolled
2	3	1	2	3	4	2 Some
3	4	2	3	4	5	3 None

SKILLS

Example: Fit handles in tools

✓

✓

✓

Explanation

Consider a skill used for you by someone else whether or not you paid this person.

How often you used the skill successfully to obtain durable results, satisfactory workmanship, and satisfactory service from the job performed will determine whether you check column 1 or 2.

Whether you check column 1 or 2 as to amount of training received will depend on how successful you were while in high school, in using the skill to obtain durable results, satisfactory workmanship, and satisfactory service from the job performed.

FARM SHOP WORK

GENERAL

1. Sketch plans for the construction of farm-mechanical jobs

WOODWORKING, GLAZING, AND PAINTING

1. Cut lumber to size with saws

2. Use hand tools other than saws to cut and shape lumber

3. Bore or drill holes in wood

4. Measure lumber to construct buildings and equipment which are correctly plumbed and squared.

5. Cut rafters

1

2

3

1

2

3

4

1

2

3

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