CORE AGRICULTURAL MECHANICS COMPETENCIES FOR VOCATIONAL AGRICULTURE TEACHERS, A NATIONAL STUDY

by

Karl Oscar Polson

Dissertation submitted to the Faculty of the
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of
DOCTOR OF EDUCATION
in
Vocational and Technical Education

APPROVED:

John H. Hillison

Gale L. Hagee

Charles A. Pinder

James L. Hoerner

Miles H. Lovingood

May 1982

Blacksburg, Virginia

DEDICATION

This study is dedicated with deepest love, affection, and appreciation to my two wonderful sons . They have experienced with me the joys and frustrations of completing the graduate school experience. Their love, patience, understanding, and presence, especially during the events of the past year, have given me the strength and courage to continue on and to successfully complete this study. It is to you, my sons, and to our futures, that I dedicate this work. May God bless us all.

ACKNOWLEDGEMENTS

Heartfelt thanks are sincerely extended to the many individuals whose support, help, guidance and encouragement have made the completion of this study possible.

To the members of my committee, Doctors John Hillison, James Hoerner, Gale Hagee, Charles Pinder and Miles Lovingood I extend appreciation for the patience exhibited and the confidence shown in me during the past year. The encouragement, support and understanding provided by each of them has helped lead me through a very difficult and trying period and to successful completion of this effort.

Special gratitude must go to Dr. John H. Hillison, my committee chairman. His willingness to help with every problem and to make himself available, even when it was inconvenient, have been key elements in the successful conduct and completion of this study. His willingness to offer suggestions, comments, criticisms and support of the study have made my work much easier. His support kept me working at a time when it would have been much easier to quit. For that I cannot thank him enough.

Appreciation is extended to for his encouragement and backing. Especially I am grateful for his help in making the financial support available without which none of this would be possible.

To I offer a special thanks. As friend, advisor, confidante, and mentor, he has kept me on the path to completion of this study. As director of the Graduate Leadership Development Program at Virginia Tech he displayed confidence in and support for me which I appreciate most deeply.

To my fellow G.L.D.P. Awardees I say thank you one and all. Your examples and support, mental, emotional and physical during the two years we were together have been an inspiration and incentive to me.

Similar recognition must go to my fellow graduate students in agricultural education, . The encouraging words each of you provided did more to sustain me than any of you will ever know. Especially I must thank , whose help and unselfish granting of time and advice have been especially important in the completion of Chapters 4 and 5.

A warm note of thanks is expressed to , a very dear and valued friend, whose help in coding data made the timely completion of this study possible.

To the remaining members of the agricultural education program area instructional staff, , and secretarial staff, , and , go special thanks for their time, help and encouragement.

To a very special thank you is extended for her patience, dedication, hard work and willingness to accommodate and help meet my deadline. The help she provided as typist has been invaluable throughout this study.

Grateful appreciation is extended to , a very special friend. Her help in the tedious job of proofreading and correction of the manuscript was invaluable.

My personal and warm thanks are extended to the many participants in this study from around the country whose time and effort in responding made it all possible.

Finally, I thank my mother, , and my youngest brother and his wife for their help and encouragement. Without their support and encouragement as

well as the support of the individuals mentioned above, this study would not have been possible.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

INTRODUCTION

Vocational agriculture education was established in the United States by the Smith-Hughes Act (Public Law 347) in 1917, and for nearly fifty years was primarily concerned with programs in production agriculture. During the latter part of the 1950's and the early 1960's, vocational agriculture began to take on a new look. With passage of the Vocational Education Act of 1963 (Public Law 88-210) and the Vocational Education Amendments of 1968 (Public Law 90-576) rapid expansion and specialization occurred. Agriculture was no longer simply the production of food and fiber, rather it came to be recognized as a complex industry of many components and specialties, all interrelated, and each with its own peculiar set of characteristics. Reorganization of vocational agriculture from traditionally production agriculture based programs into a set of agricultural specialties, or taxonomies, took place.

Eight taxonomy or specialty areas of vocational agriculture were identified, seven of which are well defined. The eighth, a sort of catchall taxonomy, includes areas of

agriculture which were not defined in the first seven, or which come into existence as a result of changing technology and other causes. The taxonomies, as reported by Stevens (1977, pp. 14, 60) are: (1) production agriculture, (2) agricultural supplies/services, (3) agricultural mechanics, (4) agricultural products, processing, and marketing, (5) horticulture, (6) renewable natural resources, (7) forestry, and (8) agriculture/agribusiness, other. Of these eight, agricultural mechanics is unique in that it is not only a specialty in its own right, but is also a component of each of the remaining seven specialties. A complete program of instruction in any of the taxonomies involves instruction in agricultural mechanics.

The Education and Research Committee of the American Society of Agricultural Engineers (ASAE) recognized, as ·-ly as 1968, the implications of increasing specialization in vocational agriculture for teacher preparation in agricultural mechanics. The Committee stated (1968, p. 148):

> The agricultural mechanization specialty has, of the new specialties, been in highest demand. In a like manner, there has been a growing pressure on colleges for improved and strengthened agricultural mechanization training programs for Teachers of Agriculture. This specialized division of agricultural teachers may more properly be identified as Teachers of Agricultural Mechanization. The task of setting up adequate agricultural education is thus a manifold problem. The training must vary in specialty content, breadth of coverage, and depth of coverage.

The committee recognized (p. 149) the need for varying instruction in agricultural mechanics with the type of specialty, and recommended that time allotments for agricultural mechanics in vocational agriculture programs vary by specialty. They said "recommended time allotment . . . will vary from nearly 100 percent, in the Agricultural Mechanization curriculum, to 15 to 25 percent in the Agricultural Supplies and Agricultural Products . . . curriculums."

At one time, most students and teachers of vocational agriculture were male and came from the rural farm population of the United States. A great deal of similarity existed in the experiences and backgrounds of the members of both groups and in the skills they possessed. Assumptions could often be safely made about the minimum proficiency level of members within each group, and programs designed to begin at that minimum level.

As the structure and diversity of agriculture changed at an ever more rapid rate during the 1950's and 1960's, the rural farm population continued to decrease while the numbers of vocational agriculture students, teachers, and programs increased. Vocational agriculture programs proliferated, with many appearing in urban or other nonrural settings. Increasing numbers of students and teachers with

nonfarm and even nonrural backgrounds began to appear during this period. Some of these students were girls, a group not previously found in vocational agriculture classrooms, and they soon became an important factor, representing about 17.2 percent of enrollments by 1979. (Rawls, 1980, p. 5)

The increasing diversity of students of vocational agriculture assured an increasing diversity in the levels of skills and experiences represented in the classroom. Teachers of vocational agriculture have also been reflecting this increasing diversity of backgrounds, experiences, and skills, with increasing numbers of nonrural men, as well as women, joining the ranks. No longer can assumptions be safely made about the minimum level of proficiency students bring either to vocational agriculture or agriculture teacher preparation programs, unless the minimum assumption is that they bring none. Newcomb (1976, p. 76) and Herr (1976, p. 101) pointed to the increasingly large number of students preparing to become vocational agriculture teachers who have neither vocational agriculture experience from high school, nor any previous agricultural background prior to college. These prospective teachers are heavily dependent on collegiate programs of instruction to provide both professional and technical skills they will need in the classroom.

Furthermore, agricultural technology has changed and expanded rapidly, with all areas of agriculture becoming heavily dependent on mechanization. In reviewing the technical advancements in mechanization, Cheatham (1980, 8-9) observed that "vocational agriculture teachers will be more involved with mechanics in the future." He further pointed out that "no machine is better than man's understanding of it and his ability to use it." Rawls (p. 5) also stressed the fact that technology in agriculture has and will continue to change rapidly. He predicted "astounding developments within the agricultural complex in the next decade."

Pruitt (1980, p. 15) considered these factors briefly in presenting his position that a core of agricultural mechanics competencies was "needed by all students prior to enrollment in a specialized program." Stark (1976) recommended developing valid means to evaluate prospective vocational agriculture teachers on possession of agricultural mechanics skills. A recommendation for vocational agriculture teachers to update competencies needed to teach skills demanded at high school level came from Henry (1973). Further study in this area was also urged by Sutfin (1977, p. 61) who suggested the need for research to determine the agricultural mechanics competencies needed by vocational agriculture teachers.

The situation existing today in regard to agricultural mechanics is one of great diversity. Most, if not all, vocational agriculture programs include some instruction in areas of agricultural mechanics, although the instruction may not be clearly identified as such. The prevailing opinion among agricultural educators has been that all vocational agriculture teachers need at least some mechanics skills. Several teacher training institutions require all candidates for teacher certification in agriculture to take one or more courses in agricultural mechanics or engineering.

Considerable research has been done to identify what is, and what should be, taught in agricultural mechanics in vocational agriculture programs. Little information clearly related to the technical agricultural mechanics competencies needed by vocational agricultural teachers is available, except that derived by inference from other studies or by asking teachers about perceptions of their own needs. This latter route has a way of becoming circular as teachers identify needs related to what they have learned, must teach, want to teach, or are teaching. The perceptions may or may not be related to what they should be teaching. It is this lack of clear identification of the technical agricultural mechanics competencies needed by teachers of voca-

tional agriculture which provided the motivation and the direction for this study.

PROBLEM STATEMENT

The problem of this study was to identify and verify the core of agriculture mechanics technical competencies needed by vocational agriculture teachers. Three levels of the problem were investigated:

1. A determination of the core agricultural mechanics competencies needed by all vocational agriculture teachers.

2. A determination of the agricultural mechanics competencies needed by vocational agriculture teachers which are common to two or more taxonomies.

3. A determination of the agricultural mechanics competencies needed by vocational agriculture teachers in each of the seven clearly defined taxonomies.

RESEARCH QUESTIONS

The major purpose of this study was to identify the core of agricultural mechanics competencies which vocational

agriculture teachers should possess. The following questions were investigated:

1. What agricultural mechanics competencies should be possessed by teachers of each vocational agriculture taxonomy?

2. What agricultural mechanics competencies needed by teachers form a cluster common to two or more taxonomies of vocational agriculture?

3. What agricultural mechanics competencies are common to, and needed by, teachers of all vocational agriculture taxonomies?

4. Do agricultural mechanics competencies needed by all vocational agricultural teachers differ by regions of the respondents?

5. Do agricultural mechanics competencies needed by all vocational agriculture teachers differ by respondent position category?

JUSTIFICATION OF THE STUDY

Complete programs of instruction in any of the vocational agriculture taxonomies, because of the highly techno-

logical nature of agriculture, involve instruction in related areas of agricultural mechanics. Evidence of this point was provided by McClay's study (1978) which covered 196 agricultural occupations and included numerous occupations from every vocational agriculture taxonomy except "Agriculture/Agribusiness, other." Agricultural mechanics abilities were identified as being important to occupations in every taxonomy area. In fact, nearly every occupation of the 196 surveyed in the study clearly required some knowledge or ability in agricultural mechanics. Unfortunately, the McClay study never addressed the questions of which competencies were common to the several taxonomies, or which competencies were needed by teachers. Indeed, those were not the purposes of the study.

Teacher preparation programs for vocational agriculture are not generally subdivided by taxonomy, and perhaps there is no reason they should be. However, a question has remained whether all teachers of vocational agriculture needed similar preparation in technical skills in certain areas, such as agricultural mechanics. The prevailing attitude among agricultural educators has been that all teachers needed some skills in agricultural mechanics. Differences have begun to arise when asking the question of which skills were needed for each taxonomy.

Several researchers have addressed the question of skills or competencies needed by workers in various taxonomies (Anderson and Iha, Grant, Shipley, Hollandsworth, Knotts and Webb, McClay). Were preparation programs for vocational agriculture teachers taxonomy specific, these studies would perhaps have provided much of the necessary information to determine specific teacher needs in the area of agricultural mechanics. However, other problems arose when it was recognized that vocational agriculture teachers often taught either general programs involving several taxonomies, or programs in taxonomy areas other than that in which they were specifically prepared. Furthermore, mobility within and among regions may have influenced to some degree the technical mechanics skills needed by teachers. While it has been accepted that many mechanics skills were generalizable to a variety of taxonomies, it has not been generally known which were most needed and which were common to several taxonomies. Teacher preparation in this area has remained largely oriented toward the traditional preparation given teachers of agriculture before introduction of the eight taxonomy areas of vocational agriculture. It seemed appropriate to ask if this traditional style of preparation was adequate for today's students, teachers, and programs.

SIGNIFICANCE OF THE STUDY

The research in this study was an effort to gather information about the agricultural mechanics competencies needed by vocational agriculture teachers to conduct their programs. Specifically, the study attempted to provide information useful for: (1) planning preservice agricultural mechanics programs for prospective teachers of vocational agriculture, and (2) planning inservice agricultural mechanics programs for vocational agriculture teachers. As Briers (1980, p. 4) pointed out, we have often assumed that agricultural education students' experiences in agriculture or technical agriculture courses have provided adequate background for teaching agriculture. He states that it is essential that our teachers be technically competent as "the technical competence of the teacher of vocational agriculture in the practical aspects of agriculture can be one assurance that the vo-ag program will meet the needs of agricultural industry." The significance of this study, which sought to identify a common core of agricultural mechanics competencies needed by vocational agriculture teachers resided ultimately in teacher preparation and inservice training, and the effectiveness of teachers in their respective programs and classrooms.

LIMITATIONS OF THE STUDY

1. The study was specifically limited to technical competencies in agricultural mechanics.

2. The vocational agriculture teachers and agriculture craft committee members in the study sample were purposely selected to represent outstanding programs in each of the randomly selected states.

3. Data collected from agricultural education teacher educators and state supervisors of agricultural education were not possible to contrast and compare by taxonomy with the taxonomy specific data collected from all vocational agriculture teachers and agriculture craft committee members.

4. Data collected on specific taxonomies were confined to that data collected from vocational agriculture teachers and agriculture craft committee members.

5. Data collected from vocational agricultural teachers and agriculture craft committee members were confined to teachers and craft committee members associated with programs in the seven clearly identified taxonomies.

DEFINITION OF TERMS

The following terms were defined according to their use in this study in order to assist the reader in achieving a clear understanding of their meaning and use.

1. Agricultural Education--a college or university program for the preparation of vocational agriculture teachers.

2. Agricultural Mechanics--subject matter or activities for the development of abilities needed to perform operations and processes related to selection, operation, and maintenance of agricultural power units, machinery and equipment, structures and utilities, soil and water management, and agricultural mechanics laboratories.

3. Agricultural Mechanization--subject matter and activities for development of abilities in selection, maintenance, and operation of agricultural power and equipment.

4. American Association of Teacher Educators in Agriculture (AATEA)--the national professional organization for agriculture teacher educators.

5. Competency--knowledge, skill, and ability necessary to perform a specific job or activity.

6. Craft Committee--a committee of lay persons who serve in an advisory capacity for a vocational agriculture program regarding curriculum, labor needs, and program relevance to the job market.

7. Taxonomy or Vocational Agriculture Specialty Area--one or more of the following areas of vocational agriculture instruction: (1) production agriculture, (2) agricultural supplies/services, (3) agriculture mechanics, (4) agricultural products, processing, and marketing, (5) horticulture, (6) renewable natural resources, (7) forestry, and (8) agriculture/agribusiness other.

8. Vocational Agriculture--a program of systematic instruction in secondary schools under public supervision and control, designed to prepare individuals for employment in an agricultural field.

SUMMARY

During the past twenty-five years both agriculture and vocational agriculture have undergone much change in the

United States. Agriculture experienced a technological revolution while vocational agriculture programs expanded from farm oriented production agriculture into eight areas of agriculture and agribusiness. The United States experienced a decline in farm populations while vocational agriculture experienced a growth in both students and programs. The students and teachers in these new programs often had no agricultural experience to provide a common skills base for instruction, and also brought to the programs a wide range of vocational objectives. The diversity of programs, as well as of students and teachers in the programs, have contributed to problems in identification of the technical competencies needed by students and teachers. This problem was particularly evident in the area of agricultural mechanics, which has been both a specialty area in vocational agriculture and a component of a complete program of instruction in all the other areas of vocational agriculture. This study sought to address one side of this problem, the technical competencies in agricultural mechanics needed by vocational agriculture teachers.

CHAPTER II

REVIEW OF RELATED LITERATURE AND RESEARCH

The objective of this chapter is to present a review of selected literature and research in order to define, explain, and clarify the current situation and to provide a foundation for the proposed study. This chapter is grouped into five sections: (1) Agricultural Mechanics Competencies Taught in Vocational Agriculture Programs, (2) Agricultural Mechanics Competencies Needed by Agricultural Workers, (3) Agricultural Mechanics Competencies Needed by Vocational Agriculture Teachers, (4) Miscellaneous Related Studies, and (5) Summary.

AGRICULTURAL MECHANICS COMPETENCIES TAUGHT IN VOCATIONAL AGRICULTURE PROGRAMS

Which of the hundreds of agricultural mechanics competencies are actually taught in vocational agriculture programs? Probably the answer is "all of them" in one place or another. Although many studies have been conducted on this or similar questions, the most useful ones date from about the time of the Vocational Education Act of 1963. It was at that time vocational agriculture programs as we know them

today began to take form. Agricultural education began to evolve from the traditional farming based production agriculture programs to the diverse group of eight taxonomies and many subspecialities which comprise today's programs.

George (1964) identified 73 farm mechanics jobs, in 16 areas of mechanics, which were taught in Missouri high school vocational agriculture classes. His job categories were broad and were based on the suggested course of study in mechanics which then existed in Missouri. He found that teachers were, in general, following the suggested course of study in all areas across the state. His conclusions further indicated that there was ample evidence to support a common pattern of mechanics instruction across the state. He noted that teachers were aware of both necessary local variations as well as changes which would be necessitated by the anticipated coming program changes.

The extent of time devoted to instruction of agricultural mechanics was studied in public supported educational agencies in Iowa during 1970-1971 by Breece (1972). A mean total of 211.8 hours of instruction in mechanics was reported by his respondents for four-year vocational agriculture programs.

A need for semester courses in selected agricultural mechanics areas in California was discovered by Crum and Dowler (1974). Areas included welding, small engines, farm power, surveying, and structures. Their study was intended for use in upgrading agricultural mechanics instruction in California vocational agriculture programs.

A study of 165 agricultural mechanics tasks taught or performed by Virginia horticulture teachers was conducted by Schinstock (1977). The results showed that all tasks identified were taught by Virginia horticulture teachers but that none were taught by all the teachers. Neither were all the 165 tasks taught by any single teacher. Schinstock's study also showed significant correlations between the mechanics tasks taught/performed and: (1) years of teaching experience, (2) occupational experience in farming, and (3) preservice specialization in agricultural production.

Polson (1979) found, in a study of agricultural mechanics jobs taught in Mississippi vocational agriculture programs, that all of the 146 selected jobs identified were perceived as appropriate by vocational agriculture teachers. However, no job was taught by all teachers.

AGRICULTURAL MECHANICS COMPETENCIES NEEDED BY AGRICULTURAL WORKERS

The competencies and skills in agricultural mechanics which are needed by agricultural workers of all types, in both on and off-farm occupations have been extensively studied. In a study focusing on 75 agricultural mechanics skills, drawn from recommended courses of study in five western states, Anderson and Iha (1969, p. 72) surveyed 25 agribusiness firms in North Central Colorado. Functions of the firms varied from retailing to manufacturing directly related to production agriculture in the region, and a wide diversity of agricultural occupations was represented. The study showed a direct relationship between need for farm mechanics skills and farm machinery or farm service occupations. Some relationship existed between mechanics skills and the processing occupations, but the relationship was weak in the areas of the sales and service occupations studied.

Grant (1971) in Pennsylvania, and Shipley (1972) in Illinois, conducting independent studies of agricultural mechanics skills deemed important by employers in several horticultural occupational areas, found that all of the mechanics competency groups and skills they had identified were found to be of at least some importance across all the

occupational areas included. The competencies and skills varied in degree of importance from highly desirable to little or no importance; but none, in either study, were deemed of no value by all employers or teachers. Most were rated highly desirable, but some significant differences were noted by occupational area, particularly by Shipley.

In his study of graduates of one Kansas high school vocational agriculture program, Hollandsworth (1972) found that mechanics skills required for farm and nonfarm employment were very similar. He concluded that since the skills were similar, they could be taught in the same class.

Competencies in power and machinery skills were reported by Knotts and Webb (1974) to be most needed by Texas farmers, with those in the maintenance and service categories being the most needed.

As noted previously, the so-called National Ag Occupations Competency Study compiled by McClay (1978), and probably the most extensive work of its type, indicated that agricultural mechanics competencies are important to occupations in every agricultural taxonomy area. The nature of this national study does not provide a clear picture of a pattern of needed competencies, however. Also, because of the diversity of procedures used to generate the data, as

well as other factors, it seems unlikely that further detailed analysis of the data presented would contribute to their usefulness in clarifying the situation.

AGRICULTURAL MECHANICS COMPETENCIES NEEDED BY VOCATIONAL AGRICULTURE TEACHERS

Data on the agricultural mechanics competencies needed by teachers of vocational agriculture have generally resulted from surveys of vocational agriculture teachers. Frequently, the studies have concentrated on self perceived teacher competency and training.

Dettmann (1965) surveyed four 39 member groups of Iowa agriculture teachers concerning a list of 186 competencies identified by a panel of experts. His study focused on the mechanics competencies needed by the teachers, the competencies they possessed, and where the competencies were acquired. College was identified as the leading place where the mechanics competencies were acquired, with on-the-job experience ranking a close second. Among Dettman's conclusions was the implication that preservice insructional programs could play a part in developing many more mechanics competencies before teachers were actually in the classroom.

Jacobs (1972) conducted an appraisal of the importance of 117 selected agricultural mechanics competencies presumably needed by teachers of agricultural mechanization in 21

western states. Among the implications of Jacobs' study was the suggestion that teacher training programs, based on the competencies evaluated, would be equally appropriate throughout the geographic area covered by the study. It was also concluded that, with the exception of some power and machinery skills, the competencies were applicable to all levels of instruction: high school, area vocational school, and community college.

Among West Virginia vocational agriculture teachers surveyed, Glotfelty (1975) found a universal desire for additional training in every listed mechanics instructional area. However, all teachers felt they had above average proficiency in every area listed except farm power and machinery. Glotfelty also found on-the-job experience to be the most common means of competency acquisition. Further, his study showed the greatest use of inservice training programs being made by the more experienced teachers.

West (1975) also found a desire for additional training in 41 of 44 shop skills by West Virginia agriculture teachers. Reduction in the need for inservice training was observed when certain preservice courses were taken by the teachers represented in the survey. Agricultural power was identified by the teachers as the area of greatest training need.

In his study to determine the agricultural mechanics competencies that should be taught to preservice vocational agriculture teachers in two required agricultural engineering courses in the production curriculum in Ohio, Lovingood (1977) studied 240 competencies. The study involved two groups of 40 Ohio teachers of production agriculture who were completing two to four years of service. Each group was asked to respond to a list of 120 of the competencies by indicating their ability to teach or perform each competency, where it was acquired, and whether they actually taught the competency in their program. One- half of the respondents indicated little preparation would be needed to teach or perform competencies while the other half indicated some to much preparation would be needed. Thirty- four percent acquired the competencie on the job, and 29 percent reported college as the source of competencies; work experience and high school accounted for the balance, in that order of importance. Sixty-six percent of respondents utilized some or all of the competencies included in the survey.

MISCELLANEOUS RELATED STUDIES

In an attempt to find out who was assuming responsibility in the area of agricultural mechanics instruction for

vocational agriculture teachers in the United States, Salmon (1969, pp. 73, 75) conducted a survey of teacher education institutions. The responses received from 101 agricultural education and agricultural engineering department heads led him to conclude that there was no clear division of responsibility for instruction of agricultural education undergraduates in agricultural mechanics. Further, he found that offerings were following the traditional (farm mechanics) lines of instruction and were not keeping pace with technology. Salmon suggested that since agricultural engineering departments nationwide assumed the major responsibility for determining course content and instruction of agricultural mechanics for preservice teachers, they needed to be aware of their needs. He summarized his study by saying:

> Evidence seems to indicate that there is no common agreement on how to prepare prospective teachers of vocational agriculture in agricultural mechanics. No one is taking the major responsibility for determining what the agricultural mechanics undergraduate curriculum should be, nor do they seem to be concerned. The responsibility tends to float between various departments with agricultural engineering doing most of the teaching. Few curriculum innovations appear to be taking place. (p. 75)

McCracken and Yoder (1975) conducted a study of 28 representative agricultural occupations, selected by a study advisory committee of Ohio agricultural educators for the purpose of identifying a common core of basic skills for

agribusiness and natural resources education. On the basis of the study, a core of 48 tasks was identified as the common core of basic skills across agricultural occupations. Among the conclusions of the study were that the 48 skills were common to most agricultural occupations, they should be developed in students with career goals in agriculture, and they represented only a small portion of the skills needed by workers. However, the researchers stated that "examination of the tasks will reveal that few of them are 'agricultural' in nature." Review of the list of 48 skills reveals that 46 of them are actually agricultural mechanics or mechanics related skills, and that a certain degree of redundancy exists among them. The remaining two skills were office related (greeting people, and use of telephone).

In his study to determine a core of technical competencies in animal science needed by vocational agriculture teachers Sutfin (1977) surveyed a sample of 40 teachers and 40 people in animal science occupations in the three Pacific Coast states. A questionnaire listing 130 animal science technical competencies to be rated on a five point Likert-type scale was used in the study. Sutfin found the greatest variation to exist between the competencies teachers felt were important and those that the animal industry people felt were important. He found differences on 57 of the com-

petencies in this test. Sutfin indicated among his implications that agriculture education curricula have not kept pace with teacher needs, and students need more opportunity to learn manipulative skills in college. He also indicated a need for research to determine competencies in agricultural mechanics needed by vocational agriculture teachers (pp. 60-61).

SUMMARY

Technical competencies in agricultural mechanics have been studied at many different levels and in many different ways. Results of studies consistently suggested that agricultural mechanics competencies were important in all occupational areas of agriculture and should be taught in vocational agriculture programs. Numerous studies also indicated that competencies in agricultural mechanics were needed by all vocational agriculture teachers.

Some degree of concern was suggested in the literature about the direction of teacher preparation in agricultural mechanics. A related concern was the degree to which technical preparation of teachers matched the technological change which had occurred in agriculture. These concerns seemed particularly important in view of the increasing levels of specialization in both agriculture and vocational agriculture programs.

While the general consensus appeared to be that agricultural mechanics competencies were important for vocational agriculture teachers, there was no clear indication of what those competencies were, or should be. Some investigations of agricultural mechanics competencies needed by teachers in either selected areas of agricultural mechanics or in selected taxonomy areas have been conducted. However, no clear attempt has been made to study competencies from all areas of agricultural mechanics needed by teachers in all taxonomies of vocational agriculture.

Existing studies did suggest methodological foundations for a study to identify a core of competencies in agricultural mechanics needed by vocational agricultural teachers. Those suggestions included: (1) identification and evaluation of a selected competency list, (2) selection of a sample representing both agricultural education and industry, (3) utilization of a rating scale to assess need for the competencies, (4) determine if the competencies are actually taught or performed, and (5) determine how, or if, teachers acquired the competencies.

CHAPTER III

RESEARCH DESIGN AND METHODOLOGY

Chapters I and II presented the foundation and framework upon which the study was based. This chapter provides a description of the (1) population, (2) sample selection, (3) design of the study, (4) instrumentation, (5) data collection procedures, and (6) data analysis.

DESCRIPTION OF THE POPULATION

The population of this study consisted of four separate groups. The groups were (1) agricultural teacher educators (teacher educators), (2) state vocationa agriculture education supervisory staff (supervisors), (3) secondary vocational agriculture teachers (teachers or vocational agriculture teachers) associated with programs identified as "outstanding" by head state supervisors, and (4) vocational agriculture craft committee members (craft committee members or committee members) associated with programs identified as "outstanding" by head state supervisors.

SELECTION OF THE SAMPLE

The United States was stratified into the four regions identified by the constitution of the AATEA as shown in Table 1. The states in each region are identified in Appendix A. Three states were randomly selected from each region for inclusion in the study and are identified by asterisks.

The head state supervisor of agricultural education in each of the randomly selected states was contacted by telephone and by mail to explain the study, solicit support, and to secure assistance in identifying the teacher sample. Each of the head supervisors were asked to verify the list of supervisory personnel from the 1981-1982 Agriculture Teacher's Directory for accuracy. They were also asked to identify the two outstanding programs in each vocational agriculture taxonomy area represented in their states and to supply the names of the respective teachers, their school addresses and telephone numbers. A sample of the letter sent to each supervisor, and the form used for identification of the outstanding programs in each state, is presented in Appendix B.

A maximum of three supervisors were chosen from each state for inclusion in the study from the list verified by the head supervisor. In the cases of the states which had

TABLE 1

REGIONS OF THE AMERICAN ASSOCIATION OF TEACHER EDUCATORS IN AGRICULTRE

Region	Number of States
Central	12
Eastern	12
Southern	13
Western	11

more than three supervisors, consecutive numbers were assigned to each supervisor's name. A random numbers table was used to draw the sample from the group of consecutive numbers assigned. In cases where three or fewer supervisors existed in a state, all supervisors were included in the sample. A sample of 28 supervisors was selected for inclusion.

Teacher educators were chosen in an identical manner from the 1980-81 Directory of Agriculture Teacher Educators compiled by Rogers, and released by the United States Department of Education, Office of Vocational and Adult Education. A sample consisting of 36 teacher educators was included in the study.

The teacher sample was selected from the lists of outstanding programs and teachers supplied by the head state supervisors. Whenever possible the teacher and program listed first was selected for inclusion in the study. The only exceptions to selection of the first listed teacher were cases where the teacher identified was in a postsecondary program. As expected, most states did not have programs existing in all seven taxonomy areas. The final sample consisted of 67 high school vocational agriculture teachers.

Craft committee members were identified by incorporating a form for that purpose in each of the survey instruments sent to the teachers in the sample. The cover letter mailed to each teacher explained the purpose of the form and the procedures to be followed in contacting committee members identified. A maximum of three committee members were selected to represent each program from the lists supplied by each teacher in the same manner that the supervisors and teacher educators were selected. When three or fewer members were identified by a teacher, all names were included in the sample. As expected, some teachers did not provide a list of committee members' names. The final sample of craft committee members selected for inclusion in the study totaled 127. A copy of the form mailed with teacher instruments and used to identify committee members is in Appendix C.

The sampling technique applied in selection of teachers and craft members was believed to be appropriate because of the purpose of the study. The purpose of the study was essentially to determine what a core of agricultural mechanics competencies for vocational agriculture teachers should be, rather than to determine what competencies currently exist. Alpert (1952) offered the following observations related to appropriateness of sampling techniques:

> The choice of sampling unit will depend not only on mathematical sampling theory but also on the prior specialized knowledge the investigator has regarding the nature of sub-units, how they have been developed and why. (p. 32).
>
> Fashion is the enemy of the utilitarian. In the field of techniques, it operates especially to increase the incidence of faulty applications of the particular technique which happens to be in fashion . . . .It is not surprising, therefore, to find surveys being designed to include probability samples even though such a design is not the most effective or most relevant to the situation being studied. (p. 33).

Furthermore, the reseacher's statistical consultant, Dr. Robert Schulman (1981), in a consultation session related to suggested sampling techniques for this study, deemed the sampling method to be appropriate to the purpose of the study for the subgroups of teachers and craft committee members.

DESIGN OF THE STUDY

The study was designed to determine the core of agricultural mechanics competencies needed by vocational agriculture teachers of all taxonomy areas. The study was also designed to facilitate determination of the needed agricultural mechanics teacher competencies common to two or more taxonomy areas of vocational agriculture education.

Descriptive survey research was the method used in conducting this study. Isaac and Michael (1971, p. 14) identi-

fied the purpose of descriptive research as being "to describe systematically a situation or area of interest factually and accurately. Kerlinger (1973, p. 422) stated that "survey research is probably best adapted to obtaining personal and social facts, beliefs, and attitudes. He also stated, "obviously, survey research is a useful tool for educational fact-finding." He further indicated that "it is unsatisfactory to depend upon relatively hit-or-miss, so-called representative samples based on 'expert' judgements," (p. 421). Kerlinger also stated in his discussion of the development of the survey method of research, that the developers "have put a rigorous scientific stamp on survey research and, in the process, have profoundly influenced the social sciences," (p. 401).

INSTRUMENTATION

The instrument which was used in this study was a mailed survey questionnaire. The instrument consisted of an agricultural mechanics competency list which was comprised of 90 items and a brief supplementary information section related to respondent's training and experience in agriculture and agricultural education.

The agricultural mechanics competency section of the questionnaire consisted of a list of competencies from each

area of agricultural mechanics and was compiled from a review of the literature. The original list consisted of 113 general competencies, each with several underlying skills. The intention of using general competencies versus specific skills was to provide broad, in-depth coverage of all areas of agricultural mechanics while maintaining an instrument of manageable size.

The original list of 113 general competencies was submitted to a panel of 12 judges from six states which were not a part of the study. The panel was composed of agriculture teacher educators, agricultural mechanics specialists in teacher education, state supervisors and vocational agriculture teachers. The panel was asked to evaluate the list of competencies and to make recommendations about: (1) appropriateness of the items, (2) completeness of the list, (3) clarity of the items, (4) additions, deletions, and/or combining of items, and (5) other comments or suggestions they felt were appropriate.

All of the judges responded, offering comments and suggestions which were reviewed item by item. The panel unanimously agreed that the competency list was appropriate and complete. Their suggestions resulted in rewording of some items and consolidation of several others. The recommenda-

tions and comments of the panel of judges resulted in the final list of 90 competencies which composed the main body of the instrument. A four point Likert-type scale was then added to the instrument to rate the extent to which teachers need to possess skill in each of the 90 competencies.

A field test of the revised instrument was conducted, using a group of four individuals, one representing each of the sample subgroups. The field test subjects were asked to complete the instrument. Each was also asked to time the completion of the instrument and to comment on: (1) clarity of directions, (2) clarity of items, (3) organization of the instrument, and (4) ease of completion. All field test subjects reported an approximate completion time of 15 minutes, and every subject felt directions were clear, clarity of items was good, the instrument was well-organized and easy to follow, and that completion was not difficult. Upon completion of the field test, and receipt of the information from the field test subjects, the final instruments were prepared and submitted to the study sample. A copy of the survey instrument mailed to all subgroups and a copy of the supplementary information sheet mailed are provided in Appendix C.

DATA COLLECTION PROCEDURES

The data collection procedures followed were based on a system developed by Dillman (1978). Concern for achievement of high response rates from the four subgroups which made up the sample existed from the beginning. The method of survey research which Dillman outlined was reported to achieve exceptionally high rates of response on a consistent basis. His method involved careful consideration of all factors and steps of the research process as a package, rather than attention to single aspects in hopes of increasing response rates. Careful attention was given to all aspects of the data collection process, particularly (1) instrument design, construction, and quality; (2) format and content of cover letters, follow-up cards, and follow-up letters; and (3) conduct of the follow-up mailings.

Data collection was begun with the mailing of survey instruments, cover letters, and stamped return envelopes to teacher educators and supervisors on November 23, 1981. The initial mailing of instruments to teachers was completed on December 19, 1981. A postcard follow-up was mailed on January 4, 1982, to all nonrespondents in the first three subgroups. A second follow-up mailing was sent to the remaining nonrespondents on March 11, 1982. During the entire period between mailings returns continued to be received.

Several telephone calls were also made in response to requests from members of the three sample subgroups, and approximately 10 individual remailings of instruments resulted from the telephone conversations. In every case the instruments were promptly completed and returned.

Selection of the sample of craft committee members, based on the names and addresses provided by teachers, was completed on March 1, 1982. The initial mailing of cover letters and insruments to craft committee members was completed on March 3, 1982. Follow-up postcards were sent to nonrespondent craft committee members on March 16, followed by a final complete follow-up mailing, including replacement instruments, on March 24, 1982. Data collection was closed on April 9, 1982, for all subgroups in the sample. The cover letters mailed to each group of respondents were tailored to their positions, and copies of each are provided in Appendix D. Samples of the follow-up cards and letters appear in Appendices E and F, respectively. The summary of all mailings and response rates is presented in Table 2.

DATA ANALYSIS

Data analysis for the study was accomplished by use of the Virginia Polytechnic Institute and State Univesity Com-

TABLE 2

SUMMARY OF MAILINGS AND RESPONSE RATES

Group	Questionnaires Mailed	Responses Received	Percent Response
Teacher Educators	36	33	91.7
State Supervisors	28	25	89.3
Teachers	67	54	80.6
Committee Members	127	96	75.6
Total	258	208	80.6

puter Facilities and the Statistical Package for the Social Sciences (SPSS) system. Data were coded to optically scanned test sheets which were mechanically processed to create a tape file of all data. Punched computer cards were then created from the tape file.

Frequencies for all subgroups of the sample were determined for each of the 90 items on the competency list. A mean cutoff of 2.000, equal to the instrument rating for a "moderate" amount of skill needed by teachers, was used to determine which competencies were included as core competencies. Group means for each of the 90 competency items were used to calculate grand means for the combined groups to eliminate effects of unequal group size on the grand means.

Frequencies for the combined teacher and committee member groups were determined for each of the 90 competency items by taxonomy area. A cutoff of 2.000 was again used to determine which competencies were included as core competencies for each taxonomy.

The data were next collapsed into ten general clusters of competencies. A one-way ANOVA procedure was used to analyze these data for differences by position subgroups and by AATEA regions, using a .05 alpha level.

SUMMARY

Chapter III presents the research design and methodology used in the study. The topics specifically discussed were: (1) the population, (2) sample selectiion procedures, (3) the design of the study, (4) instrumentation for the study, (5) data collection procedures, and (6) analysis of data.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA INTRODUCTION

The purpose of this study was to determine the agricultural mechanics competencies needed by vocational agriculture teachers which form a core all teachers should possess. The research questions posed for this study and the statistical analysis of the data are presented in this chapter.

DATA ANALYSIS

Data for this study were analyzed using the SPSS system. Subprogram "Frequencies" was used to determine means on all competency data. Means were determined for teacher educator and supervisor subgroups on each competency, and a grand mean was calculated for every competency. Data from teachers and craft committee members were analyzed to determine means for each competency by taxonomy area. Competencies were also grouped into 10 clusters, and SPSS subprogram "ONEWAY" was used to analyze the clustered data by position and by region to determine differences between groups. A posthoc test, using the Scheffe procedure, was performed on each ANOVA which showed significant differences betwen

groups to determine where the differences existed. A reliability coefficient of 0.98 was also determined for the instrument using coefficient alpha.

Mechanics Competencies for Vocational Agriculture

Research Question Number 1: What agricultural mechanics competencies should be possessed by teachers of each vocational agriculture taxonomy?

Data which could be analyzed at a taxonomy level were gathered from the teacher and craft committee member subgroups of the population. Each of these respondents was identified as being associated with a vocational agriculture program representing a specific taxonomy area. Mean scores were calculated for all respondents representing each taxonomy area on each of the 90 agricultural mechanics competencies included in the study. Table 3 shows the numbers of teacher and craft committee respondents for each taxonomy area.

A mean score for all respondents of 2.000 or above was established as the cutoff point for competencies which were to be identified as core mechanics competencies needed by teachers of each taxonomy area. The mean score of 2.000 was equal to the raw score on the data collection instrument

TABLE 3

NUMBERS OF RESPONDENTS FOR EACH TAXONOMY

Taxonomy Area	Teachers	Members of Craft Committees	Total
1. Production Agric.	11	15	26
2. Agric. supp./services	8	19	27
3. Agric. mechanics	9	14	23
4. Agricultural products, proc. and marketing	4	5	9
5. Horticulture	8	13	21
6. Renewable nat. res.	6	13	19
7. Forestry	8	17	25
Total	54	96	150

associated with a moderate amount of skill needed by teachers for each competency. Table 4 summarizes the numbers of competencies for each taxonomy area which achieved a mean score of 2.000 or above. The production agriculture respondents identified the largest number of agricultural mechanics competencies needed by teachers with 58. Respondents representing the agricultual products, processing, and marketing taxonomy and the horticulture taxonomy identified the fewest mechanics competencies needed by teachers with six each.

A mean score of 2.000 or above was achieved for 72 competencies in at least one of the seven taxonomy areas. Only competency number 41, "sharpen knives, chisels, twist drills, and/or other cutting tools," achieved the 2.000 cutoff level for all seven taxonomy areas. The remaining 18 competencies failed to achieve a mean rating of 2.000 for any taxonomy area. Table 5 presents the competencies which achieved mean scores of 2.000 or above for any taxonomy area. Appendix G provides all of the mean scores for the 90 agriculture mechanics competencies for each of the seven taxonomy areas.

TABLE 4

NOS. OF COMPETENCIES ACHIEVING MEANS OF 2.000 OR GREATER AS DETERMINED BY TEACHERS & CRAFT COMMITTEE MEMBERS

Taxonomy	Number of Competencies
1. Production agriculture	58
2. Agricultural supplies/services	25
3. Agricultural Mechanics	52
4. Agricultural prod., proc., and mktng.	6
5. Horticulture	6
6. Renewable Natural Resources	49
7. Forestry	22

TABLE 5

COMPETENCIES ACHIEVING A MEAN OF 2.000 OR MORE FOR AT LEAST ONE TAXONOMY

Competency List Item Number	Competency	Prod. Ag.	Ag. Supplies/ Services	Ag. Mech.	Ag. Prod. Proc. & Mktg.	Hort.	Renewable Nat. Res.	Forestry
		N=26	N=27	N=23	N=9	N=21	N=19	N=25
		Tax. 1	Tax. 2	Tax. 3	Tax. 4	Tax. 5	Tax. 6	Tax. 7
1.	Sketch and/or draw basic plans							*
2.	Read and interpret plans or blueprints	*		*		*	*	
3.	Determine and compute bill of materials	*	*	*		*	*	*
4.	Identify, select, size and/or grade lumber	*						
5.	Identify, select, and use wood and/or metal fasteners	*		*				
6.	Measure and mark wood and/or metal	*	*	*			*	*
7.	Saw, plane, chisel and/or bore wood to dimension with hand or power tools	*	*	*			*	*
8.	Use hand woodworking tools	*	*	*			*	*
9.	Use stationary and portable woodworking power tools	*	*	*			*	*
10.	Layout frame and sheathe structures	*						
11.	Layout rafters and trusses	*		*			*	
14.	Identify and/or select metals			*				
16.	Use stationary and portable metal working equipment and tools	*		*			*	
17.	File and/or drill cold metal	*						
18.	Select and use taps, dies, and screw extractors	*		*				
19.	Prepare metal for welding	*	*	*			*	
20.	Classify and select arc welding equipment and supplies	*	*	*			*	*

TABLE 5 (continued)

Competency List Item Number	Competency	Prod. Ag.	Ag. Supplies/ Services	Ag. Mech.	Ag. Prod. Proc. & Mktg.	Hort.	Renewable Nat. Res.	Forestry
		N=26	N=27	N=23	N=9	N=21	N=19	N=25
		Tax. 1	Tax. 2	Tax. 3	Tax. 4	Tax. 5	Tax. 6	Tax. 7
21.	Arc weld in flat position, all joints	*	*	*			*	
22.	Arc weld in vertical, horizontal and/or overhead positions, any or all joints	*	*	*			*	
29.	Select and maintain oxy-fuel gas tips and torches	*	*	*				
30.	Set up and operate oxy-fuel gas, welding and heating equipment	*	*	*			*	*
31.	Cut metal with oxy-fuel gas cutting torches	*	*	*			*	
32.	Weld in flat position with oxy-fuel gas equipment, all joints	*	*	*			*	
34.	Braze with oxy-fuel gas equipment, all joints	*		*			*	
38.	Operate bench and/or portable grinding equipment	*		*			*	
39.	Select, maintain and use grinding wheels, handstones and/or files	*		*			*	
40.	Replace tool handles	*					*	
41.	Sharpen knives, chisels, plane irons, axes, twist drills and/or other cutting tools	*	*	*	*	*	*	*
42.	Clean and store tools and equipment	*	*	*	*	*	*	
43.	Prepare surfaces for paint or finishes	*	*					
44.	Select and maintain applicating equipment for painting, finishing and/or preserving	*					*	
45.	Select, mix and/or apply wood or metal preservatives, paints, or finishes						*	
46.	Apply paints to machinery and/or equipment						*	
48.	Estimate bill of materials for concrete and/or masonry							*
49.	Determine orders for ready-mixed concrete	*		*			*	
52.	Identify and select electrical tools, devices, and conductors by type and use	*		*			*	*

TABLE 5 (continued)

Competency List Item Number	Competency	Prod. Ag.	Ag. Supplies/ Services	Ag. Mech.	Ag. Prod. Proc. & Mktg.	Hort.	Renewable Nat. Res.	Forestry
		N=26	N=27	N=23	N=9	N=21	N=19	N=25
		Tax. 1	Tax. 2	Tax. 3	Tax. 4	Tax. 5	Tax. 6	Tax. 7
53.	Plan and/or interpret electrical circuits and wiring diagrams	*	*				*	*
54.	Install or replace electrical fixtures and/or wiring	*		*				
55.	Select, install and/or maintain electric motors	*		*				
56.	Splice electric wire	*	*	*	*			
57.	Clean, disassemble, inspect and reassemble engines	*		*			*	
58.	Identify engines by model, type and make	*		*				
59.	Troubleshoot engines	*	*	*		*	*	*
60.	Maintain and service engine lubrication systems	*		*		*	*	*
61.	Maintain and/or service engine cooling systems	*		*			*	
62.	Maintain service and/or repair fuel and air systems on spark ignition engines	*		*			*	*
63.	Maintain service and/or repair fuel and air systems on diesel engines	*					*	*
64.	Maintain service and/or repair engine ignition/ electrical systems	*		*			*	*
65.	Inspect, repair, and/or replace bearings, seals, and crank assemblies on engines	*						
66.	Clean, inspect, repair or replace pistons, cylinders and/or valve systems on engines	*		*				
67.	Maintain, repair, and/or replace carburetor and governor systems on engines	*					*	
68.	Use parts and service manuals and order engine or equipment parts	*	*	*			*	*

TABLE 5 (continued)

Competency List Item Number	Competency	Ag. Prod. Ag.	Ag. Supplies/ Services	Ag. Mech.	Ag. Prod. Proc. & Mktg.	Hort.	Renewable Nat. Res.	Forestry
		N=26	N=27	N=23	N=9	N=21	N=19	N=25
		Tax. 1	Tax. 2	Tax. 3	Tax. 4	Tax. 5	Tax. 6	Tax. 7
69.	Prepare engines for storage	*		*				
70.	Use measuring devices for accurate parts inspection on engines and equipment	*		*			*	
71.	Evaluate engine or equipment parts for replacement or reconditioning	*		*			*	*
72.	Adjust and maintain power transmission systems (gears, chains, shafts, belts)			*			*	
73.	Identify, maintain and/or repair hydraulic system components	*		*			*	
74.	Service, maintain and adjust bearings on equipment and tractors	*		*			*	
75.	Operate and adjust agricultural tractors, equipment and/or machinery	*	*	*	*		*	*
76.	Maintain agricultural tractors, equipment and/or machinery	*	*	*	*		*	*
77.	Select, use and store fuels, oils and greases	*	*	*			*	*
78.	Set up and adjust level or transit	*	*	*				
79.	Determine elevations with level or transit		*	*				
80.	Lay out foundations and/or other sites with a level or transit							
81.	Measure land by pacing and/or measuring devices						*	
82.	Run land boundary closures						*	
85.	Identify and select plumbing equipment, supplies pipe and fittings	*		*	*			
86.	Sweat copper pipe and tubing joints	*						
87.	Fit plastic pipe to iron pipe or copper tubing	*						
88.	Prepare and install iron, copper and/or plastic pipe and tubing	*						
89.	Connect plumbing fixtures to pipe or tubing			*				
90.	Maintain and/or repair, plumbing and protect from freezing	*						

* Mean = 2.0 or greater

Research Question Number 2: What agricultural mechanics competencies needed by teachers form a cluster common to two or more taxonomies of vocational agriculture and to which taxonomies are they common?

Mean scores of 2.000 or above in two or more taxonomy areas were achieved by 55 of the 90 listed agricultural mechanics competencies. The remaining 17 competencies (of the 72 which achieved ratings of 2.000 or above in a taxonomy) did so in only one of the seven taxonomies. Table 5 illustrates the competencies which achieved means of 2.000, indicates the competencies with means at or above that level which are common to two or more of the seven taxonomies, and also the taxonomies to which they are common.

Research Question Number 3: What agricultural mechanics competencies are common to, and needed by teachers of all vocational agriculture taxonomies?

Group means of teacher educators and supervisors were calculated on all of the 90 agricultural mechanics competencies. The group means were then used to calculate a grand mean for each competency in order to eliminate the effects of unequal sub-sample sizes.

The grand means were used as the criteria for determining which agricultural mechanics competencies were needed by teachers of all agricultural taxonomy areas. Competencies which attained a grand mean of at least 2.000, equal to the instrument rating for moderate skill needed by teachers, were considered to be needed by all teachers of vocational agriculture. Sixty-nine of the 90 competencies listed on the instrument had a grand mean of 2.000 or greater. These competencies are listed in rank order in Table 6. The sample group means and grand means for each competency are presented in Appendix H in the order they appeared on the instrument.

TABLE 6

Rank Ordered Competencies Needed by All Vocational Agriculture Teachers as Identified by Teacher Educators and Supervisors

Rank	Competency	Grand Mean
1.	Arc weld in flat position, all joints	2.709
2.	Use stationary and portable woodworking tools	2.678
3.	Measure and mark wood and/or metal	2.673
4.	Saw, plane, chisel, and/or bore wood to dimension, with hand or power tools	2.643
5.	Determine and compute bill of materials	2.638
6.	Prepare metal for welding	2.623
7.	Set up and operate oxy-fuel gas welding and heating equipment.	2.618
8.	Use parts and service manuals and order engine parts	2.578
9.	Select and maintain oxy-fuel gas tips and torches	2.573
10.	Operate bench and/or portable grinding equipment	2.568
	Maintain and service engine lubrication systems	2.568
12.	Cut metal with oxy-fuel gas cutting torches	2.563
13.	Maintain and/or service engine cooling systems	2.553
14.	Maintain agricultural tractors, equipment, and/or machinery	2.543
	Select use, and store fuels, oils, and greases	2.543
16.	Maintain, service, and/or repair fuel and air systems on spark ignition engines	2.523
17.	Clean and store tools and equipment	2.508
18.	Troubleshoot engines	2.492
19.	Select, maintain, and use grinding wheels, handstones and/or files	2.468
20.	Classify and select arc welding equipment and supplies.	2.457
	Weld in flat position with oxy-fuel gas equipment, all joints.	2.457
22.	Use hand woodworking tools	2.452
	Operate and adjust agricultural tractors, equipment, and/or machinery	2.452
24.	Identify and select electrical tools, devices and conductors by type and use	2.417
25.	Sharpen knives, chisels, plane irons, axes, twist drills and/or other cutting tools	2.412

26.	File and/or drill cold metal	2.383
27.	Splice electric wire	2.381
28.	Arc weld in vertical, horizontal, and/or overhead positions, any or all joints	2.361
29.	Select and use taps, dies, and screw extractors	2.342
30.	Identify, select, and use wood and/or metal fasteners	2.341
31.	Use measuring devices for accurate parts inspection on engines and equipment.	2.322
32.	Maintain, service, and/or repair fuel and air systems on diesel engines	2.312
33.	Maintain, service, and/or repair engine ignition/electrical systems	2.307
34.	Prepare surfaces for point or finishes	2.297
	Install or replace electrical fixtures and/or wiring. 36. Prepare engines for storage	2.297 2.286
37.	Braze with oxy-fuel gas equipment all joints	2.277
	Maintain and/or repair plumbing and protect from freezing	2.277
39.	Identify and/or select metals	2.237
	Use stationary and portable metal working equipment and tools	2.237
41.	Plan and/or interpret electrical circuits and wiring diagrams	2.235
42.	Replace tool handles	2.231
	Estimate bill of materials for concrete and/or masonry	2.231
	Identify engines by model, type, and make	2.231
	Evaluate engine or equipment parts for replacement or reconditioning	2.231
	Fit plastic pipe to iron pipe or copper tubing	2.221
47.	Select and maintain applicating equipment for painting, finishing, and/or preserving	2.221
48.	Determine orders for ready mixed concrete	2.206
	Clean, disassemble, inspect, and reassemble engines	2.206
50.	Select, install, and/or maintain electric motors	2.200
	Set up and adjust level or transit	2.166
52.	Sweat copper pipe and tubing joints	2.155
53.	Construct forms, place, finish and cure concrete	2.141
	Identify and select plumbing equipment, supplies, pipe, and fittings	2.141
55.	Determine elevations with level or transit	2.140
56.	Apply paints to machinery and/or equipment	2.136
57.	Read and interpret plans and/or blueprints	2.135

58.	Service, maintain, and adjust bearings on equipment and tractors	2.131
	Prepare and install iron, copper, and/or plastic pipe and tubing	2.131
60.	Select and/or prepare masonry and concrete materials and mixtures	2.106
61.	Layout foundations and/or other sites with a level or transit	2.105
62.	Maintain and/or service engine cooling systems	2.101
63.	Adjust and maintain power transmission systems (gears, chains, shafts, belts)	2.100
	Connect plumbing fixtures to pipe or tubing	2.100
65.	Sketch and/or draw basic plans	2.090
66.	Cut, pierce, gouge, and/or bevel metal with arc welder	2.080
67.	Measure land by pacing and/or measuring devices	2.071
68.	Weld out of position with oxy-fuel gas equipment, all joints.	2.070
69.	Identify, select, size, and/or grade lumber	2.065

Influence of Region and Respondent Position on Competencies

The 90 individual competencies were collapsed into 10 general competency clusters. Summated scores for each competency cluster were analyzed, using SPSS subprogram "ONEWAY," by region and position to determine if differences existed in regard to the summated scores. Post hoc tests, using the Scheffe procedure, were performed when differences were significant at the .05 level to determine where differences existed.

The results of the one-way analysis of variance (ANOVA) procedures and the Scheffe procedures are presented by competency cluster. Research questions four and five are each addressed in the discussion of all of the 10 competency clusters. Competencies assigned to each cluster are listed in Appendix I. Cluster means appear in Appendix J.

Research Question Number 4: Do agricultural mechanics competencies needed by all vocational agriculture teachers differ by regions of the respondents?

Research Question Number 5: Do agricultural mechanics competencies needed by all vocational agriculture teachers differ by respondent category?

Plans and Materials.

Results of the oneway ANOVA on the competency cluster plans and materials showed no significant differences by region at the .05 level. Table 7 presents the summary ANOVA for the plans and materials competency cluster analyzed by AATEA Region. Differences by position for this competency cluster were significant at the .05 level. The Scheffe post hoc test revealed that significant differences existed between state supervisors and teachers as well as between state supervisors and craft committee members.
The summary ANOVA for the plans and materials cluster by respondents' position categories is shown in Table 8.

Welding.

The competency cluster welding combined electric and oxy-fuel welding competencies. The ANOVA procedure failed to show significant differences among respondent regions for this competency cluster. The summary ANOVA is in Table 9. When compared by position categories, differences were significant. Results of the Scheffe procedure showed the significant differences to exist between teacher educators and teachers and between supervisors and teachers.
The summary ANOVA for positions is shown in Table 10.

TABLE 7

Summary ANOVA for Plans and Materials Cluster by Respondent Region

Source	Degree of Freedom	Sum of Squares	Mean Squares	F-Ratio	F-Prob.
Between Groups	3	6.351	2.117	0.242	0.867
Within Groups	204	1781.635	8.734		
TOTAL	207	1787.986			

TABLE 8

Summary ANOVA for Plans and Materials Cluster by Respondent Position Category

Source	Degree of Freedom	Sum of Squares	Mean Squares	F-Ratio	F-Prob.
Between Groups	3	181.181	60.394	7.668	0.0001
Within Groups	204	1606.805	7.877		
TOTAL	207	1787.986			

TABLE 9

Summary ANOVA for Welding Cluster by Respondent Region

Source	Degree of Freedom	Sum of Squares	Mean Squares	F-Ratio	F-Prob.
Between Groups	3	744.729	248.243	1.672	0.174
Within Groups	203	30132.676	148.437		
TOTAL	206	30877.405			

TABLE 10

Summary ANOVA for Welding Cluster by Respondent Position Category

Source	Degree of Freedom	Sum of Squares	Mean Squares	F-Ratio	F-Prob.
Between Groups	3	2470.610	823.537	5.885	0.0007
Within Groups	203	28406.788	139.935		
TOTAL	206	30877.398			

Carpentry.

Analysis of the carpentry cluster for differences by region using one-way ANOVA revealed no significant differences at the .05 level. Table 11 presents the summary ANOVA for regions.

The ANOVA for the carpentry cluster by position categories was significant at the .05 level. The Scheffe post hoc procedure revealed differences between state supervisors and craft committee members. The summary ANOVA appears in Table 12.

Cold Metal and Tool Fitting.

A one-way analysis of variance on the cold metal and tool fitting competency cluster by respondent region showed no significant differences at the .05 level. Table 13 presents the summary ANOVA for the cold metal and tool fitting competency cluster.

The ANOVA procedure for this competency cluster by position category, indicated differences existed which were significant at the .05 level. Results of the Scheffe procedure showed the differences were between the craft committee member group and the teacher educator and supervisor groups.

TABLE 11

Summary ANOVA for Carpentry Cluster by Respondent Region

Source	Degree of Freedom	Sum of Squares	Mean Squares	F-Ratio	F-Prob.
Between Groups	3	19.219	6.406	0.366	0.777
Within Groups	204	3566.284	17.482		
TOTAL	207	3585.503			

TABLE 12

Summary ANOVA for Carpentry Cluster by Respondent Position Category

Source	Degree of Freedom	Sum of Squares	Mean Squares	F-Ratio	F-Prob.
Between Groups	3	269.420	89.807	5.525	0.0011
Within Groups	204	3316.074	16.255		
TOTAL	207	3585.494			

TABLE 13

Summary ANOVA for Cold Metal and Tool Fitting Cluster by Respondent Region

Source	Degree of Freedom	Sum of Squares	Mean Squares	F-Ratio	F-Prob.
Between Groups	3	180.924	60.308	1.742	0.1597
Within Groups	204	7064.457	34.630		
TOTAL	207	7245.381			

Significant difference also existed between teacher educators and teachers. The summary ANOVA and group means by position categories are presented in Table 14.

Painting and Preserving.

The analysis of variance test revealed no significant differences between respondent regions for the painting and preserving competency cluster. The summary ANOVA for regions is shown in Table 15.

Differences between position categores of respondents were significant at the 0.05 level as indicated by the one-way ANOVA test. The Scheffe post hoc procedure showed the significant differences to be between the teacher educator group and the craft committee member group. Table 16 presents the summary ANOVA for the painting and preserving cluster by respondent positions.

Concrete and Masonry.

No significant differences between regions were indicated by the ANOVA test for the concrete and masonry cluster of competencies. The summary ANOVA for regions appears in Table 17.

TABLE 14

Summary ANOVA for Cold Metal and Tool Fitting Cluster by Respondent Position Category

Source	Degree of Freedom	Sum of Squares	Mean Squares	F-Ratio	F-Prob.
Between Groups	3	766.332	255.444	8.043	0.0000
Within Groups	204	6479.053	31.760		
TOTAL	207	7245.385			

TABLE 15

Summary ANOVA for Painting and Preserving Cluster by Respondent Region

Source	Degree of Freedom	Sum of Squares	Mean Squares	F-Ratio	F-Prob.
Between Groups	3	3.959	1.320	0.197	0.899
Within Groups	204	1367.552	6.704		
TOTAL	207	1371.511			

TABLE 16

Summary ANOVA for Painting and Preserving Cluster by Respondent Position Category

Source	Degree of Freedom	Sum of Squares	Mean Squares	F-Ratio	F-Prob.
Between Groups	3	78.409	26.136	4.123	0.007
Within Groups	204	1293.099	6.339		
TOTAL	207	1371.508			

TABLE 17

Summary ANOVA for Concrete and Masonry Cluster by Respondent Region

Source	Degree of Freedom	Sum of Squares	Mean Squares	F-Ratio	F-Prob.
Between Groups	3	57.266	19.089	1.951	0.123
Within Groups	204	1995.951	9.784		
TOTAL	207	2053.217			

The ANOVA test for this competency cluster by postion categories showed significant differences to exist between positions at the .05 level of significance. However, the Scheffe post hoc procedure failed to show where differences existed between position categories, indicating instead that "no two groups are significantly different at the 0.050 level." Table 18 presents the summary ANOVA for the concrete and masonry cluster by position categories of respondents.

Electricity.

Regional differences of respondents for the electricity cluster of competencies were shown not to be significant at the .05 level by the analysis of variance test. The summary ANOVA for electricity by respondent region is illustrated in Table 19.

The ANOVA test for the electricity cluster of competencies revealed that significant differences existed among position categories. The differences were determined to be between the supervisor and craft committee groups by the Scheffe post hoc procedure. Table 20 illustrates the summary ANOVA for position categories on the electricity competency cluster.

TABLE 18

Summary ANOVA for Concrete and Masonry Cluster by Respondent Position Category

Source	Degree of Freedom	Sum of Squares	Mean Squares	F-Ratio	F-Prob.
Between Groups	3	103.617	34.539	3.614	0.0142
Within Groups	204	1949.602	9.557		
TOTAL	207	2053.219			

TABLE 19

Summary ANOVA for Electricity Cluster by Respondent Region

Source	Degree of Freedom	Sum of Squares	Mean Squares	F-Ratio	F-Prob.
Between Groups	3	47.866	15.955	1.470	0.2238
Within Groups	204	2214.230	10.854		
TOTAL	207	2262.096			

TABLE 20

Sumary ANOVA for Electricity Cluster by Respondent Position Category

Source	Degree of Freedom	Sum of Squares	Mean Squares	F-Ratio	F-Prob.
Between Groups	3	154.511	51.504	4.985	0.0023
Within Groups	204	2107.589	10.331		
TOTAL	207	2262.100			

Power and Machinery.

The ANOVA test for differences between respondent regions on the power and machinery competency cluster showed no significant differences to exist at the .05 level. The summary ANOVA for this test is shown in Table 21.

Significant differences between positions on the power and machinery cluster were indicated by the ANOVA test. The results of the Scheffe post hoc procedure did not reveal which position category groups differed, indicating instead that "no two groups are significantly different at the 0.050 level." Results of the ANOVA are summarized in Table 22 for position category groups on the power and machinery cluster.

Land Measurement.

Significant differences were shown to exist among the AATEA Regions of the respondents by the analysis of variance test for the land measurement competency cluster at the .05 level. The Scheffe post hoc procedure revealed that the significant differences were between respondents in the Eastern Region and respondents in the Southern Region. Table 23 presents the summary ANOVA for regions on the land measurement competency cluster.

TABLE 21

Summmary ANOVA for Power and Machinery Cluster by Respondent Region

Source	Degree of Freedom	Sum of Squares	Mean Squares	F-Ratio	F-Prob.
Between Groups	3	894.124	298.041	1.969	0.1198
Within Groups	204	30883.523	151.390		
TOTAL	207	31777.647			

TABLE 22

Summary ANOVA for Power and Machinery Cluster by Respondent Position Category

Source	Degree of Freedom	Sum of Squares	Mean Squares	F-Ratio	F-Prob.
Between Groups	3	1495.057	498.352	3.357	0.0198
Within Groups	204	30282.670	148.445		
TOTAL	207	31777.727			

TABLE 23

Summary ANOVA for Land Measurement Cluster by Respondent Region

Source	Degree of Freedom	Sum of Squares	Mean Squares	F-Ratio	F-Prob.
Between Groups	3	189.378	63.126	4.001	0.0085
Within Groups	204	3218.524	15.777		
TOTAL	207	3407.902			

No significant differences between position categories for the land measurement competency cluster were indicated by the ANOVA procedure for this competency cluster. The summary ANOVA for position categories appears in Table 24

Plumbing.

Results of the analysis of variance test for regional differences of respondents on the plumbing competency cluster showed that differences were not significant at the .05 level. Table 25 presents the summary ANOVA for regions on the plumbing cluster of competencies.

The ANOVA test for differences among respondent position categories indicated significant differences existed at the 0.05 level. However, the Scheffe post hoc procedure failed to reveal any differences, indicating that "no two groups are significantly different at the 0.050 level." The summary ANOVA for position categories on this competency cluster is shown in Table 26.

SUMMARY

Chapter IV provided the presentation and analysis of data. Results of the analysis of data received from respondents in the study were used to identify agricultural

TABLE 24

Summary ANOVA for Land Measurement Cluster by Respondent Position Category

Source	Degree of Freedom	Sum of Squares	Mean Squares	F-Ratio	F-Prob.
Between Groups	3	69.105	23.035	1.407	0.2417
Within Groups	204	3338.797	16.367		
TOTAL	207	3407.902			

TABLE 25

Summary ANOVA for Plumbing Cluster by Respondent Region

Source	Degree of Freedom	Sum of Squares	Mean Squares	F-Ratio	F-Prob.
Between Groups	3	8.942	2.981	0.178	0.9109
Within Groups	204	3406.731	16.700		
TOTAL	207	3415.673			

TABLE 26

Summary ANOVA for Plumbing Cluster by Respondent Position Category

Source	Degree of Freedom	Sum of Squares	Mean Squares	F-Ratio	F-Prob.
Between Groups	3	196.193	65.398	4.144	0.0071
Within Groups	204	3219.481	15.782		
TOTAL	207	3415.674			

mechanics competencies needed by vocational agriculture teachers. Competencies needed by vocational agriculture teachers were determined by mean scores for each of 90 competencies. Competencies needed by teachers were identified at three levels: (1) those needed by each taxonomy area, (2) those common to two or more taxonomy areas, and (3) those needed by all vocational agriculture teachers.

Competency clusters were created and analyzed to determine if differences existed in the need for the competencies based on the respondents' regional locations and on their position category in vocational agriculture. Differences were found to be significant at the .05 level by region only for the land measurement competency cluster. The land measurement cluster was also the only cluster for which there were no significant differences among position categories of the respondents. A Scheffe post hoc procedure was used to determine where differences were significant between groups. In three cases where significant differences were indicated by the test statistic, the post hoc procedure failed to identify any significant difference between groups.

CHAPTER V

SUMMARY, CONCLUSIONS, RECOMMENDATIONS AND DISCUSSION

Chapter V contains a summary of the procedures of the study, the conclusions drawn from study findings, recommendations, and a general discussion.

SUMMARY OF STUDY

Purpose of Study

The primary purpose of this study was to identify the core of agricultural mechanics competencies which all teachers of vocational agriculture should possess. Secondary purposes were to (1) identify agricultural mechanics competencies needed by teachers of one or more specialty areas or taxonomies, (2) determine if need for competencies differed by AATEA regions, and (3) determine if need for competencies was perceived differently by teacher educators, supervisors, teachers, and craft committee members.

Investigative Procedures

The study population consisted of four subgroups associated with vocational agriculture programs: (1) teacher educators, (2) state supervisors (3) teachers of programs in each taxonomy identified by supervisors as outstanding and (4) craft committee members associated with the outstanding programs. Twelve states were randomly selected to participate in the study and the members of each of the four subgroups were selected from within the 12 states.

The instrument contained 90 agricultural mechanics competencies generated from a review of the literature and validated by a panel of 12 judges. A four point Likert-type scale was used to determine the extent which each competency was needed by vocational agriculture teachers. The instrument was mailed to all members of the sample. Follow-up procedures included a postcard mailing and a final mailing of a second instrument. The overall response rate for all subgroups was 80.6 percent.

Statistical procedures used to analyze the data consisted of frequencies, oneway ANOVA, and a post hoc multiple comparison test. Means generated from the frequencies procedure were used to determine the competencies needed by vocational agriculture teachers of each taxonomy and of all

taxonomies. The F-test (ANOVA) was used to determine if significant differences existed between the ratings of competency clusters by respondents in relation to their regional service category (AATEA Region) and their position category. The Scheffe post hoc multiple ranges comparison was used to determine where differences were located when a significant F-statistic was found. Computer analysis of data was accomplished using The Statistical Package for the Social Sciences (SPSS).

SUMMARY OF FINDINGS

The findings are summarized according to the five research questions established for the study. The first three research questions focused on the agricultural mechanics competencies needed by vocational agriculture teachers. Questions four and five focused on differences among regions and among respondent position categories regarding need for skill in competency clusters by all vocational agriculture teachers. Findings are summarized for each major component of the study.

Agriculture Mechanics Competencies Which Should be Possessed by Teachers of Each Vocational Agriculture Taxonomy

The first research question was designed to identify which agricultural mechanics competencies were needed by teachers of each of seven vocational agriculture taxonomy

areas. Only data provided by teachers and craft committee members were used to answer question 1 as data from the other two subgroups were not taxonomy specific.

A mean score of 2.000, equal to the instrument rating for moderate skill, was used as the cutoff point to determine which skills were needed by teachers of each taxonomy area. Means were generated for each of the seven taxonomies.

Inspection of the indivdual group means for each taxonomy indicated that 58 competencies were needed by production agriculture teachers, 52 by agricultural mechanics teachers, 49 by natural resources teachers, 25 by sales and services teachers, 22 by forestry teachers and six each by agricultural products, processing, and marketing teachers and by horticulture teachers. Eighteen competencies did not achieve a group mean of 2.000 or higher in at least one taxonomy area. Table 5 indicates the competencies by taxonomy and Appendix G provides the mean scores for each competency.

Agricultural Mechanics Competencies Needed by Teachers Which Form a Cluster Between Two or More Vocational Agriculture Taxonomies.

The second research question was designed to identify the mechanics competencies common to two or more taxonomy areas of vocational agriculture. The means used to answer question 1 were also used to answer question 2.

Inspection of the individual taxonomy group means for each competency revealed that 55 competencies achieved a group mean of 2.000 or more in at least two of the seven taxonomy areas. Means of 2.000 or more were achieved for all seven taxonomies by 1 competency, for six taxonomies by 5 competencies, for five taxonomies by nine competencies, for four taxonomies by 12 competencies for three taxonomies by 15 competencies and for two taxonomies by 13 competencies.

Agricultural Mechanics Competencies Common to, and Needed by, Teachers of All Vocational Agriculture Taxonomies

The third research question was designed to address the primary purpose of the study which was to identify the core of agricultural mechanics competencies all teachers of vocational agriculture should possess. Data from teacher educator and supervisor subgroups were used to answer this question. Means were generated for both position subgroups and a grand mean was calculated for each competency. A minimum grand mean of 2.000 was used as the cutoff to determine which competencies should be included in the core for all teachers of vocational agriculture.

Sixty-nine of the 90 agricultural mechanics competencies achieved a grand mean of 2.000 or greater. The grand mean of 2.000 was equal to the instrument rating for moder-

ate skill needed by teachers. The 69 competencies achieving the 2.000 minimum rating were considered to be the core mechanics competencies which all teachers of vocational agriculture should possess.

Do Agricultural Mechanics Competencies Differ by Regions of the Respondents?

Ten clusters of agricultural mechanics competencies were tested for differences among AATEA regions using oneway ANOVA procedures. Nine clusters were shown to be not significantly different among regions. The land measurement cluster produced a signficant F-statistic, and the post hoc multiple ranges test (Scheffe) revealed that the difference existed between the Eastern and Southern Regions.

Do Agricultural Mechanics Competencies Differ by Respondent Position Categories?

The ten clusters of agricultural mechanics competencies, when analyzed by respondent categories, produced a significant F-statistic for all but one cluster. The land measurement cluster ANOVA showed no significant differences to exist among position categories. Findings for each of the nine competency clusters with a significant F-statistic at the .05 level were:

1. Plans and Materials--the post hoc test showed significant differences to exist between state supervisors and teachers and also between state supervisors and craft committee members.

2. Welding--the post hoc test showed significant differences to exist between teacher educators and teachers as well as between state supervisors and teachers.

3. Carpentry--the post hoc test showed significant differences to exist between state supervisors and craft committee members.

4. Cold Metal and Tool Fitting--the post hoc test showed significant differences to exist between teacher educators and craft committee members and between teacher educators and teachers. A significant difference also existed between state supervisors and craft committee members.

5. Painting and Preserving--the post hoc test showed significant differences to exist between teacher educators and craft committee members.

6. Concrete and Masonry--the post hoc test showed no significant differences between any two groups despite the fact that the F-statistic was significant at the .05 level.

7. Electricity--the post hoc test showed significant differences to exist between the state supervisors and teachers and between the state supervisors and craft committee members.

8. Power and Machinery--the post hoc test showed no significant differences between any two groups despite the fact that the F-statistic was significant at the .05 level.

9. Plumbing--the post hoc test showed no significant differences between any two groups despite the fact that the F-statistic was significant at the .05 level.

CONCLUSIONS

This study was primarly concerned with the identification of agricultural mechanics competencies needed by voca-

tional agriculture teachers. The following conclusions are based on the results of data analysis using group means and/or the one-way analysis of variance procedure and the Scheffe post hoc test. The following conclusions are established:

1. Agricultural mechanics competencies are needed by vocational agriculture teachers of every clearly defined taxonomy area.

2. The agricultural mechanics competencies which should be possessed by teachers tend to vary greatly depending on the taxonomy area taught.

3. A core of agricultural mechanics competencies which should be possessed by all vocational agriculture teachers does exist.

4. Agricultural mechanics competencies in general do not vary significantly in their appropriateness among AATEA regions of the United States. The exception is the land measurement group of competencies.

5. Teacher educators and state supervisors tend to agree about the clusters of agricultural mechanics competencies which vocational agriculture teachers should possess.

6. Teachers and craft committee members displayed statistical agreement about the clusters of agricultural mechanics competencies which vocational agriculture teachers should possess.

7. Teacher educators and state supervisors tend to differ with teachers and craft committee members about the agricultural mechanics competencies which vocational agriculture teachers should possess.

RECOMMENDATIONS

Based on findings and conclusions of this research the following recommendations are offered:

1. The core of agricultural mechanics competencies should be used as a basis in program planning for agricultural education students and/or vocational agriculture teachers.

2. A mechanism should be established to improve communication among teacher educators, state supervisors, teachers, and agricultural industry (craft committees) regarding needs of vocational agriculture at the program delivery level.

RECOMMENDATIONS FOR FURTHER STUDY

Recommended topics for further study are:

1. Advisement of preservice teacher education students in agricultural education should be evaluated to ensure students receive adequate preparation in agricultural mechanics.

2. Further study to determine if existing course or unit requirements in agricultural mechanics for students preparing to teach vocational agriculture, are adequate to meet teacher needs identified in this study.

3. Further study is needed to identify the skills underlying the competencies identified for teachers by this study.

4. Further study is needed to determine how to insure that all vocational agriculture teachers have the necessary competencies in agricultural mechanics as well as the other taxonomies of vocational agriculture.

5. Further study of existing teacher education programs should be made, based on agricultural mechanics competencies identified as needed by

vocational agriculture teachers, to ensure that provisions for acquiring these competencies are adequate.

6. Further study is needed of methods to include core agricultural mechanics competencies not currently available to vocational agriculture teacher education students in the program.

7. Further study is needed in each state or region to determine any additional agricultural mechanics competencies which may be needed within, and which are unique to, that state or region.

DISCUSSION

Vocational agriculture programs have undergone great change since the passage of the Smith-Hughes Act in 1917. Probably the greatest changes occurred during the past 20 years with the shift of emphasis from production agriculture based programs to specialty programs in seven clearly defined taxonomy areas of agriculture and agribusiness. The increased presence of urban and suburban students, and others with little or no agricultural background, in vocational agriculture teacher preparation programs has placed pressures on colleges and universities to provide all or most of

the technical preparation needed by teachers. Proliferation of specialty programs has eased to some extent, the problems associated with technical preparation of teachers, while complicating it in other ways. Technical skills and competencies clearly associated with specialty areas of instruction have generally been well identified and developed. The supporting skills and technical competencies needed by teachers of the several taxonomies, however, have not traditionally been so clearly identified and provided. Agricultural mechanics skills needed by teachers are among the supporting skills which have not been clearly identified for each of the taxonomy areas of vocational agriculture. The tendancy has been to continue agricultural mechanics instruction for all vocational agriculture teachers in much the same way it was done for teachers in the pre-specialty era when production agriculture was the primary emphasis.

Results of this study have reinforced the notion that agricultural mechanics competencies are needed by teachers of all vocational agriculture taxonomy areas. They also seem to clearly indicate that the needs of teachers for skills in agricultural mechanics competencies vary according to the taxonomy taught. It seems evident from the results of this study that production agriculture teachers have need for a wider range of agricultural mechanics competencies

than do teachers of agricultural products, processing, and marketing or teachers of horticulture.

In general, a clear tendency for lower order competencies within competency clusters to have the higher mean scores existed in the data. This is consistent with, and rational in relation to, the normal skill building process.

Apparently there is little difference attributable to geographic area in the agricultural mechanics competencies needed by vocational agriculture teachers. This would tend to indicate that teacher preparation in mechanics which was adequate in one area of the country would also be adequate in all the other areas of the country. Conversely, inadequate preparation for one area would probably be inadequate elsewhere.

The research findings further suggest that the teacher educators and state supervisors tended to differ from the teachers and craft committee members about the competencies needed by teachers. On the whole, teacher educators and supervisors rated competencies higher than did teachers or craft committee members. This was expected and may be due to several factors. Two of the more likely possible causes seem to be that (1) the teacher educators and supervisors take a much broader view of vocational agriculture than the

teachers and craft committee members and/or (2) the teacher educators and supervisors are further out of touch with what is going on in the field than the teachers and craft committee members are.

SUMMARY

In general, it seems clear that a core of agricultural mechanics competencies which all vocational agriculture teachers should possess does in fact exist and that it is appropriate on a wide geographic basis. Despite the proliferation of specialty, programs, and the ever increasing tendency for vocational agriculture teachers to specialize in single areas of agriculture, the need for supporting skills from other areas of agriculture still exists, at least in the area of agricultural mechanics.

BIBLIOGRAPHY

Alpert, H. Some observations on the sociology of sampling. Social Forces, 1952, 31, (1), 30-33.

American Association of Teacher Educators in Agriculture. Constitution and By-Laws. Article III, Section 1.

Anderson, H. and Iha, J. V. Mechanical competencies needed in agricultural occupations. The Agricultural Education Magazine, 1969, 42, 72.

Breece, H. E. Public supported agricultural mechanics instruction in Iowa (Ph.D. dissertation, Iowa State University, 1972). Dissertation Abstracts International, 1973, 33, 4292A. (University Microfilms No. 73-3, 861).

Briers, G. E. Making vo-ag relevant--are you up to the challenge. The Agricultural Education Magazine, 1980, 52, (9), 4-5.

Cheatham, W. J. Technology in agricultural mechanization. The Agricultural Education Magazine, 1980, 53, (1), 8-9.

Crum, M. and Dowler, L. Agricultural mechanics study--secondary schools of California. Summaries of Studies in Agricultural Education--Pacific Region 1973-1974, Tucson: Univeristy of Arizona, 1974. (ERIC Document Reproduction Service No. ED 109 376), 17.

Dettman, E. P. Competencies in agriculture mechanics needed by vocational agriculture instructors. Masters thesis, Iowa State University, 1965. (Published Abstract).

Dillman, D. A. Mail and Telephone Surveys--The Total Design Method. New York: John Wiley and Sons, Inc., 1978

Education and Research Committee (American Society of Agricultural Engineers). Agricultural engineering phases of teacher education in agriculture. Agricultural Engineering, 1968, 49, 148-151.

George, W. C. A study of farm mechanics jobs taught by teachers of vocational agriculture in Missouri. Ph.D. dissertation, University of Missouri, 1964.

Glotfelty, T. A. How advanced agricultural mechanics competencies are obtained by vocational agriculture teachers in West Virginia. Summaries of Research and Development Activities in Agricultural Education--1975-1976--United States of America, Columbus: The Ohio State University, 1976. (ERIC Document Reproduction Service No. ED 134 707), 108-109.

Grant, L. P. Identification of mechanics competency groups needed for skilled and semi-skilled labors in horticultural occupations. Summaries of Studies in Agricultural Education--North Atlantic Region--1970-1971 New Brunswick, N. J.: Rutgers, the State Univesity, 1971. (ERIC Document Reproduction Service No. ED 061 415), 20.

Henry, A. I. Vocational agriculture teachers in Florida: Relationship between their pre-service preparation and perceptions of their effectivensss (Ph.D. dissertation, University of Florida, 1973). Dissertation Abstracts International, 1973, 35, 125A. (University Microfilms No. 74-19, 150).

Herr, R. D. Teacher preparation--tell it like it is. The Agricultural Education Magazine, 1976, 49, 101-102.

Hollandsworth, R. Determination of agricultural mechanics skills needed by vocational agriculture graduates of Wamego High School 1965-1969. Summaries of Studies in Agricultural Education--Central Region--1971-1972, Urbana: The University of Illinois, 1972. (ERIC Document Reproduction Service No. ED 076 800), 28-29.

Isaac, S. and Michael, W. B. Handbook in research and evaluation. San Diego: EDITS Publishers, 1971.

Jacobs, C. O. An appraisal of competencies needed by teachers of agricultural mechanization. Staff Study, University of Arizona, 1972.

Kerlinger, F. N. Foundations of behavioral research (2nd. ed.) New York: Holt, Rinehart, and Winston, Inc., 1973.

Knotts, C. D. and Webb, E. S. Content priorities for farm mechanics. The Agricultural Education Magazine, 1974, 46, 236-237.

Lovingood, M. H. Competencies needed in construction, maintenance, and engine power by teachers of vocational agriculture. Ph.D. dissertation, The Ohio State University, 1977.

McClay, D. R. Identifying and validating essential competencies needed for entry and advancement in major agriculture and agribusiness occupations (U.S. Office of Education, Occupational and Adult Education Branch). Washington, D.C.: U.S. Government Printing Office, 1978.

McCracken, J. D. and Yoder, E. P. Determination of a common core of basic skills for agribusiness and natural resources. Final report. Columbus: The Ohio State University, 1975. (ERIC Document Reproduction Service No. ED 115 791).

The National Vocational Education (Smith-Hughes) Act. Public Law 347. 64th Congress, 1917.

Newcomb, L. H. The design of teacher education field experience to meet the needs of a new clientele. The Agricultural Education Magazine, 1976, 49, 76-77.

Nie, N. N., Hull, C. H., Jenkins, J. G. et. al. Statistical package for the social sciences (SPSS) (2nd ed.). New York: McGraw Hill Book Co., 1975.

Polson, K. O. A study of selected agricultural mechanics jobs taught by teachers of vocational agriculture in Mississippi. Unpublished masters thesis, Mississippi State University, 1979.

Pruitt, A. P. A competency-based core program in agricultural mechanics. The Agricultural Education Magazine, 1980, 52, (10), 15.

Rawls, B. F. Facing a decade of change. The Agricultural Education Magazine, 1980, 52, (7), 5-6.

Rogers, R A. Directory of agriculture teacher educators. Washington, D.C.: U.S. Department of Education, Office of Vocational and Adult Education, 1980.

Salmon, V. M. Agricultural mechanics for prospective teachers. The Agricultural Education Magazine, 1969, 42, 73, 75.

Schulman, R. Consultation interview on statistical methods for proposed study. Virginina Polytechnic Institute and State University. February 16, 1981.

Schinstock, J. L. A determination of the agricultural mechanics tasks performed by teachers of horticulture in Virginia. Ed.D. dissertation, Virginia Polytechnic Institute and State University, 1977.

Shipley, W. E. A study of agricultural mechanics knowledges and skills needed by entry-level employees in ornamental horticulture occupations and recommended levels for teaching those knowledges and skills. (Ed.D. thesis, University of Illinois, 1972). Dissertation Abstracts International, 1973, 34, 680A-681A. (University Microfilms No. 73-17, 414).

Smith, P. R., editor. Agriculture teachers directory, 1981, 81, 106, 113, 116, 125, 131, 132, 140, 151, 165, and 168.

Stark, C. M. A study of the teacher competencies list mandated by the Ryan Act for the agricultural mechanics curriculum in California. (Ph.D. dissertation, Brigham Young University, 1976). Dissertation Abstracts International, 1976, 37, 146A. (University Microfilms No. 76-18, 351).

Stevens, G. Z. A revised taxonomy for agriculture/agribusiness instruction programs. Agriculture Teachers Directory, 1977, 14 and 60.

Sutfin, W. H. A study to identify the animal science technical competencies needed by vocational agriculture instructors. Ed.D. dissertation, Oregon State University, 1977.

Vocational Education Act of 1963. Public Law 88-210, 88th Congress, 1963.

Vocational Education Amendments of 1968. Public Law 90-576, 90th Congress, 1968.

West, W. C. The need for agricultural mechanics workshops as perceived by West Virginia vocational agriculture teachers. Summaries of Research and Development Activities in Agricultural Education--1975-1976--United States of America, Columbus: The Ohio State University, 1976. (ERIC Document Reproduction Service No. ED 134 707) 113-114.

Appendix A

STATES IN AATEA REGIONS AND IN SAMPLE

Eastern	Central
Connecticut	Illinois
Deleware	Indiana
Maine	*Iowa
*Maryland	Kansas
Massachusetts	Michigan
New Hampshire	Minnesota
New Jersey	*Missouri
*New York	Nebraska
Pennsylvania	North Dakota
Rhode Island	*Ohio
*Vermont	South Dakota
West Virginia	Wisconsin
Southern	**Western**
Alabama	Arizona
*Arkansas	California
Florida	Colorado
Georgia	Idaho
Kentucky	*Montana
*Louisiana	Nevada
Mississippi	*New Mexico
North Carolina	Oregon
Oklahoma	Utah
*South Carolina	*Washington
Tennessee	Wyoming
Texas	
Virginia	

*Denotes states included in the study sample

Appendix B

LETTER TO HEAD STATE SUPERVISORS

COLLEGE OF EDUCATION

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DIVISION OF VOCATIONAL & TECHNICAL EDUCATION

Recently, I spoke with you by telephone concerning a research study to be conducted in cooperation with Dr. John Hillison of the Agricultural Education Program Area at Virginia Tech. We are about to undertake a national study to determine a core of agricultural mechanics technical competencies needed by all vocational agriculture teachers. This study is expected to have implications for preservice and inservice teacher education in agriculture.

The study will involve a group of state supervisors, teacher educators, vocational agriculture teachers, and craft committee members from each of twelve states representing four regions of the United States. Your state has been selected for inclusion in the study, and we need your assistance in its conduct. Due to the potential size of the study, we find it necessary to identify the two most outstanding vocational agriculture programs from each of the seven clearly identified taxonomy areas in the sample states. Because we are unfamiliar with the individual programs in your state, your assistance in identifying the outstanding programs is essential to us if this study is to be successful.

Enclosed is a form identifying the seven taxonomy areas, with space provided for the necessary information. Your help in providing teacher names, school names and addresses, and a telephone number for the school or department, will be greatly appreciated. We would also appreciate very much permission to mention your name in our contact letter to the teachers and craft committee members in eliciting participation.

We believe this is an important study, and thank you for your cooperation. Your prompt reply will be greatly appreciated as the study cannot begin without this information and time is of the essence. A stamped, self-addressed envelope is included for your convenience. Please return the form by September 11, 1981.

We thank you in advance for your cooperation and assistance and welcome any questions or comments you might care to offer.

Sincerely,

Karl O. Polson
Principal Investigator

KOP/jv

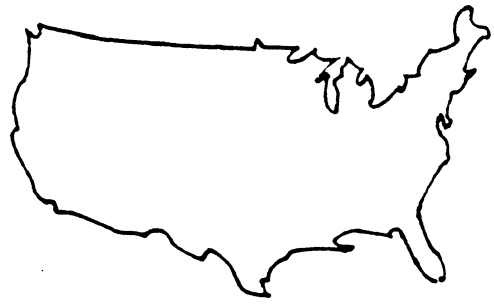
Enclosures

Appendix C

FINAL INSTRUMENT

AGRICULTURAL MECHANICS COMPETENCIES NEEDED by

VOCATIONAL AGRICULTURE TEACHERS: A NATIONAL STUDY



This survey is being conducted to identify the technical competencies in agricultural mechanics which all vocational agriculture teachers should possess. The competencies are purposely quite general, and may or may not apply to any single specialty of vocational agriculture. We believe, however, that every specialty area of vocational agriculture will have some listed competencies which apply. With this in mind, we ask that you please respond to every item to the best of your ability.

Results of this study will be of value for planning of teacher training programs. A summary of the results will be available to all participants and agencies requesting them. If you would like to receive a summary of the results of this study please print your name and address on the back of the enclosed return envelope (NOT on this questionnaire). We will see that you are sent a copy of the summary of results as soon as it is available.

Thank you for your time and help with this study. Please remove this cover sheet from the attached forms prior to returning the questionnaire to:

Karl O. Polson
Agricultural Education
324 Lane Hall
Virginia Tech
Blacksburg, VA 24061

As the representatives of local agricultural businesses and industries, craft/advisory committee members provide advice to help keep vocational agriculture programs in tune with local needs. Their involvement extends to many other areas including employment of program graduates. Responses of your committee members are very important to this study, and can be obtained only with your help.

Please list the names and mailing addresses of your craft/advisory committee members in the spaces provided on this form. Three of the names you provide will then be randomly selected for participation in this study. All information will be treated as confidential, none will be released to any other person or agency, and names will be used for the conduct of this study only. Your help in providing this information and promptly returning this form with the completed mechanics competencies sheets will be greatly appreciated. A stamped, self-addressed envelope is enclosed for your convenience.

Thank you very much for your assistance.

Sincerely,

Karl O. Polson
Principal Investigator

MEMBER NAME	ADDRESS	CITY	STATE	ZIP

AGRICULTURAL MECHANICS COMPETENCY SHEET

Directions: Please read before proceeding.

A. Please read each competency carefully, then circle the number which best represents the level of skill you believe a vocational agriculture teacher should have in the competency.

B. Please respond to every item. Your response is important to this study.

C. Please do not pass these data sheets to anyone else to complete. You have been carefully selected to participate in this study and it is your responses which we need.

Scale Ratings: 0 = None - Teacher does not need skill
1 = Some - Teacher needs a slight amount of skill
2 = Moderate - Teacher needs considerable skill but less than complete mastery
3 = Extensive - Teacher needs to be highly skilled

COMPETENCY	Level of Teacher Skill Needed (None Some Moderate Extensive) 0 1 2 3
1. Sketch and/or draw basic plans	0 1 2 3
2. Read and interpret plans or blueprints	0 1 2 3
3. Determine and compute bill of materials	0 1 2 3
4. Identify, select, size and/or grade lumber	0 1 2 3
5. Identify, select, and use wood and/or metal fasteners	0 1 2 3
6. Measure and mark wood and/or metal	0 1 2 3
7. Saw, plane, chisel and/or bore wood to dimension with hand or power tools	0 1 2 3
8. Use hand woodworking tools	0 1 2 3
9. Use stationary and portable woodworking power tools	0 1 2 3
10. Layout frame and sheathe structures	0 1 2 3
11. Layout rafters and trusses	0 1 2 3
12. Select and install insulating materials	0 1 2 3
13. Select and install roofing materials	0 1 2 3
14. Identify and/or select metals	0 1 2 3
15. Cut shape and/or heat-treat cold metal	0 1 2 3
16. Use stationary and portable metal working equipment and tools	0 1 2 3
17. File and/or drill cold metal	0 1 2 3
18. Select and use taps, dies and screw extractors	0 1 2 3
19. Prepare metal for welding	0 1 2 3
20. Classify and select arc welding equipment and supplies	0 1 2 3
21. Arc weld in flat position, all joints	0 1 2 3
22. Arc weld in vertical, horizontal and/or overhead positions, any or all joints	0 1 2 3
23. Hardsurface with arc welder	0 1 2 3
24. Cut, pierce, gouge and/or bevel metal with arc welder	0 1 2 3
25. Arc weld cast iron	0 1 2 3
26. Arc weld stainless steel and/or aluminum	0 1 2 3
27. TIG weld in flat position, all joints	0 1 2 3
28. MIG weld in flat position, all joints	0 1 2 3
29. Select and maintain oxy-fuel gas tips and torches	0 1 2 3
30. Set up and operate oxy-fuel gas, welding and heating equipment	0 1 2 3
31. Cut metal with oxy-fuel gas cutting torches	0 1 2 3
32. Weld in flat position with oxy-fuel gas equipment, all joints	0 1 2 3
33. Weld out of position with oxy-fuel gas equipment, all joints	0 1 2 3
34. Braze with oxy-fuel gas equipment, all joints	0 1 2 3
35. Hardsurface with oxy-fuel gas equipment	0 1 2 3
36. Weld cast iron with oxy-fuel gas equipment	0 1 2 3
37. Weld stainless steel and/or aluminum with oxy-fuel gas equipment	0 1 2 3

	COMPETENCY	None Some Moderate Extensive 0 1 2 3
38.	Operate bench and/or portable grinding equipment	0 1 2 3
39.	Select, maintain and use grinding wheels, handstones and/or files	0 1 2 3
40.	Replace tool handles	0 1 2 3
41.	Sharpen knives, chisels, plane irons, axes twist drills and/or other cutting tools	0 1 2 3
42.	Clean and store tools and equipment	0 1 2 3
43.	Prepare surfaces for paint or finishes	0 1 2 3
44.	Select and maintain applicating equipment for painting, finishing and/or preserving	0 1 2 3
45.	Select, mix and/or apply wood or metal preservatives, paints, or finishes	0 1 2 3
46.	Apply paints to machinery and/or equipment	0 1 2 3
47.	Select and/or prepare masonry and concrete materials and mixtures	0 1 2 3
48.	Estimate bill of materials for concrete and/or masonry	0 1 2 3
49.	Determine orders for ready-mixed concrete	0 1 2 3
50.	Construct forms, place, finish, and cure concrete	0 1 2 3
51.	Lay masonry block and/or brick	0 1 2 3
52.	Identify and select electrical tools, devices, and conductors by type and use	0 1 2 3
53.	Plan and/or interpret electrical circuits and wiring diagrams	0 1 2 3
54.	Install or replace electrical fixtures and/or wiring	0 1 2 3
55.	Select, install and/or maintain electric motors	0 1 2 3
56.	Splice electric wire	0 1 2 3
57.	Clean, disassemble, inspect and reassemble engines	0 1 2 3
58.	Identify engines by model, type and make	0 1 2 3
59.	Troubleshoot engines	0 1 2 3
60.	Maintain and service engine lubrication systems	0 1 2 3
61.	Maintain and/or service engine cooling systems	0 1 2 3
62.	Maintain service and/or repair fuel and air systems on spark ignition engines	0 1 2 3
63.	Maintain service and/or repair fuel and air systems on diesel engines	0 1 2 3
64.	Maintain service and/or repair engine ignition/electrical systems	0 1 2 3
65.	Inspect, repair, and/or replace bearings, seals and crank assemblies on engines	0 1 2 3
66.	Clean, inspect, repair or replace pistons, cylinders and/or valve systems on engines	0 1 2 3
67.	Maintain, repair, and/or replace carburetor and governor systems on engines	0 1 2 3
68.	Use parts and service manuals and order engine or equipment parts	0 1 2 3
69.	Prepare engines for storage	0 1 2 3
70.	Use measuring devices for accurate parts inspection on engines and equipment	0 1 2 3
71.	Evaluate engine or equipment parts for replacement or reconditioning	0 1 2 3
72.	Adjust and maintain power transmission systems (gears, chains, shafts, belts)	0 1 2 3
73.	Identify, maintain and/or repair hydraulic system components	0 1 2 3
74.	Service, maintain and adjust bearings on equipment and tractors	0 1 2 3
75.	Operate and adjust agricultural tractors, equipment and/or machinery	0 1 2 3
76.	Maintain agricultural tractors, equipment, and/or machinery	0 1 2 3
77.	Select, use and store fuels, oils and greases	0 1 2 3
78.	Set up and adjust level or transit	0 1 2 3
79.	Determine elevations with level or transit	0 1 2 3
80.	Lay out foundations and/or other sites with a level or transit	0 1 2 3
81.	Measure land by pacing and/or measuring devices	0 1 2 3
82.	Run land boundary closures	0 1 2 3
83.	Use hand compass and sighting level	0 1 2 3
84.	Run contour lines with surveying instruments	0 1 2 3
85.	Identify and select plumbing equipment, supplies, pipe and fittings	0 1 2 3
86.	Sweat copper pipe and tubing joints	0 1 2 3
87.	Fit plastic pipe to iron pipe or copper tubing	0 1 2 3
88.	Prepare and install iron, copper and/or plastic pipe and tubing	0 1 2 3
89.	Connect plumbing fixtures to pipe or tubing	0 1 2 3
90.	Maintain and/or repair, plumbing and protect from freezing	0 1 2 3

Appendix D

COVER LETTERS FOR FIRST MAILINGS

A LAND-GRANT UNIVERSITY

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Agricultural Education

Blacksburg, Virginia 24061

LETTER TO SUPERVISORS AND TEACHER EDUCATORS

Dear

Nearly all teachers of vocational agriculture are involved in teaching some skills related to agricultural mechanics, regardless of their specialty. As specialty programs in vocational agriculture developed, we have not always taken a close look at the technical competencies needed by teachers. Without a clear understanding of the technical competencies all agriculture teachers need, it is difficult to modify or develop programs to provide the necessary skills.

Your state is one of twelve states selected to participate in a national study to determine what agricultural mechanics competencies are needed by all vocational agriculture teachers. Data will be gathered from supervisory staff and teacher educators as well as agriculture teachers and craft committee members.

You are one of a small number of carefully selected individuals being asked to give their opinion on this matter. In order that results truly represent the thinking of each group of participants nationally, it is extremely important that every questionnaire be completed and returned. Because you are carefully selected as a participant, it is also important that only you complete the questionnaire to the best of your ability.

All information provided will be treated as confidential, and will not be used for any purpose unrelated to this study, nor will any individual, institution or agency be identified. All forms are number coded so that we may check your name off the mailing list without ever placing it on the questionnaire.

Return of the completed questionnaire by December 4, 1981 will be greatly appreciated. If you have any questions regarding the study I will be happy to answer them if you will write or call. The telephone number is . If I am not available I will return your call as soon as possible. Thank you very much for your assistance.

Sincerely,

Karl O. Polson
Principal Investigator

A LAND-GRANT UNIVERSITY

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

Agricultural Education

LETTER TO TEACHERS

Dear

Nearly all teachers of vocational agriculture are involved in teaching some skills related to agricultural mechanics, regardless of their specialty. As specialty programs in vocational agriculture developed, we have not always taken a close look at the technical competencies needed by teachers. Without a clear understanding of the technical competencies all agriculture teachers need, it is difficult to modify or develop programs to provide the necessary skills.

Your state is one of twelve states selected to participate in a national study to determine what agricultural mechanics competencies are needed by all vo-ag teachers. The program you conduct in was identified by your state staff as outstanding, and you were selected as the study participant for this specialty in your state. The information you provide will be valuable in training future teachers. Also, craft/advisory committee members are critical to this study and we need your help to contact them.

As part of a small and carefully selected group, you and your committee members' opinions are very important. Your help in supplying names and addresses of members on the enclosed form is critical to this study. Upon receipt of the completed form and questionnaire from you, identical questionnaires will be sent to three selected members, along with a letter explaining the study and its importance. If results are to truly represent the thinking nationally, it is essential that every questionnaire be completed and returned by the selected participants.

All information provided will be treated as confidential, and will not be used for any purpose unrelated to this study, nor will any individual, institution or agency be identified. All forms are number coded so that we may check your name off the mailing list without ever placing it on the questionnaire.

Prompt completion and return of the enclosed form and questionnaire will be greatly appreciated. If you have any questions regarding the study I will be happy to answer them if you will write or call. The telephone number is . If I am not available I will return your call as soon as possible. Thank you very much for your assistance.

Sincerely,

Karl O. Polson
Principal Investigator

Enclosure

COLLEGE OF EDUCATION

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DIVISION OF VOCATIONAL & TECHNICAL EDUCATION

LETTER TO CRAFT COMMITTEE MEMBERS

Many specialized programs in vocational agriculture have developed during the past twenty years in schools across the United States. Most of these programs include instruction in some areas of agricultural mechanics. Agriculture teachers are usually well prepared technically in their major specialty but often the skills they should possess in related areas are not clearly known. When this occurs, as it often does with agricultural mechanics, it is difficult to provide programs designed to develop the needed skills.

In an effort to identify the agricultural mechanics skills all vo-ag teachers should possess, we are conducting a national study. Input is being sought from four groups: teacher educators, state education department staff, vo-ag teachers and agriculture program advisory committee persons such as yourself. As a representative of local agricultural industry we believe your qualifications are probably the best of all the groups to provide the information we need, as you are in best contact with needs of local agriculture.

The process we have gone through to identify and contact you has been very exhaustive, beginning in May of 1981. You are part of a very small and carefully selected group representing twelve states and the outstanding program of its type in your state. If results of this study are to truly represent the situation nationally it is essential that every questionnaire be completed and returned by the selected participants. The questionnaire requires about fifteen minutes to complete and will be a valuable contribution to the future of agricultural education.

All information will be confidential and not used for any purpose unrelated to this study. No person or agency will be identified in any way. All forms are number coded so that we may check your name off the mailing list without ever having it appear on the questionnaire.

Prompt completion and return of the enclosed questionnaire in the envelope provided will be greatly appreciated. If you have any questions regarding the study I will be happy to answer them if you will write or call. The telephone number is . If I am not available I will return your call as soon as possible. Thank you very much for your assistance.

Sincerely,

Karl O. Polson
Principal Investigator

Enclosure

Appendix E

FIRST FOLLOW-UP MAILING (POSTCARD)

A short time ago a questionnaire seeking to identify the agricultural mechanics competencies needed by vocational agriculture teachers was mailed to you. You were chosen as one of a very small group to represent your state in this study.

If you have already completed and returned it to us please accept our sincere thanks. If not, please do so today. Because the survey has been sent to a small carefully selected group it is extremely important that yours be included if results are to accurately represent the national situation.

In the event you did not receive the questionnaire for some reason, or if it is misplaced, please call ( ) or write now and I will immediately mail a replacement to you.

Agricultural Education
Virginia Tech
Blacksburg, VA 24061

Sincerely,

Karl O. Polson
Principal Investigator

Appendix F

FINAL FOLLOW-UP MAILING (LETTER)

COLLEGE OF EDUCATION

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DIVISION OF VOCATIONAL & TECHNICAL EDUCATION

Several weeks ago I wrote to you seeking your opinion about the agricultural mechanics skills needed by all vocational agriculture teachers. At this time your completed questionnaire has not yet been received.

We are conducting this study because we believe that agricultural mechanics is a part of any complete program in all specialty areas of vocational agriculture. We recognize that the need for mechanics skills on the part of teachers probably differs according to the type of program taught. In order to provide teacher preparation programs designed to meet the differing needs it is important to identify what the needs are.

I am writing to you again because of the importance of your opinion to this study. Participants were very carefully selected to provide a representative sample of all groups involved and as broad a range of interests and specialties as possible. If results are to truly represent the national situation it is essential that every participant complete and return their questionnaire. Only you can provide the information we need.

In the event your questionnaire has been misplaced, a replacement is enclosed. It will require about fifteen minutes to complete, and a return envelope is again enclosed for your convenience in returning it. If you will take the brief time required from your busy schedule to complete and mail the questionnaire promptly it will be greatly appreciated.

Thank you for your cooperation.

Cordially,

Karl O. Polson
Principal Investigator

KOP/ds

Enclosure

Appendix G

MEAN SCORES FOR TAXONOMY AREAS

Competency List Item Number	Competency	Prod. Ag.	Ag. Supplies/ Services	Ag. Mech.	Ag. Prod. Proc. & Mktg.	Hort.	Renewable Nat. Res.	Forestry
		N=26	N=27	N=23	N=9	N=21	N=19	N=25
		Tax. 1	Tax. 2	Tax. 3	Tax. 4	Tax. 5	Tax. 6	Tax. 7
1.	Sketch and/or draw basic plans	1.962	1.962	1.913	1.778	1.619	1.842	2.040
2.	Read and interpret plans or blueprints	2.077	1.963	2.043	1.667	2.000	2.158	1.920
3.	Determine and compute bill of materials	2.423	2.296	2.261	1.778	2.238	2.316	2.360
4.	Identify, select, size and/or grade lumber	2.000	1.667	1.957	1.444	1.429	1.895	1.720
5.	Identify, select, and use wood and/or metal fasteners	2.154	1.815	2.087	1.556	1.476	1.895	1.760
6.	Measure and mark wood and/or metal	2.538	2.185	2.348	1.778	1.714	2.316	2.120
7.	Saw, plane, chisel and/or bore wood to dimension with hand or power tools	2.385	2.148	2.391	1.889	1.571	2.263	2.240
8.	Use hand woodworking tools	2.385	2.037	2.261	1.889	1.524	2.263	2.240
9.	Use stationary and portable woodworking power tools	2.423	2.037	2.348	1.889	1.476	2.263	2.280
10.	Layout frame and sheathe structures	2.038	1.667	1.957	1.333	1.476	1.895	1.840
11.	Layout rafters and trusses	2.000	1.741	2.043	1.111	1.286	2.053	1.880
12.	Select and install insulating materials	1.846	1.556	1.652	1.333	1.333	1.684	1.480
13.	Select and install roofing metals	1.846	1.630	1.739	1.111	1.333	1.789	1.520
14.	Identify and/or select materials	1.808	1.889	2.043	1.333	1.333	1.947	1.920
15.	Cut shape and/or heat-treat cold metal	1.962	1.852	1.652	1.111	1.238	1.895	1.560
16.	Use stationary and portable metal working equipment and tools	2.231	1.852	2.087	1.111	1.333	2.053	1.920
17.	File and/or drill cold metal	2.115	1.741	1.870	1.222	1.333	1.789	1.880
18.	Select and use taps, dies, and screw extractors	2.308	1.963	2.087	1.222	1.095	1.895	1.880
19.	Prepare metal for welding	2.423	2.111	2.348	1.000	1.381	2.158	1.920
20.	Classify and select arc welding equipment and supplies	2.577	2.007	2.261	1.222	1.571	2.105	2.160

Competency List Item Number	Competency	Prod. Ag.	Ag. Supplies/ Services	Ag. Mech.	Ag. Prod. Proc. & Mktg.	Hort.	Renewable Nat. Res.	Forestry
		N=26	N=27	N=23	N=9	N=21	N=19	N=25
		Tax. 1	Tax. 2	Tax. 3	Tax. 4	Tax. 5	Tax. 6	Tax. 7
21.	Arc weld in flat position, all joints	2.577	2.192	2.522	1.222	1.476	2.053	1.920
22.	Arc weld in vertical, horizontal and/or overhead positions, any or all joints	2.154	2.115	2.304	1.000	1.381	2.105	1.880
23.	Hardsurface with arc welder	1.962	1.769	1.957	1.000	1.190	1.895	1.640
24.	Cut, pierce, gouge and/or bevel metal with arc welder	1.923	1.577	1.870	0.889	1.381	1.737	1.480
25.	Arc weld cast iron	1.846	1.577	1.957	1.000	1.238	1.895	1.560
26.	Arc weld stainless steel and/or aluminum	1.654	1.500	1.783	0.778	1.143	1.895	1.280
27.	TIG weld in flat position, all joints	1.846	1.462	1.696	1.000	1.143	1.579	1.360
28.	MIG weld in flat position, all joints	1.808	1.500	1.739	1.000	1.238	1.421	1.480
29.	Select and maintain oxy-fuel gas tips and torches	2.577	2.115	2.435	1.000	1.667	1.947	1.880
30.	Set up and operate oxy-fuel gas, welding and heating equipment	2.538	2.231	2.435	1.000	1.667	2.053	2.220
31.	Cut metal with oxy-fuel gas cutting torches	2.654	2.154	2.391	1.000	1.571	2.211	1.840
32.	Weld in flat position with oxy-fuel gas equipment, all joints	2.231	2.192	2.261	1.000	1.571	2.105	1.800
33.	Weld out of position with oxy-fuel gas equipment, all joints	1.923	1.731	2.130	0.889	1.429	1.895	1.480
34.	Braze with oxy-fuel gas equipment, all joints	2.192	1.923	2.217	0.889	1.571	2.105	1.840
35.	Hardsurface with oxy-fuel gas equipment	1.731	1.423	1.522	0.889	1.476	1.789	1.320
36.	Weld cast iron with oxy-fuel gas equipment	1.654	1.577	1.696	1.111	1.333	1.947	1.560
37.	Weld stainless steel and/or aluminum with oxy-fuel gas equipment	1.423	1.423	1.565	0.778	1.238	1.842	1.360
38.	Operate bench and/or portable grinding equipment	2.385	1.963	2.304	1.222	1.429	2.158	1.960
39.	Select, maintain and use grinding wheels, handstones and/or files	2.423	1.815	2.174	1.22	1.381	2.211	1.880
40.	Replace tool handles	2.308	1.630	1.957	1.667	1.524	2.000	1.680

Competency List Item Number	Competency	Prod. Ag.	Ag. Supplies/ Services	Ag. Mech.	Ag. Prod. Proc. & Mktg.	Hort.	Renewable Nat. Res.	Forestry
		N=26	N=27	N=23	N=9	N=21	N=19	N=25
		Tax. 1	Tax. 2	Tax. 3	Tax. 4	Tax. 5	Tax. 6	Tax. 7
41.	Sharpen knives, chisels, plane irons, axes, twist drills and/or other cutting tools	2.385	2.074	2.304	2.111	2.048	2.263	2.120
42.	Clean and store tools and equipment	2.462	2.259	2.348	2.111	2.095	2.158	1.920
43.	Prepare surfaces for paint or finishes	2.192	2.000	1.870	1.778	1.667	1.947	1.680
44.	Select and maintain applicating equipment for painting, finishing and/or preserving	2.077	1.926	1.870	1.556	1.714	2.000	1.800
45.	Select, mix and/or apply wood or metal preservatives, paints, or finishes	1.923	1.889	1.957	1.667	1.524	2.105	1.720
46.	Apply paints to machinery and/or equipment	1.962	1.852	1.870	1.778	1.524	2.000	1.680
47.	Select and/or prepare masonry and concrete materials and mixtures	1.923	1.778	1.739	1.556	1.619	1.947	1.800
48.	Estimate bill of materials for concrete and/or masonry	1.962	1.926	1.957	1.778	1.714	1.941	2.040
49.	Determine orders for ready-mixed concrete	2.038	1.889	2.043	1.333	1.667	2.000	1.880
50.	Construct forms, place, finish, and cure concrete	1.962	1.889	1.739	1.667	1.619	1.947	1.960
51.	Lay masonry block and/or brick	1.692	1.519	1.304	1.444	1.238	1.526	1.800
52.	Identify and select electrical tools, devices, and conductors by type and use	2.308	1.889	2.087	1.778	1.571	2.000	2.080
53.	Plan and/or interpret electrical circuits and wiring diagrams	2.269	2.000	1.957	1.667	1.571	2.000	2.080
54.	Install or replace electrical fixtures and/or wiring	2.269	1.963	2.130	1.667	1.619	1.842	1.840
55.	Select, install and/or maintain electric motors	2.077	1.852	2.000	1.778	1.429	1.737	1.720
56.	Splice electric wire	2.423	2.037	2.217	2.000	1.667	1.947	1.720
57.	Clean, disassemble, inspect and reassemble engines	2.423	1.963	2.087	1.667	1.810	2.000	1.960

Competency List Item Number	Competency	Prod. Ag.	Ag. Supplies/ Services	Ag. Mech.	Ag. Prod. Proc. & Mktg.	Hort.	Renewable Nat. Res.	Forestry
		N=26	N=27	N=23	N=9	N=21	N=19	N=25
		Tax. 1	Tax. 2	Tax. 3	Tax. 4	Tax. 5	Tax. 6	Tax. 7
58.	Identify engines by model, type and make	2.115	1.852	2.043	1.444	1.429	1.947	1.640
59.	Troubleshoot engines	2.500	2.037	2.217	1.556	2.095	2.263	2.200
60.	Maintain and service engine lubrication systems	2.346	1.963	2.130	1.778	2.000	2.158	2.080
61.	Maintain and/or service engine cooling systems	2.346	1.9631	2.087	1.667	1.857	2.211	1.920
62.	Maintain service and/or repair fuel and air systems on spark ignition engines	2.423	1.963	2.081	1.889	1.857	2.263	2.000
63.	Maintain service and/or repair fuel and air systems on diesel engines	2.269	1.667	1.957	1.667	1.476	2.105	2.040
64.	Maintain service and/or repair engine ignition/ electrical systems	2.308	1.778	2.087	1.667	1.619	2.158	2.040
65.	Inspect, repair, and/or replace bearings, seals, and crank assemblies on engines	2.038	1.630	1.870	1.556	1.524	1.947	1.880
66.	Clean, inspect, repair or replace pistons, cylinders and/or valve systems on engines	2.000	1.704	2.000	1.444	1.571	1.842	1.760
67.	Maintain, repair, and/or replace carburetor and governor systems on engines	2.192	1.778	1.957	1.556	1.762	2.000	1.840
68.	Use parts and service manuals and order engine or equipment parts	2.308	2.000	2.435	1.778	1.952	2.316	2.080
69.	Prepare engines for storage	2.269	1.630	2.217	1.889	1.571	1.947	1.720
70.	Use measuring devices for accurate parts inspection on engines and equipment	2.423	1.889	2.217	1.667	1.667	2.158	1.880
71.	Evaluate engine or equipment parts for replacement or reconditioning	2.231	1.926	2.217	1.889	1.952	2.368	2.160
72.	Adjust and maintain power transmission systems (gears, chains, shafts, belts)	1.846	1.778	2.130	1.556	1.714	2.053	1.680
73.	Identify, maintain and/or repair hydraulic system components	2.000	1.704	2.000	1.444	1.524	2.053	1.760
74.	Service, maintain and adjust bearings on equipment and tractors	2.038	1.778	2.130	1.778	1.667	2.105	1.880
75.	Operate and adjust agricultural tractors, equipment and/or machinery	2.231	2.074	2.261	2.111	1.952	2.368	2.120

Competency List Item Number	Competency	Prod. Ag.	Ag. Supplies/ Services	Ag. Mech.	Ag. Prod. Proc. & Mktg.	Hort.	Renewable Nat. Res.	Forestry
		N=26	N=27	N=23	N=9	N=21	N=19	N=25
		Tax. 1	Tax. 2	Tax. 3	Tax. 4	Tax. 5	Tax. 6	Tax. 7
76.	Maintain agricultural tractors, equipment, and/or machinery	2.346	2.074	2.304	2.000	1.905	2.368	2.200
77.	Select, use and store fuels, oils and greases	2.462	2.074	2.217	1.778	1.905	2.368	2.160
78.	Set up and adjust level or transit	2.115	2.037	2.174	1.556	1.667	1.895	1.920
79.	Determine elevations with level or transit	1.962	2.037	2.087	1.667	1.571	1.947	1.880
80.	Lay out foundations and/or other sites with a level or transit	1.923	1.889	1.913	1.667	1.762	1.842	1.920
81.	Measure land by pacing and/or measuring devices	1.962	1.778	1.783	1.667	1.619	2.053	1.920
82.	Run land boundary closures	1.500	1.423	1.478	1.444	1.190	2.000	1.640
83.	Use hand compass and sighting level	1.654	1.481	1.739	1.333	1.429	1.947	1.840
84.	Run contour lines with surveying instruments	1.538	1.667	1.913	1.667	1.333	1.947	1.640
85.	Identify and select plumbing equipment, supplies, pipe and fittings	2.115	1.926	2.043	2.000	1.762	1.842	1.760
86.	Sweat copper pipe and tubing joints	2.154	1.815	1.913	1.444	1.381	1.684	1.560
87.	Fit plastic pipe to iron pipe or copper tubing	2.077	1.889	1.826	1.556	1.571	1.684	1.440
88.	Prepare and install iron, copper and/or plastic pipe and tubing	2.077	1.852	1.957	1.667	1.524	1.737	1.560
89.	Connect plumbing fixtures to pipe or tubing	1.962	1.852	2.043	1.444	1.667	1.737	1.520
90.	Maintain and/or repair, plumbing and protect from freezing	2.192	1.926	1.913	1.667	1.667	1.895	1.800

Appendix H

TEACHER EDUCATOR, SUPERVISOR, AND GRAND MEANS FOR ALL COMPETENCIES

Competency Number	Competency	Supervisor Means	Teacher/Educator Means	Grand Means
1.	Sketch and/or draw basic plans	2.240	1.939	2.090
2.	Read and interpret plans or blueprints	2.240	2.030	2.135
3.	Determine and compute bill of materials	2.760	2.515	2.638
4.	Identify, select, size, and/or grade lumber	2.160	1.970	2.065
5.	Identify, select, and use wood and/or metal fasteners	2.440	2.242	2.341
6.	Measure and mark wood and/or metal	2.800	2.545	2.673
7.	Saw, plane, chisel, and/or bore wood to dimension with hand or power tools	2.680	2.606	2.643
8.	Use hand woodworking tools	2.600	2.303	2.452
9.	Use stationary and portable woodworking power tools	2.720	2.636	2.678
10.	Layout frame and sheathe structures	2.080	1.667	1.874
11.	Layout rafters and trusses	2.200	1.788	1.994
12.	Select and install insulating materials	2.040	1.939	1.990
13.	Select and install roofing materials	2.040	1.727	1.884
14.	Identify and/or select metals	2.200	2.273	2.237
15.	Cut, shape, and/or heat-treat cold metal	1.960	2.000	1.980
16.	Use stationary and portable metal working equipment and tools	2.200	2.273	2.237
17.	File and/or drill cold metal	2.280	2.485	2.383
18.	Select and use taps, dies, and screw extractors	2.320	2.364	2.342
19.	Prepare metal for welding	2.640	2.606	2.623
20.	Classify and select arc welding equipment and supplies	2.520	2.394	2.457
21.	Arc weld in flat position, all joints	2.720	2.697	2.709
22.	Arc weld in vertical, horizontal, and/or overhead positions, any or all joints	2.480	2.242	2.361
23.	Hardsurface with arc welder	2.080	1.909	1.995
24.	Cut, pierce, gouge, and/or bevel metal with arc welder	2.160	2.000	2.080
25.	Arc weld cast iron	1.960	1.879	1.920
26.	Arc weld stainless steel and/or aluminum	1.840	1.424	1.632
27.	TIG weld in flat position, all joints	1.960	1.636	1.798
28.	MIG weld in flat position, all joints	2.000	1.818	1.909
29.	Select and maintain oxy-fuel gas tips and torches	2.600	2.545	2.573
30.	Set up and operate oxy-fuel gas, welding and heating equipment	2.600	2.636	2.618
31.	Cut metal with oxy-fuel gas cutting torches	2.520	2.606	2.563
32.	Weld in flat position with oxy-fuel gas equipment, all joints	2.520	2.394	2.457
33.	Weld out of position with oxy-fuel gas equipment, all joints	2.200	1.939	2.070
34.	Braze with oxy-fuel gas equipment, all joints	2.280	2.273	2.277
35.	Handsurface with oxy-fuel gas equipment	1.800	1.697	1.749
36.	Weld cast iron with oxy-fuel gas equipment	1.800	1.697	1.749
37.	Weld stainless steel and/or aluminum with oxy-fuel gas equipment	1.520	1.303	1.412

Competency Number	Competency	Supervisor Means	Teacher/Educator Means	Grand Means
38.	Operate bench and/or portable grinding equipment	2.560	2.576	2.568
39.	Select, maintain, and use grinding wheels, hand-stones and/or files	2.480	2.455	2.468
40.	Replace tool handles	2.280	2.182	2.231
41.	Sharpen knives, chisels, plane irons, axes, twist drills, and/or other cutting tools	2.400	2.424	2.412
42.	Clean and store tools and equipment	2.440	2.576	2.508
43.	Prepare surfaces for paint or finishes	2.320	2.273	2.297
44.	Select and maintain applicating equipment for painting, finishing, and/or preserving	2.200	2.242	2.221
45.	Select, mix, and/or apply wood or metal preservatives, paints, or finishes	2.080	2.121	2.101
46.	Apply paints to machinery and/or equipment	2.120	2.152	2.136
47.	Select and/or prepare masonry and concrete materials and mixtures	2.120	2.091	2.106
48.	Estimate bill of materials for concrete and/or masonry	2.280	2.182	2.231
49.	Determine orders for ready-mixed concrete	2.200	2.212	2.206
50.	Construct forms, place, finish, and cure concrete	2.160	2.121	2.141
51.	Lay masonry block and/or brick	1.880	1.758	1.819
52.	Identify and select electrical tools, devices, and conductors by type and use	2.440	2.394	2.417
53.	Plan and/or interpret electrical circuits and wiring diagrams	2.440	2.030	2.235
54.	Install or replace electrical fixtures and/or wiring	2.320	2.273	2.297
55.	Select, install and/or maintain electric motors	2.400	2.000	2.200
56.	Splice electric wire	2.520	2.242	2.381
57.	Clean, disassemble, inspect and reassemble engines	2.320	2.091	2.206
58.	Identify engines by model, type and make	2.400	2.061	2.231
59.	Troubleshoot engines	2.560	2.424	2.492
60.	Maintain and service engine lubrication systems	2.560	2.576	2.568
61.	Maintain and/or service engine cooling systems	2.560	2.545	2.553
62.	Maintain, service, and/or repair fuel and air systems on spark ignition engines	2.560	2.485	2.523
63.	Maintain, service, and/or repair fuel and air systems on diesel engines	2.320	2.303	2.312
64.	Maintain, service, and/or repair engine ignition/ electrical systems	2.280	2.333	2.307
65.	Inspect, repair, and/or replace bearings, seals, and crank assemblies on engines	2.040	1.606	1.823
66.	Clean, inspect, repair, or replace pistons, cylinders, and/or valve systems on engines	1.920	1.636	1.778
67.	Maintain, repair, and/or replace carburetor and governor systems on engines	1.960	1.970	1.965
68.	Use parts and service manuals and order engine or equipment parts	2.520	2.636	2.578
69.	Prepare engines for storage	2.360	2.212	2.286
70.	Use measuring devices for accurate parts inspection on engines and equipment	2.280	2.364	2.322
71.	Evaluate engine or equipment parts for replacement or reconditioning	2.280	2.182	2.231

Competency Number	Competency	Supervisor Means	Teacher/Educator Means	Grand Means
72.	Adjust and maintain power transmission systems (gears, chains, shafts, belts)	2.200	2.000	2.100
73.	Identify, maintain, and/or repair hydraulic system components	1.960	1.848	1.904
74.	Service, maintain, and adjust bearings on equipment and tractors	2.200	2.061	2.131
75.	Operate and adjust agricultural tractors equipment and/or machinery	2.480	2.424	2.452
76.	Maintain agricultural tractors, equipment, and/or machinery	2.480	2.606	2.543
77.	Select,use, and store fuels, oils and greases	2.600	2.485	2.543
78.	Set up and adjust level or transit	2.240	2.091	2.166
79.	Determine elevations with level or transit	2.280	2.000	2.140
80.	Layout foundations and/or other sites with a level or transit	2.240	1.970	2.105
81.	Measure land by pacing and/or measuring devices	2.080	2.061	2.071
82.	Run land boundary closures	1.640	1.485	1.563
83.	Use hand compass and sighting level	1.960	1.758	1.859
84.	Run contour lines with surveying instruments	1.920	2.000	1.960
85.	Identify and select plumbing equipment, supplies, pipe, and fitting	2.160	2.121	2.141
86.	Sweat copper pipe and tubing joints	2.280	2.030	2.155
87.	Fit plastic pipe to iron pipe or copper tubing	2.280	2.182	2.231
88.	Prepare and install iron, copper, and/or plastic pipe and tubing	2.200	2.061	2.131
89.	Connect plumbing fixtures to pipe or tubing	2.200	2.000	2.100
90.	Maintain and/or repair, plumbing and protect from freezing	2.280	2.273	2.277

Appendix I

COMPETENCY CLUSTERS

COMPETENCY CLUSTERS

I. PLANS AND MATERIALS

Sketch and/or draw basic plans
Read and interpret plans or blueprints
Determine and compute bill of materials
Identify, select, size, and/or grade lumber
Identify, select, and use wood and/or metal fasteners
Measure and mark wood and/or metal

II. WELDING

Prepare metal for welding
Classify and select arc welding equipment and supplies
Arc weld in flat position, all joints
Arc weld in vertical, horizontal, and/or overhead positions, any or all joints
Hardsurface with arc welder
Cut, pierce, gouge, and/or bevel metal with arc welder
Arc weld cast iron
Arc weld stainless steel and/or aluminum
TIG weld in flat position, all joints
MIG weld in flat position, all joints
Select and maintain oxy-fuel gas tips and torches
Set up and operate oxy-fuel gas, welding and heating equipment
Cut metal with oxy-fuel gas cutting torches
Weld in flat position with oxy-fuel gas equipment, all joints
Weld out of position with oxy-fuel gas equipment, all joints
Braze with oxy-fuel gas equipment, all joints
Hardsurface with oxy-fuel gas equipment
Weld cast iron with oxy-fuel gas equipment
Weld stainless steel and/or aluminum with oxy-fuel gas equipment

III. CARPENTRY

Saw, plane, chisel, and/or bore wood to dimension with hand or power tools
Use hand woodworking tools
Use stationary and portable woodworking power tools
Layout, frame, and sheathe structures
Layout rafters and trusses
Select and install insulating materials
Select and install roofing materials

IV. COLD METAL AND TOOL FITTING

Identify and/or select materials
Cut, shape, and/or heat-treat cold metal
Use stationary and portable metal working equipment and tools
File and/or drill cold metal
Select and use taps, dies, and screw extractors
Operate bench and/or portable grinding equipment
Select, maintain, and use grinding wheels, handstones, and/or files
Replace tool handles
Sharpen knives, chisels, plane irons, axes, twist drills, and/or other cutting tools
Clean and store tools and equipment

V. PAINTING AND PRESERVING

Prepare surfaces for paint or finishes
Select and maintain applicating equipment for painting, finishing, and/or preserving
Select, mix, and/or apply wood or metal preservatives, paints, or finishes
Apply paints to machinery and/or equipment

VI. CONCRETE AND MASONRY

Select and/or prepare masonry and concrete materials and mixtures
Estimate bill of materials for concrete and/or masonry
Determine orders for ready-mixed concrete
Construct forms, place, finish, and cure concrete
Lay masonry block and/or brick

VII. ELECTRICITY

Identify and select electrical tools, devices, and conductors by type and use
Plan and/or interpret electrical circuits and wiring diagrams
Install or replace electrical fixtures and/or wiring
Select, install, and/or maintain electric motors
Splice electric wire

VIII. POWER AND MACHINERY

Clean, disassemble, inspect, and reassemble engines
Identify engines by model, type, and make
Troubleshoot engines
Maintain and service engine lubrication systems
Maintain and/or service engine cooling systems
Maintain, service, and/or repair fuel and air systems on spark ignition engines
Maintain, service, and/or repair fuel and air systems on diesel engines
Maintain, service, and/or repair engine ignition/electrical systems
Inspect, repair, and/or replace bearings, seals and crank assemblies on engines
Clean, inspect, repair, or replace pistons, cylinders, and/or valve systems on engines
Maintain, repair, and/or replace carburetor and governor systems on engines
Use parts and service manuals and order engine or equipment parts
Prepare engines for storage

Use measuring devices for accurate parts inspection on engines and equipment
Evaluate engine or equipment parts for replacement or reconditioning
Adjust and maintain power transmission systems (gears, chains, shafts, belts)
Identify, maintain, and/or repair hydraulic system components
Service, maintain, and adjust bearings on equipment and tractors
Operate and adjust agricultural tractors, equipment and/or machinery
Maintain agricultural tractors, equipment and/or machinery
Select, use, and store fuels, oils and greases

IX. LAND MEASUREMENT

Set up and adjust level or transit
Determine elevations with level or transit
Lay out foundations and/or other sites with a level or transit
Measure land by pacing and/or measuring devices
Run land boundary closures
Use hand compass and sighting level
Run contour lines with surveying instruments

X. PLUMBING

Identify and select plumbing equipment, supplies, pipe, and fittings
Sweat copper pipe and tubing joints
Fit plastic pipe to iron pipe or copper tubing
Prepare and install iron, copper, and/or plastic pipe and tubing
Connect plumbing fixtures to pipe or tubing
Maintain and/or repair plumbing and protect from freezing

Appendix J

COMPETENCY CLUSTER MEANS BY REGIONS AND POSITIONS

Competency Cluster	Eastern Region Means	Central Region Means	Southern Region Means	Western Region Means	Region Grand Means	Unit Competency Means	Unit Competency Rank
Plans and Materials	12.559	12.569	12.196	12.660	12.496	2.083	1
Welding	35.914	32.745	37.667	37.192	35.880	1.888	8
Carpentry	13.966	13.451	14.196	13.532	13.786	1.969	5
Cold Metal and Tool Fitting	20.576	19.078	19.980	21.723	20.339	2.034	4
Painting and Preserving	7.983	7.843	7.686	7.638	7.788	1.947	6
Concrete and Masonry	8.678	9.706	9.255	10.064	9.426	1.885	9
Electricity	10.119	9.784	11.020	9.894	10.204	2.041	3
Power and Machinery	46.271	40.569	43.549	43.255	43.411	2.067	2
Land Measurement	9.983	10.118	12.117	11.638	10.979	1.568	10
Plumbing	11.729	11.294	11.549	11.2.3	11.446	1.908	7

Competency Cluster	Committee Member Means	Teacher Means	Supervisor Means	Teacher Educator Means	Position Grand Means	Unit Competency Means	Unit Competency Rank
Plans and Materials	11.813	12.259	14.640	13.242	12.989	2.165	1
Welding	35.221	31.685	42.200	39.697	37.201	1.958	8
Carpentry	12.885	13.704	16.360	14.667	14.404	2.058	5
Cold Metal and Tool Fitting	19.031	19.315	23.120	23.606	21.268	2.127	3
Painting and Preserving	7.302	7.648	8.720	8.788	8.115	2.029	6
Concrete and Masonry	9.104	8.704	10.640	10.364	9.703	1.941	9
Electricity	9.927	9.370	12.120	10.939	10.589	2.118	4
Power and Machinery	42.250	41.296	48.840	46.849	44.809	2.134	2
Land Measurement	10.490	10.852	12.280	11.303	11.231	1.604	10
Plumbing	10.969	10.704	13.400	12.667	11.935	1.989	7

The 4 page vita has been removed from the scanned document

The 4 page vita has been removed from the scanned document

The 4 page vita has been removed from the scanned document

The 4 page vita has been removed from the scanned document

CORE AGRICULTURAL MECHANICS COMPETENCIES FOR VOCATIONAL AGRICULTURE TEACHERS, A NATIONAL STUDY

by

Karl O. Polson

(Abstract)

The primary purpose of the study was to identify the core of agricultural mechanics competencies which should be possessed by all vocational agriculture teachers. Secondary purposes were to determine mechanics competencies appropriate for each vocational agriculture taxonomy area, determine if differences existed by regions in mechanics competencies needed, and determine if differences existed by respondent position category about mechanics competencies needed by vocational agriculture teachers.

The population consisted of teacher educators in agriculture, state supervisory staff in agricultural education,

teachers of vocational agriculture associated with programs identified as outstanding by head state supervisors and craft committee members associated with the programs identified as outstanding. A total of 258 individuals from the four sub-groups were identified for inclusion in the study sample. A questionnaire listing 90 agricultural mechanics competencies was developed and mailed to the sample. Two follow-up mailings were conducted. Responses were received from 208 respondents representing 80.6 percent of the sample.

Five research questions were answered, based on data analysis using group means and/or a oneway ANOVA procedure. Findings of the study included:

1. Some agricultural mechanics competencies were needed by teachers of every vocational agriculture taxonomy area.
2. A core of 69 agricultural mechanics competencies needed by all vocational agriculture teachers does exist.
3. Agricultural mechanics competencies needed by vocational agriculture teachers do not differ significantly among regions of the United States with the exception of land measurement competencies.
4. Teacher educators tended to agree with state supervisors about mechanics competencies needed by teachers of vocational agriculture.
5. Teachers tended to agree with craft committee members about mechanics competencies needed by teachers of vocational agriculture.