

AGRICULTURE MECHANICS ACTIVITIES FOR
HIGH SCHOOL STUDENTS

by 149

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INTRODUCTION

Background

During the 1960's, farm machinery continued to represent an increasing farm operational investment. "With the increased mechanization of farms, it has become necessary for the successful farmer to be proficient in the use, repair and maintenance of mechanical equipment of various kinds."¹ This meant some one had to train farm students to be able to do some of the maintenance and repair jobs. It seemed logical to the writer that boys who were studying vocational agriculture in high school, of which agriculture mechanics instruction occupied a significant part of the course of study, were in an excellent position to receive such training.

In Phipps' book it is stated that:

Agriculture mechanics involves the development of the mechanical abilities of students in performing agriculture shop activities: in operating, maintaining, repairing, and adjusting farm machinery; in constructing and maintaining farm buildings; in installing and maintaining farm electrical systems; and in performing the mechanical activities in soil and water management programs.²

It became necessary to train operators of farm machinery to be very alert to the possible causes of breakdown, and

¹Mack M. Jones, Shopwork on the Farm (second edition; New York: McGraw-Hill Book Company, Inc., 1955), p. 1.

²Lloyd J. Phipps, Handbook on Agricultural Education in Public Schools (Danville: The Interstate Printers and Publishers, Inc., 1965), p. 529.

frequently had these minor causes of breakdown been corrected at the proper time, they could have been avoided. Consequently, high school educators have begun to think in terms of developing a meaningful curriculum in machinery maintenance and repair as an integral part of the agriculture mechanics instruction in vocational agriculture.

Brown, in his text, pointed out: "The key man in preventive maintenance is the tractor operator. There is a great deal of difference between an operator and a person who merely drives the tractor."¹

The proper care and maintenance of machinery involved many different jobs. DeForest called attention to the many tasks that needed care:

Keep machinery in top-notch adjustment and lubricated so minimum power is needed for operation. Have cutting edges sharp, plow and cultivator aligned, moving parts working smoothly,² timing and metering mechanisms in good condition.

Such statements suggested that training in agriculture mechanics should cover a wide range of instructions and activities.

¹Arlen D. Brown and Ivan Gregg Morrison, Farm Tractor Maintenance (second edition; Danville: The Interstate Printers and Publishers, Inc., 1959), p. 5.

²S. S. DeForest, "How to Cut Machinery Cost," Successful Farmer, March 10, 1957, pp. 70-71.

Statement of the Problem

The research was carried on to determine what agriculture mechanics activities in certain areas, parents considered that graduating high school students should be able to perform. The study included some skill areas and some areas dealing more with maintenance of machinery in an effort to help determine an instructional program in vocational agriculture in high school that would meet the needs of students.

Limitations of the Study

Following are the limitations the author observed in doing this research: (1) The population used in this study was confined to the parents or rural male students graduating from Hillsboro High School in two school years, 1966 and 1967, (2) The responses of parents were limited by their understanding of the terms used in the questionnaire, (3) The responses of the parents may have varied according to the occupation their boy planned to follow, and (4) The responses of the parents may have varied according to the further educational plans of their boys.

Importance of the Study

It was anticipated that the findings of this study would give guidance to the author in setting up a meaningful course of study in vocational education in agriculture.

The results of the study should also give guidance in developing facilities, materials, teaching aids, and time schedule to make agriculture mechanics a valuable experience for each student in vocational agriculture.

Definition of Terms

Agriculture mechanics.

An agriculture mechanics program includes all the unspecialized mechanical activities that a progressive farmer or other agricultural worker should perform with the kinds of tools and equipment he will have accessible.¹

Phipps also made the following comment concerning the meaning of agriculture mechanics:

The terms 'agriculture mechanics' and 'agriculture shop' have often been used interchangeably in the past. The latest interpretation, however, is that 'agriculture mechanics' is a more inclusive term than 'agriculture shop!' The instruction in agriculture shop is now considered one of the phases of instruction in an agriculture mechanics program.²

The term "agriculture mechanics" was used throughout this report instead of terms like "farm mechanics" or "agriculture shop" except in cases of direct quotation.

Shop construction jobs. Those instructor-approved creative skills that provide the student with the opportunity

¹Lloyd J. Phipps, Handbook on Agricultural Education in Public Schools (Danville: The Interstate Printers and Publishers, Inc., 1965), p. 529.

²Ibid.

to express his skills and creativity by construction of a project.

Machinery maintenance and repair jobs. Those jobs that deal with adjustment, safety, daily and periodic check-up, and repair of broken and worn parts of machinery.

Hardsurfacing. "Hard surfacing is the name used to describe the application of a wear-resistant layer of metal on the surface or edge of a part."¹

MIG welding.

(Gas Metal Arc Welding) - An arc welding process wherein coalescence is produced by heating with an electric arc between a filler metal (consumable) electrode and the work. Shielding is obtained from a gas, a gas mixture (which may contain an inert gas) or a mixture of a gas and a flux.²

TIG welding.

(Gas Tungsten-Arc Welding) - An arc welding process wherein coalescence is produced by heating with an electric arc between a single tungsten (nonconsumable) electrode and the work. Shielding is obtained from a gas or gas mixture (which may contain an inert gas). Pressure may or may not be used and filler metal may or may not be used.³

Rural. "Of or pertaining to the country, as distinguished from a city or town; designating or pertaining to

¹Harold L. Kugler, Arc Welding Lessons for School and Farm Shop (second edition; Cleveland: The James F. Lincoln Arc Welding Foundation, 1965), p. 258.

²Hobart Brothers Company, Vest Pocket Guide A Guide to Better Welds (Troy: Hobart Brothers Company, 1964), p. 28.

³Ibid., p. 30.

country people, or country occupations, especially agriculture."¹

REVIEW OF SELECTED LITERATURE

A survey was made of literature, which included master's reports, doctor's dissertations, textbooks, bulletins, pamphlets, and other published and unpublished material. From the survey, certain literature was selected for review in this report.

The research in this report dealt with agriculture mechanics abilities for students in vocational agriculture in high school. Phipps stated that:

The instruction in agriculture mechanics is an integral part of the program in agricultural education. It provides for the development of many mechanical abilities essential for success in agriculture and family living.²

In Phipps' discussion of the importance of agriculture mechanics in vocational agriculture, he further stated that:

Local, state and national administrators are becoming more cognizant of the need for instruction in agriculture mechanics. This will mean larger and better agriculture shops in the future and more comprehensive program for high school pupils and for young and older adults.³

¹ Webster, Webster's New Collegiate Dictionary (Springfield: G. & G. Merriam Co., Publishers, 1961), p. 742.

² Lloyd J. Phipps, Handbook on Agriculture Education in Public Schools (Danville: The Interstate Printers and Publishers, Inc., 1965), p. 532.

³ Ibid.

Merrill made a study to evaluate the agriculture mechanics course of study in Idaho and he made the following statement: "Success in teaching farm mechanics will depend on the constant re-valuation and revision necessary to keep abreast of the ever changing farming world."¹

The aforementioned quotations support the thinking that agriculture mechanics will continue to be a very significant part of instruction in vocational education in agriculture.

In this section of the review of selected literature, the writer attempted to use quotations and ideas from various sources of information that will be referred to in the presentation of data.

Farm Mechanics Text and Handbook, written by Phipps, McColly, Scranton, and Cook, stated the following concerning the place of arc welders:

The electric arc welder has become an important piece of equipment on many farms throughout the United States. It is especially desirable for use in farm machinery maintenance. It may be used to rebuild surfaces that become worn and to weld broken parts. It can also be used in the construction of labor saving equipment for a farm.²

¹Keith C. Merrill, "Idaho Farmers Evaluate the Farm Mechanics Course of Study," Agricultural Education Magazine (May, 1962), p. 262.

²Lloyd J. Phipps and others, Farm Mechanics Text and Handbook (new edition; Danville: The Interstate Printers and Publishers, Inc., 1954), p. 206.

American Oil Company found the following to be true:
"Field surveys show that the average tractor owner wastes about 10% of his fuel each year just because he does not have the carburetor of his tractor properly adjusted."¹

The hand saw is a very common tool in the farm shops but it has been observed by the writer that few people handle a saw properly, thus the saw is not able to give the best service in many cases. Jones made the following statement:
"The proper method of using the saw is not difficult to learn, and everyone studying shopwork should early master the art of sawing."²

A study made of fifty farm tractors in Kansas summarized the importance of using spark plugs that are in good condition in the following statement:

With new spark plugs the effect on horsepower varied from no change to as much as 8.6 per cent increase. The average increase for all tractors was 5.6 per cent. Fuel consumption decreased an average of 6.1 per cent.

In each of seven tractors that misfired under load, new plugs increased their horsepower 21.5 per cent and decreased fuel consumption by 14.2 per cent.

It is well recognized too that if spark plugs are still in good mechanical condition they can be

¹American Oil Company, Farm Tractors (Engineering Bulletin No. FT - 53, Chicago: American Oil Company, 1963), p. 16.

²Mack M. Jones, Shopwork on the Farm (second edition; New York: McGraw-Hill Book Company, Inc., 1955), p. 58.

cleaned and re-gapped to give added power and fuel savings.¹

In a magazine article, "Check Your Mower Adjustment," Bates commented that:

You can improve the field performance of your mower by spending the necessary time to adjust and recondition it. Heavy draft, ragged cutting, and excessive breakage usually are caused by improper adjustment, poor lubrication, or badly worn parts.²

The Operation, Care and Repair of Machinery, prepared by Deere and Company, emphasized the importance of proper care and maintenance of the grain drill with this quotation: "The drill should be cleaned, lubricated, and put in condition for the next season's seedings before it is stored."³

Increased farm uses of electricity brought with it increased need for the safe installation and handling of electricity. It became urgent that everyone know something of the basic principles of electricity in order to obtain the best services and to develop the greatest amount of safety as users. "Electrical equipment has come to be quite important on the modern farm, and while it is reasonably trouble-free and foolproof, a certain amount of repair and

¹G. E. Henderson and others, Tractor Maintenance (Athens: Southern Association of Agricultural Engineering and Vocational Agriculture, 1964), pp. 42-43.

²D. W. Bates, "Check Your Mower Adjustment," Hoard's Dairyman (May 25, 1967), p. 681.

³Deere and Company, The Operation, Care and Repair of Farm Machinery (Moline: Deere and Company, 1957), p. 129.

maintenance work is necessary for best results."¹

The South Dakota Rural Electric Association made this comment concerning the use of electricity: "In these enlightened times, it is vital for all to possess some basic knowledge and understanding of electricity as well as some practical skills in its use."²

A number of vocational agriculture departments in Kansas have metal lathes as part of their instructional equipment. The lathe is also used in the construction or repairing of equipment.

No phase of lathe operation is more interesting or profitable than the cutting of screws and threads; and no operation requires more care and study. The thread cutting range of the modern lathe is practically unlimited.³

The use of agricultural chemicals to control weeds has become very useful in increasing crop yields. However, a great deal of caution surrounds the use of these chemicals in order to obtain the best control of weeds and to minimize crop damages.

¹Mack M. Jones, Shopwork on the Farm (second edition; New York: McGraw-Hill Book Company, Inc., 1955), p. 578.

²The South Dakota Rural Electric Association, Electricity for Farming and Homemaking (Madison: Specialty Printing, 1965), p. foreword.

³Atlas Press Company, Manual of Lathe Operation and Machinists Tables (Kalamazoo: Atlas Press Company, 1961), p. 95.

Nearly all agricultural chemicals must be applied accurately, or they may do more harm than good. An overdose of some materials not only wastes expensive chemicals but may also harm crops. An underdose will fail to get desired results, so every effort should be made to apply agricultural chemicals at a correct, known rate.¹

Jones made the following statement concerning the usefulness of twist drills in the farm shop:

Sharpening of twist drills is one of the most important jobs in the farm shop. Drilling equipment enables many repair jobs to be done that would otherwise be impossible. Yet drilling equipment is practically worthless without sharp drill bits, and if bits are used much, they require frequent resharpening. Most drilling difficulties and most drill breakage can be traced to faulty sharpening.²

Instructors of agriculture mechanics in vocational agriculture were aware of the many hazards a farmer encounters through the daily operation of farm machinery and equipment. Phipps and others commented on the urgency of safety instructions.

At one time the most frequent cause of accidents on farms was animals. At present the most frequent source of injuries in farming is farm machinery. Most farm accidents resulting from farm mechanics activities may be prevented by the development of safe habits. Many of the safe habits needed in all farming activities may be developed while learning

¹Gustave E. Fairbanks and Floyd N. Reece, How to Determine Rate of Application of Field Sprays (Manhattan, Kansas: Agricultural Experiment Station, Kansas State College of Agriculture and Applied Science, August, 1957), p. 2.

²Mack M. Jones, Shopwork on the Farm (second edition; New York: McGraw-Hill Book Company, Inc., 1955), p. 224.

the skills and developing the abilities needed in farm mechanics.¹

A student should not use tools, especially power tools, until he has received instruction regarding their safe use. A student who uses a tool before receiving instruction regarding its safe use may not only injure himself, but he may also develop some habits in using the tool which are dangerous. These unsafe habits are often difficult to eliminate and may sooner or later cause an accident.²

In the review of selected literature, this area will give a variety of pertinent quotations from various sources concerning the importance of proper management of soil and water. Bennet stated, concerning the importance of conservation of soil and water to both city and rural population:

Basically, the economic stability of both city and rural populations depends on how farmers use and care for their land. The sooner an understanding of the inescapable need for the conservation of soil and water permeates the nation -- through schools, churches, the civic organizations, the businesses and industries - the sooner conservation farming can be spread across the land to hold the soil while using it. In this way, the welfare of present and future generations and the permanent security of the nation can be maintained.³

Further, comment concerning the significance of water to everyone, was made by Benson: "Nearly everyone in this

¹Lloyd J. Phipps and others, Farm Mechanics Text and Handbook (new edition; Danville: The Interstate Printers and Publishers, Inc., 1954), p. 23.¹

²Ibid., p. 25.

³Hugh Hammond Bennett, Elements of Soil Conservation (second edition; New York: McGraw-Hill Book Company, Inc., 1955), p. 1.

country in the past few years has experienced some problem caused by too much water when we do not want it or too little water when we do want it."¹

The management of soil and water was so meaningful to everyone that the government set up a program to enable all people to share in the financial needs of such a program. Following is a quotation from the 1965 Handbook, Agricultural Conservation Program:

Productive soil, adequate water, and well managed woodland are the foundation of American agriculture: the Agricultural Conservation Program is the means through which all our people, including farmers, share the costs of conserving these essential national resources. This program increases the rate of application of the research, education, technical, credit, and other services of the Department of Agriculture in actual accomplishment of essential conservation work on the land.²

With high investment in farm machinery and equipment, it became necessary to understand something of the manufacturer's instruction for proper lubrication of machinery. Jones stated that: "To be sure that the right kind of lubricant is used and that no points of lubrication have been overlooked, it is a good plan to consult the instruction book

¹Ezra Taft Benson, The Yearbook of Agriculture, Water, United States Department of Agriculture (Washington: Government Printing Office, 1955), p. foreword.

²Agricultural Conservation Program, Agricultural Conservation Program Handbook for Kansas, 1965 (Washington: Government Printing Office, 1965), p. foreword.

for the particular machine."¹

In connection with caring for grinding wheels, Jones made the following statement: "A grinding wheel must be dressed occasionally if it is to continue to give good service."² Jones further commented about the possibility of a grinding wheel being defective:

Sometimes wheels are cracked in shipment or in handling. Before mounting a new wheel, it is a good plan, therefore, to test it for hidden cracks or flaws. This may be done by striking a light blow with a small hammer. If the wheel is sound, it will ring; if there are flaws, it will give a dull thud.³

The Operation, Care and Repair of Farm Machinery, by Deere and Company, emphasized the importance of proper care of crankcase lubrication as follows:

At the time the crankcase oil is replaced or changed, the replaceable oil filter element should be removed and a new element installed.

The importance of the oil filter element cannot be overemphasized. The modern tractor engine, built to close tolerances, as mentioned previously, can be seriously damaged by grit particles as small as one-thousandth of an inch. For this reason, the filter element is designed to remove these tiny particles.⁴

American Oil Company stated the following about lubrication in the crankcase:

¹Mack M. Jones, Shopwork on the Farm (second edition; New York: McGraw-Hill Book Company, Inc., 1955), p. 575.

²Ibid., p. 203.

³Ibid.

⁴Deere and Company, The Operation, Care and Repair of Farm Machinery (Moline: Deere and Company, 1957), p. 41.

The function of the lubricating oil in the crankcase to supplement engine cooling is achieved principally by keeping down frictional head. However, since the oil is circulated or is splashed freely over all surfaces within the engine it also serves as a cooling medium.¹

Many times it becomes necessary for a farmer to make repairs or adjustments on equipment. At such times, sharp, well-conditioned tools are very important. Jones commented in his book, Shopwork on the Farm as follows:

Sharp tools are the mark of good workmen. Only poor workmen or an amateur will struggle along with a dull tool rather than take time to sharpen it, for the time required is soon regained in faster and better work.²

Following are some comments made by Phipps, concerning the need for instruction in maintenance, repair, and adjustment of farm machinery.

Maintenance, repair and adjustment of agricultural machinery and maintenance and repair of farm buildings are often neglected in agriculture mechanics curriculums in favor of shop activities and the construction of buildings and new pieces of equipment.

Most of the agriculture mechanics activities of farmers and others in agriculturally oriented businesses concern the maintenance, repair, and adjustment of agricultural machinery. The repair and maintenance of farm buildings are often of more importance than is the construction of new buildings.

¹American Oil Company, Farm Tractors (Engineering Bulletin No. FT - 53, Chicago: American Oil Company, 1963), p. 64.

²Mack M. Jones, Shopwork on the Farm (second edition; New York: McGraw-Hill Book Company, Inc., 1955), p. 200.

An appreciation of the economy involved in the proper maintenance of agricultural machinery and buildings is vital to the efficient operation of a farm.¹

PROCEDURE OF INVESTIGATION

Method

The investigation was made by interviewing parents of vocational agriculture students, and giving them the opportunity to mark their responses on a questionnaire.

Source of Data

The parents of rural male students graduating from Hillsboro High School in the years 1966 and 1967 composed the population used in this study.

Collection of Data

The researcher telephoned each parent and made an appointment of thirty minutes to assist in determining what agriculture abilities each parent considered that a graduate from high school should be able to accomplish.

After arriving at the parent's home, the writer spent a few minutes in a casual visitation. Followed by an explanation of the purpose of the interview, an explanation of the scope of the study and directions were given to guide

¹Lloyd J. Phipps, Handbook on Agricultural Education in Public Schools (Danville: The Interstate Printers and Publishers, Inc., 1965), p. 538.

the parent in completing the questionnaire. Then the parent was given a questionnaire and instructed to indicate his opinion as to whether or not each ability was needed.

PRESENTATION OF THE DATA

From the teaching plan book for vocational agriculture at Hillsboro High School, it was noted that twelve lessons were normally given in arc welding during the four-year curriculum. In addition, students had been allowed to develop their abilities in arc welding through construction of projects in the vocational agriculture shop and at home.

The data in Table I show the responses of the parents concerning the need for the performance of five abilities in arc welding. They were asked if, in their opinion, high school students should be able to accomplish the five abilities listed in Table I at the end of a four-year curriculum in vocational agriculture.

The data in Table I indicated that 100 per cent of both groups of parents interviewed, those who had a son graduate in 1966 and those who had a son graduate in 1967, considered that the students should be able to arc weld in the flat position and in the horizontal position. The findings agreed with Phipps' comment concerning the usefulness of arc welders.¹

¹Phipps, op. cit., p. 7.

TABLE I
ARC WELDING ABILITIES FOR STUDENTS

Abilities	Parent responses		
	N = 9 1966	N = 9 1967	N = 18 Average Per cent
Weld in flat position	100.0	100.0	100.0
Weld in horizontal position	100.0	100.0	100.0
Weld in vertical position	100.0	88.9	94.4
Weld in overhead position	77.8	44.4	61.1
Apply hard surfacing rod with an arc welder	55.5	33.3	44.4

Concerning the markings of the parents on the questionnaire relating to the question of a high school graduate's ability to arc weld in the vertical position, 94.4 per cent of the parents indicated that the student should be able to achieve this ability. However, the responses of parents concerning the ability to arc weld in the overhead position were not as favorable for this area as for the other positions, and it appeared to indicate to the writer that this particular area was not needed as badly as welding in the flat, horizontal, and vertical positions.

In the analysis of the data in Table I, concerning the ability to apply hard surfacing rod with an arc welder, it was found that 44.4 per cent of the parents interviewed

considered that graduates should be able to apply hard surfacing rod with an arc welder.

An area of study was included to give parents an opportunity to indicate what certain abilities in the area of maintenance of fuel system for farm units they thought high school graduates should be able to accomplish. Table II shows the data concerning the parental responses in this area.

TABLE II
ABILITIES FOR THE MAINTENANCE OF FARM POWER
FUEL SYSTEMS FOR STUDENTS

Abilities	Parent responses		
	N = 9 1966	N = 9 1967 Per cent	N = 18 Average
Remove, clean, and replace the sediment bowl	100.0	88.9	94.4
Adjust idle and load needles of gasoline engine carburetor	100.0	88.9	94.4
Keep the exterior of the fuel system clean	88.9	77.8	83.3
Repair the fuel system	44.4	22.2	33.3
Dismantle, clean, rebuild, and adjust carburetor	33.3	33.3	33.3

In Table II, the data indicated that 83.3 per cent of the parents considered that high school graduates should be able to keep the exterior of the fuel system clean. Data

also indicated that 94.4 per cent of the responses from parents considered that the students should be able to perform the following two maintenance abilities on fuel systems: clean the sediment bowl, and adjust idle- and load-needles of gasoline engine carburetors. It was of interest to note that the American Oil Company found that on the average, proper carburetor adjustment could save fuel consumption.¹

The two fuel system maintenance abilities: repair of the fuel pump and to dismantle, clean, rebuild, and adjust the carburetor were marked by 33.3 per cent of the parents as being needed. This seemed to indicate that the two maintenance abilities were not as important as the other three listed abilities in connection with caring for the fuel system of power units.

In the construction of farm buildings and equipment, metal and concrete replaced wood as a construction material in many of the buildings and pieces of equipment. The writer obtained parental thinking concerning the need for high school graduates to be able to use a hand saw and a skill saw. Consequently, an area concerning the use of hand saws and skill saws was developed. Table III shows the responses of parents concerning certain carpentry abilities.

Apparently, the parents considered that graduates should be able to saw a board to exact measurements with a

¹American Oil Company, op. cit., p. 7.

TABLE III
 ABILITIES IN THE AREA OF FARM CARPENTRY FOR STUDENTS

Abilities	Parent responses		
	N = 9 1966	N = 9 1967 Per cent	N = 18 Average
Saw a board to exact measurements with a hand saw	100.0	100.0	100.0
Saw a board to exact length and make all cuts square	88.9	88.9	88.9
Use a skill saw for simple jobs	88.9	77.8	83.3
Use a skill saw for almost every job	55.5	22.2	38.9

hand saw, because 100 per cent of the parents indicated this as an ability which high school graduates should be able to perform. It appears from the data in Table III that 88.9 per cent of the parents of the graduates agreed that the ability to saw a board to exact length and to make square cuts was needed. The findings concerning the use of the hand saw agreed with Jones' statement that everyone in shopwork should master the art of sawing.¹

The data from Table III indicated that 83.3 per cent of the parents considered that high school graduates should be able to use a skill saw for simple jobs. However, 38.9

¹Jones, op. cit., p. 8.

per cent of the parents of rural male graduates considered that graduates should be able to use a skill saw for almost every job. The responses of parents of the two groups differed 55.5 per cent in the 1966 group, while 22.2 per cent of the 1967 group indicated that the use of the skill saw was needed for almost every job.

Table IV was prepared to show the data of the responses of parents concerning certain abilities connected with the ignition of farm power units. The choices in this area were an effort to determine what abilities graduates should be able to accomplish.

TABLE IV
ABILITIES WITH THE IGNITION OF FARM POWER
UNITS FOR STUDENTS

Abilities	Parent responses		
	N = 9 1966	N = 9 1967	N = 18 Average Per cent
Replace spark plugs	100.0	88.9	94.4
Remove, clean, check, and set electrode gap and replace spark plugs	100.0	88.9	94.4
Clean the surface of the electrical system	100.0	77.8	88.9
Remove distributor cap and set the ignition points	66.7	88.9	77.8
Use a timing light to check the timing of ignition	55.5	44.4	50.0

Apparently, the parents of 1966 and 1967 graduates agreed that senior boys should be able to perform the following: replace spark plugs and remove, clean, check, and set electrode gaps and replace spark plugs. These two skills were considered by 94.4 per cent of the parents as being needed by high school graduates.

Henderson made reference to a survey of Kansas farm tractors, and the findings of the study indicated that spark plug maintenance was very necessary for the most efficient operation of tractors.¹

The data in Table IV indicate that over three-fourths of the parents considered graduates should be able to accomplish the following abilities: to remove the distributor cap and set the ignition points, and to clean the surface of the electrical system. The ability to use a timing light to check the timing of ignition apparently did not appear as important as the four other abilities in the ignition of farm power units.

In Table V, the data show that 94.4 per cent of the parents considered that a high school graduate should be able to mix and carry mortar for masonry units. Data in Table V also indicate that the parents considered the ability to assist a skillful brick layer as being rather important

¹Henderson, op. cit., p. 8.

TABLE V
MASONRY ABILITIES FOR STUDENTS

Abilities	Parent responses		
	N = 9 1966	N = 9 1967 Per cent	N = 18 Average
Mix and carry mortar for masonry units	88.9	100.0	94.4
Assist skillful brick layer	88.9	66.7	77.8
Lay a straight wall	44.4	55.5	50.0
Lay up a corner and door opening	44.4	22.2	33.3
Skillfully lay a brick wall on his own	22.2	33.3	27.8

because 77.8 per cent of the parents marked that skill as being needed by the graduating high school male student.

Fifty per cent of the responses of the parents indicated that the ability to lay a straight wall was needed. Only 33.3 per cent of the parents considered that the ability to lay up a corner and door opening was needed. Twenty-seven and eight tenths per cent indicated that ability to lay a brick wall skillfully, on his own, was necessary.

The study included data concerning the maintenance of the cutting unit of mowers. Table VI summarizes the responses of parents concerning various listed abilities.

TABLE VI
 ABILITIES IN THE AREA OF MOWER MAINTENANCE
 FOR STUDENTS

Abilities	Parent responses		
	N = 9 1966	N = 9 1967 Per cent	N = 18 Average
Rivet new sections into the sickle	100.0	100.0	100.0
Adjust the hold-down clips of a cutter bar	77.8	100.0	88.9
Replace and adjust worn wearing plates	100.0	66.7	83.3
Adjust the register "timing" of the sickle	66.7	55.5	61.1
Adjust the cutter bar to correct lead	66.7	55.5	61.1

From the data in Table VI, it appears that parents considered that all the listed abilities in the area of mower maintenance were needed. However, the ability of a graduate boy to rivet new sections into the sickle appeared to be the most needed, because 100 per cent of the parents checked that skill.

The parents apparently agreed that high school graduates should be able to adjust the register "timing" of the sickle and to adjust the cutter bar to correct lead, because the responses to these abilities were identical for the 1966 and the 1967 parent groups. The importance of proper

adjustments and care of the mower was pointed out by Bates.¹ The findings of this study indicate that parents considered that graduating seniors should be able to do many of such adjustments.

There was some disagreement between the responses concerning the ability to replace and adjust worn wearing plates. One hundred per cent of the 1966 parents indicated that this ability was needed, but 66.7 per cent of the 1967 group indicated that this ability was needed.

Data in Table VII show the results of parental responses to the given abilities in the area of maintenance of grain drills.

The data in Table VII indicated that all parents apparently agreed that high school graduates should be able to perform the following: clean the grain and fertilizer from the boxes, and properly oil or grease the drill. The findings concerning cleaning the grain and fertilizer boxes of the grain drill agreed with the instruction Deere and Company gave concerning care and operation of the grain drill.²

The abilities to adjust the hitch to level the grain box and to replace worn driving gears were marked by 83.3 per

¹Bates, *op. cit.*, p. 8.

²Deere and Company, *op. cit.*, p. 9.

TABLE VII
 ABILITIES IN THE AREA OF GRAIN DRILL MAINTENANCE
 FOR STUDENTS

Abilities	Parent responses		
	N = 9 1966	N = 9 1967 Per cent	N = 9 Average
Clean the grain and fertilizer from the boxes	100.0	100.0	100.0
Properly oil or grease the drill	100.0	100.0	100.0
Adjust the hitch to level the grain boxes	88.9	77.8	83.3
Replace worn driving gears	88.9	66.7	77.8
Calibrate the drill	44.4	55.5	50.0

cent and 77.8 per cent, respectively, by the 1966 group of parents and the 1967 group of parents. The data in Table VII also show that 50 per cent of the parents considered that graduates should be able to calibrate the grain drill.

As automation came to the farms, electricity was used in many new ways. The increased services that electricity offered to the farm people also increased the number of service outlets needed for electrical motors and appliances. Table VIII gives the data concerning the responses of parents to certain abilities involved in electrical wiring.

The data in Table VIII indicate that 100 per cent of the parents considered that graduates should be able to

TABLE VIII
ELECTRICAL WIRING ABILITIES FOR STUDENTS

Abilities	Parent responses		
	N = 9 1966	N = 9 1967 Per cent	N = 18 Average
Install a convenience outlet	100.0	100.0	100.0
Reset a circuit breaker	100.0	88.9	94.4
Construct an extension cord	100.0	77.8	88.9
Install an overhead light with a wall switch	77.8	44.4	61.1
Be able to properly wire a house or farm shop accord- ing to code	11.1	22.2	16.7

install a convenience outlet. Furthermore, the data in Table VIII appeared to indicate that parents thought graduates should be able to reset circuit breakers, because 94.4 per cent of the parents marked that ability. The South Dakota Rural Electric Association commented that it is vital for all to possess some understanding of electricity as well as some practical skill in its use. Such comment agrees with the responses of the parents concerning the need for graduating students to be able to accomplish some basic skills in the area of electricity.¹

¹The South Dakota Rural Electric Association, op. cit., p. 9.

The responses of parents, as shown by the data in Table VIII, appeared to indicate that the parents were not entirely agreed on the need of high school graduates to be able to perform the following two skills: to construct an extension cord, and to install an overhead light with a wall switch. However, 88.9 per cent and 61.1 per cent of the parents suggested that these two skills were important. Parent responses, as shown by the data in Table VIII appeared to suggest the ability to wire a house or a farm shop properly according to code was of lesser importance. Only 16.7 per cent of the parents checked that ability. This might indicate that parents of high school graduates considered that ability to be too complex for high school graduates.

An area covering some abilities with the metal lathe was included in this study. The data in Table IX indicate the apparent thinking of parents concerning jobs in the operation of the metal lathe.

The data in Table IX seemed to suggest that parents were of the opinion that high school graduates should be able to perform the following skills: lubricate the turning lathe, center stock in the lathe, and sharpen lathe tools. Over three-fourths of the responses of the parents indicated that these three abilities were needed. The responses of parents in Table IX indicated a little variation in parental thinking concerning the ability to turn a shaft to

TABLE IX
METAL LATHE ABILITIES FOR STUDENTS

Abilities	Parent responses		
	N = 9 1966	N = 9 1967 Per cent	N = 18 Average
Center stock in the lathe for turning metal shafts	100.0	88.9	94.4
Sharpen lathe tools	77.8	88.9	83.3
Lubricate the turning lathe	77.8	77.8	77.8
Turn a shaft to specifications	66.7	44.4	55.5
Cut precision threads on a shaft	33.3	55.5	44.4

specifications; however, the combined responses indicated that 55.5 per cent of the parents considered that graduates should be able to accomplish that ability. The data in Table IX also indicated that 44.4 per cent of the parents considered that graduates should be able to cut precision threads on a shaft. A statement by Atlas Press Company that no operation of the metal lathe requires more study and care than cutting threads, might indicate that the job of cutting precision threads is too complicated for high school graduates.¹

¹Atlas Press Company, *op. cit.*, p. 10.

Along with the increased mechanization of agricultural production came the increased use of weed sprayers to apply chemicals to help control weed problems in crops. The data in Table X give the responses of parents as to the need for abilities in the use of weed sprayers.

TABLE X
WEED SPRAYER ABILITIES FOR STUDENTS

Abilities	Parent responses		
	N = 9 1966	N = 9 1967 Per cent	N = 18 Average
Fill with proper spraying solution	100.0	100.0	100.0
Connect sprayer pump	100.0	77.8	88.9
Replace worn nozzles	100.0	55.5	77.8
Calculate proper speed to travel and rates of application	88.9	55.5	72.2
Calibrate nozzle discharge	88.9	22.2	55.5

The data in Table X apparently indicated that the parents of 1966 graduates considered that graduates needed more abilities in the use of weed sprayers than did the parents of the 1967 group of graduates concerning needed abilities with the operation of weed sprayers.

According to the responses of the parents of the 1967 graduates, several abilities in the use of a weed sprayer

were of lesser importance. Only 22.2 per cent of the responses of the 1967 parents indicated that the ability to calibrate nozzle discharge was needed, compared to 88.9 per cent of the responses of the 1966 parents. The responses of the 1967 parents indicated that 55.5 per cent of the parents considered that the ability to replace worn nozzles was needed, compared to 100 per cent of the responses of the 1966 parent group. In addition, 55.5 per cent of the responses of the 1967 group, compared to 88.9 per cent of the responses of the 1966 parent group, indicated that the ability to calculate proper speed to travel and rates of application was needed.

How to Determine Rate of Application of Field Sprays, written by Fairbanks and Reece, stated that the proper dose of spray material is very important in obtaining maximum weed control and minimum crop damages.¹ It was noted that in 100 per cent of the responses, parents considered that high school graduates should be able to fill the tank with the proper spray solution.

The parents were asked to respond to the importance of the selection, care, and sharpening of twist drills. The Data in Table XI indicate how parents responded to the abilities they considered high school graduating students

¹Fairbanks and Reece, op. cit., p. 10.

TABLE XI
SELECTION, CARE, AND SHARPENING TWIST DRILL
ABILITIES FOR STUDENTS

Abilities	Parent responses		
	N = 9 1966	N = 9 1967 Per cent	N = 18 Average
Properly lubricate when drilling	100.0	100.0	100.0
Set drill press to correct speed in light of drill size	77.8	66.7	72.2
Sharpen a drill with a jig	66.7	77.8	72.2
Ability to select the correct twist drill in light of service requirements	44.4	55.5	50.0
Sharpen a drill without a jig	55.5	33.3	44.4

should be able to achieve in connection with the use of twist drills.

Jones stated that drilling equipment is practically worthless without sharp drill bits and if twist drill bits are used much, they will require frequent resharpening.¹ The data in Table XI show that the same percentage (72.2) of parents considered that high school graduates should be able to accomplish the following two skills in the area of twist drills: set drill press to correct speed in light of drill

¹Jones, op. cit., p. 10.

size and sharpen a drill with a jig. The responses of this study and the statement made by Jones seem to agree on the importance of caring for twist drills.

It was noted that 100 per cent of both groups of parents interviewed considered that students should have the ability to lubricate the drill properly when drilling.

Concerning the ability to sharpen a drill without a jig, the responses of the parents indicated that 44.4 per cent considered that graduating high school students should be able to sharpen a drill without a jig. The data show that 50 per cent of the parents thought high school graduates should be able to select the correct twist drill in light of service requirements.

With increased mechanization in agricultural production, came increased problems surrounding the safe operation of farm equipment. For the past six years, the vocational agriculture classes at Hillsboro High School have viewed and discussed a farm safety film entitled, "Miracle in Paradise Valley," available through the Kansas Farm Bureau Association, Manhattan, Kansas.

The data in Table XII indicate the responses of the parents of the rural male graduates of Hillsboro High School for the years 1966 and 1967 concerning the study of farm safety.

TABLE XII
STUDIES IN THE SAFE OPERATION OF EQUIPMENT
FOR HIGH SCHOOL GRADUATES

Safety instruction	Parent responses		
	N = 9 1966	N = 9 1967 Per cent	N = 18 Average
Systematic study of safety	100.0	88.9	94.4
Discussion of safety where applicable	88.9	88.9	88.9
Careful enough instruction so the operator will accept his responsibilities for the safety of himself and others	88.9	88.9	88.9
Development of an attitude of safety in all of life situations	77.8	100.0	88.9
Pass a written safety test covering farm machinery safety	66.7	55.5	61.1

The results of the data gathered concerning safe operation of equipment, as shown in Table XII, indicated that 94.4 per cent of the parents considered a systematic study of safety was needed. Phipps commented concerning the need for safety instruction.¹ He stated that at the time students receive instructions as to how to use a tool, they should also receive instructions concerning safe practices in using the tool or equipment. Phipps' emphasis on safety

¹Phipps, op. cit., p. 11.

supports these data, showing the need for safety instruction, in Table XII. Furthermore, the data indicating parent responses showed that 88.9 per cent of the parents considered the following three levels of instruction necessary for graduates: a discussion of safety where applicable, careful instruction so the operator will accept his responsibilities for the safety of himself and others, and the development of an attitude of safety in all life situations.

The data in Table XII, showing the responses of parents concerning the need for graduates to be able to pass a written safety test covering farm machinery, indicated that 61.1 per cent of the parents thought graduates should be able to pass a written safety test in the area of farm machinery.

As the world population continues to increase and the farm ground available for production of food and fiber decreases, there is a need for study in the area of soil and water management.

Data in Table XIII show the responses of parents of 1966 and 1967 rural male graduates of Hillsboro High School regarding the abilities they considered as necessary for graduating boys.

In the area of soil and water management, the data in Table XIII, showing the responses of parents, appeared to indicate that this area might be of limited importance.

TABLE XIII
SOIL AND WATER MANAGEMENT ABILITIES FOR STUDENTS

Abilities	Parent responses		
	N = 9 1966	N = 9 1967 Per cent	N = 18 Average
Maintain terraces and waterways	44.4	66.7	55.5
Develop a conservation plan	66.7	22.2	44.4
Run contour lines	22.2	33.3	27.8
Construct terraces and waterways	22.2	22.2	22.2
Figure the ACP payments for conservation practices	11.1	22.2	16.7

The ability in soil and water management that parents marked most frequently was the ability to maintain terraces and waterways. This ability was marked by 55.5 per cent of the parents. It was noted from the responses of parents concerning the ability to develop a conservation plan, that there was considerable variation between the two parent groups. In the 1966 group of parents, 66.7 per cent marked this ability as needed; whereas, 22.2 per cent of the 1967 group marked this ability as needed.

Bennett stated that conservation of our national resources, soil, and water is the concern of everyone.¹

¹Bennett, *op. cit.*, p. 11.

According to the data in Table XIII, 27.8 per cent of the parents considered that graduates should be able to run contour lines. Responses also indicated that 22.2 per cent of the parents considered the ability to construct terraces and waterways was necessary. Three out of eighteen parents, or 16.7 per cent, indicated that they considered the ability to figure ACP payments for conservation practices as necessary.

An area concerning the lubrication of farm machinery was included in this study. The responses of parents are shown in Table XIV as to which of the given abilities they thought graduates should be able to accomplish.

TABLE XIV
LUBRICATION OF FARM MACHINERY ABILITIES FOR STUDENTS

Abilities	Parent responses		
	N = 9 1966	N = 9 1967 Per cent	N = 18 Average
Lubricate the machinery	100.0	100.0	100.0
Select correct oil filters	88.9	88.9	88.9
Locate excessive wear of parts	100.0	66.7	83.3
Follow a manufacturer's lubrication instructions for individual machines	88.9	77.8	83.3
Select proper lubricants in light of service requirements	55.5	44.4	50.0

One hundred per cent of the parents, according to data, considered the ability to lubricate machinery as needed. The ability to select correct oil filters was marked by 88.9 per cent of the parents. According to the data, 83.3 per cent of the parents considered these two abilities: to locate excessive wear or parts, and to follow a manufacturer's lubrication instructions for individual machines as needed for graduates of high school.

The data in Table XIV appeared to indicate that the ability to select proper lubricants in light of service requirements might be of lesser importance, because 50 per cent of the parents considered that ability necessary.

The agriculture mechanics instructions in vocational agriculture classes at Hillsboro, Kansas, included instruction in the area of gas welding. Since only a few farms in this area had gas welding equipment, most of the work and experiences of students with gas welding was obtained from the school vocational agriculture farm shop.

The responses of parents of the rural male graduates of the years 1966 and 1967, concerning abilities in gas welding, are shown by the data in Table XV.

The data in Table XV indicated that apparently there was agreement between the two parent groups concerning the ability to cut mild steel with a cutting tip, because 100 per cent of both groups of parents indicated that graduates

TABLE XV
GAS WELDING ABILITIES FOR STUDENTS

Abilities	Parent responses		
	N = 9 1966	N = 9 1967 Per cent	N = 18 Average
Cut mild steel with cutting tip	100.0	100.0	100.0
Fuse mild steel metals	100.0	55.5	77.8
Weld broken gray cast iron	44.4	44.4	44.4
Hard surfacing, using a hard surfacing rod	22.2	44.4	33.3
Silver solder	0.0	22.2	11.1

should be able to cut mild steel with gas welding equipment. One hundred per cent of the parents of the 1966 group, compared to 55.5 per cent of the parents of the 1967 group, considered that graduates should have the ability to fuse mild steel with gas welding equipment.

Parent responses, as shown by the data in Table XV, indicated that 44.4 per cent of the parents considered that graduates should have the ability to weld broken gray cast iron with gas welding equipment. The ability to apply hard surfacing with gas welding equipment, using a hard surfacing rod, was marked by 33.3 per cent of the parents. It would appear, from the responses shown in these data, that parents considered the ability to silver solder as having limited need.

Shop bench grinders and portable grinders were found to have numerous uses in the agriculture mechanics shops in Kansas. Such grinders were used to make vee joints for arc and gas welding, sharpening tools, dress up weld beads, improve fit-up on construction jobs, and many other uses. It was found that the agriculture mechanics shop at Hillsboro, Kansas, had three bench grinders and two portable grinders. A study of the daily lesson plan book showed that two hours of instruction were given concerning grinders during the four-year curriculum in vocational agriculture. This study included an area on shop bench grinders. The parents were asked to indicate which of the five abilities covered by the Hillsboro Vocational Agriculture Department they considered graduates should be able to accomplish.

The responses of the parents to the five abilities studied concerning shop bench grinders are indicated in the data in Table XVI.

Responses shown in the data of Table XVI indicated that all the parents who were interviewed considered that graduates should be able to clean and sharpen the stone with a star wheel dresser; likewise, 100 per cent of the interviewed parents considered graduates should be able to check the grinding wheel for flaws. The responses of the parents appeared to have agreed with the thinking of Jones.¹

¹Jones, op. cit., pp. 12-13.

TABLE XVI
SHOP BENCH GRINDER ABILITIES FOR STUDENTS

Abilities	Parent responses		
	N = 9 1966	N = 9 1967 Per cent	N = 18 Average
Check grinding wheel for flaws	100.0	100.0	100.0
Clean and sharpen stone with star wheel dresser	100.0	100.0	100.0
Select proper grinding wheel	88.9	100.0	94.4
Adjust the tool rest	88.9	66.7	77.8
True the stone with a diamond point grinding wheel dresser	77.8	55.5	66.7

The ability to select proper grinding wheels was included in this study, and responses of both groups of parents indicated that 94.4 per cent considered that by the time a boy was ready to graduate, he should be able to select proper grinding wheels.

The responses from the groups of parents used in this research, concerning the need for graduates to be able to adjust the tool rest of the grinder, showed that 77.8 per cent of the parents considered this to be a needed skill.

The responses of parents as to what abilities graduates should be able to perform were shown in the data in Table XIV. That discussion of lubrication of machinery was

rather general; consequently, an area was developed to cover certain abilities pertaining to the crankcase only. Table XVII was developed to show the responses of parents concerning what abilities they considered necessary in the area of crankcase lubrication.

TABLE XVII
ABILITIES FOR STUDENTS IN THE AREA OF CRANKCASE
LUBRICATION

Abilities	Parent responses		
	N = 9 1966	N = 9 1967 Per cent	N = 18 Average
Do a complete oil and filter change	100.0	100.0	100.0
Keep the oil area free from dirt	100.0	88.9	94.4
Check the crankcase oil level	100.0	88.9	94.4
Replace oil filter	100.0	88.9	94.4
Detect any abnormal oil problems	55.5	77.8	66.7

One hundred per cent of the parents checked the ability to do a complete oil and filter change as an ability high school graduates should be able to achieve, according to the data given in Table XVII. These responses agreed with the concern of Deere and Company¹ and American Oil

¹Deere and Company, op. cit., p. 13.

Company¹ as to the needs of proper lubrication and care of the crankcase.

Data gathered indicated that apparently parents of the two groups considered these three abilities: to keep the oil areas free from dirt, to check the crankcase oil level, and replace the oil filter of equal importance because the parents' markings of these three abilities were identical. A study of the data in Table XVII indicated that 94.4 per cent of the parents considered the above-mentioned three abilities as needed.

Responses of parents, concerning the ability to detect any abnormal oil problems, are shown in the data of Table XVII. The data indicated that 66.7 per cent of the parents considered this ability as needed by high school graduates.

Farm people frequently have occasion to use hand tools for repair and construction of farm buildings and equipment. The writer developed an area on cutting tools, and the responses of parents as to which of the certain abilities they thought needed are given in the data in Table XVIII.

One hundred per cent of the parents considered that graduates should have the ability to sharpen the tool so it is workable, as indicated by the data in Table XVIII.

¹American Oil Company, op. cit., p. 13.

TABLE XVIII
CUTTING TOOL ABILITIES FOR STUDENTS

Abilities	Parent responses		
	N = 9 1966	N = 9 1967 Per cent	N = 18 Average
Sharpen hand tool so it is workable	100.0	100.0	100.0
Use hand tools safely	88.9	88.9	88.9
Ability to select the correct quality of tool in light of service requirements	55.5	66.7	61.1
Sharpen tool with precision	33.3	44.4	38.9
Recondition cutting tools	44.4	33.3	38.9

It was noted that the responses of parents concerning the ability to sharpen a hand tool so it was workable agreed with Jones.¹ The same data also indicated that both groups of parents apparently agreed as to the need of a graduate being able to use hand tools safely, because eight out of nine in both groups marked it as a needed ability.

In Table XVIII, the data indicate similar feelings on the two abilities: to sharpen the tool with precision, and to recondition the cutting tools, because 38.9 per cent of the parents of rural male graduates of Hillsboro High School of the years 1966 and 1967 marked these two abilities

¹Jones, op. cit., pp. 13-14.

as needed. It was also noted from the responses of parents that 61.1 per cent of them considered the ability to select the correct quality of tool in the light of service requirements as needed.

The course of study in vocational agriculture at Hillsboro High School showed that the Vocational Agriculture II students received three hours of instruction on how to handle, read, and set up the farm level. In addition to the instruction, each student does three assignments involving the use of the farm level. In addition to instruction in handling, reading, and setting up the equipment, five hours of instruction and exercises for practices are given on making field notes and problems involving determining the percentage slope of various fields.

A study was made to determine parental thinking in connection with abilities surrounding the use of the farm level. Data in Table XIX show the results of the study in the area of farm level.

The data in Table XIX indicate that 83.3 per cent of the parents of rural male graduates of Hillsboro High School, for the years 1966 and 1967, considered the ability to handle a farm level and rod correctly as needed by high school graduates. The total of 72.2 per cent of both groups of parents marked the two following abilities as needed: to read a rod correctly, and to set up the farm level. The data

TABLE XIX
FARM LEVEL ABILITIES FOR STUDENTS

Abilities	Parent responses		
	N = 9 1966	N = 9 1967	N = 18 Average
Handle a farm level and rod correctly	88.9	77.8	83.3
Read a rod correctly	77.8	66.7	72.2
Set up the farm level	88.9	55.5	72.2
Take elevation readings and make correct field notes	55.5	44.4	50.0
Develop information needed to determine percentage slope of the field from field notes	33.3	22.2	27.8

indicated that the two groups were not in full agreement concerning the ability to set up the farm level, because 88.9 per cent of the parents of the 1966 group marked that ability as needed; whereas, 55.5 per cent of the 1967 group marked that ability as needed.

Fifty per cent of the parents considered the ability to take elevation readings and make correct field notes as needed by high school graduates. Concerning the ability to develop information needed to determine percentage slope of the field from field notes, 27.8 per cent of the parents considered that as a needed ability.

A study was conducted in the area of "Inert Gas" welding to determine what parents thought rural high school graduates should be able to accomplish in this area. Table XX shows the responses concerning "Inert Gas" welding.

TABLE XX
"INERT GAS" WELDING ABILITIES FOR STUDENTS

"Inert Gas" welding abilities	Parent responses		
	N = 9 1966	N = 9 1967	N = 18 Average Per cent
Weld mild steel with MIG welder	33.3	44.4	38.4
Set up "Inert Gas" welding equipment	44.4	22.2	33.3
Weld stainless steel with a TIG welder	11.1	11.1	11.1
Weld sheet aluminum with TIG welder	0.0	0.0	0.0
Weld broken castings with TIG welder	11.1	11.1	11.1

The data in Table XX indicated that 33.3 per cent of the parents of high school graduates considered that graduates should be able to set up the "Inert Gas" welding equipment. Concerning the ability to weld mild steel with a MIG welder, it was noted that 38.9 per cent of the parents considered that graduates should be able to accomplish that skill.

The responses, according to the data in Table XX, appeared to indicate that the parents thought the ability to operate a TIG welder had limited need. It appeared, from the data collected, that instruction in the area of "Inert Gas" was not as important as instructions in the other areas of this study.

SUMMARY AND CONCLUSIONS

The data in Table XXI were prepared to show a composite of the analyses of the data of the previous twenty tables. In the left column of the table are graduated intervals with a 10 per cent range. The middle column shows how many abilities were checked in each of the 10 per cent intervals. The column on the right edge of the table shows the per cent of abilities checked in each interval.

TABLE XXI
COMPOSITE OF THE ANALYSES OF THE DATA

Response frequency Per cent	Number	Abilities Per cent
100 - 90	28	28.2
89 - 80	17	17.2
79 - 70	13	13.1
69 - 60	8	8.1
59 - 50	9	9.1
49 - 40	5	5.1
39 - 30	9	9.1
29 - 20	4	4.0
19 - 10	5	5.1
9 - 0	1	1.0

The data in Table XXI indicate that 28.2 per cent of the abilities included in this study were checked as needed by at least 90 per cent of the parents. Further, an additional 17.2 per cent of the abilities included in the study were checked as being necessary by at least 80 per cent of the parents interviewed. And 13.1 per cent of the abilities in the study were checked as being needed by high school graduating boys, by at least 70 per cent of the parent responses.

One per cent of the abilities were checked by 9 per cent or less of the parents.

The data in Table XXI, showing the responses of parents, appear to agree with Phipps' thought that most of the agriculture mechanics activities of farmers involves maintenance, adjustment, and repair of farm machinery and equipment.¹

In Kansas, it was recommended that two-fifths of the vocational agriculture schedule be devoted to agriculture mechanics. Also, a great deal of the cost of the total vocational agriculture program was to cover expenses in the area of agriculture mechanics.

In accordance with the parental responses of this study: (1) Instruction in agriculture mechanics should give

¹Phipps, op. cit., p. 14.

added efforts to instruction in care and maintenance of farm machinery and equipment, and (2) More instruction should be given covering the safe operation of farm machinery and equipment.

The writer concluded that instructors of vocational agriculture should give careful consideration as to how much time in agriculture mechanics should be devoted to instruction in maintenance of machinery and equipment, and how much time should be allowed for shop construction jobs.

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APPENDIX

Following are the instructions for completing the questionnaire. Mark your choices by placing a check mark (✓) in front of the choices that represent your thinking as to what farm mechanics jobs you feel high school students should be able to accomplish.

Example: Which of these towns are in Marion County?

- Herington
- Marion
- Hillsboro
- Abilene
- Peabody

1. In the area of Arc Welding:
 - Weld in flat position.
 - Weld in horizontal position.
 - Weld in vertical position.
 - Weld in overhead position.
 - Apply hard surfacing rod with an arc welder.

2. In the area of Fuel System for farm power units:
 - Keep the exterior of the fuel system clean.
 - Remove, clean and replace the sediment bowl.
 - Adjust idle and load needles of gasoline engine carburetor.
 - Repair the fuel pump.
 - Dismantle, clean, rebuild and adjust carburetor.

3. In the area of Farm Carpentry:
 - Saw a board to exact measurements with hand saw.
 - Saw a board to exact length and make all cuts square.
 - Use a skill saw for simple jobs.
 - Use a skill saw for most every job.

4. In the area of Ignition of farm power units:
 - Clean the surface of the electrical system.
 - Replace spark plugs.
 - Remove, clean, check and set electrode gap and replace spark plugs.

- ___ Remove distributor cap and set the ignition points.
- ___ Use a timing light to check the timing of Ignition.

5. In the area of Masonry skills:

- ___ Mix and carry mortar for masonry units.
- ___ Assist skillful brick layer.
- ___ Lay a straight wall.
- ___ Lay up a corner and door opening.
- ___ Skillfully lay a brick wall on his own.

6. In the area of Mowers:

- ___ Adjust the hold down clips of a cutter bar.
- ___ Replace and adjust worn wearing plates.
- ___ Rivet new sections into the sickle.
- ___ Adjust the register "timing" of the sickle.
- ___ Adjust the cutter bar to correct lead.

7. In the area of Grain Drills:

- ___ Clean the grain and fertilizer from the boxes.
- ___ Adjust the hitch to level the grain box.
- ___ Properly oil or grease the drill.
- ___ Replace worn driving gears.
- ___ Calibrate the drill.

8. In the area of Electrical Wiring:

- ___ Reset a circuit breaker.

- ___ Construct an extension cord.
- ___ Install a convenience outlet.
- ___ Install an overhead light with a wall switch.
- ___ Be able to properly wire a house or farm shop according to code.

9. In the area of Metal Lathe operation:

- ___ Lubricate the turning lathe.
- ___ Center stock in the lathe for turning metal shafts.
- ___ Sharpen lathe tools.
- ___ Turn a shaft to specifications.
- ___ Cut precision threads on a shaft.

10. In the area of Weed Sprayers:

- ___ Connect sprayer pump.
- ___ Fill with proper spraying solution.
- ___ Calibrate nozzle discharge.
- ___ Replace worn nozzles.
- ___ Calculate proper speed to travel and rates of application.

11. In the area of Twist Drills:

- ___ Set drill press to correct speed in light of drill size.
- ___ Properly lubricate when drilling.
- ___ Sharpen a drill with a jig.
- ___ Sharpen a drill without a jig.

- ___ Ability to select the correct twist drill in light of service requirements.

12. In the area of Safe Operation of equipment:

- ___ Discussion of safety where applicable.
- ___ Systematic study of safety.
- ___ Pass a written safety test covering farm machinery.
- ___ Careful enough instruction so the operator will accept his responsibilities for safety of himself and others.
- ___ Development of an attitude of safety in all of life situations.

13. In the area of Soil and Water management:

- ___ Develop a conservation plan.
- ___ Run contour lines.
- ___ Maintain terraces and waterways.
- ___ Figure the ACP payments for conservation practices.
- ___ Construct terraces and waterways.

14. In the area of Lubrication of farm machinery:

- ___ Lubricate the machinery.
- ___ Follow a manufacturer's lubrication instructions for individual machines.
- ___ Locate excessive wear of parts.
- ___ Select correct oil filters.
- ___ Select proper lubricants in light of service requirements.

15. In the area of Gas Welding:

- Fuse mild steel metals.
- Cut mild steel with cutting tip.
- Weld broken gray cast iron.
- Silver solder.
- Hard surface using a hard surfacing rod.

16. In the area of Shop Bench Grinders:

- Check grinding wheel for flaws.
- Adjust the tool rest.
- Clean and sharpen stone with star wheel dresser.
- True the stone with a diamond point grinding wheel dresser.
- Select proper grinding wheels.

17. In the area of Crankcase lubrication:

- Keep the oil areas free from dirt.
- Check the crankcase oil level.
- Replace oil filter.
- Do a complete oil and filter change.
- Detect any abnormal oil problems.

18. In the area of Cutting Tools:

- Use hand tools safely.
- Sharpen the tool so it is workable.
- Sharpen the tool with precision.
- Recondition cutting tools.

- ___ Ability to select the correct quality of tool in the light of service requirements.

19. In the area of Farm Level:

- ___ Handle a farm level and rod correctly.
- ___ Read a rod correctly.
- ___ Set up the farm level.
- ___ Take elevation readings and make correct field notes.
- ___ Develop information needed to determine per cent of slope of the field from field notes.

20. In the area of "Inert Gas" welding:

- ___ Set up "Inert Gas" welding equipment.
- ___ Weld mild steel with MIG welder.
- ___ Weld stainless steel with TIG welder.
- ___ Weld sheet aluminum with TIG welder.
- ___ Weld broken castings with TIG welder.

AGRICULTURE MECHANICS ACTIVITIES FOR
HIGH SCHOOL STUDENTS

by

TRUMAN LEROY DIENER

B. S., Kansas State University, 1952

AN ABSTRACT OF A MASTER'S REPORT

submitted in partial fulfillment of the

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MASTER OF SCIENCE

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The purpose of this study was to give guidance to the agriculture mechanics part of the vocational agriculture at Hillsboro High School. In an effort to develop a meaningful course of study in vocational agriculture, which included the agriculture mechanics skills, the writer endeavored to secure the opinions of parents concerning what abilities they considered high school graduating seniors should be able to perform.

Eighteen parents were interviewed in the collection of data. The research population consisted of the parents of Hillsboro High School rural male graduates for the years 1966 and 1967. A questionnaire was developed in order to give parents an opportunity to select which abilities they considered important. The questionnaire was set up in twenty areas. Each of the areas was broken down into a number of skills or abilities, and the parents were asked to study each ability in each area and mark the abilities they thought a rural male high school graduate should be able to achieve.

A review of literature was made to locate any similar studies so a comparison of results could be made. The review of literature further included references to many sources of information pertinent to the findings of this study.

There were some variations of responses between the two groups of parents concerning a certain ability. However, in most instances of differences, the variation was not

greater than 33.3 per cent. But in one case, the variation was 66.7 per cent. It appears that the responses of parents were rather consistent as to the need of various abilities.

In the responses concerning various abilities, it was noted that the responses ranged all the way from 100 per cent on some abilities to zero per cent on one ability. This would indicate that the questionnaire covered a wide enough range to give parents an opportunity to mark their choice.

The data in Tables I through XX show that fifteen abilities out of the ninety-nine were marked by 100 per cent of those interviewed. The data further indicate that 28.2 per cent of the abilities were marked as necessary by 90 per cent or more of the responses, and only 1 per cent of the abilities were marked by less than 9 per cent of the responses.

Seventy per cent of parents of rural male graduates of Hillsboro High School for the years 1966 and 1967, marked 58.5 per cent of the abilities as needed for high school graduates. The responses to the questionnaire showed that 40.5 per cent of the abilities were selected by not less than 10 per cent and not more than 69 per cent of the parents interviewed.