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Farm mechanics skills to be developed by high school vocational agricultural students

Jerald C. Weatherford

To the Graduate Council:

I am submitting herewith a thesis written by Jerald C. Weatherford entitled "Farm mechanics skills to be developed by high school vocational agricultural students." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agriculture and Extension Education.

George W. Wiegers Jr., Major Professor

We have read this thesis and recommend its acceptance:

F. F. Bell, C. H. Shelton

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

July 24, 1962

To the Graduate Council:

I am submitting herewith a thesis written by Jerald C. Weatherford entitled "Farm Mechanics Skills to be Developed by High School Vocational Agricultural Students." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Education.

E. W. Wiegers, Jr

We have read this thesis and recommend its acceptance:

Frank Bell

C. H. Shelton

Accepted for the Council:

Hilton A. Smith
Dean of the Graduate School

FARM MECHANICS SKILLS TO BE DEVELOPED BY HIGH SCHOOL VOCATIONAL AGRICULTURAL STUDENTS

A Thesis

Presented to

The Graduate Council of

The University of Tennessee

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

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by

Jerald C. Weatherford

August 1962

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THE PROBLEM AND ITS DEFINITION

I. THE PROBLEM

Statement of the problem. The problem was to determine the value of basic skills included in courses of study in agricultural mechanics and to indicate skills that could be developed in completing selected jobs or projects in agricultural mechanics.

Importance of the study. This study is of importance because of the need for the instructor to have specific skills in mind to develop in the student when a job or project is selected.

Improved agricultural mechanics programs, better arranged shops, and more time spent in teaching mechanical jobs or projects have been some of the accomplishments realized in the field of agricultural mechanics in recent years. The course of study based on dividing the instructional program into work areas has created new interest in mechanics on the part of teachers and students.

Many excellent courses of study in mechanics for vocational agriculture departments have been prepared and put into use. Most of these courses, however, have not gone beyond the point of breaking the work areas down into jobs or projects. The writer has observed that a number of programs list, under the different work areas, both jobs and skills with no effort to break the jobs down into the skills that the

student would be expected to acquire in doing the job or project. The writer realizes that the dividing line between a skill and a job or project is very fine, but it is hoped that this study will add meaning to what is frequently found in a course of study.

It is also hoped that the materials presented will be helpful to teachers in selecting the content of their course of study, assist them in determining desired skills to develop in the student, and suggest some activities or exercises through which these goals may be accomplished.

II. DEFINITIONS OF TERMS USED

Agricultural mechanics course of study. The term as employed in this study is used to designate a written instructional guide, prepared by the vocational agricultural teacher, to be used in teaching desired skills and in constructing useful articles in the different instructional areas in agricultural mechanics.

Instructional area. The term refers to the divisions of work into which the agricultural mechanics course of study is divided, such as: agricultural shop and electricity.

Project or job. The term refers to an activity in an instructional area intended to develop specific abilities and skills in the learner and at the same time produce a useful product.

Basic skill. The term as used in this study refers to the smallest of units resulting from the breakdown of a project or job into its minor activities or exercises.

Activity. The term refers to a proposed exercise or experience to help the student achieve the desired skills and a useful product.

Exercise. The term refers to an experience or activity proposed to develop in the student the ability to use desired skills in producing useful products.

Farm mechanics. The term in this study refers to the work done by students in agricultural shop, agricultural buildings and structures, agricultural power and machinery, electricity, and soil and water management areas, as a part of his vocational agricultural program.

Farm shop. The term in this study refers to the work done by the student in arc and gas welding, cold and hot metal, soldering, woodworking, and tool fitting activities of the agricultural shop area.

III. ASSUMPTIONS

Individual students doing selected exercises and appropriate jobs or projects in each of the instructional areas in agricultural mechanics courses can be taught basic skills needed.

It is the responsibility of all secondary high schools offering vocational agriculture to provide training to vocational agricultural students in the instructional areas of agricultural mechanics.

Learning the basic skills needed in agricultural mechanics is one of the most important problems that young farm people face today.

IV. METHOD OF PROCEDURE

Over a period of four years, materials relating to mechanical skills and problems were collected by the writer. A detailed list of skills and projects was compiled under the different instructional areas of the agricultural mechanics program. This list was revised many times after discussing the problems with teachers of vocational agriculture, mechanics teachers, farm machinery repairmen, and mechanics in general in the State. This list of skills was screened and checked on numerous occasions by personnel of the agricultural engineering departments of The University of Tennessee, Martin Branch, and The University of Tennessee, at Knoxville. Personnel of the agricultural education department of The University of Tennessee gave guidance and counsel on many, many occasions.

After the skills list was developed, a jury of nine agricultural teachers of the State was selected. Under guidance, and with suggestions from the head of the agricultural education department, three teachers representing each of the three sections of the State were selected. These teachers were selected on the basis of their agricultural mechanics programs in their own locations, mechanical experience, abilities and interests. A list of 818 skills representing twenty-one instructional areas was delivered in person or mailed to the selected jurors. Each juror was asked to rate each skill listed as to its value to students. He checked either very valuable, valuable, some value, or no value.

Personal contact was made with seven of the nine members of the jury in regard to their feelings and response to the list of skills

included in the survey under the different instructional areas. A list of basic skills was established from the surveys checked by the jurors. This was accomplished by determining a weighted index for each skill rated by the jurors as very valuable, valuable, and some value. Each skill checked was given a unit value. Those rated very valuable were assigned four units, those rated valuable were assigned three units, those rated some value were assigned two units, and those rated no value were assigned no units. The skills were finally selected by a weighted index based on one hundred. This weighted index was determined by multiplying the total units voted each skill by twenty-five, the number of times the largest unit value is contained in one hundred, divided by nine, the number of jurors polled. One juror rated the skill of selecting a wood chisel very valuable for 4 units, seven jurors rated this skill valuable for 21 units (three for each vote), and one juror rated this skill some value for 2 units. This gives the skill a total of 27 units (4 plus 21 plus 2), according to the juror ratings. The weighted index based on one hundred was determined by multiplying the 27 units by 25 (the number of times the largest single unit 4 is contained in one hundred) for a product 675. Divide 675 by nine (the number of jurors rating the skill), giving a quotient seventy-five which is the weighted index for the skill, "Selecting a Wood Chisel." Only those skills with a weighted index of sixty-five to one hundred were selected as a basic or firm skill and used in this study.

The writer, with the counsel of the agricultural education department, selected a proposed list of projects or jobs that could be

used to teach these basic or firm skills. These proposed projects or jobs and the basic or firm skills were arranged in table form and checked as to the possible skills that could be developed by doing each particular project or job.

V. RELATED STUDIES

Ellis,[1] in a study at The University of Tennessee, analyzed one hundred and eight courses of study in farm mechanics by vocational agricultural teachers of Tennessee. These courses were selected to represent all sections of the State. From the courses of study he arranged the instructional areas in sequence, the one being planned by the most number of teachers being first. Each of the areas was broken down into activities with some suggested projects to make.

Wiegers[2] compiled a detailed list of farm mechanics skills arranged by instructional areas to be used in developing agricultural mechanics courses of study. Each of the instructional areas included was analyzed into techniques and skills that one might be expected to learn in doing exercises or work in that area. No attempt was made to place priorities on the skills.

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[1]Dwight Cox Ellis, "An Analysis of One Hundred and Eight Courses of Study in Farm Mechanics" (unpublished Master's thesis, The University of Tennessee, Knoxville, 1956), 53 pp.

[2]George W. Wiegers, Jr., "Farm Mechanics Skills" (Knoxville: The University of Tennessee, 1955), 11 pp. (Mimeographed.)

Miller[3] mailed out 292 checklists of 204 technical skills on the doing level which he prepared by checking with teacher trainers and farm mechanics specialists in Colleges of Agriculture in the North Atlantic Region. The areas in which teachers used skills to the greatest extent in order were: woodworking, cold metal, toolfitting, soldering, sheet metal, glazing, painting, and refinishing. Areas in order with the least used skills were: fencing, plumbing, water supply, oxyacetylene welding, and concrete. Skills were found in all areas that a high per cent of the teachers used and rated high in value.

Schafer[4] selected fourteen areas of farm mechanics and developed teaching units for each of these areas. Each unit contained abilities to be learned, content that may be associated with each ability, teaching-learning activities that may be used to teach the abilities, appropriate jobs and projects that may be constructed or repaired by the learner and references to be used.

Bartlett[5] made a study in 1948 in the state of West Virginia to determine the farm shop jobs and skills needed by farmers and made

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[3]Harry T. Miller, "Technical Skills in Farm Mechanics Requiring a Planned Demonstration for Effective Teaching Needed by Beginning Teachers of Vocational Agriculture in The North Atlantic Region" (Master's thesis, The University of Maryland, College Park, 1952), 143 pp.

[4]Wallace A. Schafer, "Teaching Units in Farm Mechanics for Courses of Study in Arizona Departments of Vocational Agriculture" (Special study, Master's Agricultural Education, University of Arizona, Tucson, 1951), 99 pp.

[5]Laurence Farrell Bartlett, "A Farm Shop Study" (unpublished Master's thesis, West Virginia University, Morgantown, 1948), 102 pp.

an instructional course to meet the needs of students of vocational agriculture. A survey of farms provided him with a list of what they thought should be taught in a course of farm mechanics to vocational agricultural students.

Campbell[6] compiled a list of problems universally accepted for shop work in vocational agriculture from all the teachers of vocational agriculture in Missouri in 1926. The problems found to be accepted in the different work shop areas formed a basis for selecting jobs for farm shop work. A special list of twenty problems with composite ratings was compiled.

Davies[7] conducted a study to compare the farm shop work required in various states and the content and scope of the work. His purpose was to determine if the Colorado State Plan was different from accepted good practices in other states and to determine the farm shop jobs in construction and repair that farmers considered essential in farm shop courses. He found the Colorado plan included the types of farm shop work accepted by other states.

McDonough[8] made a study to determine what areas and jobs are

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[6]Jesse Lee Campbell, "Universal Shop Problems for Vocational Agriculture" (Master's thesis, The University of Missouri, Columbia, 1926), 114 pp.

[7]Llewellyn Rhys Davies, "Farm Shop Work in Vocational Education" (Master's thesis, Colorado Agricultural College, Fort Collins, 1923), 44 pp.

[8]Walter McDonough, "A Study of the Areas of Farm Mechanics Emphasized in the All-Day Program of Vocational Agriculture in North Carolina With Suggestions for Improvement" (unpublished Master's thesis, North Carolina State College, Raleigh, 1948), 104 pp.

being taught and the number of hours given to each area and job in the farm mechanics program. Through a survey of teachers, he found the areas and jobs were fairly evenly divided over a four-year period. In general, more instruction in farm power and machinery, farm buildings and conveniences, soil and water conservation, and rural electrification is given in the third and fourth year.

Kindschy[9] did a study to determine the content of a course in welding, farm machinery, and tractors in Iowa. By means of surveys to former vocational agricultural students enrolled in young farmer classes, he secured a list of skills they thought important.

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

CHAPTER II

PRESENTATION OF DATA BY AREAS OF INSTRUCTION

It is the purpose of this chapter to present the various basic skills compiled from a detailed list of 818 skills rated by nine selected jurors from over the state of Tennessee. These rated skills were matched with a group of suggested projects or jobs which would develop these basic skills in the learner.

The skills and projects are presented in table form by instructional areas. The instructional areas are arranged under the following general headings: Agricultural Shop, Agricultural Buildings and Structures, Agricultural Power and Machinery, Electricity, and Soil and Water Management.

I. AGRICULTURAL SHOP AREAS

The skills areas included in this group, toolfitting, woodworking, cold and hot metal working, soldering, gas and arc welding, are those areas which deal with the common shop jobs and skills found in the ordinary farm shop. Many of the skills are found to be very specific in nature. See Table I for a complete list.

These areas are recognized, by those familiar with the vocational agricultural teachers' shop program, as those areas that made up the mechanical skills training program up to the present time. This is true with the exception of sheet metal working, leather working,

TABLE I

INSTRUCTIONAL AREAS, NUMBER OF SKILLS AND AVERAGE WEIGHTED SKILL INDEX IN EACH AREA OF AGRICULTURAL MECHANICS

Areas	Number of Skills	Average Weighted Index
Agricultural Shop		
Gas Welding	40	86.6
Arc Welding	43	84.6
Cold Metal Working	55	79.5
Soldering	34	77.1
Plans, Drawings and Sketches	20	75.6
Woodworking	94	74.1
Tool Fitting	45	72.8
Sheet Metal Working	44	66.4
Hot Metal Working	45	64.8
Rope Working	27	59.3
Leather Working	30	28.9
Agricultural Buildings and Structure		
Buildings	27	87.9
Masonry	37	79.8
Painting	34	79.5
Plumbing	49	78.7
Glazing	13	77.5
Agricultural Power and Machinery		
Agricultural Machinery	55	89.9
Agricultural Tractors	64	89.7
Power Transmission	12	80.7
Electricity		
Electrical Skills	39	86.9
Soil and Water Management		
Soil and Water Management Skills	17	81.0

and rope working, which was left out of this study because of the lack of importance in the farm program of the present day as judged by the writer and the rating given by the jurors. The areas of plumbing, masonry, painting, and glazing were shifted to the building and structures section. Sheet metal was included in the cold metal area and plans, drawings and sketches were included in the woodworking area. Electricity area and the soil and water management area were given a section to themselves, which will be discovered in the last sections of this chapter.

Tool Fitting Skills

The basic skills and a proposed list of jobs or projects through which these skills may be learned are found in Table II.

This table appears at first thought to show that the skills that may be learned are rather limited to the specific types of tools. After further observation and study it is realized that a great many tools are sharpened or conditioned on a common piece of equipment. For example, the work that may be done on the power grinder.

Attention should also be directed to the fact that there are several different kinds and types of beveled tools. There are tools that are beveled from one side, those beveled from two sides to a vee, and those that are beveled to a point at the center. It is found also that there are variations in these types. For example, a chisel beveled from one side may be either flat, convexed, or concaved. Each of these types and variations in tools provide different projects that may be used to develop skills in sharpening and conditioning tools.

TABLE II

PROPOSED PROJECTS FOR TEACHING
TOOL FITTING SKILLS

Skills	Projects									
	Ax or Hatchet	Cold Chisel	Center Punch	Twist Drill	Auger Bit	Plane Iron or Wood Chisel	Mower Knife	Bailer, Enslige Cutter & Shear Plate	Plow Shear or Cultivator Shovels	Hedge Trimmer or Scissors
Identifying tools and parts of tools	x	x	x	x	x	x	x	x	x	x
Selecting tools	x	x	x	x	x	x	x	x	x	x
Adjusting tools	x	x	x	x	x	x	x	x	x	x
Selecting and using power grinder	x	x	x	x		x	x	x	x	x
Selecting and installing grinding wheels	x	x	x	x		x	x	x	x	x
Truing grinder wheels	x	x	x	x		x	x	x	x	x
Adjusting grinder tool rest		x	x	x		x		x	x	x
Selecting and using oilstones	x					x				
Selecting and using files	x				x					

TABLE II (continued)

Skills	Projects									
	Ax or Hatchet	Cold Chisel	Center Punch	Twist Drill	Auger Bit	Plane Iron or Wood Chisel	Mower Knife	Bailer, Enslige Cutter & Shear Plate	Plow Shear or Culti-vator Shovels	Hedge Trimmer or Scissors
Grinding beveled tools	x	x	x	x		x	x	x	x	x
Honing tools	x					x				
Sharpening wood boring tools				x	x					
Sharpening metal boring tools				x						
Conditioning power machine cutters and shearing devices							x	x	x	
Conditioning soil preperation tools									x	
Cleaning tools	x	x	x	x	x	x	x	x	x	
Sharpening shear-ing edge tools										

Practically all of the garden, many farm, and general hand tools require handles. Fitting handles in tools provide a host of opportunities to develop skills.

No area or shop work will provide more opportunities to develop basic skills on small items than will the area of toolfitting. No area will provide basic skills that are more important to good work than will toolfitting.

Woodworking Skills

The basic skills of woodworking covered in this study along with suggested projects or jobs are found in Table III.

These skills were arranged in an attempt to have them come in the order that they will be done when performing that exercise. For example, the first few skills listed, in this area and others scattered through the table, deal with knowledge or mental skills.

Next, manipulative skills, the doing skills, are found in the table. Then the skills that develop the abilities to use power woodworking machines are found in the last parts of the table.

Some of the skills are very limited in application as compared to other skills. For example, applying glue as compared to measuring and marking lumber.

To develop a particular skill to a high degree, special attention must be given to the selection and application of the different jobs or projects that will provide drill and practice in that given skill area.

The number of jobs or projects in this area is very broad. The

TABLE III

PROPOSED PROJECTS FOR TEACHING
WOODWORKING SKILLS

Skills	Projects									
	Screen Frame	Shipping Crate	Class-room Table	Small Out Build-ing	Truck Bed and Sides	Range Shelter	Nail Box	Bee Hive Com-plete	Portable Feeder Swine	Farm Gate
Identifying the kinds of lumber	x	x	x	x	x	x	x	x	x	x
Identifying woodworking tools and equipment	x	x	x	x	x	x	x	x	x	x
Selection and care for lumber	x	x	x	x	x	x	x	x	x	x
Figuring bills of materials	x	x	x	x	x	x	x	x	x	x
Calculating costs of lumber and other materials	x	x	x	x	x	x	x	x	x	x
Figuring board feet	x	x	x	x	x	x	x	x	x	x
Measuring and marking lumber	x	x	x	x	x	x	x	x	x	x
Selecting and using framing square	x	x	x	x	x	x	x	x	x	x
Laying out work line				x	x	x	x	x	x	x

TABLE III (continued)

Skills	Projects									
	Screen Frame	Shipping Crate	Class-room Table	Small Out Build-ing	Truck Bed and Sides	Range Shelter	Nail Box	Bee Hive Com-plete	Portable Feeder Swine	Farm Gate
Marking ridge or upper plumb cut of rafter				x		x			x	
Determining and marking length of rafter body				x		x			x	
Locating and marking rafter bird's mouth				x		x			x	
Locating and marking off rafter tail				x		x			x	
Determining rise, run, and pitch for rafter				x		x			x	
Determining the length of material needed for a rafter				x		x			x	
Selecting the handsaw	x	x	x	x	x	x	x	x	x	x
Cutting common rafters				x		x			x	
Doing straight sawing with and across the grain of the wood	x	x	x	x	x	x	x	x	x	x

TABLE III (continued)

Skills	Projects									
	Screen Frame	Shipping Crate	Class-room Table	Small Out Build-ing	Truck Bed and Sides	Range Shelter	Nail Box	Bee Hive Com-plete	Portable Feeder Swine	Farm Gate
Using miter box to saw mitered joints	x		x	x	x			x	x	
Learning types of bolts, hinges, screws, fasteners, etc.	x	x	x	x	x	x	x	x	x	x
Selecting nails, brads and wood fasteners	x	x	x	x	x	x	x	x	x	x
Placing, driving and drawing nails	x	x	x	x	x	x	x	x	x	x
Selecting, assembling and adjusting planes	x	x	x	x	x		x	x	x	x
Selecting and using bit braces		x	x	x	x	x	x	x	x	x
Selecting twist drills and auger bits, wood		x	x	x	x	x	x	x	x	x
Inserting and driving wood screws		x	x	x	x	x	x	x	x	x
Selecting wood glue and clamps			x					x	x	

TABLE III (continued)

Skills	Projects									
	Screen Frame	Shipping Crate	Class-room Table	Small Out Build-ing	Truck Bed and Sides	Range Shelter	Nail Box	Bee Hive Com-plete	Portable Feeder Swine	Farm Gate
Preparing wood for gluing			x					x		
Applying glue and clamping			x					x		
Sanding and finishing wood by hand			x				x	x		
Selecting fillers and sealers			x	x	x	x	x	x	x	
Learning principles of safety in power tool operation	x	x	x	x	x	x	x	x	x	x
Practice and master all safety rules	x	x	x	x	x	x	x	x	x	x
Adjusting tilting and mitering controls on power saws			x	x	x	x	x	x	x	x
Crosscutting with the power saw	x	x	x	x	x	x	x	x	x	x
Ripping with power saw	x	x	x	x	x	x	x	x	x	x
Cutting miter joints with the power saw	x		x	x	x			x	x	x

TABLE III (continued)

Skills	Projects									
	Screen Frame	Shipping Crate	Class-room Table	Small Out Build-ing	Truck Bed and Sides	Range Shelter	Nail Box	Bee Hive Com-plete	Portable Feeder Swine	Farm Gate
Cutting bevels and angles with the power saw		x	x	x	x	x	x	x	x	x
Selecting and using portable electric handsaws	x	x	x	x	x	x	x	x	x	x
Crosscut, bevel and miter cutting with portable electric handsaw	x	x	x	x	x	x	x	x	x	x
Ripping with portable electric saw	x	x	x	x	x	x	x	x	x	x
Adjusting and setting portable electric saw	x	x	x	x	x	x	x	x	x	x
Selecting thickness planer	x	x	x	x	x	x	x	x	x	x
Adjusting a planer	x	x	x	x	x	x	x	x	x	x
Dressing lumber to same thickness on a thickness planer	x	x	x	x	x	x	x	x	x	x
Selecting a drill press and attachments		x	x	x	x		x	x		

instructor may be able to select other similar projects that will provide opportunities to develop these same skills. Projects may be selected that will fit better into a given situation and at the same time construct objects that will be more useful when completed.

Cold Metal Working Skills

Table IV presents a great variety of activities and exercises that give opportunity to develop the fifty-five basic skills compiled. These skills vary from selecting and planning, mental skills, to the doing skills such as bending, drilling, cutting, welding and shaping.

Hot Metal Skills

It is shown in Table V that the skills in the hot metal area are based on the abilities to identify metals and the working heats of these different kinds of metals. This area is one of the areas that is being affected by changes and new ideas of the age. That is the shifting to the purchase of prepared items rather than make them from the forge; for example, the cold chisel or punch. A change to the use of gas or arc welders to do the welding, heating of metals, and repairing metals.

The author believes, along with the jurors, that there is sufficient justification for teaching and learning the basic skills of hot metal work.

TABLE IV

PROPOSED PROJECTS FOR TEACHING
COLD METAL WORKING SKILLS

Skills	Projects						
	Poultry Catching Hook	Metal Feeder	Shoe Scraper	Machine Belt	Machinery Leveling Jack	Pipe Floor Truck	Funnel
Identifying and distinguishing between kinds of iron and steel	x	x	x	x	x	x	x
Selecting measuring and marking tools	x	x	x	x	x	x	x
Sketching and laying out job	x	x	x	x	x		
Selecting hacksaw and blades		x	x	x	x	x	
Holding work while hacksawing		x	x	x	x	x	
Holding and using hacksaw		x	x	x	x	x	
Selecting cold chisels		x			x	x	
Holding and striking cold chisels		x			x	x	
Cutting metal in vise with cold chisel		x			x	x	
Cutting round stock	x	x		x	x	x	
Cutting with welding equipment		x	x	x	x	x	

TABLE IV (continued)

Skills	Projects						
	Poultry Catching Hook	Metal Feeder	Shoe Scraper	Machine Bolt	Machinery Leveling Jack	Pipe Floor Truck	Funnel
Using bolt cutters	x	x		x	x		
Shaping, bending and straightening stock	x	x	x	x	x	x	x
Removing broken nuts, bolts, and rivets		x					
Removing tight bolts and rivets		x					
Identifying, selecting and using bolts		x	x	x			
Selecting wrenches		x	x	x			
Selecting files	x	x	x	x	x	x	x
Selecting twist drills		x	x		x	x	
Inserting and securing drills in chucks		x	x		x	x	
Marking or center punching	x	x	x	x	x	x	x
Holding metal while drilling		x	x		x	x	
Selecting drilling and threading lubricants		x	x	x	x	x	

TABLE IV (continued)

Skills	Projects						
	Poultry Catching Hook	Metal Feeder	Shoe Scraper	Machine Bolt	Machinery Leveling Jack	Pipe Floor Truck	Funnel
Determining drilling pressure and speeds		x	x		x	x	
Drilling small and large holes		x	x		x	x	
Drilling round stock and pipes		x			x	x	
Selecting types of threads		x		x	x		
Selecting taps and dies		x		x	x		
Tapping holes or nuts				x	x		
Threading rods or bolts		x		x	x		
Cutting sheet metal with snips		x					x
Riveting thin sheet metals		x					x
Soldering sheet metals		x					x

TABLE V

PROPOSED PROJECTS FOR TEACHING
HOT METAL WORKING SKILLS

Skills	Projects							
	Eye Bolt	Cold Chisel	Twisted Gate Hook	Wreck-ing Bar	Shoe Scraper	Lap Link	Hay Hook	Gate Hinge
Identifying metals	x	x	x	x	x	x	x	x
Distinguishing difference between metals	x	x	x	x	x	x	x	x
Selecting hot metal tools		x	x	x	x	x	x	x
Lining a forge	x	x	x	x	x	x	x	x
Estimating amount of stock needed for job	x	x	x	x	x	x	x	x
Measuring and cutting stock	x	x	x	x	x	x	x	x
Heating metals in the forge	x	x	x	x	x	x	x	x
Identifying heats	x	x	x	x	x	x	x	x
Holding and handling stock while working	x	x	x	x	x	x	x	x
Mastering technique of striking with hammer	x	x	x	x	x	x	x	x
Cutting tool steel		x		x				

TABLE V (continued)

Skills	Projects							
	Eye Bolt	Cold Chisel	Twisted Gate Hook	Wreck-ing Bar	Shoe Scraper	Lap Link	Hay Hook	Gate Hinge
Forging tool steel		x		x				
Using gas welding equipment in heating and working hot metals		x	x	x	x	x		
Using gas welding equipment in cutting metals		x	x	x	x	x		x
Tempering punches, chisels, screw drivers and other tools		x		x				

Soldering Skills

The basic skills and a proposed list of projects or jobs that may be used to teach soldering and to develop the abilities to perform the activities in the soldering area are found in Table VI.

Many of the skills to be developed in the area of soldering deals with the preparation of the materials and projects for soldering. Some of the skills deal with servicing and operating the equipment that is used in doing the job of soldering. The skills are found to provide those manipulative activities dealing with the application of solder and the techniques of doing soldering under different conditions.

Gas and Arc Welding Skills

The gas and arc welding projects and jobs proposed to teach the basic skills in these welding areas are found in Tables VII and VIII respectively.

The welding area skills are more numerous than the skills in some other areas of work. There is a great number of mental, manipulative, and mechanical skills to be learned before the actual welding skills can be begun. A great deal of practice is necessary before the learner can actually master the skill of either gas or arc welding successfully. There must be an accumulation of knowledge about the materials and equipment to be used in doing the welding exercises. For example, the student must understand the principles of operation and adjustment of the equipment as well as the principles involved in the use of gas or electricity as the case may be. The student must

TABLE VI

PROPOSED PROJECTS FOR TEACHING
SOLDERING SKILLS

Skills	Projects							
	Solder Funnel	Solder Electric Splice	Solder Tank With Outlet	Repair Leaky Cook Pan	Copper Water-lines Project	Repair Large Hole in Tank	Gutter-ing	Supply Drawers
Identifying different types of solder	x	x	x	x	x	x	x	x
Identifying soldering equipment and tools	x	x	x	x	x	x	x	x
Selecting soldering equipment and tools	x	x	x	x	x	x	x	x
Operating a blowtorch	x	x	x	x	x	x	x	x
Servicing and remedying blowtorch troubles	x	x	x	x	x	x	x	x
Selecting and using electric irons	x	x	x	x		x	x	x
Cleaning and care for electric irons	x	x	x	x		x	x	x
Cleaning and tinning soldering coppers	x	x	x	x		x	x	x
Heating soldering irons or coppers	x	x	x	x		x	x	x

TABLE VI (continued)

Skills	Projects							
	Solder Funnel	Solder Electric Splice	Solder Tank With Outlet	Repair Leaky Cook Pan	Copper Water-lines Project	Repair Large Hole in Tank	Gutter-ing	Supply Drawers
Maintaining proper working temperature in irons and coppers	x	x	x	x		x	x	x
Keeping irons clean while in use	x	x	x	x		x	x	x
Selecting soldering fluxes	x	x	x	x	x	x	x	x
Applying soldering flux	x	x	x	x	x	x	x	x
Preparing and cleaning metal surfaces for soldering	x	x	x	x	x	x	x	x
Applying solder	x	x	x	x	x	x	x	x
Soldering electrical connections		x						
Soldering zinc and galvanized iron	x		x			x	x	x
Solder seams	x		x				x	x
Solder joints	x		x		x		x	x
Solder small holes			x	x			x	x
Solder a patch, repairing large holes and sweating			x		x	x	x	x

TABLE VII

PROPOSED PROJECTS FOR TEACHING
GAS WELDING SKILLS

Skills	Projects					
	Metal Storage Rack	Clothes Line Posts	Weld-ing Table	Repair Broken Plow	Construct Two-Wheel Trailer	Repair Water Valves
Selecting gas welders and equipment	x	x	x	x	x	x
Understanding principles of gas welding	x	x	x	x	x	x
Identifying gases used and function of each	x	x	x	x	x	x
Selecting safety supplies	x	x	x	x	x	x
Connecting oxygen-acetylene regulators	x	x	x	x	x	x
Connecting hose and blow-pipes	x	x	x	x	x	x
Selecting welding tips	x	x	x	x	x	x
Connecting tips	x	x	x	x	x	x
Opening tanks and setting regulators	x	x	x	x	x	x
Lighting tips with flint lighter	x	x	x	x	x	x
Controlling backfire	x	x	x	x	x	x
Controlling flashback	x	x	x	x	x	x
Adjusting blowpipe flame	x	x	x	x	x	x
Selecting welding rods size and type	x	x	x	x	x	x

TABLE VII (continued)

Skills	Projects					
	Metal Storage Rack	Clothes Line Posts	Weld-ing Table	Repair Broken Plow	Construct Two-Wheel Trailer	Repair Water Valves
Selecting rods compatilbe with metal	x	x	x	x	x	x
Selecting flux compatible with metal	x	x	x	x	x	x
Practicing straight flat welds on steel	x	x	x		x	
Making fusion weld without rod	x		x		x	
Making square-butt welds	x	x	x		x	
Making vee-butt welds				x	x	
Making lap welds	x		x	x	x	
Making fillet welds	x	x	x	x	x	
Making corner welds	x		x		x	
Making edge welds	x		x		x	
Making sheet metal welds			x		x	
Welding with bronze				x		x
Welding cast iron				x		
Hard-surfacing				x		
Testing welds	x	x	x	x	x	x
Turning off blowpipes	x	x	x	x	x	x
Cleaning and caring for welding tips	x	x	x	x	x	x

TABLE VII (continued)

Skills	Projects					
	Metal Storage Rack	Clothes Line Posts	Weld-ing Table	Repair Broken Plow	Construct Two-Wheel Trailer	Repair Water Valves
Selecting cutting tips	x	x	x	x	x	
Connecting cutting torch and attaching cutting tips	x	x	x	x	x	
Lighting the cutting torch	x	x	x	x	x	
Adjusting the cutting torch flame	x	x	x	x	x	
Cutting cast iron and steel	x	x	x	x	x	
Cutting holes in metal			x		x	
Shutting off the cutting torch	x	x	x	x	x	
Closing the regulators and tanks	x	x	x	x	x	x

TABLE VIII

PROPOSED PROJECTS FOR TEACHING
ARC WELDING SKILLS

Skills	Projects						
	Welding Table	Electrode Holder	Watering Trough	Light Farm Wagon	Weld Machinery Casting	Weld Plow Shares	Welding Table and Frame
Identifying kinds and types of welders	x	x	x	x	x	x	x
Identifying arc welding equipment and supplies	x	x	x	x	x	x	x
Learning welding terms	x	x	x	x	x	x	x
Care and maintenance of arc welders	x	x	x	x	x	x	x
Selecting safety supplies	x	x	x	x	x	x	x
Selecting proper hoods and glass fronts	x	x	x	x	x	x	x
Selecting arc welding tools	x	x	x	x	x	x	x
Installing arc welders properly	x	x	x	x	x	x	x
Practicing safety in the working area	x	x	x	x	x	x	x
Treating burns and eye damage or burns	x	x	x	x	x	x	x
Identifying electrodes size and type	x	x	x	x	x	x	x
Selecting electrodes suited to welding	x	x	x	x	x	x	x

TABLE VIII (continued)

Skills	Projects						
	Welding Table	Electrode Holder	Watering Trough	Light Farm Wagon	Weld Machinery Casting	Weld Plow Shares	Picnic Table and Frame
Welding in horizontal, vertical and overhead positions	x	x	x	x	x	x	x
Controlling distortion, warping and cracking	x	x	x	x	x	x	x
Preparing metals or work for welding	x	x	x	x	x	x	x
Setting correct amperage	x	x	x	x	x	x	x
Striking and holding an arc	x	x	x	x	x	x	x
Running stringer beads	x	x	x	x			x
Restarting continuous bead	x	x	x	x			x
Making square-butt welds	x		x	x			x
Making vee-butt welds				x	x		
Making lap welds	x		x	x			x
Making fillet welds	x	x	x	x	x		x
Making corner welds	x	x	x	x			x
Making edge welds	x	x	x	x			x
Cleaning and preparing castings for welding					x		
Preheating cast iron					x		

TABLE VIII (continued)

Skills	Projects						
	Welding Table	Electrode Holder	Watering Trough	Light Farm Wagon	Weld Machinery Casting	Weld Plow Shares	Picnic Table and Frame
Controlling heat in the casting					x		
Making cast iron welds					x		
Cooling cast iron welds to prevent cracking					x		
Finishing the cast iron weld, grinding, etc.					x		
Hard-surfacing with electrodes				x		x	
Cutting with the arc welder	x	x	x	x	x	x	x

also learn the different kinds of welds that may be used, and their application to the projects or jobs to be performed. The learner must also gain some knowledge of metals and heats and the welding temperatures of the different metals.

The area of welding is a very popular area of work and study with students. The jurors rated it high in their evaluation of importance. They gave the ninety-two skills listed an average index rating of 85.6, with one hundred as the highest possible rating.

IX. BUILDING AND STRUCTURES AREAS

It is observed that the skills and projects included in these areas are much broader in nature and application than the agricultural shop area skills.

Building Skills

Table IX presents the proposed projects or jobs for teaching the basic skills in the building area.

It is observed that the building skills are smaller in number than the other building and structures area skills but are broad in scope. The skills in this area were given an average weighted figure of 87.9 by the jurors, using the base figure of one hundred.

The building skills offer special attraction to students who look forward to constructing some object that is usable and has value to it.

TABLE IX

PROPOSED PROJECTS FOR TEACHING BUILDING SKILLS

Skills	Projects					
	Hog House	Pump House	Range Shelter	Pole Barn	Milk-ing Parlor	Pig Parlor
Planning layout for buildings or project	x	x	x	x	x	x
Making drawings and sketches	x	x	x	x	x	x
Reading and interpreting the plans	x	x	x	x	x	x
Selecting building materials	x	x	x	x	x	x
Selecting fasteners, nails, bolts and other hardware	x	x	x	x	x	x
Choosing the type of construction	x	x	x	x	x	x
Recognizing and selecting desirable construction practices	x	x	x	x	x	x
Determining quantities and costs of materials	x	x	x	x	x	x

Masonry Skills

The basic skills and projects through which the masonry skills may be taught and developed in a student are found in Table X.

It may be observed that the majority of these skills deal primarily with concrete exercises. Most of these skills, however, will apply to other masonry jobs such as selecting materials to make mortar for laying brick or masonry blocks.

Painting and Glazing Skills

The proposed projects for developing and teaching the basic skills in the painting and glazing areas are found in Table XI and Table XII, respectively.

Many new revolutionary ideas (for example, new latex paints) are coming along which add meaning and interest to these areas.

In the area of glazing most of the skills listed are limited to repair jobs. Although some construction projects are included, other construction projects may be added by the instructor to give more practice in developing these skills.

Fencing Skills

The basic skills included in this area are limited to the mental and technical skills of determining the fencing needs for construction. The fencing skills and a proposed list of projects are found in Table XIII.

The mechanical phase of the fencing program may be included in the teaching program to give the learner the actual practice in doing fence construction work. The possibilities of developing the mechanical skills

TABLE X

PROPOSED PROJECTS FOR TEACHING MASONRY SKILLS

Skills	Projects						
	Portable Shoe Scraper Base	Pig Parlor Floor	Mail Box Post	Construct a Septic Tank	Construct Block Pump House	Build Out-Door Fire-place	Construct Walk
Planning, laying out building forms and footings		x	x	x	x	x	x
Estimating amount of materials needed	x	x	x	x	x	x	x
Figuring cost of masonry jobs	x	x	x	x	x	x	x
Selecting masonry materials	x	x	x	x	x	x	x
Determining mixture conditions of sand and gravel	x	x	x	x	x	x	x
Testing and grading mixture materials	x	x	x	x	x	x	x
Selecting concrete mixture	x	x	x	x		x	x
Construct forms for concrete	x	x	x	x		x	x
Reinforcing concrete	x	x	x	x		x	x
Placing anchor bolts	x	x		x	x	x	
Making expansion joints		x					x
Measuring mixture materials	x	x	x	x	x	x	x

TABLE X (continued)

Skills	Projects						
	Portable Shoe Scraper Base	Pig Parlor Floor	Mail Box Post	Construct a Septic Tank	Construct Block Pump House	Build Out-Door Fire-place	Construct Walk
Mixing materials by hand or machine	x	x	x	x	x	x	x
Placing or pouring concrete	x	x	x	x	x	x	x
Scridding or rough floating concrete	x	x	x	x		x	x
Selecting finishes for concrete, floors, walls and walks	x	x		x		x	x
Finish floating, troweling or brushing	x	x	x	x		x	x
Curing concrete	x	x	x	x		x	x
Protecting fresh concrete from freezing	x	x	x	x	x	x	x
Making concrete watertight		x		x			
Preparing mortar					x	x	
Laying masonry blocks, applying mortar, placing and setting blocks					x	x	
Tooling mortar joints					x	x	

TABLE XI

PROPOSED PROJECTS FOR TEACHING PAINTING SKILLS

Skills	Projects						
	New Small Out Building	Re-paint Building	Farm Machine	Trailer or Truck Bed	Wheel barrow	Loading Chute	Classroom Table or Desk
Estimating area to be painted	x	x	x	x	x	x	x
Calculating amount of paint needed	x	x	x	x	x	x	x
Selecting outside wood paint	x	x		x	x	x	
Selecting inside wood paint	x	x					x
Selecting metal paint	x		x	x	x		x
Selecting supplies and brushes	x	x	x	x	x	x	x
Breaking in new brush	x	x		x			
Determining when to paint	x	x	x	x	x	x	x
Recognizing paint failures	x	x	x	x	x	x	x
Preparing surfaces for painting	x	x	x	x	x	x	x
Priming and use of fillers and sealers	x	x	x	x	x	x	x
Painting new surface	x			x			
Painting with spray gun			x	x			

TABLE XI (continued)

Skills	Projects						
	New Small Out Building	Repaint Building	Farm Machine	Trailer or Truck Bed	Wheelbarrow	Loading Chute	Classroom Table or Desk
Repainting painted surface		x	x		x	x	x
Cleaning and care of brushes	x	x		x	x	x	x
Cleaning and care of spray gun			x	x			
Storing and care of unused paint	x	x	x	x	x	x	x
Storing and care of brushes in storage	x	x		x	x	x	x
Selecting wood preservatives	x	x		x	x	x	
Using wood preservatives	x	x		x	x	x	

TABLE XII

PROPOSED PROJECTS FOR TEACHING GLAZING SKILLS

Skills	Projects				
	Replace Wood Window Frame	Class Picture Frame	Replace Metal Window Pane	Install Outside Door Glass	Install Picture Window
Removing broken glass	x	x	x	x	x
Measuring for glass	x	x	x	x	x
Preparing frame or sash	x	x	x	x	x
Bedding the glass	x	x	x	x	x
Fitting the glass	x	x	x	x	x
Fastening the glass with glazier points or moulding	x	x		x	x
Fastening the glass with clips on metal			x		
Applying putty	x		x		x
Applying caulking			x		x
Painting putty, caulking, or moulding	x		x	x	x

TABLE XIII

PROPOSED PROJECTS FOR TEACHING FENCING SKILLS

Skills	Projects					
	Lawn Screening Fence	Fence Small Hog Lot	Decorative Lawn Fence	Farm Fence (Perm.)	Temporary Farm Fence	Installing Elec. Fence
Planning location and arrangement of fence	x	x	x	x	x	x
Determining the kind of fence to use	x	x	x	x	x	x
Determining quality of fencing material	x	x	x	x	x	x
Deciding kind of end or corner construction for fence	x	x	x	x	x	x
Determining the number of post	x	x	x	x	x	x
Determining the kind of post	x	x	x	x	x	x
Selecting electric fence controller					x	x
Determining types of passageways needed	x	x	x	x	x	x

of fencing is limited only to the time alloted to the study and the location of the school.

Water System Skills

A suggested list of projects for teaching the skills pertaining to water systems are found in Table XV.

The skills and projects found in this area of instruction deal primarily with the planning, selection and managerial phases of the problem. The installation or mechanical phases of this area are found in Table XIV, the plumbing area.

A good job of instruction on the problems of the water system area will lead the student to the establishment of a water system that will be adequate, efficient and serviceable over a long period of time.

Plumbing Skills

The proposed projects for teaching the plumbing skills are found in Table XIV.

The skills found in the plumbing area deal with the selection and use of plumbing equipment and supplies. Practice in the mechanical skills of plumbing are suggested. Many simple jobs, such as installing a water outlet or faucet in the yard of the home, will provide experience in making plumbing connections. It will also provide an opportunity to identify and use common plumbing tools.

Experience in making repairs to the present plumbing systems as well as installing new systems are suggested to give additional practice in developing the plumbing skills.

TABLE XIV

PROPOSED PROJECTS FOR TEACHING
WATER SYSTEM SKILLS

Skills	Projects			
	Pig Parlor	Milking Parlor	Provide Water System for Home	Providing Pasture Tanks
Determining daily water needs	x	x	x	x
Choosing the source of water	x	x	x	x
Determining capacity of pump to use	x	x	x	x
Choosing the pump	x	x	x	x
Determining the type and size of water storage	x	x	x	x
Providing protection for pump and tank	x	x	x	x
Planning pipe insulation	x	x	x	x
Determining the size and kind of pipe	x	x	x	x
Determining the motor wiring and protection	x	x	x	x

TABLE XV

PROPOSED PROJECTS FOR TEACHING
PLUMBING SKILLS

Skills	Projects						
	Pipe Door Handle	Run Water Line	Repair Bathroom Plumbing	Repair Burst Waterline Fittings	Install Sink	Place Pressure Tanking System	Repair Valves or Faucets
Identifying plumbing equipment and supplies	x	x	x	x	x	x	x
Laying out plumbing jobs or projects	x	x			x	x	
Selecting plumbing equipment	x	x	x	x	x	x	x
Selecting pipe	x	x	x	x	x	x	
Selecting pipe fittings	x	x	x	x	x	x	x
Selecting valves and faucets		x	x	x	x	x	x
Measuring pipe	x	x	x	x	x	x	x
Making up pipe and fittings to length	x	x	x	x	x	x	x
Cutting and reaming pipe	x	x	x	x	x	x	x
Threading pipe	x	x	x	x	x	x	x

TABLE XV (continued)

Skills	Projects						
	Pipe Door Handle	Run Water Line	Repair Bathroom Plumbing	Repair Burst Waterline Fittings	Install Sink	Place Pressure Tanking System	Repair Valves or Faucets
Connecting pipe with pipe wrench	x	x	x	x	x	x	x
Repairing leaky valves and faucets			x	x		x	x
Replacing washers			x			x	x
Replacing and repairing water seats			x	x		x	x
Removing fittings			x	x		x	x
Removing and replacing section of defective pipe			x	x		x	
Cleaning out or replacing traps and drains			x	x	x		
Selecting, measuring and using plastic pipe			x	x	x	x	
Connecting plastic pipe to metal pipe or fittings			x	x	x	x	

TABLE XV (continued)

Skills	Projects						
	Pipe Door Handle	Run Water Line	Repair Bathroom Plumbing	Repair Burst Waterline Fittings	Install Sink	Place Pressure Tanking System	Repair Valves or Faucets
Installing and sweating copper and fittings			x	x	x	x	x
Using cast-iron soil pipe			x		x		
Protecting from freezing		x	x	x	x	x	
Thawing frozen pipes and fixtures			x			x	

III. AGRICULTURAL POWER AND MACHINERY

The skills found under the areas of agricultural tractors, agricultural machinery and power transmission are limited to the skills of selection, operation and care, maintenance, adjustments and repairs.

In selecting the principles of adaptation of the equipment to the task to be performed, the farming program planned, soil conditions, and economy of operation and service are a few of the principles or skills that should be developed in the student. Selection is also limited in the project or job list to one machine of a type of operation on the farm. For example, the grain drill was selected from the planting machines. The instructor may substitute more desirable types of machines in the program.

Under care and operation of machinery in these areas, the principles of safety, economy and procedure of operation are three of the major skills that the writer had in mind to be developed in the learner.

Then, in the division of maintenance and repairs, the learner should be led to gain skill and knowledge in recognizing the need of adjustment and repairs. The student should acquire skills sufficient to be able to follow the manual with the machine and make minor and ordinary adjustments and repairs. The major adjustments and repairs, such as overhaul jobs, should be done by trained and experienced mechanics. These areas of work in agricultural power and machinery should be limited to that extent.

Agricultural Tractor Skills

The proposed projects for teaching agricultural tractor skills are found in Table XVI. The suggested list of skills or projects are not limited to any particular type or kind of power unit. The first group of skills of this area is limited, however, to the factors of selection of the power unit or units for a given farm condition.

The second list of skills is limited to the development of those techniques desired in a good operator; such as prechecking, alertness during operation, and safety. Next is found a list of skills to be developed in the learner pertaining to the upkeep of the power unit on job planned for it. The final three groups of skills in the agricultural tractor area deal with those skills of lubrication of the tractor as well as the care, adjustment and repair of the attached parts, or companion parts of the power unit.

Agricultural Machinery Skills

The skills of agricultural machinery and the proposed projects for developing them in a student are found in Table XVII.

The projects selected are suggested to develop the skills in this area and are limited to one piece of equipment under each of the different types of operation found on an average farm. Instructors can substitute or use other types of machinery, common to the community, in their programs to develop the same skills in the student.

The skills listed are divided into groups under selection, operation and care, maintenance, repairs and adjustments.

TABLE XVI

PROPOSED PROJECTS FOR TEACHING AGRICULTURAL TRACTOR SKILLS

Skills	Projects			
	Air-cooled Rotary Tiller	Small Garden Tractor	Gas Engine Tractor	Diesel Engine Tractor
Selecting Tractors as Power Units				
Knowing advantages and disadvantages of each type tractor	x	x	x	x
Identifying types of tractors	x	x	x	x
Original cost	x	x	x	x
Farming program	x	x	x	x
Soil conditions	x	x	x	x
Adaptability of the tractor	x	x	x	x
Economy of operation and service	x	x	x	x
Timeliness of operation	x	x	x	x
Possibilities of doing custom work			x	x
Reliability of dealer and manufacturer	x	x	x	x
Availability of service and parts	x	x	x	x
Techniques and Abilities of the Operator				
Starting and stopping tractor engine	x	x	x	x
Warming engine up before operating	x	x	x	x

TABLE XVI (continued)

Skills	Projects			
	Air-cooled Rotary Tiller	Small Garden Tractor	Gas Engine Tractor	Diesel Engine Tractor
Techniques and Abilities of the Operator (cont.)				
Making minor adjustments while tractor warms up	x	x	x	x
Checking gauges	x	x	x	x
Checking tires before operating		x	x	x
Checking oil and water levels before operating	x	x	x	x
Hitching equipment to the draw bar	x	x	x	x
Hitching rear mounted equipment		x	x	x
Checking tire slippage		x	x	x
Unhitching tractor		x	x	x
Protecting tractor from weather	x	x	x	x
Tractor Operation				
Learning to respect the power of a tractor	x	x	x	x
Carefully mounting tractor		x	x	x
Dismounting tractor with care		x	x	x
Starting tractor motion	x	x	x	x
Operating cautiously	x	x	x	x

TABLE XVI (continued)

Skills	Projects			
	Air-cooled Rotary Tiller	Small Garden Tractor	Gas Engine Tractor	Diesel Engine Tractor
Tractor Operation (cont.)				
Stopping tractor motion	x	x	x	x
Operating on hill or slopes		x	x	x
Avoiding loose clothing	x	x	x	x
Providing safety devices for road travel			x	x
Slowing and stopping tractor at road speeds			x	x
Using right-of-way in road travel			x	x
Making routine adjustments	x	x	x	x
Maintenance, Adjustment and Repairs				
Engine				
Cleaning and adjusting carburetor and air cleaner	x	x	x	x
Cleaning and adjusting spark plugs	x	x	x	
Changing oil and filter		x	x	x
Timing the engine	x	x	x	x
Maintaining the lubrication system	x	x	x	x

TABLE XVI (continued)

Skills	Projects			
	Air-cooled Rotary Tiller	Small Garden Tractor	Gas Engine Tractor	Diesel Engine Tractor
Maintenance, Adjustment and Repairs (cont.)				
Engine (cont.)				
Maintaining the cooling system		x	x	x
Locating and correcting ignition troubles	x	x	x	x
Maintaining the fuel system	x	x	x	x
Inflating and maintaining rubber tires		x	x	x
Transmission and Power Train				
Checking for oil leaks around shafts, tighten retainers	x	x	x	x
Checking for play in the gears		x	x	x
Checking the play and wear in axle bearings		x	x	x
Checking rear-wheel breaks for wear and adjusting or repairing		x	x	x
Remove drain plugs, occasionally to remove moisture and grit	x	x	x	x
Add new lubricants	x	x	x	x
Wheels and Chassis				
Checking wheels for loose rims, lugs, etc.		x	x	x

TABLE XVI (continued)

Skills	Projects			
	Air cooled Rotary Tiller	Small Garden Tractor	Gas Engine Tractor	Diesel Engine Tractor
Maintenance, Adjustment and Repairs (cont.)				
Wheels and Chassis (cont.)				
Removing front wheels, washing and repacking bearings		x	x	x
Checking wear in front wheel bearings, replacing		x	x	x
Inspecting steering mechanism for wear, repairs and adjustments		x	x	x
Checking rubber tires for cuts and bruises and make needed repairs		x	x	x
Hydraulic System				
Checking for low fluid, adding only proper kind or type		x	x	x
Using only non-foaming motor oils if motor oils are used		x	x	x
Using special precautions to keep free of dirt		x	x	x
Storing Tractors				
Servicing gas engine tractors	x	x	x	
Servicing diesel engine tractors				x

TABLE XVII

PROPOSED PROJECTS FOR TEACHING MACHINERY SKILLS

Skills	Projects						
	Plow	Disc Harrow	Culti-vator	Grain Drill	Sprayer	Mower	Harvester
Introduction							
Developing an interest in importance of agricultural machines	x	x	x	x	x	x	x
Understanding what is included in the machinery line	x	x	x	x	x	x	x
Determining the quality of machinery	x	x	x	x	x	x	x
Determining the average life of machinery	x	x	x	x	x	x	x
Determining the life of individual machines	x	x	x	x	x	x	x
Calculating average annual service for machinery	x	x	x	x	x	x	x
Selecting Agricultural Machinery Considering:							
Cost of machine in terms of service	x	x	x	x	x	x	x
First cost of the machine	x	x	x	x	x	x	x
Availability of repairs and service	x	x	x	x	x	x	x

TABLE XVII (continued)

Skills	Projects						
	Plow	Disc Harrow	Culti-vator	Grain Drill	Sprayer	Mower	Harvester
Selecting Agricultural Machinery Considering: (cont.)							
General design of the machine	x	x	x	x	x	x	x
Size of the machine	x	x	x	x	x	x	x
Adaptability of the machine to the work	x	x	x	x	x	x	x
Ease of operation	x	x	x	x	x	x	x
Reliability of the manufacturer and dealer	x	x	x	x	x	x	x
Operation and Care							
Operating the machine correctly at proper speeds	x	x	x	x	x	x	x
Preparing machine for travel on the road	x	x	x	x	x	x	x
Keeping machine clean of accumulating trash				x	x		x
Making routine inspections, adjustments and repairs	x	x	x	x	x	x	x
Storing machinery when not in use	x	x	x	x	x	x	x
Disassembling and inspecting machines	x	x	x	x	x	x	x

TABLE XVII (continued)

Skills	Projects						
	Plow	Disc Harrow	Culti-vator	Grain Drill	Sprayer	Mower	Harvester
Operation and Care (cont.)							
Making immediate repairs and adjustments	x	x	x	x	x	x	x
Maintaining proper tools to adjust and service	x	x	x	x	x	x	x
Identifying machinery parts	x	x	x	x	x	x	x
Replacing or repairing broken parts	x	x	x	x	x	x	x
Assemble and adjust machinery parts	x	x	x	x	x	x	x
Adjusting before going into the field	x	x	x	x	x	x	x
Making adjustments in the field	x	x	x	x	x	x	x
Making adjustments and repairs before season of use	x	x	x	x	x	x	x
Maintenance, Repairs and Adjustments							
Developing ability to follow operator's manual				x	x	x	x
Selecting lubricants and lubricating	x	x	x	x	x	x	x

TABLE XVII (continued)

Skills	Projects						
	Plow	Disc Harrow	Culti-vator	Grain Drill	Sprayer	Mower	Harvester
Maintenance, Repairs and Adjustments (cont.)							
Setting register and lead on mowers						x	x
Calibrating seeding mechanism				x			
Adjusting and repairing feed mechanism				x	x		x
Adjusting furrow openers and covering devices	x			x			
Repairing worn and improperly adjusted clutches				x		x	x
Repair or adjust gears				x	x	x	x
Repairing seed and fertilizer boxes				x			
Determining the center of draft in plows and adjusting hitches	x						
Repairing sprung or broken frames	x	x	x	x	x	x	x
Replacing, repairing or adjusting worn drive chains and sprockets				x	x		x
Removing and replacing worn and loose bearings	x	x	x	x	x	x	x

TABLE XVII (continued)

Skills	Projects						
	Plow	Disc Harrow	Culti-vator	Grain Drill	Sprayer	Mower	Harvester
Maintenance, Repairs, and Adjustments (cont.)							
Cleaning and repairing seeding mechanism			x				
Adjusting or repairing hitches, all types	x	x	x	x	x	x	x
Repairing or replacing worn wheels, rollers, and pulleys	x	x	x	x	x	x	x
Repairing or adjusting cylinders, augers, et cetera				x			x
Repairing chains, belts, pitmans and other power transmitting equipment	x			x	x	x	x
Repairing and adjusting lifting mechanisms	x	x	x	x	x	x	x
Removing or replacing fasteners--bolts, rivets, et cetera	x	x	x	x	x	x	x
Repairing cutting and feeding mechanism	x			x		x	x
Repairing and adjusting separation mechanism				x			x
Replacing canvasses and loose slate				x			x
Cleaning and painting machinery	x	x	x	x	x	x	x

Power Transmission Skills

Proposed projects for teaching power transmission skills are found in Table XVIII.

The skills listed in this area are rather limited in scope. Many of the skills in power transmission pertain to belts and pulleys. Most of the equipment that use belts and pulleys have progressed from the flat belts and pulleys to the vee-belts and vee-grooved pulleys. The principles in this study include both types of belts and pulleys. These same principles and skills will apply to sprockets and chains, also, and may be included in the instructional program.

Many of the heavier types of equipment require and use the power-take-off units for the transmission of power. Certainly the selection, maintenance, operation, and safety principles involved in their use should be included in the instructional program for the purpose of developing skills in the learner.

IV. ELECTRICITY AREA

The area of electricity has come to the place of such importance on the present-day farm and home that it demands special study and consideration.

Electrical problems are demanding increased attention and a place in the vocational agricultural teachers' program. It is felt by those with whom the writer has counselled that more emphasis could and should be given to this area of skills.

TABLE XVIII

PROPOSED PROJECTS FOR TEACHING
POWER TRANSMISSION SKILLS

Skills	Projects			
	Electric Appliances	Tractor	Food Processing Equipment	Crop Harvesting
Recognizing the importance of proper care and use of belts	x	x	x	x
Identifying different types of belts	x	x	x	x
Selecting suitable belts for job	x	x	x	x
Using and maintaining belts	x	x	x	x
Aligning shafts properly	x	x	x	x
Selecting types and sizes of pulleys	x	x	x	x
Figuring pulley speeds	x	x	x	x
Selecting and using power take-off units		x	x	x
Maintaining power transmission equipment	x	x	x	x

Electrical Skills

Electrical skills and a proposed list of projects which may be used to develop these skills in a student are found in Table XIX.

The electrical skills, as listed, lead the student from the planning stages for an electrical system through the selection of tools to the installation, maintenance and repair of common electrical systems and appliances.

The electrical skills are considered practical and important as judged by the rating given to the area as a whole, and to the individual skills by the nine jurors who rated them. The over-all rating given to the thirty-nine skills, using one hundred as the highest possible rating, was 86.9. The lowest rated skill, placing metering equipment, was 75 and the highest rated skill, properly grounding electrical devices, rated 100.

V. SOIL AND WATER MANAGEMENT AREA

The soil and water management area usually is found listed in the programs of most vocational agricultural teachers, but not much time has been spent in developing the skills of the area.

The writer feels that with the increased interest in soil and water by agricultural students and teachers, that the opportune time is here for more emphasis on the skills of soil and water management. Through the development of these skills, with emphasis upon them, much can be accomplished in this area.

TABLE XIX

PROPOSED PROJECTS FOR TEACHING
ELECTRICAL SKILLS

Skills	Projects					
	Electric Extension Cord	Install Brooder House	Install Electric Motor	Repair Appliances	Wiring Project	Installing Electric Fence
Providing electric current		x	x	x	x	x
Determining voltage		x	x	x	x	x
Figuring voltage drop		x	x	x	x	x
Determining amperage ratings		x	x	x	x	x
Figuring amperage on a circuit		x	x	x	x	x
Figuring electrical power units, volts, watts and killowatt hours		x	x		x	x
Becoming familiar with types and phases of electric current		x	x	x	x	x
Selecting and using proper tools and equipment	x	x	x	x	x	x
Selecting proper clothing		x	x	x	x	x
Properly grounding all electrical devices		x	x	x	x	x

TABLE XIX (continued)

Skills	Projects					
	Electric Extension Cord	Install Brooder House	Install Electric Motor	Repair Appliances	Wiring Project	Installing Electric Fence
Calculating electrical needs		x	x	x	x	x
Selecting conductors and insulators	x	x	x	x	x	x
Providing proper service drops		x	x			
Selecting and placing distribution service panels		x	x			x
Determining branch feeders and panels needed		x				x
Selecting adequate wire sizes	x	x	x	x	x	x
Providing and locating fuse boxes or circuit breakers		x	x	x	x	x
Selecting sizes and kinds of circuit protecting equipment		x	x	x	x	x
Identifying the types, sizes and kinds of electric motors			x	x		
Selecting electric motors			x			
Protecting electric motors from overload			x	x		

TABLE XIX (continued)

Skills	Projects: Electric Extension Cord	Install Brooder House	Install Electric Motor	Repair Appliances	Wiring Project	Installing Electric Fence
Lubricating electric motors			x	x		
Cleaning electric motors			x	x		
Selecting and placing fuses		x	x	x	x	x
Selecting and installing switches		x	x	x	x	x
Installing convenience outlets		x	x	x	x	
Repairing electric appliance service cords and fittings	x		x	x		
Learning and making common splices	x	x	x	x		x
Removing insulation from wires	x	x	x	x	x	x
Soldering electrical splices	x	x	x	x	x	x
Using soderless connectors		x	x	x	x	x
Making terminal connections		x				
Using special lugs or connections		x				
Insulating splices and connections	x	x	x	x	x	x

Soil and Water Management Skills

The proposed projects through which the skills of soil and water management may be learned are found in Table XX.

Using one hundred as the highest possible rating, these skills were rated an average weighted index of 81 by the jurors.

TABLE XX

PROPOSED PROJECTS FOR TEACHING SOIL AND WATER MANAGEMENT SKILLS

Skills	Projects						
	Use Level	Stake Out Farm Pond	Control Water on Field	Lay Tile Line	Improve Pasture Moisture Supply	Building a Pond	Constructing Waterways
Developing soil and water management plans		x	x	x	x	x	x
Selecting level and rod	x	x	x	x	x	x	x
Reading and interpreting scales on rod	x	x	x	x	x	x	x
Setting up and adjusting a level	x	x	x	x	x	x	x
Running differential levels	x	x	x	x	x	x	x
Running profile levels	x	x	x	x	x	x	x
Laying out contour lines	x	x	x	x	x	x	x
Laying out contour strips	x	x	x		x	x	x
Controlling gullies		x	x		x	x	x
Determining need for drainage			x	x	x	x	x

TABLE XX (continued)

Skills	Projects						
	Use Level	Stake Out Farm Pond	Control Water on Field	Lay Tile Line	Improve Pasture Moisture Supply	Building a Pond	Constructing Water ways
Planning satisfactory drainage system			x	x	x	x	x
Determining need for irrigation			x		x	x	x
Planning satisfactory irrigation system			x		x		
Learning and using symbols in land mapping	x	x	x	x	x	x	x
Measuring horizontal distances						x	x
Flow and measurement of water						x	x

CHAPTER III

SUMMARY AND RECOMMENDATIONS

I. SUMMARY

It has been the purpose of this study to determine the value of basic skills in the instructional areas included in a course of study in agricultural mechanics, to indicate skills that could be learned in completing selected jobs or projects in agricultural mechanics, and to produce products of value at the same time.

In preparing this study the writer surveyed related textbooks, related studies, and many pamphlets and mimeographed instructional materials. In working up a detailed list of skills in twenty-one areas of agricultural mechanics, the author interviewed a number of vocational agricultural teachers from all sections of the State, several auto and tractor mechanics instructors, and several farm machinery repairmen and mechanics from the Western section of the State. Assistance from professors of the departments of agricultural education and agricultural engineering were secured in preparing, from this accumulation of data, a detailed list of skills for each of the areas. This detailed list of 818 skills were delivered or mailed to a jury of nine vocational agricultural teachers to rate each skill as to its value to students. A copy of this list of skills is found in the appendix. These rated

skills were checked and given a weighted index to determine a list of basic or firm skills to be included in this study. The method used in figuring the weighted index for each skill is discussed on page five of Chapter I. The selected basic skills and the proposed projects for developing these skills are found in Tables II through XX found in Chapter II.

The instructional areas of agricultural mechanics included in this study as shown in Table I were plans, drawings and sketches, tool fitting, woodworking, glazing, painting, cold metal working, hot metal working, sheet metal working soldering, gas welding, arc welding, plumbing, masonry, rope working, leather working, electricity, building, power transmission, soil and water management, agricultural machinery and agricultural tractors.

The number of skills in the areas varied from twelve in power transmission to ninety-four in woodworking as shown in Table III.

The data in Table I show that the average weighted index for the skills in the areas ranged from 28.9 in leather working to 89.9 in agricultural machinery.

It can be expected and assumed that teachers and students in a given location might use different but similar projects to develop the same firm or basic skills in any given area of instruction in the agricultural mechanics program.

II. RECOMMENDATIONS

The information provided in this study should be useful to teachers in determining the instructional areas to include in their agricultural mechanics program of work. It should assist the teachers in determining the basic skills that can and should be developed in the students in each of the instructional areas of agricultural mechanics. This study can also offer ideas, suggestions and bring to mind other projects and jobs that can be done in agricultural mechanics activities and exercises.

The contents of this study should prove especially helpful to new teachers or to teachers who feel that they are not well prepared or experienced in agricultural mechanics program planning and training.

It can help experienced vocational agricultural teachers by giving them a guide to evaluate their present programs in agricultural mechanics and probably sponsor new ideas that will lead to improvement in the development of skills in the different areas.

This study can give guidance and build interest in ambitious students to expand their experiences into more areas and develop and learn more skills. It can give incentive and assistance to all students in selecting exercises to be studied in their agricultural mechanics training programs.

It is assumed that the instructor will have in mind a list of projects or jobs along with a list of skills that is possible to be developed in a given student. The instructor will then be able to direct the student in the selection of projects or exercises that will

developed the desired or needed skills.

It follows, too, that the instructor will need to check or test the student on his accomplishments in developing the desired and needed skills, That is, to test the ability of the student to use the skill in doing a particular job without being conscious that the skill is being used. For example, in woodworking, the use of a hand crosscut saw to cut a piece of material. The student should be able to follow a vertical line unconsciously while sawing the horizontal line across the material. In arc welding, the student becomes so involved in striking and making and arc and maintaining it that he either does or does not get penetration in the weld without thinking about penetration in welding.

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APPENDIX

APPEXDIX

	Very valuable	Valuable	Some value	No value
Plans, Drawings and Sketches				
1. Identifying and selecting drawing equipment				
2. Selecting drawing supplies				
3. Learning and practicing basic procedures in drawing				
4. Learning lining and penciling				
5. Laying out margin and title blocks				
6. Using scales of different types				
7. Lettering and numbering				
8. Drawing different views of objects				
9. Sketching objects				
10. Making freehand sketches				
11. Reading and interpreting plans				
12. Interpreting lines				
13. Reading dimensions				
14. Learning and using symbols of construction materials				
15. Making maps				
16. Learning and using symbols in land mapping				
17. Drawing and blueprinting				
18. Making out or figuring bill of materials				
19. Figuring costs of materials				
20. Figuring board feet				

	Very valuable	Valuable	Some value	No value
Tool Fitting				
1. Identifying tools and parts of tools				
2. Selecting tools				
3. Adjusting tools				
4. Straightening tools				
5. Selecting and using a Power Grinder				
6. Selecting grinding wheels and installing				
7. Truing grinder wheels				
8. Adjusting grinder				
9. Cleaning tools with pumice stone				
10. Cleaning tools with wire brush on grinder				
11. Using files and emory cloth in cleaning tools				
12. Cleaning files				
13. Sharpening an ax or hatchet				
14. Sharpening a cold chisel				
15. Sharpening a center punch				
16. Sharpening an awl or prick punch				
17. Reconditioning punches				
18. Sharpening bolt cutter knives				
19. Sharpening a twist drill				
20. Sharpening and cleaning an auger bit				
21. Sharpening a plane iron or wood chisel				

	Very valuable	Valuable	Some value	No value
Tool Fitting (cont.)				
22. Sharpening shearing-edge tools				
23. Sharpening wood-turning tools				
24. Reconditioning a star drill				
25. Sharpening carbide-tip tools				
26. Sharpening a mower knife				
27. Sharpening a garden hoe				
28. Sharpening a shovel or spade				
29. Sharpening a baler or ensilage-cutter knife and shear plate				
30. Sharpening a rolling coulter				
31. Sharpening a scythe or grass hook				
32. Sharpening a butcher knife				
33. Grinding picks, mattocks, and hoes				
34. Grinding plow shears and cultivator shovels				
35. Sharpening and burnishing a scraper				
36. Fitting wood-cutting saws (Rip, Cross-cut including timber) Jointing Setting, Filing, Side Dressing, and Cleaning				
37. Fitting Circular-Saw Blades (Cross-cut, General Purpose, Rib, Combination, and Dado Heads) Gumming, Cleaning, Jointing, Setting, and Filing				
38. Fitting Band-Saw Blades--Setting and Filing				

	Very valuable	Valuable	Some value	No value
Tool Fitting (cont.)				
39. Sharpening Chain Saws - Cutter-Raker, Round-Hood, Square-Hood				
40. Selecting the file for the chain saw				
41. Fitting ax, hatchet, and hammer handles				
42. Replacing shovel handles				
43. Replacing fork hoe, and rake handles				
44. Replacing pick and mattock handles				
45. Replacing screw driverand wood chisel handles				
Woodworking				
1. Identifying the kinds of lumber				
2. Identifying woodworking tools and equipment				
3. Selection and care for lumber				
4. Figuring bills of materials				
5. Calculating costs of lumber				
6. Figuring board feet				
7. Measuring and marking lumber				
8. Selecting and using marking and measuring devices				
9. Drawing plans, sketches and blue-prints				
10. Reading blueprints, sketches and drawings				
11. Doing layout work on stock material				

	Very valuable	Valuable	Some value	No value
Woodworking (cont.)				
12. Laying out and cutting common rafters				
13. Selecting and using framing square				
14. Laying out a work line				
15. Marking the ridge or upper plumb cut of a rafter				
16. Determining and marking the length of the body of a rafter				
17. Locating and marking the birds mouth of a rafter				
18. Locating and marking off the tail of the rafter				
19. Determining the rise, run and pitch for a rafter				
20. Determining the length of material needed for a rafter				
21. Laying out and cutting stair stringers				
22. Selecting the handsaw				
23. Doing straight sawing with the grain and across the grain				
24. Selecting the saw and doing curve sawing				
25. Using the miter box to saw mitered joints				
26. Sawing with a coping saw				
27. Selecting hammers, wrecking bars and hatchets				

	Very valuable	Valuable	Some value	No value
Woodworking (cont.)				
28. Placing, driving and drawing or pulling nails				
29. Selecting nails, brads and fasteners for wood				
30. Setting nails with a nail set				
31. Using the wrecking bar to draw nails				
32. Learning the types of bolts, hinges, screws, fasteners, etc.				
33. Selecting hardware for woodworking projects				
34. Selecting hand planes used in wood work				
35. Assembling and adjusting planes				
36. Selecting wood chisels				
37. Cutting mortises and other chisel work				
38. Selecting and using bit braces				
39. Selecting woodworking twist drills and auger bits				
40. Boring holes with wood bits				
41. Boring large holes with expansion bit				
42. Making clearance and pilot holes for screws				
43. Countersinking				
44. Driving screws with a screwdriver bit				

	Very valuable	Valuable	Some value	No value
Woodworking (cont.)				
45. Selecting and using the hand or breast drill				
46. Selecting screw drivers				
47. Inserting and driving a wood screw				
48. Selecting wood glue and clamps				
49. Preparing wood for gluing				
50. Applying glue and clamping				
51. Sanding and finishing wood by hand				
52. Selecting fillers and sealers				
53. Selecting and using electric sanders and polishers				
54. Selecting the type and kind of circular saw - Bench and Radial Arm				
55. Identifying the parts of the power saw				
56. Adjusting the tilting and mitering controls of the saw				
57. Adjusting the raising and lowering controls				
58. Selecting and installing circular-saw blades				
59. Selecting dado head or blades				
60. Crosscutting with the power saw				
61. Ripping with the power saw				
62. Rabbeting, grooving, and dadoing with the powersaw				

	Very valuable	Valuable	Some value	No value
Woodworking (cont.)				
63. Cutting miter joints with the power saw				
64. Cutting bevels and angles with the power saw				
65. Selecting and using the portable electric handsaw				
66. Crosscut, bevel and miter cutting with an electric saw				
67. Ripping with a portable electric saw				
68. Cutting rectangular openings with the portable saw				
69. Plowing and dadoing with the portable electric saw				
70. Selecting special blades for the portable saw				
71. Adjusting and setting the portable electric saw				
72. Selecting and using the band saw				
73. Adjusting the band saw				
74. Selecting and installing band saw blades				
75. Cutting angles and circles with the band saw				
76. Selecting a jointer and thickness planer				
77. Adjusting a planer or jointer				
78. Jointing ends of lumber with a jointer				

	Very valuable	Valuable	Some value	No value
Woodworking (cont.)				
79. Using the jointer in beveling, rabbeting and tapering				
80. Smoothing lumber with the jointer				
81. Selecting the jointer head for the jointer				
82. Dressing lumber to same thickness on the thickness planer				
83. Selecting a drill press and attachments				
84. Using the drill press to mortis				
85. Using the press to drill holes in wood				
86. Using the drillpress to do routing, rabbetting and grooving				
87. Selecting turning lathe and attachments				
88. Selecting turning chisels				
89. Centering stock in the lathe				
90. Placing stock in the lathe and adjusting				
91. Turning between centers				
92. Doing faceplate turning				
93. Learning the principles of safety in power tool operation				
94. Practice and master all safety rules				
Glazing				
1. Removing broken glass				
2. Measuring glass				

	Very valuable	Valuable	Some value	No value
Glazing (cont.)				
3. Cutting glass				
4. Preparing frame or sash				
5. Bedding the glass				
6. Fitting the glass				
7. Fastening with glazier points or clips				
8. Estimating the amount of putty needed				
9. Making the putty				
10. Making putty pliable				
11. Painting putty				
12. Painting putty				
13. Applying caluling				
Painting				
1. Estimating the area to be painted				
2. Calculating the amount of paint needed				
3. Selecting outside paint for wood				
4. Selecting outside paint for metal				
5. Selecting interior paints				
6. Estimating the time required for painting				
7. Selecting paint equipment				
8. Selecting paint supplies and brushes				

	Very valuable	Valuable	Some value	No value
Painting (cont.)				
9. Recognizing paint failures				
10. Preparing surfaces for painting				
11. Removing old paint by liquids and torch				
12. Repainting painted surfaces				
13. Priming and use of fillers and sealers				
14. Applying paint to new surfaces				
15. Treating knots				
16. Determining when to paint				
17. Mixing factory-made paint				
18. Applying paint with a brush				
19. Applying paint with a spray-gun				
20. Cleaning and care for brushes after use				
21. Cleaning and care for spray-gun after use				
22. Selecting spray paint equipment				
23. Rolling on paint				
24. Using wood preservatives				
25. Selecting wood preservatives				
26. Mixing and applying whitewash				
27. Preparing surface and applying calcimine				

	Very valuable	Valuable	Some value	No value
Painting (cont.)				
28. Preventing skin on unused paint				
29. Storing paint and brushes				
30. Breaking in a new brush				
31. Selecting and using stains				
32. Selecting and using varnishes				
33. Selecting and using wax products				
34. Selecting and using vinyl-latex paints				
Cold Metalwork				
1. Identifying metals				
2. Distinguishing between different kinds of iron and steel				
3. Selecting marking and measuring tools				
4. Marking and laying out the job to be done				
5. Selecting the hack saw and saw blades				
6. Holding and using the hack saw				
7. Holding the work while hack-sawing				
8. Selecting cold chisels				
9. Holding and striking a cold chisel				
10. Cutting in the vise				
11. Cutting on the anvil				

	Very valuable	Valuable	Some value	No value
Cold Metalwork (cont.)				
12. Cutting thin metal or soft metals				
13. Cutting round stock				
14. Using a slitting chisel				
15. Cutting slots and grooves				
16. Cutting with welding equipment				
17. Removing tight bolts and rivets				
18. Using bolt cutters, selecting and using				
19. Using and selecting cold cutters and lever shears				
20. Shaping, bending and straightening stock				
21. Twisting metal stock				
22. Holding stock				
23. Filing soft metal				
24. Filing cast iron				
25. Smoothing metals by using files and emory cloth				
26. Selecting files				
27. Holding and using files in straight and draw filing				
28. Punching holes				
29. Reaming holes				
30. Selecting drilling machines				
31. Selecting twist drills				
32. Holding metal for drilling				

	Very valuable	Valuable	Some value	No value
Cold Metalwork (cont.)				
33. Inserting and securing drills in chucks and various holding devices				
34. Drilling round stock and pipes				
35. Drilling large holes				
36. Selecting and using drilling lubricants				
37. Marking and drilling a hole				
38. Center punching				
39. Drilling pressure and speeds				
40. Selecting types of threads				
41. Selecting taps and dies				
42. Tapping a hole				
43. Threading a rod or bolt				
44. Threading on metal lathe (external, internal, and left hand)				
45. Identifying, selecting and using bolts				
46. Selecting wrenches				
47. Identifying types of rivets				
48. Selecting rivets and riveting				
49. Cutting rivets to length				
50. Setting rivets				
51. Removing broken bolts, nuts and rivets				

	Very valuable	Valuable	Some value	No value
Cold Metalwork (cont.)				
52. Using power hacksaw				
53. Selecting and replacing power hacksaw blades				
54. Placing stock in power hacksaw and sawing				
55. Operate metal lathe--Horizontal, Turning, Facing, Boring, and Taper				
Hot Metalwork				
1. Identifying metals				
2. Identifying heats				
3. Selecting hot metal working tools				
4. Distinguishing between different metals				
5. Selecting heating equipment				
6. Selecting heating and metal-working supplies				
7. Drafting, drawing and laying out metalworking jobs				
8. Building and starting a forge fire				
9. Maintaining and banking a forge fire				
10. Cleaning a forge and a forge fire				
11. Lining a forge				
12. Estimating the amount of stock needed for the job				
13. Measuring and cutting stock				

	Very valuable	Valuable	Some value	No value
Hot Metalwork (cont.)				
14. Heating metals in the forge				
15. Cutting tool steel				
16. Cutting hot metals using the anvil hardy				
17. Cutting hot metals using hot cutters and chisels				
18. Holding and handling stock while working it				
19. Drawing and pointing hot metals				
20. Squaring round metals or rounding square metals				
21. Upsetting hot metals				
22. Marking hot metals as a guide while working				
23. Bending, straightening and shaping hot metals				
24. Making square and angle bends				
25. Twisting metal stock				
26. Making an eye				
27. Bending flat bars edgeways				
28. Mastering the technique of striking with the hammer				
29. Punching holes in hot metal				
30. Tempering punches, screw drivers, chisels and other tools				
31. Shaping punches and chisels				
32. Tempering knives				

	Very valuable	Valuable	Some value	No value
Hot Metalwork (cont.)				
33. Forging tool steel				
34. Heat treating tool steel				
35. Hardening, tempering, and annealing steel				
36. Forge welding				
37. Selecting Fluxes for welding				
38. Scarfing the irons for welding				
39. Heating the irons for welding				
40. Setting or getting the irons together in welding				
41. Finishing the weld				
42. Using the carbon-arc in heating and working metals				
43. Using gas welders and equipment in heating and working hot metals				
44. Using gas welders and equipment in cutting metals				
45. Using arc-welding equipment in heating, cutting and shaping metals				
Sheet Metalwork				
1. Identifying sheet metal types and kinds				
2. Selecting sheet metal equipment				
3. Selecting sheet metal supplies				

	Very valuable	Valuable	Some value	No value
Sheet Metalwork (cont.)				
4. Selecting sheet metal tools				
5. Laying out sheet metal projects or jobs				
6. Measuring and marking sheet metals				
7. Cutting sheet metals with tin snips				
8. Cutting sheet metals with chisels				
9. Cutting sheet metals on square shears				
10. Cutting heavy sheet metals - with chisels - with gas welding equipment - with arc welding equipment				
11. Punching holes in sheet metals				
12. Drilling holes in sheet metals				
13. Flange sheet metals				
14. Marking, bending, and shaping sheet metals - by hand -with bar folder - with bending brake				
15. Bending broad pieces of sheet metals				
16. Rolling sheet metals				
17. Making lap seams				
18. Making grooved seams				
19. Hemming sheet metals--single and double				

	Very valuable	Valuable	Some value	No value
Sheet Metalwork (cont.)				
20. Wiring edges				
21. Burring an edge				
22. Making a cylinder or cone				
23. Making a cylinder bottom				
24. Joint making in sheet metals				
25. Folding and forming joints in sheet metal				
26. Crimping sheet metals				
27. Using a rivet set				
28. Cutting rivets to length				
29. Riveting thick sheet metals				
30. Riveting thin sheet metals				
31. Cutting large holes in sheet metals				
32. Making sheet metal riveted joints				
33. Making sheet metal welded joints - gas welders - arc welders				
34. Making a riveted lap joint				
35. Making a hook joint				
36. Smoothing sheet metal with files and emory cloth				
37. Smoothing sheet metals with power sanders				
38. Leading sheet metals				
39. Soldering sheet metals				

	Very valuable	Valuable	Some value	No value
Soldering				
1. Identifying the different types of solder				
2. Identifying soldering equipment and tools				
3. Selecting soldering tools and equipment				
4. Selecting soldering coppers				
5. Selecting soldering fluxes				
6. Operating a blowtorch				
7. Servicing and remedying blowtorch troubles				
8. Servicing electric soldering irons				
9. Cleaning and tinning soldering coppers				
10. Heating the soldering iron or coppers				
11. Keeping the soldering irons at proper working temperatures				
12. Keeping soldering irons clean while in use				
13. Preparing and cleaning metal surfaces for soldering				
14. Soldering small holes in metal containers				
15. Soldering a patch, repairing large holes				
16. Soldering joints				
17. Soldering seams				
18. Soldering or repairing tubing				

	Very valuable	Valuable	Some value	No value
Soldering (cont.)				
19. Applying solder				
20. Applying fluxes				
21. Soldering electric connections				
22. Using electric soldering irons				
23. Cleaning and caring for electric soldering irons				
24. Using arc welders to do soldering jobs				
25. Using gas welders to do soldering jobs				
26. Soldering different kinds of metals --				
Tin plating				
Soldering zinc and galvanized iron				
Soldering copper and copper alloys				
Sweating copper fitting on tubing				
Soldering lead				
Soldering black iron and steel				
Soldering stainless steel				
Soldering aluminum and aluminum alloys				
Soldering and leading sheet metal				

	Very valuable	Valuable	Some value	No value
Gas Welding				
1. Selecing gas welders and equipment				
2. Understanding the principles of gas welding				
3. Identifying the gases used and the function of each in welding				
4. Selecting safety supplies				
5. Connecting oxygen-acetylene regulators				
6. Connecting hose and blowpipes				
7. Selecting welding tips				
8. Connecting tips				
9. Lighting tips with flint lighter				
10. Controlling backfire				
11. Controlling flashback				
12. Adjusting flame				
13. Turning off the torch				
14. Cleaning and caring for welding tips				
15. Practice in straight flat welding on steel				
16. Fusion welding without a rod				
17. Making square butt welds				
18. Making vee-butt welds				
19. Making lap weld				
20. Making fillet welds				

	Very valuable	Valuable	Some value	No value
Gas Welding (cont.)				
21. Making corner welds				
22. Making edge welds				
23. Welding sheet metals				
24. Padding and build up welds				
25. Selecting welding rods as to size and types				
26. Selecting welding rods compatiable with metal being welded				
27. Selecting welding fluxes compatiable with metal being welded				
28. Welding bronze in flat, horizontal, and vertical positions				
29. Welding cast iron				
30. Hard-surfacing				
31. Testing welds				
32. Selecting cutting tips				
33. Connecting cutting torch and attaching cutting tip				
34. Cutting cast iron and steel				
35. Cutting holes with the cutting torch				
36. Soldering with the gas welder				
37. Adjusting the cutting torch				
38. Lighting the cutting torch				
39. Shutting the cutting torch off				
40. Closing the regulators and tanks				

	Very valuable	Valuable	Some value	No value
Arc Welding				
1. Identifying kinds and types of arc welders				
2. Identifying arc welding equipment and supplies				
3. Selecting safety supplies				
4. Selecting proper hoods and glass fronts				
5. Selecting arc-welding tools				
6. Installing arc welder properly				
7. Practicing safety in the working area				
8. Treating burns especially eye burns				
9. Care and maintenance of arc welder				
10. Preparing metals or work for welding				
11. Controlling distortion, warping and cracking				
12. Setting correct amperage				
13. Striking and holding an arc				
14. Running stringer beads				
15. Restarting continuous bead				
16. Running weave bead				
17. Do padding				
18. Make square-butt weld				
19. Make vee-butt weld				

	Very valuable	Valuable	Some value	No value
Arc Welding (cont.)				
20. Make lap weld				
21. Make fillet welds				
22. Make corner weld				
23. Make edge weld				
24. Make sheet metal weld				
25. Weld high-carbon and low-alloy steel				
26. Welding in horizontal, vertical and overhead positions				
27. Selecting electrodes as to size and types				
28. Selecting electrodes for type of metal being welded				
29. Using carbon-arc torch				
30. Making cast iron welds				
31. Preheating cast iron and cooling				
32. Clean and preparing casting for welding				
33. Controlling heat in the casting				
34. Finishing a cast iron weld				
35. Making a pipe weld				
36. Solder with arc welder				
37. Cutting with arc welder				
38. Grooving with arc welder				
39. Piercing, gouging, scarfing and beveling with arc welder				

	Very valuable	Valuable	Some value	No value
Arc Welding (cont.)				
40. Hard-surfacing with electrodes				
41. Hard-surfacing with powder				
42. Brazing with arc welder				
43. Learning welding terms				
Plumbing				
1. Identifying plumbing equipment and supplies				
2. Selecting plumbing equipment				
3. Selecting pipe				
4. Selecting pipe fittings				
5. Selecting valve and faucets				
6. Removing fittings				
7. Cutting gaskets				
8. Measuring pipe				
9. Making up pipe and fitting to length				
10. Cutting and reaming pipe with cutter and hacksaw				
11. Threading pipe				
12. Connecting pipe with a pipe wrench				
13. Protecting plumbing from freezing				
14. Thawing frozen pipes and other plumbing fixtures				
15. Laying out plumbing jobs or projects				

	Very valuable	Valuable	Some value	No value
Plumbing (cont.)				
16. Repairing leaky faucets and valves				
17. Replacing washers				
18. Replacing and repairing water seats				
19. Facing a valve seat				
20. Stopping leakage aroung valve and faucet stems				
21. Removing and replacing section of defective pipe				
22. Installing sink and drain				
23. Repairing flushing tank - adjusting float				
24. Replacing leaky floats				
25. Replacing and adjusting leaky inlet valve				
26. Replacing defective ball and lift wire				
27. Cleaning or replacing dirty ball or seat				
28. Replacing defective overflow or stand pipe				
29. Install simple shower				
30. Cleaning out or replacing traps and drains				
31. Using force cup or plumbers friend				
32. Using flexible closet auger or tape				

	Very valuable	Valuable	Some value	No value
Plumbing (cont.)				
33. Using water pressure to free choked or dirty drains and traps				
34. Using cast iron soil pipe				
35. Cutting soil pipe				
36. Making up joints and laying soil pipe				
37. Packing joints				
38. Leading joints				
39. Caulking lead				
40. Taking care of automatic water systems				
41. Using copper tubing, installing and sweating joints				
42. Selecting, measuring and using plastic pipe				
43. Connecting plastic pipe to steel pipe and fittings				
44. Installing or setting bathroom fixtures				
45. Installing hot water heater				
46. Installing septic tanks				
47. Care and maintenance of septic tanks				
48. Repairing water pumps				
49. Estimating costs in plumbing jobs and projects				

	Very valuable	Valuable	Some value	No value
Masonry				
1. Selecting masonry materials				
2. Determining mixture conditions of sand and gravel				
3. Selecting concrete mixtures				
4. Testing and grading concrete mixture materials				
5. Estimating the amount of materials needed				
6. Figuring costs in masonry jobs				
7. Preparing, washing and sifting, sand and gravel				
8. Measuring materials				
9. Mixing the materials, by hand or machine				
10. Constructing forms				
11. Reinforcing concrete				
12. Making expansion joints				
13. Planning, laying out, building forms and pouring footings				
14. Placing anchor bolts and screws				
15. Placing concrete				
16. Finishing concrete, walls, floors, and walks				
17. Floating concrete in the rough or scridding				
18. Finish floating, troweling or brushing				

	Very valuable	Valuable	Some value	No value
Masonry (cont.)				
19. Curing concrete				
20. Protecting fresh concrete from freezing				
21. Removing forms from concrete				
22. Making mixing box and or platform for hand mixing				
23. Drilling holes in concrete, by star drilling or carbon tips				
24. Coloring concrete				
25. Mixing and puring colored concrete				
26. Making concrete water tight				
27. Preparing mortar				
28. Laying masonry blocks, applying mortar, placing and setting units				
29. Selecting masonry units, size and type				
30. Tooling mortar joints				
31. Making sills and lintels				
32. Placing and anchoring sills and lintels				
33. Anchoring roof to concrete masonry walls				
34. Making and plumbing corners				
35. Water proofing walls				
36. Tieing walls				
37. Laying brick				

	Very valuable	Valuable	Some value	No value
Rope Work				
1. Selecting rope as to types and grades				
2. Caring for rope				
3. Storing rope				
4. Coiling, using and handling rope				
5. Securing the ends of rope by whipping				
6. Making a crown or end splice				
7. Tying knots:				
- Square knot				
-Sheet bend or Weaver's knot				
- Bowline				
- Bag or Miller's knot				
- Slip knot				
- Manger knot				
8. Making hitches:				
- Timber hitch				
- Half hitch				
- Clove hitch				
- Pipe hitch				
- Scaffold hitch				
- Sheepshank				
9. Splicing rope:				
- Short splice				
- Long splice				
- Loop splice				
- Eye splice				
- Blackwall splices, single and				
10. Making a rope halter				
11. Reeving block and tackle				
12. Repairing broken strands				
13. Making livestock tackles				

	Very valuable	Valuable	Some value	No value
Leather Work				
1. Identifying leather materials and tools				
2. Selecting leather				
3. Selecting leather working tools				
4. Marking and cutting leather				
5. Working out patterns				
6. Skiving edges for splices, etc.				
7. Making waxed thread				
8. Attaching needles				
9. Punching holes				
10. Using the sewing awl				
11. Stitching leather				
12. Lacing leather				
13. Fastening leather with rivets -brads -eyelets -snaps -fasteners				
14. Attaching snaps and buckles				
15. Making leather repairs				
16. Making a stitched splice				
17. Making a riveted splice				
18. Cleaning leather				
19. Polishing leather				
20. Oiling leather				
21. Selecting leather belts				

	Very valuable	Valuable	Some value	No value
Leather Work (cont.)				
22. Selecting other type belts				
23. Caring for leather belts, and other belts				
24. Lacing leather belts, and other type belts				
25. Determining pulley sizes and speeds				
26. Lagging pulleys				
Electricity				
1. Providing electric current				
2. Determining voltage				
3. Figuring voltage drop				
4. Determining amperage ratings				
5. Figuring amperage on a circuit				
6. Figuring electrical power units (Volts, watts and Killowatt hours)				
7. Reading electric meters				
8. Figuring electric bills				
9. Becoming familiar with types and phases of electric current				
10. Selecting and using proper tools and equipment				
11. Selecting proper clothing when doing electrical work				
12. Properly grounding all electrical devices				

	Very valuable	Valuable	Some value	No value
Electricity (cont.)				
13. Calculating electrical needs				
14. Selecting conductors and insulators				
15. Providing proper service drops				
16. Placing metering equipment				
17. Selecting and placing distribution service panels				
18. Determining branch feeders and panels needed				
19. Providing circuits needed for appliances and service				
20. Selecting adequate wire sizes				
21. Providing and locating fuse boxes or circuit breakers				
22. Selecting sizes and kinds of circuit protecting equipment				
23. Identifying the types, sizes and kinds of electric motors				
24. Selecting electric motors for the job to be done				
25. Protecting electric motors from overload				
26. Lubricating electric motors				
27. Cleaning electric motors				
28. Replacing fuses				
29. Resetting circuit breaker				
30. Replacing switches				

	Very valuable	Valuable	Some value	No value
Electricity (cont.)				
31. Replacing convenience outlets				
32. Repairing electric appliance service cords and fittings				
33. Learning and making the common splices				
34. Removing insulation from wires				
35. Soldering the splice				
36. Using solderless connectors				
37. Insulating the splice				
38. Making terminal connections				
39. Using special lugs or connectors on larger wire connections				
Buildings				
1. Planning the farmstead				
2. Making drawings and sketches				
3. Reading and interpreting drawings and sketches				
4. Securing and interpreting blueprints				
5. Selecting building materials				
6. Selecting fasteners (nails, bolts screws and other hardware)				
7. Choosing the type of construction				
8. Recognizing and selecting desirable construction practices				
9. Determining quantities and costs of materials				

	Very valuable	Valuable	Some value	No value
Buildings (cont.)				
10. Planning location and arrangement of fences				
11. Determining the kind of fence to use				
12. Determining quality of fencing materials				
13. Selecting an electric fence controller				
14. Deciding kind of end or corner construction to use for fencing				
15. Determining the number and kind of fence post				
16. Determining types of passageways needed in fencing				
17. Determining daily water needs				
18. Choosing the source of water to use				
19. Determining capacity of pump to use				
20. Choosing the type of pump to use				
21. Determining the type and size of water storage to use				
22. Selecting accessories to use with the various pumps				
23. Choosing the protection to give water sources				
24. Deciding the protection to provide for pump and tank				
25. Planning pipe insulation to make				
26. Determining size and kind of pipe to use				
27. Deciding wiring and motor protection to use				

	Very valuable	Valuable	Some value	No value
Power Transmission				
1. Recognizing the importance of proper care and use of belts				
2. Identifying different types of belts				
3. Selecting suitable belts for the job				
4. Using and maintaining belts				
5. Splicing belts				
6. Aligning shafts properly				
7. Selecting types and sizes of pulleys				
8. Figuring pulley speeds				
9. Selecting sprockets and chains				
10. Selecting and using power take-off units				
11. Selecting other power transmission equipment				
12. Maintaining power transmission equipment				
Soil and Water Management				
1. Developing soil and water management plans				
2. Learning to use equipment in soil and water management - Selecting level and rod - Reading and interpreting scales on the rod - Setting up and adjusting a level - Differential and profile leveling				

	Very valuable	Valuable	Some value	No value
Soil and Water Management (cont.)				
3. Drawing and interpreting topographical maps				
4. Laying out terrace lines				
5. Constructing and maintaining terraces and outlets				
6. Laying out contour lines				
7. Laying out contour strips				
8. Controlling gullies				
9. Determining the need for drainage				
10. Planning a satisfactory drainage system				
11. Determining the need for irrigation				
12. Planning a satisfactory irrigation system				
13. Maintaining a drainage or irrigation system				
Machinery				
Introduction				
1. Developing an interest in the importance of agricultural machinery				
2. Understanding what is included in the machinery line				
3. Knowing the history and development of machinery				
4. Determining the quality of machinery				

	Very valuable	Valuable	Some value	No value
Machinery (cont.)				
Introduction (cont.)				
5. Determining the average life of machinery				
6. Determining the life of an individual machine				
7. Calculating the average annual service of machinery				
Selecting Agricultural Machinery Considering--				
8. Cost of the machine in terms of service, etc., rather than comparative costs				
9. First cost of the machine				
10. Availability of repairs and service				
11. General design of the machine				
12. Size of the machine				
13. Adaptability to the work				
14. East of operation				
15. Reliability of the manufacturer and dealer				
Care and Operation				
16. Operating the machine correctly at proper speeds				
17. Preparing machine for travel on the road				
18. Keeping the machine clean of accumulating trash				

	Very valuable	Valuable	Some value	No value
Machinery (cont.)				
Care and Operation (cont.)				
19. Making routine inspections for adjustments and repairs				
20. Storing machinery when not in use				
21. Disassembling and inspecting machines as needed				
22. Making repairs and adjustments immediately when discovered there is a need				
23. Maintaining proper tools to adjust and service machines				
24. Identify machinery parts				
25. Repair and replace broken parts				
26. Assemble and adjust machinery parts				
27. Adjusting before going to the field				
28. Adjusting in the field				
29. Making repairs before season of use				
Maintenance, Repairs and Adjustments				
30. Developing the ability to follow operator's manual				
31. Selecting lubricants and lubricating machinery				
32. Setting register and lead on mowing machines				
33. Calibrating seeding mechanism				

	Very valuable	Valuable	Some value	No value
Machinery (cont.)				
Maintenance, Repairs and Adjustments (cont.)				
34. Adjusting and repairing feed mechanism				
35. Adjusting furrow openers and covering devices				
36. Repairing worn and improperly adjusted clutches				
37. Repairing or adjusting gears that fail to mesh				
38. Replace or repair worn pauls and drive wheels				
39. Repair leaks in seed and fertilizer boxes				
40. Finding center of draft in plows and adjusting hitches				
41. Repair sprung frames or broken frames and parts				
42. Replace, repair or adjust worn drive chains and sprockets				
43. Removing and replacing worn and loose bearings				
44. Cleaning and repairing seeding mechanism				
45. Adjusting hitches or repairing hitches all machinery				
46. Repairing or replacing worn wheels, rollers, sprockets, and pulleys				
47. Repairing or adjusting cylinders, augers, etc.				
48. Repairing chains, belts, pitmans and other power transmitting equipment				

	Very valuable	Valuable	Some value	No value
Machinery (cont.)				
Maintenance, Repairs and Adjustments (cont.)				
49. Repairing and adjusting lifting mechanisms				
50. Repairing, removing and replacing fasteners of any type--bolts, rivets, etc.				
51. Repairing cutting and feeding mechanisms				
52. Repairing and adjusting separation mechanism				
53. Replacing torn canvasses and loose slats				
54. Cleaning machinery thoroughly				
55. Painting machinery				
Agricultural Tractors				
Selecting Tractors				
1. Knowing the advantages and disadvantages of each type tractor				
2. Identifying the types of tractors				
Selecting the Tractor as a Power Unit Considering:				
3. Original cost				
4. Farming program				
5. Soil conditions				
6. Adaptability of the tractor				
7. Economy of operation and servicing				

	Very valuable	Valuable	Some value	No value
Machinery (cont.)				
Selecting the Tractor as a Power Unit Considering (cont.)				
8. Timeliness of operations				
9. Possibilities of doing custom work				
10. Reliability of manufacturer and dealer				
11. Availability of securing service, parts and repairs				
Operating a Tractor				
12. Learning to respect the power of a tractor				
13. Operator mounting a tractor carefully				
14. Operator dismounting mannerisms and making adjustments				
15. Starting tractor movement				
16. Operating tractor cautiously				
17. Operating tractor on slopes or hills				
18. Stopping tractor movement				
19. Checking clothing for safe operation				
20. Providing safety devices for road travel				
21. Slowing and stopping tractor at road speeds				
22. Using right-of-way in road travel				
23. Making routine adjustments				

	Very valuable	Valuable	Some value	No value
Machinery (cont.)				
Techniques and Abilities of the Operator				
24. Starting and stopping tractor engine				
25. Warming engine up before operating				
26. Making minor adjustments while engine is warming up				
27. Checking gauges				
28. Checking tires before operating				
29. Checking oil and water levels before operating				
30. Hitching equipment to the draw bar				
31. Hitching rear mounted equipment				
32. Checking tire slippage				
33. Unhitching tractor from equipment				
34. Protecting tractor from weather				
Maintenance, Adjustment, and Repairs --Engine				
35. Cleaning and adjusting carburetor and air cleaner				
36. Cleaning and adjusting spark plug				
37. Changing oil and oil filter				
38. Timing the engine				
39. Cleaning combustion chamber and valve				

	Very valuable	Valuable	Some value	No value
Machinery (cont.)				
Maintenance, Adjustment, and Repairs --Engine (cont.)				
40. Maintaining the lubrication system				
41. Maintaining the cooling system				
42. Locating and correcting ignition troubles				
43. Maintaining the fuel system				
44. Inflating and maintaining rubber tires				
--Transmission and Power Train				
45. Checking for oil leaks around shafts and tightening retainers				
46. Checking play in the gears				
47. Checking the play and wear in axle bearings				
48. Checking rear wheel brakes for wear and adjusting				
49. Checking belt pulley bearing and drive gear for wear				
50. Remove drain plugs, occasionally remove moisture and grit				
51. Add new lubricants				
--Wheels and Chassis				
52. Check wheels for loose or broken and bent spokes				
53. Checking wheels for loose rims, lugs and other parts				

	Very valuable	Valuable	Some value	No value
Machinery (cont.)				
Maintenance, Adjustment, and Repairs --Wheels and Chassis (cont.)				
54. Reverse rubber tires each year				
55. Remove front wheels yearly, wash and repack bearings				
56. Check wear in front wheel bearings and replace if necessary				
--Agricultural Tractors				
57. Inspect steering mechanism for wear, repairs and adjustments				
58. Check fenders, platform, draw bar, and seat for adjustments, etc.				
59. Check rubber tires for cuts and bruises and have needed repairs				
--Hydraulic System				
60. Check for low fluid and add only the proper kind or type				
61. Use only non-foaming motor oils if motor oil is used				
62. Using special precautions to keep free of dirt				
-Storing Tractors				
63. Gas engine tractors				
64. Diesel engine tractors				