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A Study of the Farm Shop Curriculum

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A STUDY OF THE FARM SHOP CURRICULUM

with

Certain Recommendations for the Selection

of the Content of Such a Course

by

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PART I

INTRODUCTION

The building of a course to teach the principles underlying mechanical operations on farms has been and still is under criticism, and probably will continue to be for some time to come; but it is such an important branch, or part, of farming that it was thought that any contribution which could be made to assist in a better understanding of the problem would be worth while, hence this study.

Purpose of Study

The purpose of this study, then, is to determine if possible whether the Farm Shop course as now organized and administered is giving as much service to the farmers as it should, and if it is not, to point out the instances where the data collected for this study indicate that a change for the better might be made.

The Farm Shop course in the South Dakota State Plan was used as a model because the inquiries, analyzed in Part III of this study, which were received at the office of the Agricultural Engineering Department of South Dakota State College, were almost entirely from South Dakota farmers or farm owners, and a great number of those received from outside the state were from absentee landlords.

The South Dakota State Plan for Vocational Agriculture is outlined as follows, only the main topics being given:

1st year - Mechanical Drawing, Woodwork, Tin work, Rope work, Harness work, Belt work, Painting.

2d year - Woodwork, Concrete work, Window repair, Farm machinery and motors.

3d year - Farm Machinery, Motors and Tractors, Farm buildings.

4th year - Surveying and drainage.

This plan designates this kind of work, "Farm Shop". We are not concerned primarily with the kind of course such a name implies. We are concerned with something more comprehensive, so hereafter in this study, our curriculum will be referred to as a Farm Mechanics Curriculum. In order to have a clearer idea of the difference between Farm Shop and Farm Mechanics we will define Farm Mechanics as: that part of farm operation which covers a knowledge of the construction of all farm equipment or buildings and the repair of all farm buildings, machinery appliances, etc., which can be done either in the shop or in the open with the tools the average farmer will have at hand, it being understood that these tools be more numerous than a hammer and a saw. In fact the average or better farm should have a variety of tools probably only stopping short of power tools. Farm Shop is but a phase of Farm Mechanics even though a good many of the manipulative processes of Farm Mechanics may be done in a shop.

This definition is a combination of definitions or statements on the subject as found in Georgia Vocational Education Bulletin #18, Minnesota Educational Monograph #4, Roehl, Federal Board Miscellaneous Bulletin 118, Tennessee Bulletin #2, the present South Dakota Supervisor and others, with Farm Mechanics substituted for Farm Shop in order to imply the larger field, knowledge first, then manipulation.

Since we have made clear the idea as to the purpose of the curriculum it will be well to define that word, curriculum, and see how it covers the phrase, Farm Mechanics.

In "The American Secondary School" Koos says that a curriculum is a complete outline of work in a given field or subject, and that a program of studies is the entire offering of subjects and courses in a given school including its plan of organization and other features of its administration.

In "The Curriculum", Bobbitt says: "From the Latin, curriculum as applied to education is that series of things which children and youth must do and experience by way of developing abilities to do things well that make up the affairs of adult life; and to be in all respects what adults should be. The Curriculum may, therefore, be defined in two ways: (1) It is the entire range of experiences, both directed and undirected, concerned in unfolding the abilities of the individual; or (2) it is the series of consciously directed training experiences that the schools use for completing and perfecting the unfoldment."

Having defined Farm Mechanics and Curriculum, it will be necessary to attempt to define Farm Mechanics Curriculum, and, combining the two definitions given above, we can say that a Farm Mechanics curriculum is one which consists of a series of consciously directed training experiences that the high school agricultural departments use for completing and unfolding the knowledge necessary for the ordinary construction and repair of all farm buildings, equipment, machinery appliances, etc., which can be done either in the shop or in the open with the tools the average farmer will have at hand.

This study, then, is concerned with a curriculum as defined above and is an attempt to determine whether the present South Dakota Farm Mechanics curriculum measures up to this definition, and what further studies will have to offer.

In looking over the brief outline on page 1 of this section, are there any general heads lacking or does it cover the entire range? We do not find electricity listed. Does the Plan allot too much time to some subjects and not enough to others? We find woodwork given for parts of two years. Does it give problems or projects which had better be left out? Under woodwork, page 18 of the State Plan, we find a milk stool listed. Is too much time devoted to manipulation and not enough to informational pursuits? The Plan gives us no information on this subject but we can draw a general inference that such is the case. Does the title of the course "Farm Shop" cause a psychological attitude in favor or manipulation? This is probably true because shop is thought of as a place where something is done and the boy takes no heed of necessary information.

Then according to our definition of a Farm Mechanics curriculum the course outlined in the South Dakota State Plan is not a curriculum and this study based on the data secured will justify some change in its make-up.

Source of Data and Methods

In order to determine these points and establish the status of the present curriculum it was necessary to secure sufficient data on the problem so that it can be approached from several angles. For this purpose four sources of data have been selected.

1. Literature on the Problem, consisting of bulletins which give results of surveys on Farm Mechanics content in other states in order that a partial knowledge may be obtained of methods used and results procured elsewhere. These bulletins were analyzed for method of approach, object, and results. It was found that the survey method is the best method of attack.

2. An analysis of the Farm Mechanic inquiries at the Office of the Agricultural Engineering Department of South Dakota State College made to obtain a knowledge of the problems which are troubling the farmers. The inquiries analyzed were a sampling of those received for the fiscal year 1928-1929. It was found that the farmers are concerned about a knowledge of things which covers a wide "field" from waxing thread for harness repair to setting up corn pickers.

3. Farm Shop and Farm Mechanics books by representative authors. These books were analyzed and compared by per cent of subject content. It was found that most of them are Farm Shop books and that the authors did not have our definition of a Farm Mechanics curriculum in mind when compiling them.

4. Projects gleaned from the inquiries, from the books, and from actual practice in the Hockings High School Agriculture Department. These were analyzed for difficulty by sending questionnaires to instructors

and experts in Farm Mechanics to have them scored, and the results were tabulated for comparison. It was found that some of them are considered very easy while some are considered quite difficult, probably too difficult for high school work. However, a good gauge for determining the difficulty of the inquiries and other projects is obtained.

The data collected from these sources are tabulated and analysed more fully in Parts II, III, IV and V while Part VI takes up in more detail the conclusions arrived at, and an attempted solution of the Problem where any has been found to exist.

PART II

LITERATURE IN THE FIELD

The matter of the Curriculum has been, and probably always will be, a fertile field of study and the specific subject, Farm Shop or Farm Mechanics, has also been the cause of much discussion and many writings so it was thought advisable to review several of the recent studies of this nature in order that the diversity of methods of approach could be more clearly understood.

1. "A Suggested Course of Study in Farm Mechanics Based on the Opinions of Five Hundred Iowa Farmers," by H. A. Sharp.

This writer attacked the problem by sending questionnaires to 1800 Iowa Farmers. These questionnaires listed "168 jobs under Woodworking, Electric Wiring, Harness, Forge, Concrete, Plumbing, Wood Finish, Gasoline Engines, Rope, Tools (Sharpen) Sheet Metal, Glass, Repair Machinery, 'which might be common to farmers or jobs which are now being taught in high school shop departments'" and the farmers were requested to mark them according to their importance, as jobs having a most direct bearing on the ordinary repair and construction work on the farm. Four columns, Important—Average—Little Value—Do not teach, were provided for these markings.

Over 600 of these papers were returned fully marked but only the first 500 were used for tabulation and from them Mr. Sharp was able to make up three groups of jobs under the different heads, woodwork, metal work, etc. which the farmers considered important, less important and of so little value that the jobs should not be considered at all.

Thus Mr. Sharp compiled a list of jobs which in the opinion of 500 of Iowa's better farmers were jobs the knowledge of whose basic principles were important. The average and better of these jobs, such as making concrete feeding floors, wiring a house for lights, riveting a harness splice, applying paint, etc., are similar to many of the inquiries listed at the Agricultural Engineering Office as referred to later in Part III. The curriculum approach offered by Mr. Sharp is by the questionnaire method with the importance of different jobs being the goal. The questionnaires were sent direct to the farmers with an explanatory letter.

He does not set up an actual curriculum but gives suggestions for getting at one.

2. A Study on Farm Repair and Construction Work
by F. E. Armstrong, reported in Educational Monograph #4.
University of Minnesota.

This study takes up the matter from the standpoint of the number of jobs the farmers did themselves or hired done on 560 farms all over Minnesota.

Mr. Armstrong states "that these farms do not represent the average condition in the state because of the high per cent of farmers owning automobiles, the high per cent of owned farms, and other facts indicating that these farms are above the average." He also says that, "they do represent the group of farms with which the teacher of agriculture is chiefly concerned."

These questionnaires were very comprehensive and included such items as: type of farming followed, size of farm, whether rented or owned, distance from trading center and blacksmiths, home conveniences,

age of farmer, the usual questions on tool lists, construction work by farmers, by skilled mechanics, repair work by farmers, by skilled mechanics, etc. etc.

The returns on this questionnaire enabled Mr. Armstrong to arrive at some definite conclusions which are briefly stated below.

1. The agricultural teacher should survey his community in order to determine what to teach.

2. The study of tools on the farm serves as a guide for determining what should be added to, or eliminated from school shop equipment.

3. Jobs relatively unimportant from the standpoint of frequency, as horse-shoeing, may be eliminated.

4. The importance of repair work is outstanding in this study.

5. A considerable part of the farm repair and construction work in which the boy needs training cannot be carried on in school.

From our standpoint the bulletin emphasized the fact that a knowledge of principles involved in the problems presented by the inquiries analysed would have made it possible for the farmers to do many of these jobs themselves.

Really his approach is by survey method with the importance of the jobs done on the farm and the equipment on the farms as the object sought, the questionnaires being sent to the agricultural instructors and explained by them to the children who took them home and helped father fill them out.

Mr. Armstrong does not set up a specific curriculum. He draws some implications from the study for teachers.

8. Principles Underlying a course of Farm Shop Work in Vocational Agriculture by Henry C. Graybeal, published as Bulletin #2 by the University of Tennessee.

This is another of these publications in the Farm Shop Field. Mr. Graybeal collected his data by sending "a letter of inquiry regarding this kind of work to supervisors and teachers all over the country." "Men who had been dealing with this subject for several years, the replies showing a great divergence of opinion on these problems."

This letter of inquiry seems to have been in the nature of a request for information as to the phases of shop work given. No definite statement is made in this respect.

In addition to this inquiry a survey of 160 farms in three communities in Tennessee was also made, "to determine the construction and repair work usually done on the farms of these communities and the tools available for this kind of work on the individual farm."

The results obtained from this study lead Mr. Graybeal to recommend several lines of work which should be studied, such as, constructing buildings, some farm appliances, tool care and operation, fencing, some iron work, harness, painting, rope, concrete.

A knowledge on the part of the farmer of the underlying principles of the subjects in the above list would have reduced the number of inquiries listed in Table I, Part III, of this paper.

Mr. Graybeal also used the survey method, obtaining his data by personal visits to the farms, and from letters to supervisors and instructors.

He makes certain recommendations in regard to the Farm Shop Curriculum for a specific school in Tennessee.

4. Bulletin #18. Vocational Agriculture in Georgia High Schools. "Farm Shop Work" by Mr. E. D. Mobley.

The author says, "Aid and suggestions have been solicited from vocational agricultural teachers, college shop instructors, hardware and implement dealers and others, all of whom have contributed helpful information.

"A questionnaire concerning shop work was sent to every vocational agricultural teacher in Georgia who is giving shop work as a part of the course in agriculture."

The content of this letter of inquiry and the make up of the questionnaire are not revealed in so many words but from the nature of the sub heads in the bulletin one infers that they had to do with such subjects as, Purpose of Farm Shop Instruction; Financing and Building a School Shop; Examples of How School Shops have been Built; Equipment for Farm Shop; Buying Equipment; Teaching Time to Be Given to Shop Instruction; Time of year to Give Shop Instruction, Outline of Farm Shop Work.

The writer does not draw any general conclusions but does make some general statements regarding the curriculum and the administration of a shop. His method of approach was also by the survey method but the survey was among instructors in high schools and colleges, hardware and implement dealers and others.

5. A Study of the Status of Farm Shop Instruction in Virginia With Suggestions for Its Improvement, by E. W. Sanders, R. E. Cline, and O. V. Nelson published as Dept. Misc. #8 by V. P. I.

The authors of this bulletin based their study on Annual Reports of Agricultural Instructors; Special reports of District Supervisors; Personal Observations; State of Virginia Publications and News Letters, Correspondence and special bulletins or other publications from

other states. Although certain curriculum recommendations are made, this bulletin is of value to us mainly because of its method of approach differing from any we have yet reviewed and from the one used in obtaining data for this study.

6. A Study of Farm Shop and Agricultural Engineering Activities on Kansas Farms--Its Relation to Vocational Agriculture in Kansas High Schools; By A. P. Davidson, Published by the Kansas State Board for Vocational Education, Topeka, Kan.

To secure his data, Mr. Davidson divided the state of Kansas into six sections, selecting in each the community which was felt to be most representative. These communities were surveyed in cooperation with the public high school. Advance literature was sent out asking for cooperation. At a personal meeting with the superintendent, agricultural instructor, local bankers, school board, etc., Mr. Davidson selected farms to be surveyed. Care was taken to get a representative group. Distance from town, size of farm, type of farm, age of farmer, finances of farmer, farm owners, tenant farmers were all considered. Other safeguards were also set up, while the questionnaire itself, which was sent to 320 farms in the six communities contained questions on Farm Carpentry, General Repair, Small Farm Appliances, Large Farm Appliances, Building Construction, Farm Building, Interior Construction, Tool List, Blacksmithing, Soldering, Harness Repairing, Plumbing, Auto, Tractor, Gas Engine etc., in an effort to get at the jobs done and the tools available for the jobs in these six communities.

Mr. Davidson does not attempt to set up a curriculum although he mentions several items in which the present Kansas Farm Shop System seems to be weak such as farm machinery, farm plumbing, water supply,

sanitation, and cement work.

Although he, too, used the survey method it is handled in a different manner than the studies previously mentioned. The communities were picked and with the aid of the schools and leading men of the community the farms were picked and questionnaires sent out which attempted "to ascertain the actual farm, shop and agricultural engineering activities practiced on the farms, and the tools and facilities with which such activities were carried on."

7. Farm Mechanics for California Schools, Agricultural Education Series No. 2, Division Bulletin No. 11, University of California, Part II by A. Smiles.

Mr. Smiles has approached the problem of obtaining data in still another manner. He says, "In order that there might be some authentic data available regarding the nature and extent of the farm mechanics work now practiced on California farms, several graduate students of the Division of Agricultural Education were encouraged to make farm mechanics surveys of typical rural communities during the spring of 1922. The university men who made the surveys visited representative farms in nine communities and filled out questionnaires with information obtained directly from the farmers themselves."

The questionnaire had the usual blanks for name, age, place, size of farm, etc., etc. and then listed six general questions, the largest list comprising those operations which pertained to the operations performed by the farmer himself with provision for a double check against the item or items the farmer considered most important. Space was left to indicate jobs that the farmer would like to do if he could.

The conclusions drawn from these data are stated by the author as follows:

"If we accept the principle that the farm mechanics subject matter taught in school should be based, as far as possible, on the mechanical work done on farms in the high school district, it is evident that a survey is not only desirable by very necessary in order to determine the thing to be taught. Table 8 indicates that a complete course in Farm Mechanics should include the following:

1. Farm Carpentry.
2. Selection, care and use of farm hand tools.
3. Selection, care, operation and repair of farm machinery.
4. Etc., listing 21 basic jobs."

Mr. Shultes method of approach was also the survey, but he used several investigators and had them conduct personal surveys among the farms selected.

8. "The Report of the Twelfth Annual North Central Region Conference, Agriculture," contains a report of the committee in Shop Work. The individual reports of two of the members, Prof. H. A. Sharp of Iowa State College, and Dr. G. E. Wiseman of South Dakota State College, are applicable to our study to a certain extent.

Prof. Sharp commenting on the content of farm mechanics courses says in part, "Several extensive surveys have been made to learn what farmers do or want their boys taught to do in the line of farm mechanics," and then makes mention of the Armstrong, Davidson and the Iowa surveys already analyzed.

Dr. Wiseman reported on, "Content of the Farm Shop Course." He also mentions the surveys which have been made for Course Content and lists the Armstrong, Davidson, Graybeal and California surveys.

In his summary, Dr. Wiseman says in part,

"It seems to me our best service to our men is to furnish a satisfactory and usable set-up of principles for selections of farm mechanics rather than to tell them in detail what the content should be."

Conclusions

We may conclude from these analyses that while many combina-

tions of methods of obtaining the data have been used, the results have been the same, i.e. showing a lack of knowledge on the farms of phases of Farm Mechanics.

Reviewing these different methods has been very interesting. Several other similarly named studies were looked over, but the methods of approach were either the same, or combinations of those mentioned here. No one of them was found, however, using the Agricultural Engineers' Letter files, for data on information needed and a questionnaire regarding the difficulties of different projects as set up in Parts III and V of this study.

While the methods of obtaining the material were perhaps as authentic as that used here it seems that a check on the relative difficulty of different projects should be considered in Curriculum Building.

The reports by Prof. Sharp and Dr. Wiseman are in line with the surveys which have been made in different sections of the country and add a strengthening note to the theory of our problem of the Curriculum.

PART III—ANALYSIS OF FARM MECHANICS INQUIRIES RECEIVED BY THE DEPARTMENT OF AGRICULTURAL ENGINEERING OF SOUTH DAKOTA STATE COLLEGE.

Several years ago the writer worked for the College Maintenance Department, most of the work being done in and around the office of the Agricultural Engineer. The number of inquiries received and answers returned by those attached to the office aroused question as to why the farmers needed so much of this help; hence, when the matter of a thesis came up, a chance word by the professor in charge of the work resulted in a determination to discover if possible the reasons for these inquiries and their relation to High School Farm Mechanics.

These data were collected from part of the letter files in the office of the Agricultural Engineering Department, the letters comprising about one-fourth year's correspondence being inspected.

The files are kept from July 1 to June 30, and the sample taken was the total number of letters in the 1925-1929 files up to the time of the inspection, which was October, 1928.

The Secretary in this office estimated the number of inquiries at around 2000 a year. A recent check shows that 1780 of these letters were received for the full year 1928-1929. The letters inspected totaled 450 and the time they covered was approximately one-fourth year, so that the estimate and the actual figures are not widely seperated by numbers. A few samples are given below to show the nature of these inquiries.

LETTER NO. 1

Huron, S. Dak.

"Would like very much if you could send me information on cost of construction of monolithic concrete silos, etc. Also how it compares with cost of other types of silos."

LETTER NO. 2

Beresford, S. Dak.

September 1, 1927

"If you have any plans or bulletins on how to build a septic tank, would you please send me one? I am having trouble with my sewer clogging because of a slow fall and a long distance to my outlet.

If you know of any good 'kink' to clear the grease and sludge out of my sewer drain, send that along too. If there is any charge for the plans, say so and I'll send along the money."

LETTER NO. 3

Watertown, S. Dak.

"Do you have any plans for outside bull pens? We have the plan furnished by the U. S. D. A. entitled 'Bull Barn,' but would like something that could be used in connection with an inside bull pen."

LETTER NO. 4

Strandsburg, S. Dak.

"Can you give me any information on a water system for use on the farm? What I have in mind is an overhead tank to get the necessary pressure. The well is on the same level as the buildings and I would not need to have any faucets higher than six feet at the most. How would it be advisable to have a tank at the well? We could use the space below the tank for a milk room or a separator room, as it is located close to the barn. Any information you can give on this subject will be greatly appreciated."

LETTER NO. 5

Ft. Pierre, S. Dak.

"Mr. _____ of Ft. Pierre said he heard that the

government had a formula for making whitewash hard; that is, putting something in it to keep it from peeling off. I am wondering if there is such a formula. I would be pleased if you would write him direct regarding this, sending me a copy of the letter."

These letters were inspected to determine the nature of the inquiry and were checked for frequency according to kind as near as it was possible to do so at the time. Later, the inquiries which had been included under Miscellaneous were classified under one of the larger heads until the groups were cut to the number shown in Table I.

It would have been possible to contract the table still more by throwing poultry and hog houses and silos in with Farm Buildings, where they rightly belong, but in order to show the variety of inquiries on Buildings and also because they were placed that way in the files, the separate items were listed.

The items have been arranged in descending order of frequency importance.

TABLE I—NUMBERS AND PERCENTS, BY CLASSIFIED GROUPS, OF A SAMPLE CONSISTING OF 450 INQUIRIES TAKEN FROM THOSE ON FILE AT THE OFFICE OF THE AGRICULTURAL ENGINEERING DEPARTMENT

PROBLEMS	NUMBER OF INQUIRIES	PERCENT OF INQUIRIES
Explosives	100	22.2
General Farm Buildings	75	16.66
Farm Machinery	72	16.0
Poultry Houses	46	10.2
Sanitation	33	7.3
Cement and Concrete	32	7.1
Hog Houses	27	6.0
Water Supply	27	6.0
Silos	21	4.66
Drainage of Land	10	2.2
Miscellaneous, such as Electricity, Farm Names, Season for Cutting Trees, etc.	7	1.55
TOTALS	450	99.87

This table shows the relative importance of the different subjects to the farmer, or rather the extent of the lack of knowledge on these subjects, and covers the same phases indicated by the studies reviewed in Part II, although it was derived in a different way.

The item "Explosives" is the only item apparently not in line, and the quantity of the letters in regard to this material was due to the fact that, beginning about 1924, the explosives sent out by the

government were bringing in numerous inquiries. Some of these letters were in regard to the method of obtaining the explosives, some about the way to use them, and some as to the kind of work they would do. Considered in this light, the number is not excessive, especially since a check this summer shows some forty letters on explosives, long since the peak of the cheap explosive business has passed.

By this table we find "General Farm Buildings" occupying the most important place, with "Hog and Poultry Houses," combined, a good second. They constitute what might be called part of the plant, and the inquiries were concerned with repair as well as with construction. While many of them are probably too technical for any but a skilled mechanic, the majority of both classes are of such a nature that most of the work could be done by "home folks."

"Farm Machinery" is the next most important frequency group. As a title "Farm Machinery" is rather misleading, for the group includes the count of all letters referring to all machinery, tools or mechanical appliances. One letter asked about making a wool press.

Here again some of the inquiries are concerning matters which are probably too technical for home work, but a large per cent of them were of such nature that they could be fitted into our State plan.

Questions concerning Sanitation form the next largest group and while many of them deal with technical matters. It was found that in this group, as in the others, many of the inquiries would not have been written if a basic knowledge had prevailed on the farm.

Thus it is with all of the rest of the items; Silos, probably, being the only group of any consequence in which it could be said that the preponderance of evidence is in favor of the "too technical," and

only them by reason of the nature of the construction work.

The items under "Miscellaneous" were listed to show a few of the separate items of which the larger heads are built up. "Season for Cutting Trees" and "Farm Names" were the only two which might not fit in well anywhere else.

CONCLUSIONS

From the data tabulated in Table II, if it were considered in the light of a local survey for some high school, the Instructor would want to set up his curriculum so that he would have:

1. A strong drawing course to fit in with the large number of inquiries on Farm Buildings, Poultry Houses, Hog Houses, Sanitation, Water Supply, Drainage, Farm Machinery and even Cement and Concrete. This would be necessary in order for the farmer to at least understand the plans others draw.

2. It would be necessary to include in the course some of the principles of construction, in different materials, as these inquiries form more than one-third of the total reviewed.

3. The setting up and repair of farm machinery would follow, because Farm Machinery inquiries constitute the next largest per cent. This would include shop work in wood and iron and probably enough of belts and rope to furnish a knowledge of the care and repair of belts and the care and use of rope in hitches for different machines.

4. Sanitation and water supply would necessitate some knowledge of surveying.

If the curriculum were set up from these tables, all those things mentioned above would be included, and it would not be necessary to give as much Woodwork as is included in the State Plan.

A curriculum set up from these inquiries would not make a good general curriculum, for although most of the basic information needed is included in the problems covered by the inquiries, it probably would be necessary to vary some of the problems according to the locality.

In other words, a curriculum set up by these inquiries would not be so good as the curriculum in the State Plan, because it would have to be mostly on construction work and thus many of the repair problems which the State Plan covers would not be included in the course.

This all indicates, however, that the farmers desire knowledge more than manipulation. In evidence that this fact is becoming better recognized, a recent letter from the South Dakota Supervisor mentions the time element of Farm Mechanics courses in the following manner: "In the proposed new set-up of ninety-minute agriculture periods, I am recommending Farm Mechanics the equivalent of two days per week and in my opinion the shop work (that is, the manipulation part) should not exceed twenty-five per cent and might well be reduced to twenty per cent of this time."

PART IV

ANALYSIS OF FARM SHOP BOOKS

Since the problem is one of curriculum in connection with the above inquiries, and since books are necessary adjuncts of curricula, it was deemed advisable to analyze certain farm shop or mechanics books in an attempt to determine what problems the respective authors think should be included in the farm mechanics course, and, at least in a general way, to see relatively how much time should be devoted to the various phases.

These authors are presumably experts in their line, at least to the extent of being proficient in their field and having written the books.

Five books on Farm Shop and one on Job Sheets were selected for analysis for the following reasons:

1. It was thought that six would be sufficient—a larger number probably being too cumbersome.

2. Four of this number are listed in the South Dakota State Plan and are by authors who have been considered experts in their line for many years.

3. The fifth book, by Field, Olson and Nylin, is a new book in the field and it was chosen for the purpose of comparing its content with the older publications. The authors of this book are also experts, but are not yet so well known as the other men.

4. The sixth book is purely a job sheet proposition and was included so that a comparison of job sheets with subject matter might be obtained if needed.

Since the table of per cents may not give a comprehensive impression, the purpose of each book as set forth by the author, or authors, is presented.

"Agricultural Mechanics" by Robert H. Smith--Lippincott. - "To be so clear in its illustrations and in its instructive matter as to fully warrant the placing of the book in the hands of each student, so that the instructor who does not have a good shop background or the one who is limited for time will not have too much trouble in getting the problems done." For subject content by per cent, see Table II.

"Farm Mechanics", Field, Olson, Hylin--Century. - To furnish farmer and student a guide which will make it possible for them to do the work on the farm in ordinary repair and construction.

Directions are arranged, step by step, and it also provides instruction of benefit in schools. Therefore, it serves as a handbook for the farm, text for the student and reference for novice in farm work, and for this reason it should be helpful in vitalizing the farm practice work of students in vocational agriculture and as an aid to help the teacher correlate the mechanical work with other forms of farm practice.

As it is designed to serve boys of high school age and mature age, tool skill has been assumed, and, as there is no sequence, the book's content is flexible in application.

"Construction and Repair Work for the Farm", Strunk--Houghton-Mifflin. - To give concrete help to those who are interested in practical construction and repair work, as it pertains to various kinds of farming with a national and not a sectional standpoint. Arranged so that sections may be used for short unit courses of instruction.

"Farm Mechanics", Crawshaw and Lehman, Industrial Arts Press. - To meet the increasing need for a textbook on the mechanical processes commonly taught in agricultural high schools and colleges and in industrial schools. Types of work applicable to the requirements of the industry upon which each type has a bearing.

"Farmers' Shop Book", Roehl, Bruce—Designed especially to be used as a shop book by the boys in the classes in vocational agriculture in the secondary schools. It is assumed that teachers of vocational agriculture and farm shop will select repair and construction problems in making up their course in shop work which will be especially adapted to the farming need of the community. Repair jobs to be brought from the farm and time made one-half the shop work.

The analysis of these books is based on the avowed purposes as set forth by the authors, and the data furnished by the following table which shows the content of the five books individually, a composite of the books and the Missouri Job Sheets. The composite was obtained by adding the per cents the books allotted to any subject and dividing by the number of books analyzed.

The Missouri Job Sheet was not included in the composite because the material it contains is largely manipulative. It tells what to do, but in most cases refers to some book as Roehl, Smith, Field, Olson, Mylin, etc., etc., or some bulletin for the information as to why. Neither is it included in the average page computation mentioned later on, for the same reason. It contains 118 pages mimeographed on one side only.

Table II - Classification of Content of Farm Shop and Farm Mechanics Books, by per cent of total pages in each. (Subjects or Topics listed as in Table No. I where possible.)

Subject of Topic	Smith	Struck	Crashaw and Lehman	Roehl	Composite of these 5 books. Olson, Fieldyling	The number of books containing a subject and the per cent. With	Without	%	Missouri Job Sheets
Farm Buildings		4.4		5.0	8.4	3	2	3.5	2.5
Cement & Concrete	5.4		15.8		5.7	3	2	4.9	8.8
Farm Machinery	8.7		18.3		23.2	3	2	9.8	6.0
Sanitation					2.1	1	4	.4	
Water	8.4		7.9		4.7	3	2	4.2	5.1
Electricity					8.4	1	4	1.7	
Rope	7.8		7.4	9.8	5.7	4	1	6.1	1.7
Shop	10.8		34.7	5.1	7.4	4	1	11.6	34.2
Painting & Glazing	4.2			1.5	4.7	3	2	2.1	13.6
Lumber & Hardware	4.3	7.3		1.7		3	2	2.7	4.3
Drawing & Geom.	6.3	2.6	2.8	3.0		4	1	2.9	5.1
Tools & Operations	9.6	6.7		3.7	5.0	4 -	1	5.0	8.6
Brick					2.9	1 -	4	.8	
Fundamentals in Construction					3.4	1 -	4	.7	
Harness & Belts	3.3	4.7	4.1	11.0	5.5	5 -	0	5.7	10.3
Heat & Light			1.2		8.8	2 -	3	2.0	
Solder & Bearings			9.3		5.2	2 -	3	2.9	6.0
Appliances	30.0	72.0		38.9		3 -	2	31.5	
Appendix		1.7		1.8		2 -	3	.8	
Total	99.8	99.4	99.5	96.2	99.2			98.9	99.3

Although the books do not contain exactly the same number of pages nor the same number of illustrations, it has been assumed that they are nearly enough the same size so that the per cents will be applicable to our problem, 370 being the average of the pages of content. The smallest number of pages is 351 and the largest 406.

Purpose of Farm Shop Books

Analyzed by the purpose expressed by the author, we find that Smith's book of Agricultural Mechanics is a job sheet proposition designed "so that the instructor who does not have a good shop background, or one who is limited for time, will not have too much trouble in getting the problem done", but no mention is made of any great amount of material similar to that found in our inquiries. Analyzed by actual content, we find that subject matter on farm buildings is entirely lacking, that there is nothing on sanitation or drainage and that over thirty per cent of the content has been devoted to farm appliances, which are well enough in themselves, but probably are not of much value in teaching underlying principles of construction and repair.

"Construction and Repair Work," by Struck, analyzed by purpose would indicate that it should fit in very well with our problem, as it is intended "to give concrete help to those who are interested in practical construction and repair work as it pertains to various kinds of farming, with a national and not a sectional standpoint." However, an analysis by actual content shows that the book devotes seventy-two per cent of its time and space to farm appliances which naturally leaves but little to be distributed over the other problems arising from the inquiries. Farm Buildings is the only one of these groups which receives specific

mention, although Harness and Belts, Tools and Operations, and Lumber and Hardware might be grouped under Farm Machinery. Even then, however, that subject would not be sufficiently covered although the total of these per cents would be high. This evidently would not make a good text-book for teaching a knowledge of operations demanded by the list of inquiries.

The purpose of Farm Mechanics by Crawshaw and Lehman is "to meet the increasing need for a textbook on the mechanical processes taught in agricultural high schools and colleges, and in industrial schools", but a glance at the table shows that it also is deficient in some of the subject matter brought out by our inquiries, namely, farm buildings. It is free of any space avowedly set aside for farm appliances, so one would be more apt to get basic principles from this book than from some of the others.

"The Farmers' Shop Book", by Koehl, is "designed especially to be used as a shop book by the boys in the classes in vocational agriculture in secondary schools," and, looking at the per cents in the table of contents, we find this true, as practically sixty per cent of the material is devoted to appliances while such things as cement, farm machinery, sanitation, water, etc. are not given any space at all. It may be possible to teach a knowledge of those basic principles by making farm appliances, but it would seem that the appliances could be made at home.

The purpose of "Farm Mechanics" by Field, Olson and Nylin is worded practically the same as that in Construction and Repair Work and reads, "To furnish farmer and student a guide which will make it possible for them to do the work on the farm in the ordinary repair and construction."

A glance at the table shows this to be true to a greater extent than is evinced by any of the other books.

Not only the subject matter covered, but the distribution of the material is more evenly balanced, so that it covers the field set up by the inquiries in a more thorough manner.

Of the whole list of subjects covered by the five books, this "Farm Mechanics" contains material on all but three, and it does not contain any appliance material, as such.

The Missouri Book of Job Sheets does not have any stated intentions other than that implied by the name, and while the subject matter is more evenly distributed over the list of topics than even that of some of the books analysed, the amount of time spent on the different topics is not very well distributed for a book of only 118 pages. As it is mostly manipulative, it is not very well adapted for anything but Job Sheets.

In order to compare the subject matter contained in these five books with that brought out by the inquiries, a table combining Table I and the composite column of Table II follows.

Table III - Showing the per cents of the different inquiries from Table I and the composite per cent from Table II.

Inquiry or Project	Percent of Inquiries	Percent of Composite	Totals of the Two Divisions
Explosives	22.2		
General Farm Buildings	16.66	3.5	
Farm Machinery	16.	9.8	
Poultry Houses	10.2		
Sanitation	7.3	.4	
Cement and Concrete	7.1	4.9	
Hog Houses	6.0		
Water	6.0	4.2	
Silos	4.66		
Drainage	2.2		
Miscel. Electricity, etc.	1.5	.7	80.5
Rope		6.1	
Shop		11.6	
Painting and Glazing		2.1	
Lumber and Hardware		2.7	
Drawing and Geom.		2.9	
Tools and Operations		5.0	
Brick		.6	
Fundamentals in Const.		.7	
Harness and Belts		5.7	
Heat and Light		2.0	
Solder and Bearings		2.9	
Appliances		31.5	
Appendix		.6	98.4
Total	99.87	98.9	98.9

This table shows more clearly than either Table I or Table II the gap in the inquiry column from rope down, and also some few short gaps in the Book Content Column above Rope. By adding these per cents we find that there is an overlap of subject matter of only thirty per cent. But an explanation of these gaps has been hinted at before in explaining the set-up of Table I, where reference was made to the fact that inquiries were counted as filed in the Engineer's office, except "Miscellaneous."

These miscellaneous items constitute one-sixth of the total sampling and were of varied nature, but all of them were finally listed under some one of the larger headings, except the few given in the table in Part III. The different items of this class constituted many problems and if they had been listed separately in the tables, the gap in the inquiry table would not have been so noticeable, although the per cents would not have been very large. If hog and poultry houses had been listed with farm buildings, the items in the upper part of the inquiry column would not have been so numerous. The item "explosive" can hardly be considered a high school project, although firing might come under electricity or farm machinery and drainage, etc. by explosives taken up in drainage merely as informational matter.

Conclusions

The tabulations and comparison given in this part of the study show that only one subject, in the whole list, "Belts and Harness", is taken up by all of the books and that only one book takes up some of the subjects, which is the reason the per cent these subjects represent in the composite is very low, illustrations being fundamentals in construction, sanitation and electricity.

So we find that not all of these books are adaptable to our purpose of making a Farm Mechanics Curriculum and that while the composite of the five books would constitute a broader base for the curriculum than the inquiries, there is one book in this group which is even better than the composite of which it forms a part. If we followed the text analysis, the curriculum would probably cover the same ground as that which could be set up from the inquiries in Part III, except for the distribution of material and time. Instead of thirty-two per cent being allotted to Farm Buildings, eight per cent plus three per cent for fundamentals in construction would be more nearly right. Instead of giving only two per cent of time to sanitation and twenty-three to Farm Machinery and seven to Shop, a little less could be given to these two and more to sanitation, and so with the other items. The Field, Olson and Nylin book is a better guide to a curriculum than the other books or even the inquiries, although the inquiries show the need of such a text and curriculum and this book, "Farm Mechanics", will probably meet the instructional needs of local surveys as well as any book can do it.

We can say, in conclusion, that Field, Olson and Nylin, or a similar book, would make a better guide for reconstructing our State Plan than the inquiries, although the inquiries considered in the nature of a survey would be of assistance in using the book or the curriculum made from the book.

However, a curriculum derived from any one source would not be so good as one built from several approaches. For this reason, we will consider the matter of difficulty next and see what it adds to the information on our problem.

PART V

DIFFICULTY ANALYSIS OF FARM SHOP AND MECHANICS PROBLEMS AND PROJECTS

The inquiries received by the Agricultural Engineering Department of South Dakota State College covered a wide range of operations. Since they were referred to a technical man, Mr. Ralph Patty, Professor of Agricultural Engineering, South Dakota State College, by the farmers it is likely that some of them would be too difficult for class work.

It was, therefore, deemed advisable to attempt to determine the difficulty of several projects so there would also be this check on curriculum material.

The questionnaire method was used in getting these data. The appended questionnaire is a copy of the form sent out, and it is marked exactly like one of those returned was marked.

The projects were selected from the material presented by the inquiries, from the books, and from the projects developed in the Brookings High School Agricultural Department. These projects were selected at random, except that an attempt was made to pick a wide enough variety to cover the field of basic principles, and to include some which off hand might be considered easy and some which might be considered difficult. Thirty was the number determined on as admitting of fair coverage of the field without being so exhaustive as to react on those to whom the questionnaires were sent for marking.

A key was set up which allowed for 5 degrees of difficulty, as follows: 1. Very easy, 2. Quite easy, 3. Medium, 4. Quite difficult, 5. Very difficult (probably too difficult for such a course),

QUESTIONNAIRE

We are working on a problem of farm shop curriculum and find that one phase of this problem is the difficulty of the different projects.

So we find it necessary to arrive at some basis for evaluating the relative difficulty of various shop projects and hope that you can cooperate with us by checking the following list and returning it at your earliest convenience.

Some of the projects listed are from actual experience, some from shop books, and some from inquiries received by the Agricultural Engineering Department of South Dakota State College.

> In order to keep the range of rankings low it has been thought better to keep the scale constricted so we have set up the following key which you will please follow by marking the number which coincides with your idea of the difficulty in the column set off for that purpose.

Remember, we are making on difficulty and not worth-whileness.

Key: 1. Very easy
2. Quite easy
3. Medium
4. Quite difficult
5. Very difficult (probably too difficult for such a course)

Project	Difficulty Score
Soldering spout	..3.
Making mitre joint	..5.
Filing a casting	..4.
Making bulletin box	..3.
Drawing up plans and specifications for hog house for 3 dows	...5.
Making a saw horse	...3.
Planning & describing septic tank	...4.
Making stock loading chute	...3.
Setting up corn picker	...4.
Determining seasons for cutting trees	...3.
Sharpening a plane bit	...3.
Constructing hayrack	...4.
Glazing 6 pane window 6x10 glass	...3.
Making feed racks for cattle	...3.
Determine methods of draining small creeks	...4.

Project	Difficulty Score
Constructing cement water troughs	..4.
Making mortise and tenon joint	..2.
Tempering cold chisel	..2.
Patching tub	..2.
Figuring window space in 20' hog house	..2.
Determining best shingles to use	..1.
Planning farm water supply	..4.
Determining the insulating qualities of different materials	...3.
Selecting and caring for lumber	...3.
Caring for and lacing belts	...3.
Applying paints	...3.
Grinding valves	...3.
Setting up and using Planet Jr.	...3.
Fitting saws	...4.
Laying out fence lines	...3.

and the people to whom these questionnaires were sent were requested to score the projects by number. This method of scoring was advised so that those who marked the papers would all have as nearly the same objective in mind, as individual differences would allow, to keep the scores within bounds, and to provide an easy method of marking.

The idea was explained in a short introductory form letter which was part of the sheet on which the questionnaire was written. (See appended form.)

Since the curriculum under advisement was a South Dakota problem, questionnaires were sent to all of the agricultural instructors in South Dakota.

This was not, however, considered sufficient so a letter was written to the supervisors of six other states, North Dakota, Minnesota, Wisconsin, Iowa, Kansas, and Nebraska, explaining the problem and asking them if they cared to furnish a list of the instructors in their respective states who were competent to determine such a rating in the subject and who might be depended upon to return replies. These supervisors all sent in lists of names of varying length and the questionnaires were sent out.

Table IV shows at a glance the number of questionnaires sent to these instructors and the number they returned.

Table IV - Showing Number of Questionnaires Sent to the Instructors and Number Returned, by States, and the Per cent these Represent

State	Questionnaires Sent Out	Answers Returned	Per Cent
South Dakota	22	18	81
North Dakota	11	7	65.5
Iowa	12	12	100.00
Minnesota	9	9	100.00
Kansas	8	7	87.5
Nebraska	12	9	75.
Wisconsin	10	6	60.
TOTAL 7	84	68	568.8 ÷ 7 = 80.9 80.9

Although the total number of questionnaires sent out was not very high, the returns were large and since the men who marked the papers were scattered from the Black Hills to Lake Michigan and from Canada to Oklahoma, it was felt that a fair sampling of this area had been obtained.

In order to secure more data on the subject and serve as a check, each supervisor was sent a questionnaire and requested to score and return it.

The supervisors did not do so well as only two of them complied with this request—the ones from Iowa and South Dakota.

As stated above, one of the reasons for asking the supervisors to score these projects was to have a check on the scoring of the instructors, but when such a large number of replies was received from the 84 men (see Table IV), it was decided that 2 would not give a good check, so the supervisor of shop at South Dakota State College was asked to score one of the sets, which he did.

Since the two state supervisors from Iowa and South Dakota were known to have had excellent results with their shop work while instructors in high schools, they could be called experts and, since the college man undoubtedly is an expert, these three scores were considered sufficient to check against the 68 replies received from the instructors, and a statistical computation which will be introduced later on will show that the scoring of both groups is close. The scores these men submitted will hereafter be referred to under the title of Experts' Scores.

Now that the method of collecting these data has been explained we are ready for the table showing the frequencies of the scoring by the different instructors and by the experts. The experts' markings are indicated by the Roman numerals. As no check column was found necessary to take care of any hiatus in the total scoring of any project, and in order to obviate the necessity of referring back to the questionnaire, the key for scoring is given again.

Table V - Results of the Scoring of the Questionnaires, by 68 Instructors and by 3 Experts. Experts' Scores indicated by Roman numerals.

Key to Scoring for Difficulty

1. Very easy
2. Quite easy
3. Medium
4. Quite difficult
5. Very difficult.

TABLE V

Project or Problem	Frequencies of Scores by Difficulty ranking, from 1 to 5					No Check	Total Inst. Scores	Total Experts' Scores
	1	2	3	4	5			
1. Soldering spout	I 7	25	II 28	12	0	1	68	5
2. Making mitre joint	7	I 23	28	II 10	0	0	68	5
3. Filing a casting	I 8	19	II 21	8	4	8	68	5
4. Making bulletin box	22	22	II 17	I 5	0	2	68	5
5. Drawing up plans & specifications for hog house for 3 sows	0	5	28	II 35	I 0	0	68	5
6. Making a saw horse	11	21	II 19	7	I 0	0	68	5
7. Planning & describing a septic tank	0	5	18	III 28	16	21	88	5
8. Making stock loading chute	2	15	II 36	5	0	0	68	5
9. Setting up corn picker	0	2	12	II 27	I 27	0	68	5
10. Determine season for cutting trees	18	I 26	I 12	2	0	I 9	68	5
11. Sharpening plane bit	18	III 30	10	3	0	0	68	5
12. Constructing hayrack	1	10	II 28	I 18	0	1	68	5
13. Glazing 6 pane window with glass	6	I 15	II 29	12	2	4	68	5
14. Making feed racks for cattle	1	I 24	II 31	12	0	0	68	5
15. Determining methods of draining small creeks	0	7	18	III 27	11	4	68	5
16. Constructive cement water troughs	3	1	25	III 26	5	2	68	5
17. Making mortise & tenon joint	2	I 17	22	II 16	1	0	68	5
18. Sharpening cold chisel	0	I 11	21	II 20	15	1	68	5
19. Patching tire	2	II 18	11	9	I 1	2	68	5
20. Figuring window space in 20' hog house	14	II 18	I 20	4	2	1	68	5
21. Determining best shingles to use	I 6	I 26	27	I 7	1	1	68	5
22. Planning farm water supply	0	I 5	11	II 38	11	2	68	5
23. Determining the insulating qualities of different materials	0	7	12	I 20	II 27	2	68	5
24. Selecting & caring for lumber	2	I 15	I 25	I 10	2	1	68	5
25. Caring for & lacing belts	2	II 18	I 40	6	0	0	68	5
26. Anealing points	7	II 20	I 20	2	0	0	68	5
27. Grinding valves	4	I 20	II 20	11	2	1	68	5
28. Setting up & using Planet Jr.	2	13	I 22	I 9	1	I 20	68	5
29. Fitting cups	1	4	18	III 32	2	0	68	5
30. Laying out fence lines	2	I 16	I 25	I 11	0	0	68	5
Total Instructors' Scores	162	475	780	444	153	66	2040	
Total Experts' Scores	3	22	25	31	7	2		90

The items or projects were entered in this table just as they had been put on the questionnaire. This was the best plan since it was meant to be the key table for this section.

In project No. 1, one expert marked the project in the first difficulty and two marked it in the third, or medium, difficulty. Therefore, we have the Roman I in column 1 and Roman II in column 3. In the eighth project, "Making stock loading chute," all of the experts marked in the third, or medium, difficulty. Hence, Roman III under column 3, and so on.

In project No. 1, seven instructors marked very easy or No. 1; 25, quite easy or No. 2; 25, medium or 3d column; 12, quite difficult or 4th column, none, very difficult or 5th column and one did not mark--which is recorded in the "No check" column.

The totals for the instructors' markings show that the 85 projects received 162 marks for very easy out of the total of 2040; 475 for quite easy, 780 marks for medium, 444 marks for quite difficult, and 151 for very difficult, while the 68 instructors left blank 68 marks for the 30 projects.

The totals for the experts is explained in the same way.

By some coincidence the total number of "No check" frequencies is the same as the number of instructors who returned replies, but it is nothing more than a coincidence and means no more than if the number had been 65 or 70. But it does have a slight bearing on our problem because in most of the cases where there was no score a question mark had been substituted. This is because the project left unscored was probably beyond the instructor. It will be noticed that the experts have two markings in this column.

If we add the frequencies of the markings of the different projects according to whether they occur in the first three or the last three columns, we find eight projects which the instructors have scored with a preponderance of marks in the last three columns, and only two of these have the most scores in the last two, "very difficult" and "no score" columns.

The results obtained in this manner are as follows:

Table VI - The Problems Considered most Difficult by Count of Frequencies in the Last Three Columns.

Project	Scores in last 3 columns	Scores in last 2 columns
Set up corn picker	54	27
Planning water supply	52	13
Insulating qualities of materials	49	29
Saw fitting	47	5
Plans for septic tank	47	19
Tempering cold chisel	38	18
Plans for 8 sow hog house	33	2

Similarly by adding the frequencies of the scores in the first two classes of difficulty we find 6 projects which have more than half the number of markings so arranged: Making bulletin box, Season for cutting trees, Sharpening plane bitts, Figuring window for 20' hog house, Applying paints, Making saw horse, which leaves 15 projects with scores centering in the medium difficulty class.

However, this is rather cumbersome to study any further so we will use several combinations derived from the figures shown, in Table V, in order that further analysis will not be too complicated. The first

one shows the per cent of frequencies given to all of the projects in the different degrees of difficulty by the experts and the instructors.

Table VII - Showing the Number of Marks and Their Per cent of the Whole Assigned to Each Degree of Difficulty for the 30 Projects by 5 Experts and 68 Instructors.

Degrees of Difficulty	Numbers and Per cents of Experts' scores		Numbers and Per cents of Instructors' scores	
	No.	%	No.	%
1. Very easy	8	3.0	160	7.9
2. Quite easy	22	24.4	475	23.2
3. Medium	25	27.7	760	37.3
4. Quite difficult	31	34.4	444	21.7
5. Very difficult	7	7.7	131	6.4
No check	2	2.2	68	3.3
Totals	90	99.4	2040	99.8

This table shows in a very clear manner the tendencies of these two groups of scores. The instructors were inclined to consider the problems just a bit easier on the whole than the experts did. As is shown by the differences between the percentages of the total given to the very easy group. Then again, the instructors placed more markings in the medium column than the experts did and, therefore, less in the quite difficult and very difficult columns, although the scores of both groups in the very difficult and no check columns total about the same. But they all group around the medium.

The findings of this table, although interesting, do not show the results desired so Table VIII has been arranged in order that the way the experts and the instructors ranked these problems may be easily seen. In this table the Flemet Jr. project has been omitted because 20 of the 68 marks were in the no check column.

Table VIII - Showing the Weights Assigned to, and ranks of, the 29 Projects by the 5 Experts and the 68 Instructors.

Value or weight figured by multiplying frequency of scoring by value of difficulty and adding the products.

Project	No.	Weights Assigned		Ranks	
		5 Exp.	68 Inst.	5 Exp.	68 Inst.
Determining season for cutting trees	1	5	118	29	29
Sharpening plane bitts	2	6	145	28	27
Figure windows for 20' hog house	3	7	162	25	24.5
Applying paints	4	7	162	25	24.5
Determining best shingles to use	5	7	172	25	23
Soldering spout	6	7	174	25	22
Caring for and lacing belts	7	7	179	25	18
Filing castings	8	8	181	20.5	26
Glazing 6 pane window	9	8	181	20.5	17
Making feed racks	10	8	190	20.5	14.5
Grinding valves	11	8	198	20.5	12
Patching tag	12	9	175	16.5	21
Laying out fence lines	13	9	187	16.5	18
Making stock loading chute	14	9	190	16.5	14.5
Selecting and caring for lumber	15	9	195	16.5	13
Making bulletin box	16	10	187	10	20
Constructing hayrack	17	10	177	10	19.5
Mortise & Tenon joint	18	10	201	10	11
Tempering cold chisel	19	10	240	10	7
Plan water supply	20	10	254	10	4
Make saw horse	21	11	298	8.5	2
Make miter joint	22	11	177	8.5	19.5
Make cement water trough	23	12	225	5.5	10
Draining small creeks	24	12	234	5.5	8.5
Septic tanks	25	12	280	5.5	5.5
Fitting saws	26	12	280	5.5	5.5
Plan & saw hog house	27	13	284	2.5	6.5
Set up corn picker	28	13	285	2.5	1
Determining insulating qualities of material	29	14	268	1	3

In order to make clear the exact method used in assigning weights to the different problems or projects, we must refer back to Table V. Using as an example the instructors' scoring of "Soldering a spout," we find that 7 of them marked it very easy or 1; 25 marked it quite easy or 2; 23 marked it medium or 3, and 12 of them marked it quite difficult or 4; none of them marked it very difficult or 5, and one did not mark it, which is listed in the no check column.

Ignoring the no check column; 7 is multiplied by 1, which gives 7; 25 is multiplied by 2, giving 50; 23 is multiplied by 3, giving 69; 12 is multiplied by 4, giving 48, and 0 is multiplied by 5, giving 0. Adding these products we have a total of 174 which is used to designate the weight of this project. All the projects were treated in a similar manner for all the scoring is done by the instructors and all the experts.

This rating or ranking of the projects shows that the instructors have grouped the items so that our 29 different projects or problems have been reduced to 24 degrees of difficulty for 5 pairs of projects received the same score, but the experts have reduced the groups to a total of 10 degrees of difficulty.

This seems to be quite a difference and may cause some suspicion as to the correlation of these two sets of scores. However, by using the ranks derived--from these, which are found in the last column of Table VIII--to compute the coefficient of correlation, we find that it comes out at .886, which is considered substantial by statisticians.

If we were to make a difficulty chart from the tabulations in Table VIII, we would use the ranking of the experts for three reasons:

1. They are experts.

2. The number of groups is smaller than the instructors' rankings make; and

3. Although the number of groups is smaller in this case than in the other, the positions of the individual projects are not much changed. That is, the experts lumped many of the degrees of difficulty, while the instructors had a more gradual transition from one class to another.

Such a chart would then have 10 degrees of difficulty grouped in three classes, very and quite easy, medium, very and quite difficult, and we have the following form.

Table IX - Showing three Classes of Difficulty and Some of the Projects which may be Included under each Class.

Degrees of Difficulty	Kinds of Projects
Very & Quite Easy	Sharpening plane bitts, Applying paints, Soldering
Medium	Making feed racks, Grinding valves
Very & Quite Hard	Fitting saws, Planning 8 sow hog house, Setting up corn picker

This score card can be built up to include more of the problems and projects scored in the questionnaire and can be used to determine the suitability of different problems for the curriculum.

The instructors should remember that this difficulty analysis is a composite of the opinions of 68 instructors in agriculture in the Northwest and of three experts in Farm Mechanics in the same area.

Conclusion

The fact that the correlation between these two sets of scores is so substantial insures a fair degree of accuracy in estimating the difficulty of many of our inquiries and will likewise serve as a guide by which to judge the practicability of using certain material in the curriculum.

By this table we find such problems as sharpening plane bitts, applying paints, figuring windows for 20' hog house, etc., ranked in the lower or easy group. This means among other things that it will not be necessary to spend a great amount of time in imparting information on subjects of this kind, for although they are important and should be learned, especially items similar to sharpening a plane bitt and applying paints; they are of such a nature that they can be acquired as other things are being done after the principle has been learned.

We might analyse the importance of the ranking of each one of the projects in a similar manner, but it would make rather tiresome reading.

However, before we stop making our comparisons, let us take a project from one of the project sources we have under consideration and see how Table IX might be applied.

As woodworking constitutes the largest list in the South Dakota State Plan, we will take one of the projects listed under woodwork. There

are a number of these, but we will take the milk stool. By the nature of the projects listed in the key we can say that making a milk stool is too easy to be bothered with in school, that while some principles of woodwork and construction are involved, it would be better to leave the milk stool alone and teach these principles through some more complicated problem. As building constitutes the largest item in the list of inquiries, we will take a small cattle barn or feeding shed.

We find in the table of difficulties that we have a 5 sow hog house listed which is grouped near the top in degree of difficulty and still the principles involved are not too complicated for advanced students, and while a roof is not always a roof so far as rafters are concerned, a knowledge of the steel square, which is basic, will enable the farmer to build his hog house or shed. More time would be needed with the principles involved in this group than if it were a case of making a stock loading chute.

Grinding the valves of a gas engine, a project in the medium group, leads to setting the ignition, the reason, and a little electricity is brought into the course.

Thus, there is hardly a project listed which cannot be compared with some other project as to degree of difficulty, and as to whether it would be advisable to try and teach it in high schools.

Therefore, the key may be applied to the composite of the books or to the projects in any one book or the material in the Missouri Job Sheets in the following manner: returning to the 5 sow hog house, we will grant that it is too difficult and takes too long to be used as a

class project. But, even when this is granted, the fact remains that the instructor can give a start of the principles involved in framing by instructing the class in the construction of a saw horse, using the steel square to lay out the legs and braces.

Therefore, we arrive at the conclusion that this difficulty analysis can be made of great value in determining the advisability of using or not using certain projects and problems which were noticed in Parts III and IV, and in the State Plan, and in helping us to decide on the amount of time to be given to a project.

PART VI

SUMMARY

Since the data collected have been tabulated and discussed, it is now possible to bring these findings to a final conclusion and to make whatever recommendations this conclusion may indicate as being necessary for the betterment of the curriculum.

From Part II, Literature on the Problem, we may conclude that, although the authors used many methods for collecting these data, the results obtained have been the same; i.e., showing there is a lack of knowledge of Farm Mechanics on the farm and that these findings are substantiated by the reports of Professor Sharp and Dr. Wiesman, that all of these findings indicate the need of local surveys.

Part III, The Nature of the Inquiries on Farm Mechanics Problems, on file at the office of the Agricultural Engineering Department, also indicate a lack of knowledge of Farm Mechanics on the farm, the farmers seemingly being more desirous of receiving information as to "why" than on manipulation. The recognition of this informational need is forcib ly brought out by the letter from the Supervisor of Vocational Agriculture for South Dakota in which he makes recommendations as to the division of the time; information to receive from 75-80 per cent of the total time allotted to Farm Mechanics.

Part IV, Books on Farm Shop and Farm Mechanics. The analysis of these books shows that not all of them are adaptable to the purpose of making a Farm Mechanics curriculum. A composite of the five books constitutes a broader base for the curriculum than the inquiries tabu-

lated in Part III. It will cover the same field the inquiries do and also covers supplementary material. However, the Field, Olson, Nylin book is a better guide to a curriculum than the other books or than the composite of which it is a part. It is also a better guide than the inquiries.

The inquiries show the need of such a text and curriculum. This book, "Farm Mechanics", contains subject matter relative to problems which might come up in the ordinary construction and repair work on the farm.

Part V, The Difficulty Analysis of Problems and Projects, shows that the rankings given these problems and projects can be a valuable aid in determining the advisability of using or not using certain Projects and Problems which have been considered in Parts III and IV, and in the South Dakota State Plan, and in helping to determine the amount of time to be given a project. This can be relied upon because it has been compiled from data secured from experts in Farm Mechanics and a large sampling of instructors in the Northwest who are teaching Farm Mechanics.

These data have shown that:

1. The farmers feel the need of information on the basic principles of construction and repair work and for that reason Farm Shop is not a good name for such a course—Farm Mechanics would be a much better phrase to use.

2. The local needs for information should govern the nature of the content of the Farm Mechanics course of any locality. This is shown by the nature of the inquiries analyzed in Part III of this

study. Coming from all over the state and being as diversified as they were, it follows that they could not be used to set up a curriculum for any one locality. These local needs should be ascertained by the survey method. This was brought out in Part II of this study.

3. Not all Farm Shop and Farm Mechanics books will make suitable texts to use in order to cover a field as extensive as that designated by the definition of Farm Mechanics Curriculum in Part I of this study.

4. It will not be possible to use all of the problems brought to light by the local survey on account of the difficulty and time necessary to work out these projects or problems, but the information involved may be taught by means of similar problems of medium difficulty. This is shown by the Difficulty Analysis in Part V.

5. The fact that information seems to be the primary desire of the farmers and not manipulation should not be lost sight of and the time allotted to this course should be divided with that end in view. The fact that the farmers desire information more than manipulation is brought out by the nature of the inquiries, discussed in Part III of this study, and by the letter from the Supervisor of Vocational Agriculture of South Dakota, also mentioned in Part III.

6. A set of principles instead of a set curriculum will be of more benefit to instructors in Vocational Agricultural Education because it has been shown in Parts II and III that, although there may be some problems which are general in application, many of them will be localized according to the nature of the farming interests of a community.

7. The South Dakota State Plan for Farm Mechanics is fairly adequate and could be used with these principles to meet the needs of any locality.

Therefore, we can say that the instructor should:

1. Always keep in mind the phrase, Farm Mechanics, and remember that Farm Shop is a phase of this larger field.

2. Make a local survey, either among the farmers or among the farmers and businessmen of the town.

3. From the results of the survey select the text which will give more of the information needed than any other book. If necessary, use more than one.

4. Use a difficulty analysis of the problems or projects brought to light by the survey. Do this in order to determine the advisability of using certain ones of them in class work, always remembering that Farm Mechanics covers outside as well as inside work and that the time should be divided so that the informational phase receives more emphasis than the manipulative.

Let us apply these principles.

Using the inquiries listed in Table I as the material resulting from a local survey, we find that Farm Buildings constitutes the largest group listed. This means construction and repair, and will involve information about drawing and at least woodwork, although instruction in concrete and masonry may be necessary.

The analysis of the books shows that the composite of these books in Table XI allots but 5.5 per cent of the total content to Farm Buildings and 2.9 per cent to drawing. One of these books, Field, Olson

and Rylin, devotes 8.4 per cent to Buildings but nothing to drawing, but it does contain a section on "Fundamental in Construction" to which the authors accord more importance than is given to drawing in most of the other books. This book, then, or one similar to it, can be used as a text. It will be noticed that a book of this type can be used as a Farm Mechanics text more frequently than any of the other books under consideration.

Applying the difficulty analysis to the project we can determine whether it can be used as a class exercise by comparing it with a similar project in the analysis. If that particular problem is not suitable because it is too easy or too difficult, some other project or problem involving the same principles but ranking nearer the medium difficulty class can be used.

Then in changing the South Dakota State Plan Farm Mechanics course to meet this local condition (set up in Table I, Part III, used as a local survey) it would be necessary to do fewer of the exercises listed under woodwork and give more time to farm buildings. It might also be necessary to eliminate all of the woodwork as such, except enough in the first year to teach the rudimentary tool operations, and then develop these operative skills along with the informational phase of construction.

In a similar manner the rest of the items in this list of inquiries can be taken up and outlined according to these principles; the correct title of the course, local survey, selection of text based on survey, and selection of problems derived from survey by using the difficulty analysis.

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