1958

Safety Programs in the High School Farm Shops in South Dakota

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SAFETY PROGRAMS IN THE HIGH SCHOOL FARM SHOPS IN SOUTH DAKOTA

By

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A problem submitted
in partial fulfillment of the requirements for the
Degree of Master of Science (Plan B) at South Dakota
State College of Agriculture
and Mechanic Arts

August, 1958

ACKNOWLEDGEMENT

The writer hereby wishes to express appreciation to Mr. Hilding Gadda, Assistant Professor of Agriculture Education at South Dakota State College for his counsel and advice in connection with this problem. Mr. Gadda extended valuable technical assistance as well as stimulating encouragement in developing and interpreting this study. The writer is sincerely grateful. The writer also wishes to thank his wife, Mrs. Shirley Hohbach, for her encouragement and assistance.

L. R. H.

TABLE OF CONTENTS

LIST OF TABLES

SECTION I

INTRODUCTION

Vocational education, vital to America, prepares for the effective work to be done in a period of progress and transition. In a broad sense of the term, vocational education refers to the experiences that enable one to carry on successfully a socially useful occupation.[1] Such experiences are provided in vocational agriculture and included in this area of training are farm shop activities.

The farm boy of the present time should be trained in the knowledge and skills that he will need to meet the mechanical problems with which the progressive farmer has to deal. To accept this challenge, the school farm shop is now provided with tools and equipment that justify the investment farmers must make in farm machinery. The rising demands for increased mechanical training have been met by many changes in the school farm shop in both teaching approach and type of equipment. New and more significant hazards must be dealt with by both teacher and students.

The program of farm mechanics is that part of vocational agriculture which includes all the unspecialized mechanical activities that a progressive farmer should perform on his home farm with the tools and equipment he will have accessible.[2] In this research paper the writer approaches the problem solely from the standpoint of the in-school instruction of farm shop, which is one phase of instruction in the farm

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[1] F. T. Struck, Vocational Education for a Changing World, p. 6.

[2] Glen C. Cook, A. Handbook on Teaching Vocational Agriculture, p.411.

mechanics program.

One of the objectives of farm mechanics instruction in vocational agriculture is to develop abilities in tool and equipment selection, maintenance, and their safe use.[3] Teachers recognize the responsibility of stressing the importance of the safe use of farm shop tools and equipment. Most of the accidents in vocational agriculture farm shop can be prevented if the proper safety precautions and safety habits are developed and observed. Avoiding accidents involves learning the hazards in an activity and the development of correct safety habits.[4]

In relating problems of safety to farm shop activities, it is evident that there is a carry-over of safe practices to conditions existing on the farm. Development of school farm shops to intensify this relationship offers a real challenge to teachers of vocational agriculture.

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[3]Ibid., p. 417.

[4]Lloyd Phipps, Your Opportunities in Vocational Agriculture, p. 85.

SECTION II

PURPOSE

Vocational agriculture teachers of South Dakota have established an enviable record for safe farm mechanics shops, in the opinion of the writer. Relatively few serious accidents have occurred despite the accelerated program and increase in farm shop tools and equipment in school farm shops.

This study purposes to discover what methods and measures are currently being used by South Dakota vocational agriculture instructors to promote safety in the school farm shop. Also ascertained by this research is information dealing with the nature, causes, number, and seriousness of recent accidents that have occurred in school farm shops in South Dakota.

This study can be desirable for the purpose of assisting vocational agriculture teachers in recognizing safety hazards in the farm shop and what their responsibilities are in minimizing the risks to their students. The results of this research could also be beneficial in determining how to best meet the challenge of training prospective vocational agriculture teachers to adequately appreciate the observance and practice of safe procedures in teaching vocational agriculture students in farm mechanics.

Students having received safety instruction might avoid accidents in the shop and also benefit by associating the safe practices learned in school farm shops to future farming operations. This will in turn prevent the occurrence of casualities on the farm.

SECTION III

PROCEDURE

The information for this study was secured through the use of a questionnaire, since that method was deemed most practicable for gathering the needed data from so many different individuals. A questionnaire was developed to obtain personal opinions and practices of vocational agriculture instructors who have had three or more years of experience. It was the writer's belief that at least three years of experience would constitute enough time to lend validity and reliability to the replies of the teachers.

A list of names and addresses of vocational agriculture instructors in South Dakota with the type of tenure indicated was selected with the assistance of the teacher trainer. Forty-eight instructors were selected who had in operation farm shop programs of a superior nature indicated by the extent and quality of instruction.

A copy of a questionnaire (Appendix B) was sent to each instructor accompanied by a letter of explanation (Appendix A) and a stamped self-addressed envelope. Most of the questionnaires were returned in a few weeks and a second mailing brought in a total of 45 responses, or 93¾ per cent of those mailed. The information thus secured was tabulated and analyzed. The interpretations as indicated in the results of this study were based on the data secured in the questionnaire. Recommendations were based partially on the writer's experience in teaching vocational agriculture but primarily through interpretation of the results of the research conducted.

SECTION IV

REVIEW OF LITERATURE

Much has been written pertaining to the field of farm shop. However, only a relatively few have confined such research to the consideration of the safety factors in the school farm shop. This interest has been developed recently through various means. Widespread recognition of the responsibility of the teacher in the event of accidents that occur in the school farm shop has contributed to this interest. Webb,[5] in conducting a study in 1954 of safety policies that could be used in vocational agriculture departments in Georgia, found that teachers have a definite responsibility in the event of accidents to students and that they may be held liable for damages if teacher negligence can be proved.

Increased emphasis on farm machinery repair, expanded farm-mechanics programs, and the increased use of power tools in the school farm shop are some of the factors tending to increase the possibility of accidents. A definite, carefully planned safety program seems to be the only justifiable procedure for the teacher to follow if shop accidents are to be reduced to a minimum, is the opinion of Baldwin[6] of Virginia.

In a study of safety programs in farm shops in Oklahoma, Frye[7] reveals that 70 per cent of the teachers contacted were adequately

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[5]Eustace Webb, Developing Some Safety Policies That Can Be Used in Vocational Agriculture Departments in Georgia.

[6]O. L. Baldwin, "How Safe Is Your Farm Shop," Agricultural Education Magazine, XIX (April, 1947), p. 195.

[7]Neil T. Frye, Safety Programs in the High School Farm Shops of Oklahoma.

trained to operate the machines in their shops; however, a larger proportion were of the opinion that more college shop courses should be required of prospective agriculture instructors. From this report it can be deducted that many teachers would feel more adequately qualified to teach the safe use of tools and equipment if the foregoing suggestion was followed.

A similar study was completed in 1954 by Russell[8] of Texas in which the causes of 55 accidents occurring in school farm shops were analyzed. The power saw was responsible for 13 accidents as was also the jointer. The arc welder was used in 44 of the 45 schools surveyed and 17 cases of eye damage were reported. The results indicated that following safety practices and the use of safety devices would eliminate a high percentage of farm shop accidents.

C. S. Anderson,[9] in an article dealing with the occurrence of accidents in Pennsylvania, showed that the wood chisel accounted for five times as many accidents as any other hand tool. The jointer was considered three times more dangerous than the tilting arbor saw. It was found in this study that fewer accidents result in connection with the use of power tools than with hand tools, but accidents that do occur are more likely to be fatal and far more maiming.

J. R. Lyday[10] of Georgia found in a study that 545 accidents

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[8]Eugene Russell, A Study of Farm Shop Safety in Forty-five Vocational Agriculture Departments in Texas.

[9]C. S. Anderson, "Teaching by Accidents," Agricultural Education Magazine, XXIV (November, 1951), p. 113.

[10]J. R. Lyday, Developing Some Safety Measures That Can Be Used in High School Farm Shops in Georgia.

occurred in 150 school farm shops over a three year period. Three hundred and ninety of these accidents required first aid and one was fatal. Twenty schools reported having no accidents. It was revealed that 95 per cent of the accidents were caused by lack of proper instructions and safety practices, already indicated in previously cited studies.

The opportunities that vocational agriculture teachers have to present safety education are brought out in an article by Nicol[11] of the National Safety Council, written in 1946. His feelings that safe practices may be taught more effectively when included as a part of each specific job rather than when set aside as a special-course unit labeled "Farm Safety" are also indicated in other studies.

The amount of time specifically devoted to the teaching of farm safety in Illinois is brought out in a study by Young.[12] He found that 127 days were spent teaching safety in the farm mechanics program by instructors in that state.

Cunningham has reviewed recent trends in instructional procedures used in school farm shops.[13] The logical need for safety instruction is emphasized by the present rate of farm accidents. Vocational agriculture instructors must take advantage of every opportunity to get safe practical methods followed daily in order to form proper habits on the part of

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[11] Marvin Nicol, "Why Not Teach Farm Safety," Agricultural Education Magazine, XIX (July, 1946), p. 10.

[12] Orville Young, "What Are They Teaching in Farm Mechanics," Agricultural Education Magazine, XXIII (March, 1951), p. 208.

[13] E. C. Cunningham, "Safety in the Farm Mechanics Program," Agricultural Education Magazine, XXVIII (January, 1956), p. 23.

students. Farm shop instructors must be constantly alert to safety hazards as a basis for most effective instructional procedures.

SECTION V

RESULTS OF THE STUDY

Safety is a continuing problem in farm shop instruction. Vocational agriculture instructors in South Dakota are sincerely attempting to hold shop accidents to a minimum and are sincerely interested in preventive practices.

Of the 48 teachers of vocational agriculture in South Dakota contacted in this study, 45 returned questionnaires which were used to compile the survey information presented. The data presented in the first part of the study include areas dealing with teacher tenure, size of shop, and teacher training. Other areas dealt with are concerned with measures and procedures used in promoting school shop safety. The latter part deals with causes, frequency, and seriousness of accidents that have occurred in the 45 farm shops over the past five years.

Table I. Tenure of Teachers Included in the Study

Range in years having taught farm mechanics	Number	Per cent
1 - 4	4	8.9
5 - 9	23	51.1
10 - 14	11	24.4
15 - 19	4	8.9
20 - Over	3	6.7
Total	45	100.0

It is interesting to note that over half, or 51.1 per cent of the vocational agriculture teachers have taught farm mechanics for periods of time ranging from 5 to 9 years. This is an indication that vocational agriculture has made rapid growth since World War II. The range in experience of the instructors was from 4 to 25 years. The average tenure of the 45 men surveyed was 9 years. Teachers with this type of tenure should logically be expected to present reliable information on the questions presented in the survey questionnaire. Adequate tenure would also tend to increase the validity of the information gathered.

Table II. Sizes of Farm Shops in 45 Vocational Agriculture Departments in South Dakota

Size of area in square feet	Number	Per cent
500 - 799	3	6.7
800 - 1099	4	8.9
1100 - 1399	4	8.9
1400 - 1699	5	11.2
1700 - 1999	7	15.5
2000 - 2299	8	17.7
2300 - 2599	6	13.3
2600 - 2899	4	8.9
2900 - Over	4	8.9
Total	45	100.0

The size of farm shops included in this survey varied from 500 to 3400 square feet. The size of shops plays an important part in the problem of shop safety although it would be difficult to correlate. Shops of adequate size are primarily the result of widespread and increased interest in vocational agriculture and facilitate extensive and effective farm mechanics programs. Small shops are frequently more hazardous due to crowded conditions under which equipment is operated.

Table III. How 45 Vocational Agriculture Teachers Regard the Adequacy of Their Training in the Safe Operation of Common Power Tools

Items	Number	Per cent
Received adequate training	10	22.2
Did not receive adequate training	35	77.8
Total	45	100.0

Only 10 teachers from 45 departments reporting were adequately trained in the operation of all the power tools listed in the questionnaire, as shown in Table III. A large number of teachers indicated inadequate training in some of the machines listed since some of them are not frequently found in farm shops. These and other tools are also not included in college shop courses prescribed for prospective vocational agriculture teachers. Forty per cent of those instructors adequately trained in the operation of shop tools received their training in college shop courses. How and where the other 60 per cent received their training was not presented, but it is evident from responses that in-service

training accounts for a large proportion.

Table IV. Appraisals By Teachers of Vocational Agriculture Regarding the Present Level of Farm Shop Training and Recommended Training Requirements

Items	Number	Per cent
Feel additional training in farm shop would help in teaching the safe use of shop machines	43	95.6
Feel more college shop courses should be required for prospective vocational agriculture instructors	43	95.6
Feel that a college course in shop safety should be included in the curriculum for vocational agriculture instructors	37	82.2

Forty-three vocational agriculture instructors, as shown in Table IV, believe that more training in farm mechanics would increase the efficiency of teaching the safe use of shop machines and feel more courses in farm shop should be required for prospective vocational agriculture teachers. The foregoing appraisal, according to the writer's interpretation, has been based on the curriculum standards at the time of their graduation. Eighty-two per cent of the teachers believe that a course in shop safety would be a desirable addition to the agriculture education curriculum. Short courses in shop tool operations and workshops in school shop safety would favorably lend themselves to meeting the requirements of teachers already in the field.

Table V. How Safety Instruction Is Incorporated in Teaching By Vocational Agriculture Instructors

Pattern Followed	Number	Per cent
Taught as a planned daily integrated part of shop teaching	34	75.6
Taught only when occasions arise making it necessary	0	0
Taught in sessions devoted only to shop safety	11	24.4
Total	45	100.0

The teaching of shop safety on an integrated basis presents a more practical approach to the problem of shop safety and has been most widely used by vocational agriculture instructors. Its application in the everyday use of shop equipment provides realistic training, and hazards are recognized and treated with caution. In teaching shop safety in sessions devoted specifically to this subject, student attention is directed to a single area of instruction without application of all laws of learning. Table V indicates that more than three-fourths of the vocational agriculture instructors integrate safety as a part of shop instruction largely because of its greater effectiveness. Twenty-five per cent feel they reach their objectives in shop safety more satisfactorily by teaching sessions devoted only to safety.

Table VI. Approximate Time Received in Shop Instruction by a Typical Student During Four Years of Vocational Agriculture

Amount of time (hours)	Number	Per cent
4 - 9	12	26.7
10 - 14	7	15.6
15 - 19	6	13.3
20 - 24	8	17.8
25 - 29	6	13.3
30 - Over	6	13.3
Total	45	100.0

In ascertaining the approximate amount of time devoted specifically to the teaching of shop safety through four years of vocational agriculture, it is interesting to note the extreme variation among the departments surveyed. A range of 4 to 40 hours spent on shop safety was reported in Table VI.

All departments surveyed used occasional review of previously taught shop safety rules. Obviously, such review is regarded by teachers as an essential factor in the prevention of shop accidents. After lapses in shop instruction, such as vacations from school, review of safety rules would provide its maximum benefits.

Table VII. Methods and Techniques Used in Shop Safety Instruction in 45 Vocational Agriculture Departments in South Dakota

Methods and Techniques Used	Number and Rank											
	1	2	3	4	5	6	7	8	9	10	11	12
Safety Demonstrations	26	10	2	2	2	1	2					
Classroom Recitation	8	13	15	4	2	1	2					
Safety Rules	4	9	15	10	3	2	1	1				
Safety Posters		1	2	6	8	6	6	3	2	1		
Safety Tests		3	2	7	6	6	5	4	2	2	1	
Safety Charts		1	1	5	4	12	5	4	4	1		
Mechanical Provisions	7	6	9	8	8	2	3		1	1		
Safety Committees				1	3	1	3	2	2	2	2	1
Moving Pictures			1		6	5	6	8	4	5	1	
Filmstrips		1		2	3	4	3	6	8	3	2	
Slides				1		1	3	3	3	4	7	2
Exhibits		1				2						
Reports				1							1	

Thirteen of the most frequently used methods and techniques in teaching school shop safety and their rank are shown in Table VII. Four additional measures were listed on the survey questionnaire but were not ranked frequently enough to be significant and therefore are not reviewed. The measure ranking first in importance was that of safety demonstrations, which was ranked first by 26 of the men, and which was employed somewhere in the instructional process by all of them. All the instructors also

indicated classroom teaching of safety, safety rules and regulations, and mechanical provisions as effective measures being used in teaching shop safety. Mechanical provisions are construed to mean such devices as safety shields and guards on machines and equipment such as goggles and eye shields provided for the use of the students. Four other measures checked as being frequently used are submitted herewith:

1. Use of safety posters.
2. Safety tests for students.
3. Safety charts.
4. Moving pictures.

Each of the foregoing measures was ranked by 77 per cent or more of the instructors.

Undoubtedly there are other important measures used in presenting shop safety to vocational agriculture students than those listed here. However, Table VII points out the measures most frequently ranked by the 45 respondents.

Table VIII. The Power Tools Ranked as the Three Most Dangerous by 45 Vocational Agriculture Instructors in South Dakota

Power Tool	Number and Rank 1st	2nd	3rd
Stationary circular saw	16	14	8
Jointer and Planer	18	13	9
Band Saw	5	3	6
Grinder		4	6
Drill Press		2	7
Wood Lathe		4	4
Portable Saw	6	4	
Arc Welder			5
Gas Welder		1	

The nine power tools considered the most dangerous by the vocational agriculture instructors are listed in Table VIII. The stationary circular saw was the single tool ranked as the most dangerous shop power tool. Either the jointer or planer or both were listed by 40 instructors as hazardous in comparison with other power tools. The acetylene welder was ranked by only one instructor although the potential danger is very high if this equipment is mishandled.

Table IX. The Hand Tools Ranked as the Five Most Dangerous by 45 Vocational Agriculture Instructors in South Dakota

Hand Tool	Number and Rank				
	1st	2nd	3rd	4th	5th
Wood Chisel	25	15	2	3	
Saw	3	12	14	8	1
Hammer	4	3	14	8	8
Draw Knife	3	4	2	6	3
Cold Chisel	4	2	2	2	6
Files and Rasps		3		6	6
Screw Driver		3	3	3	6
Wrenches	2		2	4	6
Hatchet	2		1	1	4
Planes		2	2	2	
Hack Saw		1			1
Jack Knife		1			1
Lathe Tools		1		1	
Hand Drill			1	1	

Hand tools, although potentially not as dangerous as power equipment, contribute frequently to shop accidents. How the instructors ranked the hand tools on the basis of how dangerous they are is revealed in Table IX. All instructors ranked the wood chisel, with 25 men listing it as the most dangerous hand tool. Two of the most widely used tools, the saw and the hammer, were ranked by 38 and 37 instructors respectively as potentially dangerous tools. This is substantiated by

vocational agriculture teachers in Table XX which lists the tools contributing to accidents that have actually occurred in their farm shops during the last five years. Other tools ranked frequently were the draw knife, cold chisel, files and rasps, screw drivers, and wrenches.

Table X. Departments Allowing First Year Students to Use Power Equipment

Items	Number	Per cent
Allow first year boys to use power equipment	14	31.2
Do not allow first year boys to use power equipment	31	68.8
Total	45	100.0

Over two-thirds of the vocational agriculture instructors surveyed believe freshman students to be too immature and untrained to properly and safely use power equipment. Whether students should be permitted to use power tools in their first year of vocational agriculture would be dependent to a great extent on the amount of training in the operation of power tools they had received previous to their freshman year in agriculture. Many instructors believe most of the work done in the first year should be completed with hand tools in order to acquire skills in their use.

All the instructors contacted indicated that they gave previous instructions to vocational agriculture students before the students were permitted to operate power equipment. Such preliminary instruction is

essential to the safe use of equipment found in the farm shop. Many instructors required the passing of safety tests before power equipment could be operated by individual students. This would assure a fundamental understanding of safe procedures before initial operation by the boys.

Table XI. Appraisal of 45 Vocational Agriculture Departments in South Dakota With Respect to Adequacy of Space

Items	Number	Per cent
Departments having adequate space for largest class	22	48.8
Departments having adequate space for machinery and equipment	20	44.5

Over half of the departments surveyed were inadequate in size, a major impediment to the promotion of shop safety, as illustrated in Table XI. Of the shops that indicated sufficient room for both their largest class and all machinery and equipment, most of them are of recent construction and located in communities where problems of future enrollment and necessary equipment space have been taken into consideration.

Table XII. Appraisal of School Farm Shops In Regard To Adequacy of Lighting and Ventilation

Items	Number	Per cent
Having adequate lighting	33	73.3
Having adequate ventilation	33	73.3

Nearly three-fourths of the vocational agriculture instructors surveyed reported adequate facilities for lighting and ventilation in Table XII. The optimum amount of light for safe working conditions should be equal to 30 foot candles at the working surface. More detailed work requires correspondingly more light. Alertness to hazards on the part of the student is augmented by adequate ventilation.

Table XIII. Appraisal of School Farm Shops With Respect to Possession of First Aid Kits and Fire Extinguishers

Items	Number	Per cent
Have well-equipped first aid kits	34	75.6
Have fire extinguishers	43	95.6

The majority of farm shops have well-equipped first aid kits readily available, as indicated in Table XIII. Because of the frequency of minor accidents requiring only superficial first aid, a first aid kit is apparently an essential item in farm mechanic shops.

Practically all of the farm shops studied are equipped with fire

extinguishers. Because of the varied types of activities carried on in farm shops, instructors have recognized the danger of fire hazards and have implemented the provision of fire extinguishers. State fire inspection regulations also require fire protection equipment readily available in public schools.

Sixty-three per cent of the instructors who have shops equipped with fire extinguishers teach their students the principles of using such equipment. To avoid unnecessary delay in fire fighting in event of fire, such a practice is a highly important segment of safety instruction in farm mechanics.

Table XIV. Number of Departments Reporting the Use of Eye Protective Equipment

Items	Number	Per cent
Use eyeshields or goggles when cutting, chipping, grinding, and welding	40	88.8
Use welding screen when welder is in shop	28	62.2

Forty of the forty-five departments surveyed required boys to wear goggles or eye shields when operating equipment which could cause eye injuries as indicated in Table XIV. Shop operations such as arc and acetylene welding, grinding, chipping, and cutting metal were considered to be those jobs requiring the use of protective equipment.

Sixty-two per cent of the shops reported the use of welding screens when the welder was used in the shop. The instructors indicated

conclusively that protection from arc radiation is important. Severe eye burn could thus be prevented to curious watchers.

Table XV. Practices Involving the Use of Storage Containers in School Farm Mechanics Shops

Items	Number	Per cent
Store combustibles in safety cans properly labeled	36	80.8
Use adequate and plainly marked containers for scrapwood, scrap metal, and oil wastes	25	55.5

Improper storage of combustible materials used in shop operations present an obstacle to their continued safe use. Therefore, 36 farm shops store their combustible materials in safety cans properly labeled for positive identification, as shown in Table XV. Twenty per cent reported improper storage of these same materials. Over half of the departments make provisions for the proper disposal of waste materials by providing plainly marked containers of ample capacity.

Adequate storage facilities for building materials are frequently limited in many shops and their presence is definitely a factor to consider in shop safety. Thirty-eight of the 45 shops surveyed reported storing building materials inside the shop working space. Such a situation frequently contributes to the occurrence of accidents.

Table XVI. Number of Departments Having Danger Zones Marked Around Shop Machines

Items	Number	Per cent
Have work danger zones marked around shop machines	11	24.4
Do not have work danger zones marked around shop machines	34	75.6
Total	45	100.0

Few farm shops are adequate in size to properly mark work danger zones around power equipment and adhere to their use. Only 11 departments reported using this safety measure. Much improvement in this area of safety is in order, as evidenced by Table XVI.

Table XVII. Proportion of Departments Having a Safety Color Scheme in the School Farm Shop

Items	Number	Per cent
Use a safety color scheme	8	17.8
Do not use a safety color scheme	37	82.2
Total	45	100.0

A safety color scheme is a little used safety measure in South Dakota farm shops as shown in Table XVII. Only 8 shops indicated using colors to make students more aware of danger areas. Color dynamics

contribute to shop safety by directing the attention of the operator to moving parts of hazardous power tools. Painting the area of moving parts a bright orange and working surfaces pale green and outlined with ivory is a highly recommended safety color scheme. The proper color scheme on walls, ceiling and floor also contributes to safety.

Table XVIII. Number of Departments Requiring the Wearing of Protective Clothing When Performing Special Shop Operations

Items	Number	Per cent
Require protective clothing	26	57.8
Do not require protective clothing	19	42.2
Total	45	100.0

Loose fitting or improper clothing is frequently the cause of accidents in farm shops especially when welding or working with power tools. Table XVIII indicates over half the departments surveyed have largely prevented the risk by requiring the wearing of specified protective clothing when the boy is performing certain shop operations. The wearing of properly fitted coveralls without cuffs when welding would be an excellent example of this safety practice.

Table XIX. Number of Departments Having Electrically-Operated Equipment Grounded

Items	Number	Per cent
Have electrically-operated equipment grounded	21	46.7
Do not have electrically-operated equipment grounded	24	53.3
Total	45	100.0

Fewer than half of the 45 departments contacted reported their electrically-operated equipment to be properly grounded as shown in Table XIX. This survey indicated that the hazard of operating ungrounded equipment is not fully recognized.

Of the various measures used in preventing shop accidents, there is considerable variation in their use by vocational agriculture instructors. However, the requirement that all accidents be reported immediately to the instructor is unanimous among the 45 reporting departments.

The information and data collected and analyzed thus far in this research deal with measures used to promote shop safety. The reader's attention is now directed to information dealing with actual accidents occurring throughout a five-year period in the 45 departments surveyed. The numbers of accidents and the equipment contributing to their occurrence are reviewed in Table XX.

Table XX. Hand and Power Equipment Contributing to 193 Shop Accidents as Reported by 45 Vocational Agriculture Departments and Occurring Throughout a Five Year Period

Cause of Accident	Number of Accidents
Arc welder	40
Power saws	26
Wood chisel	21
Hand saw	20
Hammer	15
Acetylene welder	8
Grinder	8
Jointer	8
Lathe	8
Band saw	6
Belt sander	3
Planer	2
Drill press	2
Glass cutter	2
Plane	2
Wrench	2
Miscellaneous	20
Total	193

Of the accidents reported in Table XX only 44 required a doctor's care. Few of the accidents were serious and the majority of them required only minor first aid for treatment. Eye and skin burns resulting from operation of the arc welder were responsible for 40 of the accidents reported in Table XX. Power saws contributed to 26 accidents and were ranked second in frequency of occurrence. Three of hand tools, namely, the wood chisel, hand saw, and hammer followed in order of their frequency of contributions to accidents. Factors involved in 14 accidents were not indicated and were included as miscellaneous accidents. Wood

slivers, a chain hoist, a blow torch, a draw knife, and the swallowing of a nail were other miscellaneous contributing causes of shop accidents.

Table XXI. Year of Instruction in Vocational Agriculture in Which Accidents Occurred

Year of Instruction	Number	Per cent
Agriculture One	48	25.0
Agriculture Two	38	19.6
Agriculture Three	77	40.0
Agriculture Four	30	15.4
Total	193	100.0

It is interesting to note that the largest number of accidents was reported as happening to students in their third year of vocational agriculture. Most departments of vocational agriculture use the junior year primarily for farm mechanics instruction which consists of the farm shop work area of training. This results in the large number of accidents occurring in that year, as is borne out in Table XXI. The combination of juniors and seniors in vocational agriculture in many schools results in larger classes which may also have an important effect on the number of accidents reported for that year of training.

There was considerable variation in the frequency with which some of the rules were listed in Table XXII which follows, but it is difficult to arrange them according to importance. They all play an important part

in the prevention of accidents in farm shops in South Dakota. The writer selected the rules listed most frequently as those outstanding examples practiced in South Dakota farm shops.

Table XXII. Principle Safety Measures Listed by 45 Vocational Agriculture Teachers as Those Most Important in Maintaining Shop Safety

1. Have thorough knowledge of operation of equipment
2. Allow no horseplay or loafing
3. Observe all rules and regulations
4. Allow operator only around machine
5. Keep tools sharp and in good repair
6. Demonstrate before allowing use of tools
7. Wear proper clothes and protective equipment
8. Use the proper tool for the proper work
9. Do not hurry or run in shop
10. Practice courtesy
11. Respect machinery
12. Use safety tests before initial operation
13. Keep safety guards in place
14. Do not operate equipment when instructor is absent
15. Arrange tools and equipment properly and leave in designated places
16. Provide proper ventilation
17. Keep shop clean
18. Use previous accidents as examples
19. Instructor should set example

Table XXII (Continued)

20. Use safety visual aids
21. Keep welders shielded
22. Help and check each other when needed
23. Keep combustibles in proper containers
24. Supervise closely
25. Do not talk to or distract machine operator

SECTION VI

SUMMARY

In conducting this study, the writer sought to discover the emphasis being placed on farm shop safety by vocational agriculture teachers in South Dakota. The teachers used in this study were representative of a cross section of the state. Over one-half of the teachers had taught farm shop from 5 to 9 years. Forty per cent had taught for 10 years or more. These instructors taught in varying sizes of shops, the most common sizes ranging from 1400 to 2600 square feet of floor space.

Only 22 per cent of the teachers indicated adequate training in the safe operation of common power tools found in their shops. This result may be due to the fact that many shops are limited in the number of machines. It is evident that more training is needed in the operation of welders, jointers, planers, and wood lathes.

Over 95 per cent of the teachers indicated insufficient knowledge of shop machinery. This figure definitely implies the need for more training in farm shop. A vast majority also believe a college course in shop safety would be desirable.

Teaching farm shop safety as a daily integrated part of shop experiences was considered most effective by 75 per cent of the instructors. Twenty-five per cent felt they could fulfill their objectives more satisfactorily by sessions covering only shop safety. The most frequent amount of time indicated for the teaching of shop safety was 20 to 24 hours throughout a four-year program.

Agriculture instructors make frequent use of various methods of teaching shop safety. Those considered most effective were safety demonstrations, classroom recitation, and safety rules. All shops made use of mechanical devices and frequently used movies as effective visual aids.

Instructors felt the circular saw and jointer were the most dangerous power tools while the wood chisel was ranked highest among the hand tools. All instructors gave previous instructions before allowing boys to operate shop machines. This possibly accounts for the relatively small number of shop accidents. Also to be considered is the fact that 68.8 per cent of the instructors do not allow first year boys to use power equipment.

Many departments do not have sufficient space for proper use of machinery and are crowded when classes occupy the shop. Three-fourths of the shops are adequately lighted and ventilated.

Most of the shops were reported as being equipped with first aid kits. The lack of first aid kits is a definite indication of a weakness in the shop program. All but two departments were reported to have fire extinguishers. Their absence in farm shops could constitute a breach of fire laws. Since the possibility of fires in the farm shop are great, more than 63 per cent teaching the use of the fire extinguisher should follow this practice.

Indications are that most of the farm mechanics instructors require the use of goggles or eye shields when performing dangerous shop operations. Welding screens are not universally used to prevent eye injury.

Twenty per cent of the farm shops have inadequate storage facilities for combustible materials and only a few more than half have proper containers for waste materials. Obviously, such conditions should be remedied.

Few vocational agriculture teachers are using marked danger zones or safety color schemes to prevent shop accidents. A majority feel that protective clothing is essential to shop safety. Although the grounding of electrically-operated equipment is an important precaution in shop safety, it is surprising that only 21 of the 45 departments reported having equipment grounded.

More accidents happened in the third year of high school preparation than in any other year. The more extensive use of shop facilities during that year is likely the primary reason for such occurrence. Freshman were also subject to frequent accidents. The arc welder was responsible for 40 of the accidents reported although these consisted mostly of eye and skin burns. The power saw contributed to 26 of the 193 accidents reported. The wood chisel and hand saw were next in order. Of the 193 accidents reported, only 44 required a doctor's care and none resulted in permanent injury.

This study reveals that instructors in South Dakota have accepted the responsibility of teaching shop safety in an effort to curb the ever-rising rate of accidents among our farm youth. Through co-operative efforts on the part of both student and instructor, agriculture can become a relatively safe occupation.

SECTION VII

RECOMMENDATIONS

Teachers of vocational agriculture in South Dakota are aware of their obligation to include farm shop safety in the farm mechanics instructional program. They are in general agreement regarding practices necessary for safe participation in a school farm shop program. Through interpretation of the research data the following recommendations are presented:

1. Minimum size of a farm shop should not be less than 2000 square feet. Adequate space will lessen dangers resulting from crowding students, equipment, supplies, and projects.

2. Curriculum changes need to be made in the agriculture education program for prospective teachers, assuring adequate training in all aspects of farm mechanics safety. Work shops and short courses should be offered to in-service teachers in shop work and shop safety. Such training could be provided by the training institutions off-campus and on a district basis.

3. All vocational agriculture students should be given preliminary instructions before operating power equipment. This practice would assure the students' possession of fundamental knowledge in safe operating procedure of shop machines. Each student should also be required to satisfactorily pass a safety test before initial operation of each power tool.

4. All shops should contain a well-equipped first aid kit and have fire extinguishers readily available. In addition, all vocational agriculture students should have a fundamental knowledge of first aid application and know how to operate fire extinguishers.

5. Vocational agriculture students ought to be required to wear protective equipment and clothing when their use is desirable as a safety precaution.

6. Combustible materials used in farm shops should be stored in properly labeled safety cans away from fire hazards. Adequate and plainly marked containers should also be provided for scrap materials to assist in maintaining a neat shop.

7. Work danger zones should be marked in school farm shops to give machine operators maximum protection.

8. Color dynamics should be stressed when painting shops and equipment. Color plays an important part in keeping students aware of safety hazards.

9. Electrically-operated equipment in farm shops should be grounded. Electric shock frequently results from ungrounded equipment and presents a serious safety hazard.

10. Students need more and better instruction in the proper and safe use of such hand tools as the wood chisel, saw, and hammer. Proper conditioning of hand tools also contributes to their safe use.

11. Shop safety should be integrated into the regular program of instruction to provide well-conditioned safety habits in the daily routine of vocational agriculture students.

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A P P E N D I C E S

APPENDIX A

Le Center, Minn.
April 22, 1958

Dear Teacher of Vocational Agriculture:

I am a graduate student at South Dakota State College and am now involved in the writing of a research paper entitled: "Safety Programs in the High School Farm Shops in South Dakota".

Your school has been rated as having one of the outstanding farm shop programs in South Dakota and has been recommended to me to be used in my study.

I am enclosing a questionnaire, which when completed by you will aid me in the writing of this research paper. This paper is to be completed by summer; therefore, I would appreciate the return of the completed questionnaire as quickly as possible. Enclosed you will find a stamped self-addressed envelope which is for your convenience in the returning of the questionnaire.

I assure you that all information received from this questionnaire will be held confidential and neither your school nor your name will be associated with it in the writing of the research paper.

Sincerely yours,

L. R. Hohbach

APPENDIX B

Questionnaire Regarding Farm Mechanics Shop Safety

1. How many years have you been teaching vocational agriculture shop?
_____ years

2. What is the approximate size of your present shop? _____length
_____width

3. Indicate your training in the safe operation of common power tools by placing a Yes or No in each column.

	Adequate	Inadequate	Received training in college
a. Circular power saw			
b. Drill press			
c. Jointer			
d. Planer			
e. Grinders			
f. Electric welders			
g. Acetylene welders			
h. Lathes			
i. Band saw			

4. Do you think more undergraduate college shop courses should be required for ag teachers? (Underline choice) Yes No

5. Do you think a college course in shop safety should be set up for prospective ag teachers? (Underline choice) Yes No

6. What method do you consider most effective in teaching shop safety? Indicate one choice by checking (X).
_____a. Taught as a daily integrated part of shop teaching?
_____b. Taught only when occasions arise making it necessary?
_____c. Taught in sessions devoted only to shop safety?

7. Approximately how much time in shop safety instruction does each boy receive in four years of agriculture? _____hours

8. Do you feel occasional review of shop safety rules important in keeping boys aware of dangers in their work? (Underline your answer)
Yes No

9. Check (X) the following measures currently used by you in shop safety instruction:

___a. Safety demonstrations
___b. Classroom teaching of safety
___c. Safety rules and regulations
___d. Use of safety posters
___e. Safety tests for students
___f. Safety charts
___g. Mechanical provisions (Guards, shields, etc.)
___h. Safety committees
___i. Movies
___j. Filmstrips
___k. Slides
___l. _____

How do you rank them in importance? (1st, 2nd, 3rd, etc.)
a. __ b. __ c. __ d. __ e. __ f. __ g. __ h. __ i. __ j. __ k. __ l. __

10. What power tools do you regard as most dangerous? List in order of three most dangerous.
1. _____
2. _____
3. _____

11. What hand tools do you regard as most dangerous? List in order of the five most dangerous.
1. _____ 3. _____
2. _____ 4. _____
5. _____

Underline your answer to each of the following questions:

12. Do your first year boys use power equipment? Yes No

13. Do any of your boys use shop power tools without previous instruction? Yes No

14. Is your shop space adequate for its largest class? Yes No

15. Are machinery and equipment crowded in your shop? Yes No

16. Is your shop adequately lighted? Yes No

17. Is your shop adequately ventilated? Yes No

18. Do you have a well-equipped first aid kit in your shop? Yes No

19. Do you have a fire extinguisher in your shop? Yes No

20. Are all students trained to use the fire extinguisher in an emergency? Yes No

21. Do you use a welding screen or booth if welder is in shop? Yes No

22. Do boys wear goggles or eyeshields when cutting, chipping, grinding, or welding? Yes No

23. Do you store combustibles in safety cans properly labeled? Yes No

24. Do you store building materials inside of shop working space? Yes No

25. Do you provide adequate and plainly marked containers for scrapwood, scrap metal, and oil wastes? Yes No

26. Do you have danger zones marked around your machines? Yes No

27. Do you use a safety color scheme in your shop? Yes No

28. Do boys wear protective clothing when performing hazardous shop functions, such as welding? Yes No

29. Is all electrically-operated equipment grounded? Yes No

30. Are all shop accidents reported to you immediately? Yes No

31. How many accidents have occurred in your farm shop during the last five years? (Include previous shop if you have not been in your present location five years)

With what hand tool or machine	Nature or seriousness of accident	Cause of accident

32. Within the last five years, how many accidents in the school farm shop have occurred to boys in Ag I __ Ag II__ Ag III__ Ag IV__.

33. How many of the foregoing accidents required a doctor's attention? _____

34. Have you ever had a fatal accident occur in your shop? ____ If so, what was the nature and cause? _____

35. State the rules you believe are most effective in preventing shop accidents.

_____

_____

_____