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AGRICULTURAL MECHANICS FACILITIES IN MINNESOTA HIGH SCHOOLS

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EDITOR'S NOTE: *Of all the areas of instruction in the field of vocational agriculture none is more challenging than Agricultural Mechanics. The tremendous advances in technology are reflected in the growing sophistication of the machines, equipment, and tools utilized in today's modern agriculture. It goes without saying that agricultural educators must maintain a constant program of field study, research and development of curriculum materials to keep the teaching in line with the needs and problems of people who operate and maintain modern agricultural machinery.*

It was something like 40 years between the time the first grain combine operated on the Great Plains until they were available on an economical basis to the farmer in up-state New York. In recent years, however, the innovations in farm machinery have come about at an increasingly rapid rate. This puts added pressure on the teacher of vocational agriculture and underlines the need for adequate facilities and equipment in the departments of vocational agriculture in the public schools.

Under the guidance and leadership of Dr. W. F. Bear, a series of studies have been initiated. The Visitor presents in this issue one of these studies dealing with Agricultural Mechanics facilities in Minnesota high schools. This study was conducted by Mr. Verne Spengler, a member of the vocational agriculture staff at Thief River Falls, Minnesota. In the article which follows, Mr. Spengler presents a condensation of his study and the recommendations which grew out of it.

What agricultural mechanics facilities are available in Minnesota High Schools? How do these facilities measure up to standards established by the U.S. Office of Education? Does a school district's financial assets or its financial effort affect the size and quality of agricultural mechanics facilities? A comprehensive study of agricultural mechanics was undertaken to determine what facilities and equipment are presently available in Minnesota vocational agricultural departments. Since facilities vary greatly within the state their present status must be known before recommendations can be projected for future educational programs. The major objective was to measure the relationship between financial assets, financial effort and the quality of physical plant and the number of tools and equipment available. Specific objectives of this research project were to determine:

(1) The relationship between a school district's financial assets and the size and quality of physical plant for agricultural mechanics.

(2) The relationship between a school district's financial effort and the size and quality of physical plant for agricultural mechanics.

(3) The relationship between age of the agricultural mechanics laboratory and the size and quality of physical facilities.

(4) The number of tools and equipment that are available as related to financial effort.

(5) The number of tools and equipment available as related to utilization of the shop.

(6) The relationship between utilization of the shop and financial effort and financial assets.

(7) Variations in shop facilities, tools and equipment which exist among vocational agriculture regions within the state.

(8) The relationship between free floor space per student and utilization of the agricultural mechanics shop.

(9) The relationship between the quarter hour credits of agricultural mechanics the teacher received in college and the number of shop tools available in the department.

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Two hundred twenty-eight, or 81 per cent, of the schools with vocational agriculture departments comprised the sample. Twenty schools had no agricultural mechanics facilities. The 208 schools with facilities averaged 1761 square feet of free floor space. This allowed 108 square feet of free floor space per student in the largest class. The United States Office of Education recommendations call for 150 square feet of floor space per student in the largest class. Less than 15 per cent of the schools in the study met this requirement.

Over 63 per cent of the shops had from 70 to 150 square feet of floor space per student in the largest class and approximately 22 per cent had below 70 square feet per student. (see Table I). Free floor space is the actual square feet of open, useable floor space in the shop. It was determined by subtracting the square feet of space occupied by stationary tools, workbenches and tables from total square feet in the shop and dividing by the number of students in the largest class.

Of the schools with agricultural mechanics facilities 52 per cent were shared shops. A shared shop was one that was shared with industrial arts or other school uses such as school bus maintenance or storage. Thus of the 228 schools studied only 100 provided facilities used exclusively for vocational agriculture.

Financial data for each school in the study were obtained from records in the Research Section, State Department of Education. The indicator of financial assets used as determined by the Equalization Aid Review Committee is the EARC value per Resident Pupil Unit. This amount is the adjusted assessed valuation of taxable property of the school district divided by the number of resident pupil units in average daily attendance. It averaged $7,755 for the schools in the study.

The financial effort a school district exerts in relation to its ability is the local effort index by EARC. It is expressed in mills and is the total mill rate needed to meet all local costs. This mill rate becomes an index of local effort and may be used to compare the relative contributions of the local districts in support of educational programs. Local effort index averaged 39 mills for schools in the study.

Coefficients of correlation of these and other factors influencing agricultural mechanics facilities appears in Table II.

No significant positive relationships were found between EARC value, local effort index and the related factors which influence agricultural mechanics facilities. It appears that a school's financial condition does not affect the size or construction features for agricultural mechanics or the quantity of tools available.

TABLE I

FREE FLOOR SPACE PER STUDENT IN THE LARGEST CLASS AS RELATED TO UTILIZATION OF AGRICULTURAL MECHANICS FACILITIES

Free Floor Space per student (sq. ft.)	Utilization				TOTAL	
	Vo-Ag Facility		Shared Facility			
	N	%	N	%	N	%
12-70	24	53.3	21	46.7	45	21.6
71-110	36	47.4	40	52.6	76	36.6
111-150	30	53.6	26	46.4	56	26.9
151-600	10	32.3	21	67.7	31	14.9
TOTAL	100	48.0	108	52.0	208	100

TABLE II

COEFFICIENTS OF CORRELATION OF FACTORS INFLUENCING AGRICULTURAL MECHANICS FACILITIES

		1	2	3	4	5	6	7	8
1.	EARC Value	1.00						n=208	
2.	Local Effort Index	-.65**	1.00						
3.	Teacher Tenure	-.05	.04	1.00					
4.	Quarter Hour Credits in Agricultural Mechanics	.01	-.03	.27**	1.00				
5.	No. of Vo-Ag Teachers in the School System	-.07	.01	-.03	.20**	1.00			
6.	Total Free Floor Space	-.09	-.01	.02	.18**	.23**	1.00		
7.	Free Floor Space per Student	.09	.04	.07	.05	.01	.67**	1.00	
8.	Total H.S. Vo-Ag Enrollment	-.14*	.03	.09	.12	.62**	.05	-.30**	1.00

*5% level of significance .13

**1% level of significance .17

Factors which were positively significant at the one per cent level include: (1) quarter hour credits of agricultural mechanics earned by the teacher in college and number of agricultural teachers in the school; (2) quarter hour credits earned in agricultural mechanics and total free floor space in the shop; and (3) number of agriculture teachers in the school and total free floor space.

The quarter hour credits of agricultural mechanics earned in college by the instructor had a definite affect upon the total number of tools in the agricultural mechanics shop. This is illustrated graphically in figure 1. When instructors' college quarter hours ranged from 0 to 14, 35 per cent of the schools had from 1 to 36 tools; 26 per cent had from 37 to 54 tools and 14 per cent had from 55 to 90 tools. However, when quarter hour credits reached the 21-50 level, 21 per cent of the schools had from 1 to 36 tools, 29 per cent had from 37 to 54 tools and 52 per cent had from 55 to 90 tools.

When schools with a relatively large number of available tools were compared with the method of shop utilization, it was found that shared shops had larger numbers of tools in the areas of carpentry, cold metal, plumbing, concrete and masonry. Shops used exclusively for agricultural mechanics were most frequently well equipped in the areas of farm machinery repair, power mechanics, electrification and hot metal, including welding.

Variations in shop size and facilities were found among the eight vocational agriculture regions. Region five reported the most schools with relatively large shops, 76 per cent being in excess of 1500 square feet of free floor space. Region one reported the largest proportion of schools with small shops with 47 per cent reporting shops of 200 to 1500 square feet. Region eight had the most schools (over 16 per cent) without shops.

Ninety-two per cent of the agricultural mechanics shops in this study were constructed within the past 15 years. Twenty per cent were 1 to 5 years of age, 41 per cent were 6 to 10 years of age and 31 per cent were 11 to 15 years of age. When size of shop was compared with age, it was found that of the shops 1 to 5 years of age 76 per cent had in excess of 1500 square feet and 39 per cent had in excess of 2000 square feet free floor space. Seventy-two per cent of the 6 to 10 year old shops were over 1500 square feet and 34 per cent were over 2000 square feet. Of the shops 16 years and older 59 per cent were under 1500 square feet.

As a result of this study the following recommendations are being made concerning agricultural mechanics programs and facilities in Minnesota:

(1) That when constructing new facilities school administrators, instructors and boards of education provide a minimum of 150 square feet of free floor space per student in the largest class.

(2) That adequate restroom facilities such as student lockers, stool, urinal, multiple wash basin and drinking fountain be provided in, or adjacent to, the agricultural mechanics area.

(3) That a minimum of 200 to 400 square feet of storage space be provided adjacent to the shop.

(4) That adequate space be provided outside the facility for moving, loading and storage of large items of agricultural machinery and equipment.

(5) That a large overhead door at least 16 feet in width and 14 feet in height be provided to facilitate instruction in modern agricultural machinery and equipment.

(6) That such conveniences as hot and cold water, compressed air piped throughout and bottle gas or natural gas outlets be provided.

(7) That outside window bottoms be placed a minimum of 6 feet above the floor to allow for adequate wall storage and bench space.

(8) That such construction features as a sump floor drain, paint area with exhaust and an exhaust system for internal combustion engines be provided.

(9) That if shared shops must be constructed, adequate free floor space be provided for agricultural machinery and equipment repair, power mechanics and project construction.

(10) That students majoring in agricultural education be encouraged to obtain adequate preparation in agricultural mechanics, preferably a minimum of 20 quarter hour credits of college credit.

(11) That adequate tools in quantity and quality as recommended by the Departments of Agricultural Engineering and Education be provided for the educational program in agriculture.

FIGURE 1

NUMBER OF TOOLS AVAILABLE RELATED TO QUARTER HOUR CREDITS OF AGRICULTURAL MECHANICS EARNED IN COLLEGE