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**COMPETENCIES IN AGRICULTURE MECHANICS NEEDED  
BY VOCATIONAL AGRICULTURE INSTRUCTORS**

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Des Moines, Iowa

3-364

*This is an abstract of a thesis submitted to Iowa State University of Science and Technology by Emeron Paul Dettmann in partial fulfillment of the requirements for the degree of Master of Science in August of 1965.*

*The study is one of a series conducted by the Department of Education of Iowa State University of Science and Technology with the assistance of graduate students in agricultural education in cooperation with the Iowa Agriculture and Home Economics Experiment Station and the Vocational Agriculture Section, Division of Vocational Education, State Department of Public Instruction.*

*This abstract was prepared by Emeron Paul Dettmann with the assistance of Alan Kahler, research assistant for the Iowa Agriculture and Home Economics Experiment Station Project 1253, under the direction of Dr. Duane L. Blake.*

# COMPETENCIES IN AGRICULTURE MECHANICS NEEDED BY VOCATIONAL AGRICULTURE INSTRUCTORS

by

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## Purpose of the Study

The primary purpose of this study was to determine the competencies needed in agricultural mechanics by vocational agriculture instructors. Other purposes were to determine the possessed competencies and to determine where they were acquired.

It is a part of a study in progress to determine the competencies needed by vocational agriculture instructors in the areas of animal science, farm management, soils and crops, agricultural mechanics and certain non-agricultural competencies.

## Method of Procedure

The Iowa vocational agriculture instructors were classified into four groups by an evaluation panel of the Iowa Vocational Agriculture Teachers Association and were designated as Groups A, B, C and D with 39 instructors in each group. Group A was rated as the higher quarter and Group D the lower quarter.

A panel of consultants, consisting of vocational agriculture instructors and Iowa State University specialists, developed a list of 186 competencies. Fifty-six of the competencies were in the agricultural mechanics field. Twenty-seven of these were understandings and 29 were abilities.

The total list of competencies in the five areas were put into questionnaire form along with selected control items and mailed to all of the experienced Iowa Vocational Agriculture Instructors. They evaluated the degree each competency was needed and also the degree they possessed.

The control variables provided information on the educational background of the instructors, characteristics of their present school and department, teaching experience, classification, salary, and age.

## Findings

Of the respondents who returned usable questionnaires, 46.8 percent had not studied vocational agriculture in high school while 31.4 percent had completed four years of vocational agriculture in high school. Sixteen and seven tenths percent had received a Master's Degree while 83.3 percent had not. There were 81.4 percent with consecutive teaching experience and 75 percent of the total instructors were natives of Iowa.

When the relationship of complete years of teaching vocational agriculture and instructor classification was determined, it revealed 17.9 percent of the instructors in Group A had more than 20 complete years of teaching while Group D had 2.5 percent.

The modal range of ages for the 156 instructors was 31 to 35 years. When the relationship of age and salaries was determined, it was found that a larger percentage of the younger teachers were found in the lower salary increments. The mean average ages of the lowest three salary increments were 23.0, 29.7, and 30.2 years; whereas the mean average ages of the top three salary increments were 50.5, 57.0, and 57.0 years.

When the relationship of salary and years taught in the present system was studied, it disclosed the seven highest salaries were received by instructors with twelve or more years in the present school system.

When day school enrollment was compared with instructor classification, it showed that there were no Group A instructors with an enrollment of 10 to 19 students, whereas Group D had three within this enrollment range. In the 20 to 29 range, Group A had two while Group D had nine. In the 50 to 59 range, Group A had 11 instructors compared to two for Group D. The modal range enrollment for all instructors was 40 to 49 day school students.

The same relationship existed between Groups A and D when average attendance of adult farmer classes was compared. In the 10 to 19 attendance range, Group A had 11 instructors, while Group D had 23. In the 40 to 49 range, Group A had six instructors and Group D had one.

The mean average annual farm visits per boy was highest with 5.72 visits for the instructors in the \$7000 to \$7199 salary bracket. The lowest mean average was in the \$8400 to \$8599 salary increment, with 3.5 visits. Those in the highest salary increments averaged either four or five visits per boy.

Fifty-one and three tenths percent of Group A were teaching in towns of less than 3000 population, while Groups B and C had 71.8 percent each and Group D had 94.9 percent. When all 156 instructors were considered, 72.4 percent were teaching in towns of under 3000 population.

As shown in Table 1, Group A ranked an understanding of safety factors in welding as the competency most needed with the ability to use all power tools correctly and safely as the second most needed competency. Group D ranked using all power tools correctly and safely of the same primary importance as using common tools correctly and safely. Thus, competencies involving safety factors in the use of all tools were ranked very important by both groups on the basis of need. Other high ranking needed competencies were figuring a bill of materials, constructing and repairing buildings and equipment, electrode selection and operating principles and adjusting and maintaining farm tractors and machinery.

The mean needed scores for Group A for the three most needed competencies were 7.72, 7.69 and 7.56, while Group D had mean needed scores of 7.73, 7.73 and 7.70 on their three most needed competencies.

Table 1. Relationship of mean agricultural mechanics competency scores needed and possessed by vocational agriculture instructors in Groups A and D

Competency	Group A					Group D				
	N <sup>a</sup>	R <sup>c</sup>	P <sup>b</sup>	R	D <sup>d</sup>	N	R	P	R	D
Safety factors in welding	7.72	1	6.79	2	.91	7.65	4	6.98	3	.67
Use all power tools correctly and safely	7.69	2	6.61	4	1.08	7.73	1.5	6.90	5	.83
Safe operation of all power tools	7.56	3	6.69	3	.87	7.70	3	6.93	4	.77
Use common tools correctly and safely; saws, hammers, etc.	7.46	4	6.59	5	.87	7.73	1.5	7.20	2	.53
Safety factors in the use of electricity	7.44	5	6.10	11	1.34	7.53	5	6.75	8	.78
Figure a bill of materials	7.15	6	6.92	1	.23	7.50	6	7.28	1	.22
Construct and repair buildings and equipment	6.87	7	6.08	12.5	.79	6.85	12.5	6.33	17	.52
Electrode selection	6.82	8	6.08	12.5	.74	6.75	17	6.35	15	.40
Operation principles, adjustment and maintenance of farm tractors and machinery	6.79	9	5.38	32	1.51	7.10	8	6.08	24	1.02
Operation principles and selection of arc welders	6.74	10.5	6.28	7	.46	6.63	24	6.30	18	.33
Maintain and adjust farm tractors and machinery	6.74	10.5	5.51	30	1.23	7.15	7	6.25	19.5	.90
Operating principles and selection of electric motors	6.72	12.5	5.31	34	1.41	6.63	24	5.70	38	.93
Recondition, sharpen and fit tools	6.72	12.5	6.03	15	.69	7.08	9	6.35	15	.73
Selection of lumber and other building materials	6.64	14	5.82	20	.82	6.20	33.5	5.75	34	.45
Cut with oxyacetylene	6.62	15	6.26	8	.36	6.83	14.5	6.78	6.5	.06
Engine systems; carburetion, ignition, lubrication, hydraulic	6.59	16	6.54	6	1.13	6.65	22	6.05	26.5	.60
Prepare metal projects for welding	6.56	17	5.95	17	.61	6.83	14.5	6.53	9	.30
Distortion of metal and its control	6.54	18.5	5.46	31	1.08	6.43	31.5	5.68	39	.75
Set up oxyacetylene welder, light and adjust flames	6.54	18.5	6.18	10	.36	7.00	11	6.78	6.5	.22
Selection of wire, size, type, etc. for circuits and feeder lines	6.51	20.5	4.97	42.5	1.54	6.73	19	5.83	32.5	.90
Engine principles, two and four cycle	6.51	20.5	5.67	24	.84	6.58	28	6.05	26.5	.53
Electric arc weld in all positions	6.46	22	5.77	21	.69	7.05	10	6.48	11.5	.57
Apply paint properly with brush	6.44	23	6.23	9	.21	6.48	30	6.50	10	-.02
Principles of acetylene welding	6.41	24.5	5.67	24	.74	6.58	28	6.18	21	.40

<sup>a</sup>Degree competency needed: 0-1--None, 2-3--Little, 4-5--Some, 6-7--Much, 8-9--Very Much

<sup>b</sup>Degree competency possessed: 0-1--None, 2-3--Little, 4-5--Some, 6-7--Much, 8-9--Very Much

<sup>c</sup>Competency rank

<sup>d</sup>Difference between competency needed and possessed mean scores.

Table 1 continued.

Competency	Group A					Group D				
	Mean scores									
	N	R	P	R	D	N	R	P	R	D
Make adjustments to systems of gas engines, carburetion, ignition, etc.	6.41	24.5	5.15	38	1.26	6.80	16	5.83	32.5	.97
Proper proportioning of ingredients for quality concrete	6.36	26.5	5.64	27	.72	5.75	45	5.95	30	-.20
Lay out and cut braces and rafters	6.36	26.5	5.69	23	.67	6.73	19	6.43	13	.30
Selection of fuels, oils, and greases	6.33	29	5.26	36	1.07	6.13	35	5.40	43.5	.73
Read plans and blueprints	6.33	29	6.05	14	.28	6.60	26	6.48	11.5	.12
Select nails, screws, glue, framing anchors and other building hardware	6.33	29	5.74	22	.59	6.43	31.5	6.05	26.5	.38
Spray paint and care for gun	6.28	31	5.85	19	.43	6.58	28	6.13	22	.45
Mixing, casting, finishing and curing concrete	6.23	32	5.28	35	.95	5.98	38	6.00	29	-.02
Repair and overhaul small gas engines	6.18	33	5.05	40	1.13	6.68	21	5.88	31	.80
Cut with electric arc welder	6.15	34	5.97	16	.18	6.73	19	6.25	19.5	.48
Preparing foundations, forms, etc. for concrete	6.10	35.5	5.36	33	.74	5.88	43	6.05	26.5	-.17
Braze weld	6.10	35.5	5.67	25	.43	6.85	12.5	6.35	15	.50
Painting of buildings and machinery with brush and spray gun	6.05	37	5.54	28.5	.51	5.78	44	5.60	40	.18
How to properly insulate and ventilate farm buildings	6.03	38	4.74	49	1.29	5.98	38	5.08	52	.90
Use of the carbon arc torch	5.87	39	5.82	20	.05	6.20	33.5	5.73	37	.47
Basic metallurgy as related to welding and metal work	5.85	40.5	4.87	45	.98	5.90	41.5	5.50	41	.40
Selection of paints and other preservatives	5.85	40.5	5.13	39	.72	5.45	48	5.15	48	.30
Selection, application and maintenance of roofing materials	5.82	42	4.85	46.5	.97	5.98	38	5.35	45	.63
Fusions weld various metals: steel, cast, aluminum	5.79	43	5.03	41	.76	6.63	24	6.10	23	.53
Designing and equipping a farm service center	5.77	44	5.23	37	.54	6.00	36	5.75	34	.25
Do sheet metal work, cut, solder, rivet, etc.	5.49	45	5.54	28.5	-.05	5.93	40	5.75	34	.18
Principles of AC and DC electricity and application of Ohm's Law	5.46	46	4.82	48	.64	5.90	41.5	5.48	42	.42
Principles of soft and hard soldering (silver brazing)	5.33	47	4.44	54.5	.89	4.88	53	4.85	54	.03

Table 1 continued.

Competency	Group A					Group D				
	N	R	P	R	D	N	R	P	R	D
Use plumbing tools and install simple plumbing	5.21	48	4.85	46.5	.36	5.53	46	5.18	47	.35
Principles of farm plumbing, sewage and sanitation	5.18	49	4.51	52.5	.67	5.10	52	4.85	54	.25
Apply finishes	5.15	50	4.97	42.5	.18	5.48	47	5.40	43.5	.08
Cast concrete, lay concrete blocks, prepare mortar	5.05	51	4.21	56	.84	5.43	49	5.30	46	.13
Tie knots, splice rope, etc.	4.95	52	4.95	44	.00	4.53	54	4.85	54	-.32
Work with cold metal tools, screw plate, bending	4.92	53	4.54	51	.38	5.23	50.5	5.13	49	.10
Install copper tubing, flared and soldered joints	4.69	54	4.44	54.5	.25	5.23	50.5	5.10	50.5	.13
Selection of and caring for rope	4.18	55	4.51	52.5	-.33	3.75	56	4.30	56	.55
Do forge work	4.13	56	4.62	50	-.49	4.30	55	5.10	50.5	-.80

Ranked lowest by Group A instructors on the basis of need were installing copper tubing, flaring and soldering joints; selection of and caring for rope and doing forge work. The mean needed scores were 4.69, 4.18 and 4.13, respectively. Group D ranked tying knots and splicing rope, doing forge work and the selection and care of rope as the three needed competencies of least importance. The mean scores were 4.53, 4.30 and 3.75, respectively. These findings are also presented in Table 1.

Negative mean score differences between needed and possessed competencies were recorded by Group A instructors for doing sheet metal work, selecting and caring for rope and doing forge work. This meant they felt they possessed more competency than was needed in these areas. Negative mean score differences for Group D existed in applying paint properly with a brush; proper proportioning of ingredients for quality concrete; mixing, casting, finishing and curing concrete; preparing foundations and forms for concrete; tying knots and splicing rope and also doing forge work.

The greatest divergence in rankings was on braze welding. Group A ranked the needed competency 35.5, whereas Group D ranked it 12.5. Another wide range occurred in the proper proportioning of ingredients. Group A ranked it 26.5 in importance compared to a 45-place rating from Group D.

An examination of the mean possessed scores revealed that figuring a bill of materials was ranked highest by Group A, with safety factors in welding, second, and safe operation of all power tools was ranked third. Figuring a bill of materials was also ranked first by Group D; using common tools correctly and safely was second; and safety factors in welding, third.

The three lowest mean possessed scores for Group A were principles of soft and hard soldering; installing copper tubing; and casting concrete, laying concrete blocks and preparing mortar. Group D ranked tying knots and splicing rope; principles of farm plumbing, sewage and sanitation; and selecting and caring for rope the three lowest mean possessed scores.

The 10 possessed competencies in which no more than a one place difference in ranking existed between the two groups were: safety factors in welding; using all power tools correctly and safely; safe operation of all power tools; figuring a bill of materials; reconditioning, sharpening and fitting tools; applying paint with a brush; principles of soft and hard soldering; using plumbing tools and installing simple plumbing; applying finishes; and doing forge work.

The source of acquiring the competencies indicated college as being the place where most competencies were learned. On the job ranked a close second as a source of acquiring the competencies. This implies many more competencies could be acquired through instructional programs before instructors are actually teaching.

The findings of this study further indicated the value in selectivity of course content. Some competencies may need increased or decreased attention.



