Journal of Agricultural Education
Volume 33, Number 1, pp. 37-45
DOI: 10.5032/jae.1992.01037

Agriscience Curriculum in Ohio Agricultural Education: Teacher Utilization, Attitudes, and Knowledge

Donald D. Peasley, Graduate Associate
Janet L. Henderson, Associate Professor
The Ohio State University

Science has always been a basic tenet of agricultural instruction in the United States (True, 1929). Agriculture by definition is an applied science that combines principles of the physical, chemical, and biological sciences in the process and production of food and fiber. As the curriculum of secondary agricultural education developed over the years, the content of the instruction emphasized more on the "how" of agricultural production practices, rather than the "why" (Williams, 1990). Changes in the content reflected changes in the technology of production agriculture, e.g., new, and more efficient ways of showing "how." The nature of the population involved directly in production agriculture in the United States changed drastically during the 20th century. By the mid-1980s, the percentage of the United States population who lived on farms was 2.2% (National Research Council, 1988).

Enrollment in agricultural education in the United States has dropped steadily over the past 10 years, at a rate of 1% to 3% annually (National Research Council, 1988). In addition, the number of students from traditional farm backgrounds as a percentage of total agricultural education enrollment has dropped. Consequently, the need for the traditional production agriculture curriculum in agricultural education programs has been questioned recently. Advances in the field of biotechnology in agriculture, as well as the increasingly technical nature of agricultural careers have led many leaders in agricultural education to propose an emphasis on agriscience in high school agriculture programs.

In 1988, the National Research Council's Committee on Agricultural Education stated that major curricular revisions were needed within secondary agricultural education programs. One of the main conclusions of the Committee was that the agricultural education curriculum in high schools has failed to keep up with modern agriculture. The Committee recommended major changes in course content of the agricultural education curriculum. The Committee stated that the agricultural education curriculum be updated and revised to contain more scientific content, with an emphasis on relating that content to the increasingly scientific and technical nature of the field of agriculture. From a review of the Committee's findings and recommendations, the following definition of the term agriscience was developed: Agriscience is the notion of identifying and using concepts of biological, chemical, and physical science in the teaching of agriculture, and using agricultural examples to relate these concepts to the student (National Research Council, 1988).

In the state of Ohio, enrollments in high school agriculture programs have declined 30% over the last 10 years (Ohio Department of Education, 1990). This decline in high school agriculture enrollment mirrors a general overall enrollment decline in vocational education programs in the state of Ohio since 1980. In 1989, the Ohio legislature enacted Senate Bill 140. One part of this legislation called for Ohio vocational education programs to modernize curriculum to improve the relevance of instruction (Sommers, personal communication, 4/27/90). The Agricultural Education Service of the Ohio Department of Education began efforts to promote the teaching of agricultural science content in high school agriculture classes as part of its response to this legislative mandate for program modernization. The development of core agricultural science (i.e.,

agriscience) content to be taught in high school agriculture programs is one of the modernization efforts (Gratz, personal communication, 10/10/89).

Several factors have been shown to be related to the way that an individual responds to a curriculum change, such as the introduction of an agriscience core curriculum. A national study of high school agriculture teachers (Martin, Rajasekaran, & Vold, 1989) revealed that teacher attitudes toward the importance of teaching biological science content was related to age, experience, and the educational level of the teacher. Christiansen and Taylor (1966) summarized that the curriculum implementation process can be made to work most effectively when individual characteristics of teachers, teacher values, and awareness of the development and implementation process are considered by the implementers. Teacher attitudes, characteristics, and knowledge level appear to be important factors in the implementation of a new curriculum.

Purpose and Objectives

Although there is a concentrated effort in the state of Ohio to promote the teaching of agriscience in high school agricultural education programs, little research has been conducted to investigate if high school teachers of agriculture are teaching agriscience curriculum content. If agriscience content is essential for the improvement of agricultural education programs in the state, then research should be conducted to determine if agriscience curriculum is being taught. The main purpose of this study was to investigate teacher utilization, attitudes, and knowledge toward an agriscience curriculum.

The following research objectives were developed to guide the study to:

Describe the level to which high school agriculture teachers in Ohio are teaching agriscience curriculum.

Describe the attitudes of Ohio high school agriculture teachers toward the notion of an agriscience core curriculum and the term agriscience.

Describe the level of knowledge of Ohio high school agriculture teachers about Ohio agriscience curriculum development efforts.

Determine the relationships between the level of agriscience curriculum being taught and selected demographic characteristics of Ohio high school agriculture teachers: age, years of teaching experience, years in current position, and educational level.

Determine the relationship between the level of agriscience curriculum being taught and teacher attitudes toward an agriscience core curriculum and the term agriscience.

Determine the relationship between the level of agriscience curriculum being taught and teacher knowledge of Ohio agriscience curriculum development efforts.

Methodology

The target population was high school production agriculture teachers in the state of Ohio who were teaching production agriculture in grades 9-12 in the school year 1990-91. The source of names for the target population was the 1990-91 Agriculture Teachers Directory published by the Ohio Department of Education. A total of 315 production

agriculture teachers were on this list. The names of 45 teachers, who were used in pilot and field testing, were removed from the list leaving an accessible population of 270 teachers. A random sample of 160 teachers was drawn from this population. The sample size was sufficient to yield a 95% probability of having a sample estimate within plus or minus five percent of the population values (Krejcie % Morgan, 1970). Frame error for this study was controlled by cross-checking the names of teachers in the directory with staff from the Agricultural Education Service of the Ohio Department of Education and faculty from the Department of Agricultural Education from The Ohio State University. Selection error was controlled by checking the list to ensure that there were no duplicate names on the list. Sampling error was controlled by ensuring an adequate sample size and by using proper techniques of random sampling as outlined by Fowler (1988).

The study utilized descriptive-correlational methods. A written questionnaire was selected as the measurement instrument. The questionnaire was designed by the researcher and developed by studying other research instruments that measure demographics and attitudes toward change. Part I measured the level of teaching of agriscience content and consisted of a dichotomous (Yes or No), summated scale of agriscience objectives from the natural resources, plant science, soil science, and animal science core areas of the Ohio agriscience core curriculum. A proportional sample of 81 of these objectives was selected from the complete list of 243 objectives. Part II, which measured teacher attitudes toward an agriscience core curriculum, was developed by generating 15 statements related to an agriscience core curriculum through an examination of literature. A six-point Likert-type scale was used to assess teacher attitudes toward these statements. Part III of the instrument, which measured teacher attitudes toward the term agriscience, consisted of a six-point sematic differential scale. The semantic differential measured teacher response to the term agriscience with 13 pairs of bi-polar descriptors: dispensable/indispensable, good/bad, unimportant/important, effective/ineffective, exciting/boring, difficult/easy, dynamic/static, uncommon/common, necessary/unnecessary, essential/unessential, doubtful/sure, worthless/valuable and unwanted/wanted. The order of appearance of negative and positive adjectives in the scale was alternated. Part IV of the instrument, which collected teacher demographic information and measured teacher knowledge level about agriscience core curriculum efforts, included items developed through interviews with personnel from the Agricultural Education Service of the Ohio Department of Education. The knowledge level questions consisted of 14 statements about Ohio agriscience core curriculum development efforts that teachers were asked to check as true or false. An open-ended question that asked for general impressions of an agriscience core curriculum was included at the end of the questionnaire.

Content validity of the instrument was established by a panel of experts consisting of faculty and graduate students from the Department of Agricultural Education at The Ohio State University. Face validity was established by a field test of the instrument by eight selected Ohio high school agriculture teachers. Reliability was established through a pilot test of the instrument with 37 selected Ohio high school teachers of agriculture. Parts I and IV of the instrument had dichotomous Cronbach's Alpha coefficients of internal consistency of .89 and .59, respectively. Parts II and III had Cronbach's Alpha coefficients of internal consistency of .74 and .92, respectively. According to Nunnally (1967) an internal consistency coefficient of .50 or greater is considered acceptable for measurement instruments that are being used for the first time.

Data were collected by mail. Of the 160 teachers selected for the study, 126 (79%) returned usable questionnaires. A random sample of six nonrespondlents was contacted by phone to collect demographic data (Miller & Smith, 1983). These data were compared with corresponding data from respondents to see if there were significant differences. There were no statistically significant differences found between the respondents and the nonrespondents on the demographic characteristics. The results from the nonrespondents

were assumed to not differ significantly from the results of the respondents on other measured characteristics.

Descriptive and correlational statistics were used to analyze the data collected, using SPSS/PC+ microcomputer statistical software. Descriptive statistics were used to describe and summarize the level of teaching of an agriscience curriculum, teacher attitudes toward an agriscience core curriculum and the term agriscience, teacher knowledge of Ohio agriscience curriculum development efforts and teacher demographic characteristics. Correlation coefficients were computed to describe the magnitude and direction of the associations being investigated. Qualitative data were content analyzed and summarized by the researcher. The alpha level for testing relational statistics was set at .05. Questionnaires which contained missing item data had the mean values for the remainder of the sample substituted for the missing data. This procedure is considered appropriate as long as there are relatively low numbers of missing data (Federer, 1955).

Findings

The mean age of teachers in the sample was 39 years. Ninety-seven percent of the teachers in the sample were male and 3% were female. The mean years of total high school agriculture teaching experience was 13 years and the mean years of teaching experience at current school was 10 years. Four percent of the teachers in the sample had an Associate's degree as the highest college degree held, 52% had a Bachelor's degree, and 44% had a Master's degree.

The average number of agriscience curriculum objectives identified as being taught by Ohio high school teachers of agriculture was 51. As shown in Table 1, 48% of the teachers taught between 41 and 60 of the agriscience objectives, 58% of the teachers were teaching between 41 and 70 of the agriscience objectives, and 29% of the teachers were teaching more than 61 (75%) of the agriscience objectives.

Table 1. Level of Agriscience Curriculum Being Taught by Ohio High School Teachers of Agriculture

	Agriscience Objectives		Agriculture Teachers
	N	%	N/%
	0-30	0-36	13/10
	31-40	37-49	18/13
	41-50	50-61	30/23
	51-60	62-74	28/24
	61-70	75-86	25/19
	71-81	87-100	12/9
Total	81	100	126/100

Mean = 51
s.d. = 14.85
Mode = 58
Median = 52

Teachers' attitudes toward an agriscience core curriculum were measured with a 15 item, six-point, Likert-type scale with rankings from 1 (firmly disagree) to 6 (firmly agree). An average score greater than 3.5 could be interpreted to show a positive attitude toward an agriscience core curriculum. Individual item relative frequencies per response category from items related to an agriscience core curriculum are presented in Table 2. For the sample, the mean attitude score towards an agriscience core curriculum was 4.3 (s.d.=.50).

Table 2. Individual Item Relative Frequencies per Response Category for Items Related to An Agriscience Core Curriculum (N=126)

Item	% FD	% D	% SD	% SA	% A	% FA
An agriscience curriculum will give students a solid base for an agricultural career.	0.0	0.8	4.2	13.6	52.5	27.1
An agriscience course should be recommended to all high school students	2.5	5.9	5.9	28.0	35.6	20.3
Agriscience programs should be implemented on a trial basis in selected schools before statewide adoption	3.4	15.3	8.5	18.3	39.1	14.8
A statewide curriculum for agriscience would be valuable	1.7	1.7	2.5	12.7	35.6	44.1
High school credit should be awarded for agriscience classes	2.5	2.5	1.7	14.4	31.4	45.8
There is ample evidence to support change toward an agriscience curriculum	0.8	3.4	5.1	24.6	44.1	20.3
An agriscience curriculum is not appropriate for my community	31.4	39.8	15.3	8.5	2.4	1.7
Teaching an agriscience curriculum would enable instructors to more effectively meet the needs of students	0.8	5.1	7.6	27.1	39.8	17.8
More students would enroll in agriculture if an agriscience curriculum were offered	2.5	4.2	12.7	33.9	29.7	12.7
I am not sure what an agriscience curriculum involves*	14.4	33.9	18.6	21.2	7.6	2.5
An agriscience curriculum would not be accepted by most teachers	9.3	24.6	35.6	21.2	7.6	0.8
I am a strong supporter for the adoption of an agriscience curriculum	3.4	4.2	7.6	25.4	38.1	18.6
I am not sure of the definition of agriscience*	13.6	25.4	29.7	13.1	8.5	2.5
I believe that traditional production agriculture lprograms are better than agriscience programs*	13.6	25.4	29.7	13.1	8.5	2.5
I encourage the adoption of an agriscience curriculum as a fresh approach to teaching agriculture	0.8	3.4	11.0	27.1	39.8	16.1

FD=firmly disagree, D= disagree, SD=slightly disagree, SA=slightly agree, A=agree, FA=firmly agree.

Teachers' attitudes towards the term agriscience were measured with a 13 item, six-point semantic differential scale, scaled from 1 (strong negative attitude) to 6 (strong positive attitude). An average score greater than 3.5 could be interpreted to how a positive attitude towards the term agriscience. For the sample, the mean attitude score toward the term agriscience was 4.86 (s.d.-66).

Teacher knowledge level of statewide agriscience curriculum development efforts was measured with a 14-item cognitive test. Teachers were asked to read a statement about agriscience curriculum development in Ohio and mark the statement true or false. Teachers received one point for each correct response. A score greater than 11 points would indicate a relatively high level of knowledge about statewide agriscience curriculum development efforts. For the sample, the mean score on this measure was 11.77 (s.d.=1.91). Eighty percent of the teachers received a score of 11 or greater.

The relationships between level of agriscience curriculum being taught and teacher age (r=.08), total years experience teacher agriculture (r=.08), years at current position (r=.01), and teacher educational level (Kendall's Tau C=.04) were negligible.

The relationships between the level of agriscience curriculum being taught and teacher attitudes toward an agriscience core curriculum (r=.11) and the term agriscience (r=.20) were low. The relationship between the level of agriscience curriculum being taught and teacher knowledge level of statewide agriscience curriculum development efforts was negligible (r=.02).

The final item on the questionnaire asked Ohio teachers of agriculture to respond with any thoughts or opinions that they had regarding agriscience curriculum in Ohio. Of the 126 respondents, 86 (68%) responded with a written answer to this question. In general, the responses centered on four issues: the necessity of a state core curriculum in agriscience; the granting of science credit for high school agriculture classes; the need for curriculum materials in agriscience; and the need for leadership in the area of agriscience by state leaders of agricultural education.

Thirty-two percent of the respondents to the open ended question addressed the issue of a state core curriculum in agriscience. Some respondents to this question were not convinced that agriscience was truly an innovation: "I'm not sure that agriscience is really a new curriculum. I believe that agriscience is just a new name for what we have been doing all along." I have always taught agriculture science, even though agriscience was not a term that I used." However, other teachers responded: "I've been waiting for a core curriculum in agriscience from the state for some time." "Agriscience is the way to go. We need to get a core curriculum implemented as soon as possible."

Teachers who responded to the open-ended question addressed the issue of science credit for agriculture classes more often than any other issue. Forty-three percent of the teachers wrote about science credit for agriculture classes. Teachers seemed to be either strongly in favor of or strongly against the grating of science credit for agriculture classes. Some reasons given for the grating of science credit: "Grating science credit would be a great way to recruit students into our program." "We need to grant science credit. It's the only way I'm going to be able to retain students." Other teachers stated, however that granting science credit would cause conflicts for agriculture programs: "I'm not sure that granting science credit is a good idea. This would cause me to directly compete with teachers in the science department for students." "If we grant science credit, we will become just another science class and administrators will use this as a reason to treat ag. classes as just another general science class. I'm not sure this is desirable." "If we grant science credit, what happens to the FFA? I think this is a big mistake."

Twenty-one percent of the teachers who responded to the open-ended question addressed the need for agriscience curriculum materials. Some typical responses were: "There needs to be a good textbook on agriscience before I can teach it full time." "I have been waiting for agriscience materials from the state for some time." "I would teacher more agriscience, but where do I get the materials to teach this content?" "I want to teach agriscience curriculum, but I need more up-to-date and current materials!"

Twenty-four percent of the teachers who responded to the open-ended question called for aggressive leadership in developing agriscience curriculum from the Agricultural Education Service of the Ohio Department of Education. Some typical responses were: "We need the State office (state Ag. Ed. Service) to decide exactly where it is we are headed with this." "It is hared for me to plan for this (agriscience curriculum) without knowing for sure whether or not the Ag. Ed. Service is completely committed to agriscience or not." "The state office has to take the lead on this (agriscience curriculum)."

Conclusions and Implications

In general, high school teachers of production agriculture in Ohio are teaching a moderate level of the agriscience content. Teachers may be teaching more of the agriscience objectives, however they may be unable to teach all of the objectives in one school year. Eighty-three (68%) of the teachers in the sample are teaching between 51% and 84%of the agriscience content in an agriscience curriculum. Nearly 225% of the teachers are teaching less than 50% of the content objectives of an agriscience curriculum. Twenty-five percent of the teachers are teaching more than 75% of the content objectives of an agriscience curriculum. Ohio high school teachers of production agriculture could be described as having a positive attitude toward the notion of an agriscience core curriculum and the term agriscience. High school teachers of agriculture in Ohio are very well informed about Ohio agriscience curriculum development efforts. The teachers have a high level of knowledge of trends affecting the implementation of an agriscience core curriculum in Ohio.

Negligible relationships exist between demographic characteristics of high school teachers of agriculture in Ohio and the level of agriscience curriculum being taught. Low relationships exist between attitudes toward agriscience and agriscience core curriculum and the level of agriscience curriculum being taught. A negligible relationship exists between knowledge level of state-wide agriscience curriculum development efforts and the level of agriscience curriculum being taught. Based upon the open-ended responses, Ohio high school teachers of agriculture desire the development of agriscience curriculum materials and want leadership from the state Agricultural Education Service on agriscience curriculum development.

The findings of this study do not support research conducted by Rogers (1971) and Christiansen and Taylor (1966). These authors reported that attitudes should be significantly related with the level of teaching of a curricular change. These authors also identified knowledge and educational level as significant factors in the teaching of a curricular change. This study found low to negligible relationships between knowledge and education level of agriscience curriculum being taught. While high school teachers of agriculture in Ohio are teaching some of the agriscience content, they are not teaching all of the content. The agriscience curriculum may not be considered an innovation by Ohio high school teachers of agriculture. The fact that the agriscience curriculum may not be seen as an innovation by teachers could account for the low relationships found in the study. An agriscience curriculum may reflect more of a shift of emphasis in curriculum content as opposed to an outright change. The fact that there were low to negligible associations illustrates the need to conduct further research to identify other factors that may help explain the teaching of agriscience in Ohio agricultural education.

Recommendations

Leaders of agricultural education in Ohio should work with high school teachers of agriculture to further develop, conceptualize, and implement an agriscience core curriculum. Teachers want to move toward the development of a core curriculum, but want more leadership at the state level. High school teachers of production agriculture in Ohio

should communicate with one another to share ideas about agriscience instructional strategies and ;materials. Leaders of agricultural education in Ohio should work with high school teachers of production agriculture to reach consensus on the following issues: a) should high school students receive science credit for enrollment in agriculture courses? b) should an agriscience core curriculum be mandated state-wide, or be left to the choice of local schools? The Department of Agricultural Education at The Ohio State University, in conjunction with the Agricultural Education Service of the Ohio Department of Education, should conduct inservice workshops on new developments on the teaching of agriscience curriculum to practicing teachers of agriculture.

Research should be conducted to study the influence of agriscience curriculum on student achievement, especially upon graduation. Studies should investigate if an agriscience curriculum can explain or predict the success of an agriculture student upon graduation. Research should be conducted to compare the teaching of agriscience curriculum in Ohio with that of other states. Research should be conducted to identify barriers to the introduction of educational change in Ohio agricultural education. Qualitative studies of teachers' perceptions toward curriculum change could lead to valuable insights for planners of agricultural education in Ohio. A follow-up study should be conducted on a longitudinal basis to determine the increase or decrease in the teaching of agriscience curriculum.

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