

## ATTITUDES OF ILLINOIS HIGH SCHOOL SCIENCE TEACHERS TOWARD EDUCATIONAL PROGRAMS IN AGRICULTURE

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### Abstract

***The primary purpose of this study was to determine the attitudes of Illinois high school science teachers toward high school educational programs in agriculture. Results of the study indicated approximately one-half of the science teachers reported some collaboration with agriculture teachers. The greatest collaboration occurred in the areas of sharing laboratory and teaching materials and discussing teaching strategies and course content. Science teachers felt that (1) high school agriculture courses are beneficial for h&her achieving students; (2) stronger ties should be made between agriculture and science curricula; (3) agriculture programs should become more science based; (4) applied agricultural science courses make scientific principles more meaningful; and (5) selected agriculture courses are appropriate for lab science credit. Attitudes toward educational programs in agriculture were significantly higher if teachers were (1) familiar with the applied agricultural science courses, (2) wanted to learn more about agriculture, and (3) lived on a farm. No significant relationships were found between science teaching area and attitudes toward agriculture or educational programs in agriculture. Recommendations included directing efforts/programs toward science teachers to inform and build a more positive image of high school agriculture programs, identification of effective strategies for collaboration, and implementation***

### Introduction/Theoretical Framework

Thus far, curriculum redesign efforts in the 1990s in agricultural education have converged on identifying promising strategies that incorporate more science into high school agricultural curricula. Individual states have developed varying models for this new "agriscience" instruction, from selective incorporation of science principles into agriculture courses to developing completely new agriscience courses designed to attract a broader clientele. Illinois has been very active in the development and implementation of this latter type of agriscience instruction. From 1990 through 1994 four, one-semester Science Applications in Agriculture courses were developed. These included two semesters each in Biological Science Applications in Agriculture (BSAA) and Physical Science Applications in Agriculture (PSAA). These new courses were designed to teach science as both

content and process by connecting science concepts and principles to specific applications/practices in agriculture. Experiments have served as the predominant teaching method in these laboratory-based courses. These courses were developed to boost the image of secondary agriculture programs and to attract a larger and more diverse student body into high school agriculture courses (Osborne, Moss, and Stahl, 1990).

Efforts to highlight the scientific side of agriculture have also been dramatically increased by Colleges of Agriculture across the nation as they have sought to boost their enrollments. Many administrators in these programs have turned their attention toward high school science teachers and classrooms as a prime recruiting arena. Thus, science teachers' attitudes toward agriculture and

the extent to which they discuss agricultural issues in their classes have the potential to encourage or discourage students in choosing agriculture as a college major or professional pursuit. Perceptions of educational programs in agriculture, at both the secondary and postsecondary levels, may also influence the career “advice” that science teachers give to their students.

Calls for closer collaboration between basic science and applied science have been issued from both the basic disciplines and applied fields. The American Association for the Advancement of Science has recommended that applications of science be taught in relevant technological fields, such as agriculture (Project 2061, 1993). As the past five years of curriculum reform indicate, agricultural education is certainly in agreement with this recommendation.

The theoretical/conceptual model for this study consisted primarily of the factors that influence high school science teachers’ decisions to collaborate with secondary agriculture teachers in offering agriscience courses like BSAA and PSAA. The fundamental theoretical basis for this study lay in the work of Fishbein and Ajzen (1975). The Theory of Reasoned Action (Fishbein & Ajzen, 1980) and the Theory of Planned Behavior (Fishbein & Ajzen, 1975) suggested that demographic and related variables, knowledge, and observations influence values and beliefs, which in turn influence attitudes, intentions, and finally, behaviors. Recent applications of Fishbein and Ajzen’s work in agricultural education include studies by Thompson and Russell (1993) and Petrea (1996). As adapted to this study, this theory suggests that science teachers’ personal experiences, observations, knowledge, and values about agriculture affect their attitudes about agriculture, which in turn affect their beliefs, their intentions, and finally, their decisions to participate. Thus, science teachers’ attitudes about educational programs in agriculture are a likely determinant of the extent to which science teachers encourage their students to pursue agricultural careers. These attitudes also influence their

tendencies to collaborate with agriculture teachers in offering new agriscience courses.

Illinois has been a leading state in the development and dissemination of innovative secondary agriscience curricula. Successful implementation of the BSAA and PSAA courses has assumed support and collaboration from local science teachers. Yet, the attitudes of science teachers toward educational programs in agriculture, which theoretically influence science teachers’ decisions to support and collaborate, have not been investigated.

Increases in student achievement have been found in courses that integrate agriculture and science (Enderlin, 1992; Enderlin, 1991; Roegge and Russell, 1988). Science teachers are important stakeholders in agriscience courses (Osborne, 1994; Johnson and Newman; 1993). Extensive resource sharing and collaboration among science and agriculture teachers has been documented in several recent studies (Ohene-Adjei, 1995; Whent, 1994). However, in a national study Dormody (1992) found that levels of resource sharing among science and agriculture teachers were low (one to two times per year), even though a majority of agriculture and science teachers reported that they shared resources with each other. In terms of recruitment of students into Colleges of Agriculture, high school science teachers have been identified by students as an important influence in their decisions to choose agriculture as their field of study (Scofield, 1995).

### Purpose and Objectives

The purpose of this study was to determine the attitudes of Illinois high school science teachers toward secondary level educational programs in agriculture. The following research questions were addressed:

1. What were the attitudes of high school science teachers in Illinois toward secondary agriculture programs?

2. What were science teachers' perceptions of secondary science and agriculture program quality?
3. What was the influence of Science Applications in Agriculture courses on science teachers' attitudes toward agricultural education?
4. What were the key demographic characteristics of science teachers and what was the influence of selected teacher presage variables on their attitudes toward agricultural education?

### Procedures

A descriptive survey research design was used in the study. The target population (N= 275 8) was all high school science teachers in Illinois during the 1994-95 school year, as identified by the Illinois State Board of Education. Using Krejcie and Morgan's (1970) formula, a sample size of 336 teachers was needed, based upon a 5% degree of accuracy and a 95% confidence level. The simple random sample of teachers was selected using random number generation with the Microsoft Excel computer program.

The mailed questionnaire was adapted from one developed by the researchers for a previous study on high school guidance counselors' attitudes toward agriculture. Reliability estimates for the original version of the questionnaire ranged from .80 to .99. The final questionnaire consisted of five parts, including a section on teacher demographics. Estimates of internal consistency (reliability) for this study ranged from .56 to .93 on the constructs as follows: agriculture program quality (.93), agriculture as a career field (.87), agricultural technologies (.72), high school agriculture programs (.56), and science program quality (.86). While the reliability estimate for one construct, high school agriculture programs, was lower than desirable, the researchers were reluctant to make additional modifications in the questions comprising this

construct, since it was also used in an earlier study with guidance counselors (Dyer & Osborne, 1995). Reliability estimates in that study were .80 or better for all constructs. Five-point, Likert-type scales were used to measure teacher attitudes and perceptions. Four mailings yielded a total response rate of 63.1% and a usable return of 62.2% (211). Due to the unlikelihood of obtaining additional responses, a comparison of early and late respondents was made. No significant differences were found on the major constructs of the study; therefore, the results from the data sample were generalized to the target population of high school science teachers in Illinois. Measures of central tendency and association, as well as analysis of variance were used to summarize and analyze the data. Post hoc group comparisons were made using the Tukey-B test.

### Findings

Approximately one-third (36.8%) of the science teachers were female. The average school size was 1452 students, with 25.6% of the schools having 600 or less students. Years of experience as a science teacher ranged from 1 to 38 ( $M = 15.56$ ,  $M_o = 15.0$ ).

Nearly one-fourth (24.2%) of the science teachers indicated they were very familiar or somewhat familiar with the Science Applications in Agriculture (SAA) courses, and 8.4% reported that they had participated in an SAA workshop. A large majority of the teachers (80.5%) reported that they were familiar (very or somewhat) with the agricultural industry (Table 1). Similarly, when science teachers were asked if they would like to learn more about the agricultural industry, 58.2% responded "yes," and another 36.8% said "maybe."

Science teachers who taught in high schools with an agriculture program were asked to indicate the extent to which they collaborated with the local agriculture teacher in teaching science and agriscience. As shown in Table 2, the greatest collaboration occurred in the areas of sharing

Table 1. Frequency and Percentage of Science Teachers' Familiarity with the SAA Courses and the Agricultural Industry

Familiarity	With SAA Courses		With Agricultural Industry	
	f	%	f	%
Very familiar	8	3.9	39	19.0
Somewhat familiar	42	20.3	126	61.5
Not familiar	157	75.8	40	19.5

Table 2. Frequency and Percentage of Science Teachers by Extent of Collaboration with Agriculture Teachers

Type of Collaborative Activity	Much		Some		None	
	f	%	f	%	f	%
Sharing lab materials <sup>a</sup>	5	8.62	28	48.28	25	43.10
Sharing lab space <sup>b</sup>	1	1.75	8	14.04	48	84.21
Sharing teaching materials <sup>b</sup>	4	6.90	25	43.10	29	50.00
Discussing teaching strategies <sup>b</sup>	4	7.02	23	40.35	30	52.63
Discussing course content <sup>b</sup>	3	5.26	28	49.12	26	45.62
Team teaching <sup>b</sup>	1	1.75	5	8.77	51	89.48

<sup>a</sup>58 responses, <sup>b</sup>57 responses

laboratory and teaching materials and discussing teaching strategies and course content. Approximately half of the science teachers reported some collaboration with agriculture teachers in each of these areas. However, in no area did at least 10% of the science teachers report much collaboration with the agriculture teacher(s) in their school.

Teachers were asked to report the size of the community in which they grew up and lived at the time of the study. Approximately three-fourths of the teachers grew up in urban locations, and a similar percentage reported that they now lived in urban areas (Table 3).

Teachers were also asked to indicate all the areas of science that they teach. As expected, biology and chemistry were the most often listed science teaching areas, but a considerable percentage of the teachers were also found to teach

in other areas as well (Figure 1).

Teachers rated the overall quality of science programs in their schools as high, but rated the quality of the agriculture program at their high school as only average. As shown in Table 4, science teachers rated their science programs as high in all areas, and very high in value of the science program to students who attend college. By contrast, science teachers rated the agriculture program in their school as high on five of the eight dimensions and average in the areas of academic ability of students, value of program to those who attend college, and reputation of the program among students.

Overall, science teachers were uncertain about their attitudes toward high school agriculture programs (summed mean of 56.03, SD of 4.71, on 17 items). Science teachers felt that (1) high school agriculture courses are beneficial for higher

Table 3. Frequency and Percentage of Science Teachers by Community Where They Grew Up and Now Live

Size of Community	Grew Up		Now Live	
	f	%	f	%
Large urban (over 100,000)	59	28.8	48	23.4
Medium urban (25,000-1 00,000)	51	24.9	67	32.7
Small urban (2,500-24,999)	36	17.6	45	22.0
Rural town (<2,500)	15	7.3	24	11.7
Rural area, but not on a farm	16	7.8	13	6.3
On a farm	28	13.7	8	3.9

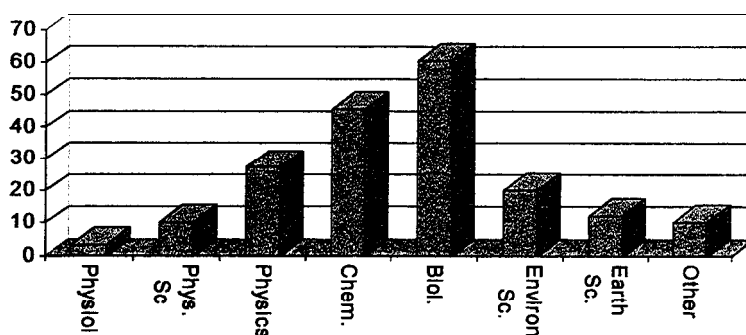


Figure 1. Percentage of Science Teachers by Science Teaching Area

Table 4. Mean and Standard Deviation of Program Quality Rating by Science Teachers\*

Program Quality Element	Science Program Quality		Agriculture Program Quality	
	M	SD	M	SD
Competency and preparation of teachers	4.37	.64	3.84	.85
Academic ability of students	3.59	.77	2.78	.77
Value of the program to students who plan to work upon graduation	3.56	.81	3.50	.90
Value of the program to students who attend college	4.54	.54	3.12	1.10
Quality of instruction	4.36	.61	3.81	.98
Reputation of the program among faculty and administration	4.40	.66	3.52	1.17
Reputation of the program among students	4.13	.70	3.21	.12
Overall quality of the program	4.26	.61	3.67	.91

Note. Mean scores were interpreted using the following scale: 1.0-1.49 = very low; 1.50-2.49 = low; 2.50-3.49 = average; 3.50-4.49 = high; 4.50-5.0 = very high.

achieving students; (2) stronger ties should be made between agriculture and science curricula; (3) agriculture programs, including lab instruction, should become more science based; (4) courses like BSAA make scientific principles more meaningful; and (5) selected agriculture courses, like BSAA, are appropriate for lab science credit. They also agreed that basic study in science, followed by applications of science in agriculture, is a good approach for learning science. The range of mean scores for these items was 3.53 to 3.89 on the five-point scale.

Science teachers disagreed that high school agriculture courses are better suited for male students. In addition, they were uncertain about the statements that follow (item mean scores ranged from 2.62 to 3.45):

1. College bound students should be encouraged to enroll in high school agriculture courses;
2. High school agriculture teachers have limited background/preparation in science;
3. Science applications in agriculture are best taught by agriculture teachers;
4. High school study in agriculture is easier than most other subjects;
5. High school agriculture courses are beneficial for lower achieving students;
6. High school agriculture programs should primarily be offered in rural communities;
7. High school agriculture courses should focus on preparing students for further study in agriculture;
8. Most high school students should take some course work in agriculture; and
9. High school agriculture programs are too vocationally oriented.

Analysis of variance results showed that attitudes toward educational programs in agriculture were significantly higher if teachers were (1) familiar with the SAA courses, (2) wanted to learn more about agriculture, and (3) lived on a farm (Table 5).

Higher mean scores for perceptions of high school agriculture program quality were reported by science teachers who had participated in SAA workshops (yes -  $M = 32.50$ , no -  $M = 26.61$ ) ( $F = 6.13$ ,  $p < .05$ ). In addition, those who taught in smaller schools ( $r = -.32$ ,  $p < .05$ ) and had fewer years of teaching experience ( $r = -.32$ ,  $p < .05$ ) tended to have more positive attitudes toward educational programs in agriculture. No significant relationships were found between science teaching area and attitudes toward agriculture or educational programs in agriculture.

#### Conclusions, Recommendations, and Implications

As a whole, Illinois science teachers are uncertain about their attitudes toward high school agriculture programs. They also feel that high school agriculture programs are of average quality. Science teachers in Illinois are uncertain as to the student clients, setting, and purpose of high school agriculture programs, as well as agriculture teacher preparation in science. Efforts/programs to inform and build a more positive image of high school agriculture programs should be directed toward science teachers. A large majority of secondary science teachers in the state teach in schools with no agriculture program, and thus, have little direct experience from which to form impressions about agriculture programs. Most high school agriculture programs in Illinois are located in smaller schools, and this study found that science teachers in smaller schools have more positive attitudes toward educational programs in agriculture. Thus, garnering more widespread support for secondary agriscience curricula from the science teacher group will likely require an expansion of agriculture programs into larger schools. In the immediate future, Colleges of Agriculture may be more

Table 5. Summary Data for Science Teacher Attitudes Toward Educational Programs in Agriculture by Group

Variable/Group	4	M	SD	SE
<u>Familiarity w/ SAA Courses*</u>				
Very familiar	8	58.50	3.07	1.09
Somewhat familiar	39	57.69 <sup>A</sup>	4.55	.73
Not familiar	148	55.39 <sup>A</sup>	4.58	.38
<u>Want to Learn More About Agriculture**</u>				
Yes	108	55.67 <sup>A</sup>	4.64	.45
Maybe	71	55.41 <sup>B</sup>	4.03	.49
No	10	51.40 <sup>AB</sup>	5.32	1.68
<u>Now Live***</u>				
Large urban area	46	55.43 <sup>A</sup>	3.59	.53
Medium urban area	64	55.00 <sup>B</sup>	4.63	.58
Small urban area	41	56.29 <sup>C</sup>	4.93	.77
Rural town	22	56.59 <sup>D</sup>	4.70	1.00
Rural area, not on a farm	12	56.25 <sup>E</sup>	4.09	1.18
On a farm	8	62.00 <sup>ABCDE</sup>	4.50	1.59

Notes having the same letter superscript within categories are significantly different.

\* $F = 5.27, p < .01$ ; \*\* $F = 7.11, p < .01$ ; \*\*\* $F = 3.82, p < .01$

successful in their recruiting from science classes/teachers if they work with teachers in smaller schools where SAA courses are offered. A long-term informational campaign aimed at science teachers in larger schools may bring higher recruitment returns to university agriculture programs in the future

Many secondary science teachers in Illinois are collaborating with agriculture teachers in key areas, but this collaboration does not appear to be extensive or continuous. Greater information sharing and collaboration among agriculture and science teachers could improve science teachers' attitudes. Effective strategies for collaboration should be identified through research and shared with agriculture and science teachers.

In addition, implementation of BSAA and/or PSAA in more Illinois high schools will likely increase science teachers' attitudes toward agricultural education. This outcome is supported

by the following findings: science teachers are supportive of the SAA courses, those familiar with the courses have more positive attitudes toward educational programs in agriculture, and those who have participated in SAA workshops have higher perceptions of agriculture program quality. Workshops should continue to be offered that involve agriculture and science teacher teams. Science teachers are supportive of agriscience in general, and the SAA courses in particular, feeling that these courses merit lab science credit. Implementation of BSAA/PSAA in additional schools may be well received and could be expected to have a positive influence on science teachers' attitudes toward agriculture.

The results of this study support the work of Fishbein and Ajzen (1975; 1980) in that (1) most Illinois science teachers lack experience with high school agriculture programs and they were found to be uncertain in their self-reported attitudes toward agriculture programs; (2) science teachers with

firsthand experience with agriculture, agriculture programs, and the SAA courses tended to report more positive attitudes toward agriculture programs; and (3) science teachers with agriculture familiarity and experience indicated a desire to learn more about the agricultural industry.

Areas of further research include: (a) identifying effective collaboration strategies for science and agriculture teachers; (b) development and testing of a model for expanding agriculture programs into larger secondary schools, giving an emphasis to agriscience curricula; (c) determining why science teachers do not encourage their students to pursue agricultural careers, even though they view agriculture positively; (d) monitoring science teachers' perceptions of agriculture program quality as informational and promotional programs are implemented; (e) determining effective strategies for involving science teachers from schools without agriculture programs in agricultural activities; (f) identifying ways to address science teachers' concerns about high school agriculture program quality.

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