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ATTITUDES OF OREGON AGRICULTURAL SCIENCE AND TECHNOLOGY TEACHERS TOWARD INTEGRATING SCIENCE

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Abstract

The purpose of this study was to determine the attitudes of Oregon Agricultural Science and Technology (AST) teachers toward integrating science into their agricultural education programs. Results of the study indicated that almost one fourth of Oregon's AST teachers have a teaching credential with a science endorsement, while almost half the teachers indicated students receive science credit for agriculture classes in their high school. Teachers felt prepared to teach biological and physical science concepts and that integrating science into agriculture classes has increased their ability to teach students to solve problems. Teachers believed that administrator and parental support for the agriculture program has increased since they integrated more science into the curriculum, and that high ability students are more likely to enroll in agricultural education courses that integrate science. There are, however, barriers to integrating science. Funding and equipment are significant barriers to integrating science. Teachers also felt that lack of agriscience workshops for agricultural education teachers is a barrier to integrating science into the agricultural education program.

Introduction/Theoretical Framework

How do Agricultural Science and Technology teachers decide what to teach? What impact do the findings of such studies as A Nation at Risk: The Imnerative for Educational Reform (1983) and the National Academy of Sciences Understanding Agriculture: New Directions for Education (1988) have on Agricultural Science and Technology teachers' decisions of what curriculum to offer their students? What affect do perceived barriers of integrating science into their program have in guiding teacher curricular and instructional decision making in agricultural education classrooms? These are a few of the questions that guided this study into the thought processes of Oregon's Agricultural Science and Technology teachers and their abilities and willingness to integrate science into the agriculture curriculum.

Calls for integrating basic science into applied sciences have been voiced from several different directions. The National Academy of Sciences (1988) and the American Association for the Advancement of Sciences (Project 206 l, 1993) both advocate including scientific principles into the agricultural education curriculum. Current brain-based research also advocates the integration of subject matter. Caine and Caine (1994) found that various disciplines relate to each other and share common information that the brain can recognize and organize. They add "the part is always embedded in a whole, the fact is always embedded in multiple contexts, and a subject is always related to many other issues and subjects" (p. 7).

As adapted to this study, the findings suggest that disciplines do not stand apart in isolated subsets. Information is shared across disciplines in ways that can help students organize their thoughts more effectively. Thus, academic subject matter could be taught in the context of traditional vocational curriculum. Specifically, scientific concepts could be taught in the agricultural education classroom where students would be allowed to apply their knowledge of

science to a rich and meaningful context.

Research findings have supported the claim that integration of science into agriculture curricula is a more effective way to teach science. Studies conducted and duplicated support the findings that students taught by integrating agricultural and scientific principles demonstrated higher achievement than did students taught by traditional approaches (Enderlin & Osborne, 1992; Enderlin, Petrea, & Osborne, 1993; Roegge & Russell, 1990; and Whent & Leising, 1988).

Curriculum redesign efforts in the 1990's in agricultural education have converged on identifying promising strategies that incorporate more science into high school agricultural curricula (Osborne & Dyer, 1998). Current research into teacher thinking as it relates to curriculum has established that teacher thinking influences teacher action and ultimately impacts the learning which takes place in schools (Clark & Peterson, 1986).

It is important that agricultural educators believe in the benefits of integrating academics into the agriculture curriculum if it is to be successful Johnson (1995) reported that Arkansas teachers perceived that offering science credit for agriculture courses would increase enrollment, benefit students, and enhance the program image. In addition, Mississippi agriscience teachers enjoyed teaching agriscience courses and perceived strong support from stakeholders in their schools (Newman & Johnson, 1994).

Although many benefits exist for the integration of academics into vocational education, several barriers limit the integration of academic and vocational education. Roberson, Flowers, and Moore (1997) stated that a lack of strong teacher support of the educational reform in North Carolina may be related to the many barriers teachers encounter when attempting to integrate vocational and academic curricula. Several researchers have recommended that in-service programs be offered to assist teachers in integrating science into the agricultural education curriculum (Kirby, 1990; Neason, 1992; Newman and Johnson, 1994; Thompson & Schumacher, 1998).

The theoretical model for this study consisted primarily of the perceptions of Agricultural Science and Technology teachers towards integrating science into their curriculum. The theoretical basis for this study is grounded in the Theory of Predicted Behavior (Fishbein, 1967) and the Theory of Planned Behavior (Fishbein & Ajzen, 1975). The theory of Predicted Behavior (Fishbein, 1967) suggested that beliefs and behavioral intentions can best be viewed as consequences of attitude. The theory of Planned Behavior (Fishbein & Ajzen, 1975) suggested that demographic variables, observations, and knowledge influence values and beliefs, which in turn affect attitudes, intentions and finally, behaviors. Both theories impact the study of factors that influence the efforts of agricultural educators to integrate science into their curriculum.

As adapted to this study, these theories suggest that agricultural educators' past experiences, personal training, values, and observations about science, influence their opinions, confidence level, and ultimately, their decisions to integrate science into their curriculum. Understanding the agricultural educators' perceptions concerning the integration of science into their curricula will help determine how likely they are to actually teach an integrated agricultural science curriculum.

Purpose/Objectives

The purpose of this study was to determine how Oregon Agricultural Science and Technology (AST) teachers perceived the impact of integrating science on agricultural education programs. To fulfill the purposes of the study, the following research questions were addressed:

1. What were demographic characteristics of Oregon AST teachers?

2. What were the perceptions of AST teachers concerning teaching integrated science?

3. What were the perceived barriers to integrating science in the agricultural education program?

4. What were the AST teachers' perceptions concerning student enrollment since integrating science into their agricultural education program?

5. What were the AST teachers' perceptions concerning support of the agricultural education program since integrating science?

Methods/Procedures

The target population for this study consisted of current Oregon Agricultural Science and Technology (AST) teachers employed during the 1997-98 school year (N = 111). The Oregon Department of Education provided the researchers with a current database containing the name and school address of each teacher. Caution should be exercised when generalizing the results of the study beyond the accessible sample.

The Integrating Science Survey Instrument developed by Thompson and Schumacher (1998) was used to identify the perceptions of the AST instructors. Validity of the instrument was established by the authors (Thompson and Schumacher, 1998). As a measure of the reliability of the attitude scale, internal consistency was established using Cronbach's alpha (a = .88 pilot study, and .81 Instrument).

The survey instrument and cover letter were mailed to the subjects. Two weeks after the initial mailing, a telephone call was placed and/or an e-mail message was sent to all non-respondents. Usable responses were received from 106 teachers for an overall response of 95.5 % Nonresponse error was controlled by comparing early and late respondents on the mean attitude scales using a t-test. 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.

Results/Findings

The average respondent was 41 years of age (SD = 9.3), had 14.3 years of teaching experience (SD = 8.95) and had taught approximately 11 years at their current school (SD = 8.4). While 92% of the respondents were male, 8% were female. Over 77% of the respondents had been enrolled in agricultural education while in high school with almost 61% of those enrolled, completing four years of high school agricultural education courses.

The respondents indicated that 84% had participated in inservice workshops/course(s) that taught them how to integrate science. Of the 84% that attended integrating science workshops, 18% had participated in one workshop, 23% had participated in two workshops, 12% had participated in 3 workshops, and 22% had participated in four or more workshops that taught them how to integrate science. While 49.5% of the respondents indicated their students receive science credit for agricultural education classes in their school, 50.5% indicated students in their classes do not receive science credit for agricultural education classes. One in every five (23%) respondents reported they currently have a teaching license with a science endorsement.

The respondents were asked to respond to 42 statements regarding integrating science into their Agricultural Education Programs. Their responses were measured using a five point Likert-type scale where 1=strongly disagree, 2=disagree 3=neutral 4=agree, and 5=strongly agree.

Cronbach's Alpha for reliability was .80

Table 1 presents Agricultural Science and Technology teachers' modal attitude toward teaching integrated science in agricultural education. Respondents agreed or strongly agreed (72.4% combined) they felt prepared to teach integrated biological science concepts, while 64.7% of the respondents agreed or strongly agreed they felt prepared to teach integrated physical science concepts. Sixty percent (60%) of the respondents agreed or strongly agreed that integrating science into agriculture classes has increased their ability to teach students to solve problems. Only one percent (1%) strongly agreed, while 5.8% disagreed and 41% of the respondents were neutral that more preparation time is required to integrate science into the curriculum.

Table 2 presents the agriculture teachers' modal attitude toward barriers to integrating science into the agricultural education program. Over eighty-three (83.8%) of the respondents agreed or strongly agreed that lack of appropriate equipment is a barrier to integrating science. Over sixty-three (63.8%) of the respondents agreed or strongly agreed that lack of adequate federal, state, or local funds is a barrier to integrating science. While over sixty-two percent (62.8%) of the teachers agreed or strongly agreed that a lack of agriscience workshops for agriculture teachers is a barrier to integrating science.

Table 1. Teachers' Perceptions Toward Teaching Integrated Science into Agricultural Education Programs (N = 106)

Teaching Integrated Science Item	SA%	A%	N%	D %	SD%	
I feel prepared to teach integrated biological science concepts.	27.6	44.8	19.0	8.6	00	
	72.4[a]				8.6[b]	
I feel prepared to teach integrated physical science Concepts.	13.3	51.4	25.7	9.5	00	
	4.7[a]				9.5[b]	
Integrating science into agriculture classes has increased my ability to teach students to solve problems.	6.7	53.3	35.2	4.8	00	
	60.0[a]				4.8[b]	
I have integrated more science in the advanced courses than the introductory courses that I teach in agricultural education,	11.4	37.1	31.4	18.1	1.9	
	48.5[a]				20.0[b]	
Integrating science into the agricultural education program requires more preparation time for me than before I emphasized integrating science	1.0	31.4	41.0	21.0	5.8	
	32.4[a]				26.8[b]	
I teach integrated science concepts in agricultural education that focus more on the biological science concepts than the physical science concepts.	1.0	25.7	39.0	27.9	6.7	
	26.7[a]				34.6[b]	

a Strongly agree and agree combined. b Strongly disagree and disagree combined

Teachers perceptions concerning studentenrollment is presented in Table 3. Over sixty-seven percent (67.5%) of the teachers agreed or strongly agreed that high ability students are more likely to enroll in agricultural education

Table 2. Perceived Barriers to Integrating Science In Agricultural Education Programs (N = 106)

Barriers Item	SA%	A%	N%	D %	S D %
Lack of appropriate equipment is a barrier to integrating science into agricultural education programs.	35.2	48.6	7.6	7.6	1.0
	83.8"			8.6[b]	
Lack of adequate federal, state, or local funds is a barrier to integrating science into agricultural education programs.	23.8	40.0	17.1	17.1	1.9
	63.8[a]			19.0[b]	
Lack of agriscience workshops for agricultural education teachers is a barrier to integrating science.	13.3	49.5	20.0	17.1	0.0
	62.8[a]			17.1[b]	
Lack of science competence among teachers in agricultural education is a barrier to integrating science.	6.7	40.0	26.7	22.9	3.8
	46.7[a]			26.7[b]	
Lack of an integrated science curriculum is a barrier to integrating science into the agricultural education program	8.6	31.4	27.6	29.5	2.9
	40.0[a]			32.4[b]	
Lack of student preparation (prior to enrolling in agricultural education) in science is a barrier to integrating science.	5.7	26.7	28.6	36.2	2.9
	32.4[a]			39.1[b]	
Lack of close proximity to high-technology firms is a barrier to integrating science in agricultural education programs.	5.7	26.7	28.6	36.2	2.9
	31.4[a]			39.1[b]	
Lack of a science teacher who is willing to help me integrate science concepts has been a barrier to integrating science	4.8	20	25.7	40	9.5
	24.8[a]			49.5[b]	
Lack of agriscience jobs in the local community is a barrier to integrating science into the agricultural education program.	3.8	14.3	31.4	43.8	6.7
	18.1[a]			50.5[b]	

"Strongly agree and agree combined. [b] Strongly disagree and disagree combined

courses that integrate science. Only 10.5% of the teachers disagreed or strongly disagreed with this statement.

Table 4 presents the agriculture teachers' modal attitude toward program support since integrating science into their agricultural education program. Over sixty percent (61.9%) of the teachers agreed or strongly agreed that local administrator support has increased since they integrated more science into the agricultural education program. Over sixty percent (6 1.9%) of the teachers also agreed or strongly agreed that parental support has increased since they integrated more science into the agricultural education program.

Conclusions and Recommendations

Based on the findings of this study, the following conclusions and recommendations were drawn:

Almost one fourth of Oregon's AST

Table 3. Teachers' Perceptions Concerning: Student Enrollment and Integrating: Science into Agricultural Education Programs (N = 106)

Student Enrollment Item	SA %	A %	N %	D %	SD %
High ability students are more likely to enroll in agricultural education courses that integrate science.	17.1	50.5	21.9	8.6	1.9
	67.6"			10.5[b]	
Average ability students are more likely to enroll in agricultural education courses that integrate science.	9.5	45.7	33.3	11.4	00
	55.2"			11.4[b]	
Total program enrollment in agricultural education has increased since I integrated science.	11.4	41.9	36.2	8.6	1.9
	53.3 [a]			10.5 [b]	
Integrating science into the agricultural education program more effectively meets the needs of special population students.	10.5	37.1	33.3	13.3	5.7
	47.6 [a]			19.0,	
Low ability students are more likely to enroll in agricultural education courses that integrate science.	11.4	25.7	33.3	24.8	4.8
	37.1,			29.6 [b]	

[a] Strongly agree and agree combined. [b] Strongly disagree and disagree combined

teachers reported having a teaching credential with a science endorsement, while 50% of the teachers indicated their students receive science credit for agricultural classes in their school. Teachers should be encouraged to earn their science endorsement, especially if they desire to teach agriculture for science credit. Further research should be conducted to determine if students that are receiving science credit for agriculture classes are receiving the necessary knowledge and skills in science.

As a group, the teachers felt prepared to teach integrated biological and physical science concepts and that integrating science into the curriculum has increased their ability to teach students to solve problems. Further research should be conducted to determine the extent and degree to which teachers felt they were prepared to teach physical and biological concepts. Do teachers feel more prepared to teach in the traditional areas of animal science, plant science, than the emerging technology areas such as biotechnology, environmental science, and aquaculture? Since, agricultural education subscribes to the problem solving approach method of teaching (Phipps & Osborne, 1988), teacher preparation programs should purport integrating science as a means of teaching students to solve problems.

Although Oregon Agricultural Science and Technology teachers didn't agree on specific barriers to integrating science, the participants indicated the most significant barriers dealt with equipment and funding. With the budget constraints in schools across the state, teachers may need to explore grant funding and business partnerships to assist in integrating science into the curriculum. Creative funding may be the catalyst

Table 4. Teachers' Perceptions Concerning; Program Support and Integrating Science into Agricultural Education Programs (N = 106)

Program Support Item	SA%	A %	N %	D %	SD%
Local administrator support has increased since I have integrated more science into the agricultural education program.	11.4	50.5	31.4	5.7	1.0
	61.9,			6.7,	
Parental support has increased since I have integrated more science into the agricultural education program.	7.6	54.3	31.4	5.7	1.0
	61.9,			6.7,	
School counselor support has increased since I have integrated more science into the agricultural education program.	9.5	49.5	33.3	6.7	1.0
	59.0 [a]			7.7,	
Community support has increased since I have integrated more science into the agricultural education program.	6.7	48.6	37.1	6.7	1.0
	55.3,			7.7,	
Science teacher support has increased since I have integrated more science into the agricultural education program.	8.6	36.2	41.0	13.3	1.0
	44.8,			14.3 [b]	
Other teacher support has increased since I have integrated more science into the agricultural education program.	4.8	31.4	54.3	7.6	1.9
	36.2,			9.5,	

[a] Strongly agree and agree combined. [b] Strongly disagree and disagree combined

to integrating science in many agriculture programs. State Department of Education leaders and teacher preparation programs should assist teachers in developing skills to write for grant funding.

The findings of the current study concur with the findings of other researchers (Roberson, Flowers & Moore, 1998; Thompson & Schumacher, 1998; Newman & Johnson, 1994), that teachers felt a lack of agriscience workshops for agricultural education teachers is a barrier to integrating science. Teacher preparation programs and state departments of education must provide workshops that will assist teachers in integrating science (Kirby, 1990). Teachers felt that integrating science into the curriculum will draw more high ability students into agricultural education programs. As we hear teachers comment about aspiring to have more high ability students in their program, they must realize that a more science oriented curriculum may be a means of attracting these students into agricultural education programs.

A majority of the teachers felt that local administrator (Newman & Johnson, 1994) and parental support has increased since they integrated more science into the agricultural education program. Administrator and parental

support are important aspects of program expansion and development. Future studies can help determine the extent of administrator and parental support for integrating science into the agricultural education program.

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