Perceptions of Texas Agricultural Science Teachers Toward Granting Science Credit for Agricultural Science Courses

Robn Haggerton Krueger
Randall Willams
Department of Agronomy and Resource Science, Texas A&M University—Kingsville, TX 78363

ABSTRACT

As early as 1887, Agriculture was recognized as a science. Hammonds (1950), author of *Teaching Agriculture*, wrote, "The 'organized body of knowledge' we call the science of agriculture is deeply rooted in the sciences that contribute to agriculture. If we strip away from agriculture the portions of other sciences that bear upon it, we perhaps do not have left a science of agriculture. To teach agriculture is to recognize that it is a science."

Data published in a national study in 1993 indicates that 34% of agricultural science teachers are teaching courses that are receiving science credit (Dormody, 1993). In a later study, Dormody found that, during the 1989-90 school year, 67% of the nation's agricultural science teachers and 73% of the nation's science departments had shared resources.

Agricultural science teachers are separated from other teachers by the fact that they are responsible for much more than just classroom and laboratory instruction. They are called upon to serve the community as an educator and an agriculturalist. There are over 1,500 agricultural science teachers in Texas. These teachers often work year-around with students, assisting them with their Supervised Agriculture Experience Program (SAEP) projects. Furthermore, they advise the school's FFA chapter and are involved in leadership and career development events (Newcomb, et al.—1993). Due to the vast curricula offered in agricultural science at the secondary level, agricultural science teachers often are asked to teach subjects that may range from biological sciences to hunter safety (Texas Education Agency—1990).

If agricultural science teachers could open their programs by offering science credit, there is a tremendous potential for increased enrollment in the agricultural science programs. Moreover, offering additional options for students to complete science credits would be beneficial to students and administrators alike.

Schools could conceivably benefit economically as well. School districts with increased enrollment in their agricultural sciences program would stand to gain additional vocational funding from the state of Texas.

PURPOSE AND OBJECTIVES

The purpose of this study is to determine the perceptions and attitudes of Texas agricultural science teachers toward granting science credit for agriculture courses.

Specific objectives are as follows:

1. Determine Texas agriculture teachers' level of support for granting science credit for agricultural science courses.

2. Determine Texas agriculture teachers' perceptions of administrator and community support levels for granting science credit for agricultural science courses.
3. Determine possible effects of granting science credit for agricultural science courses, as perceived by Texas agriculture teachers.
4. Determine Texas agriculture teachers' level of support for various methods of granting science credit for agricultural science courses.
5. Determine Texas agriculture teachers' level of support for various methods of certifying teachers to offer science credit for agricultural science courses.
6. Determine Texas agricultural science teachers' post-secondary credit hours, grade point averages and required hours in biology, chemistry, earth sciences and physics.
7. Determine the extent to which Texas teachers currently teach agricultural science courses which are granted science credit, as well as to determine the teachers' perceptions as to which classes have the proper content and potential to be used for science credit.

METHODS AND PROCEDURES

Instrumentation

Instrumentation consisted of a modified questionnaire developed from a study in Arkansas (Johnson 1995) accompanied by a disclaimer. Questions on the instrument corresponded to the objectives of the study. The instrument also contained space for written comments concerning science credit for agricultural science courses.

Population

The population for this study included a sample of the 1,504 Texas agricultural science teachers. For budgeting purposes, stratified random sampling was used. Three hundred teachers were surveyed. Using the random numbers method, a sample of 30 teachers was selected randomly from ten strata within the state of Texas. The ten areas, used by the Texas FFA Association to divide the state, were used as the strata for the sample.

Data Collection

The 300 surveys were mailed to the randomly selected individuals. Due to budget restraints, self-addressed, stamped envelope was not provided. The individuals were given a deadline of one month after mailing to complete the survey. This length of time was allowed because the spring semester is the busiest time of the year for agricultural science teachers in Texas.

Analysis of Data

Data were analyzed using Corel Quattro Pro. Some statistical testing was done by hand, using formulas from *Elementary Survey Sampling* (Scheaffer, et al., 1996). All data

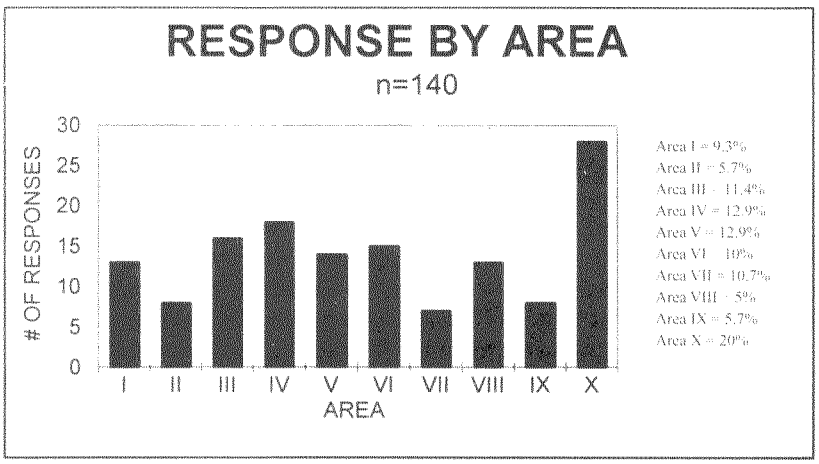

Figure 1. Response By Area

was entered into a Corel Quattro Pro spreadsheet. Various "@ Functions" were used to determine the number of different responses to each question, mean, standard deviation, mode, and median. Statistical differences were determined using a proportion estimate comparison formula from *Elementary Survey Sampling,* Chapter 4, section 4.60. All comparisons were done with 95% confidence. The results were reported as descriptive statistics and inferential statistics.

RESULTS

Demographics

The subjects were asked to provide their area, age, sex, school size, number of students in their agricultural science program, number of agricultural science teachers in the school, and number of science teachers in their school.

Response by area ranged from 23.3% to 93.3% (n = 30 for each area). As seen in Figure 1, Area VII had 7 responses, while Area X had 28 responses. Twenty percent of the total responses (n = 140) came from Area X, which includes most of South Texas. Area seven had only 5% of the total responses. (See Figure 1)

The numbers of male and female respondents were highly disproportional. Three subjects did not respond to this question (n = 137). Out of the remaining 137 surveys, there were 116 (84.7%) males and 21 (15.3%) females.

The average age of the teachers (n = 139) was 38.9, with a standard deviation of 9.216. The median and mode age was 38 and 51 respectively. The maximum age was 56, and the minimum age was 25.

The high schools in Texas are divided according to size, with 1A being the smallest and 5A being the largest. The majority of the responses (58.6%) came from teachers in 2A and 3A schools.

Most of the respondents had either 100—125 or 125—150 students in their agricultural sciences program. No respondents had less than 20 students in their program.

Table 1. Demographic Information About Survey Respondents (Including sex, size of school, and # of students in agricultural science program).

	n	Percent (%)
Sex (n=137)		
Males	116	84.7
Females	21	15.3
Size of School (n=140)		
1A	18	12.9
2A	43	30.7
3A	39	27.9
4A	21	15.0
5A	19	13.5
# of students in agricultural science programs (n=40)		
0-20	0	0
20-30	6	4.3
30-40	0	0
40-50	2	1.4
50-60	12	8.6
60-70	15	10.7
70-80	12	8.6
80-90	9	6.4
90-100	6	4.3
100-125	23	16.4
125-150	31	22.1
150-200	13	9.3
Over 200	11	7.9

The mean number of agricultural science teachers in each agricultural science program was 1.73, with a standard deviation of .62. The most frequently occurring number of teachers in a program was two.

The number of science teachers in each school varied greatly among the respondents. The mean number of science teachers was 6.7, with a standard deviation of 4.8. (See Tables 1 and 2)

Table 2. Demographic Information About Respondents (Including age, # of agricultural science teachers in the program, and # of science teachers in the school)

	n	X	SD	Med.	Mode
Age	139	38.98	9.22	38	51
# of ag. science *teachers in program*	140	1.73	0.62	2	2
# of science *teachers in school*	39	6.68	4.81	5	3

Levels of Support

Ninety two percent of the respondents supported granting science credit for agricultural science classes, with 55% answering "strongly agree," and 37% answering "agree." Seven percent were neutral and only two teachers (1%) were opposed.

Table 3. Perceived Support for Granting Science Credit for Agricultural Science Classes

Support From: (n = 140)	Strongly Agree %	Agree %	Neutral %	Disagree %	Strongly Disagree %
Building Admin.	38.0	33.6	15.7	11.3	1.4
Students	76.4	21.5	2.1	0	0
Guidance Counselors	35.7	35.7	16.4	10.8	1.4
Science Teachers	12.9	35.0	27.8	20.0	4.3
Parents	32.9	53.6	10.7	2.8	0

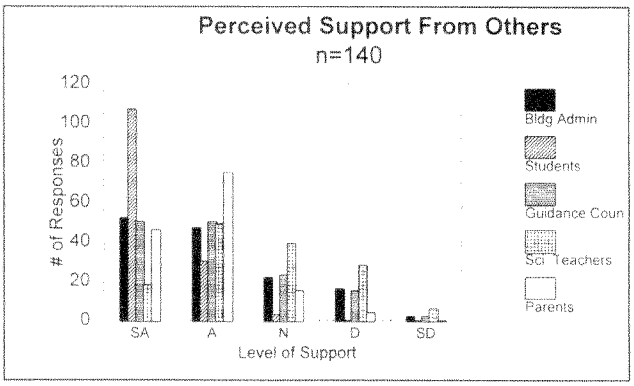

Figure 2. Bar Graph Comparing Perceived Support of Building Administrators, Students, Guidance Counselors, Science Teachers, and Parents. (SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree) agricultural science program.

The majority of the respondents also felt that their building administrators (vocational director, principal, etc.), students, counselors, parents, and science teachers would support granting science credit for agricultural science classes. Perceived support was highest for students and lowest for science teachers. (See Table 3 and Figure 2)

Effects of Granting Science Credit

As a group, the agricultural science teachers felt that granting science credit for agricultural science classes would have positive effects on their programs. Over ninety one percent (91.6%) of the teachers felt it would increase enrollment in their.

As shown in Table 4, most of the teachers felt that granting science credit would: (1) increase enrollment at all learning levels, (2) benefit students, (3) benefit the program, (4) increase student interest in agriculture, and (5) cause agricultural science teachers to work more closely with the science teachers.

While concerns about granting science credit do exist, Table 4 shows that a minority of agricultural science teachers disagree or strongly disagree with the concept. For example, 52.2% either disagreed or strongly disagreed when asked if granting science credit would

Table 4. Effects of Granting Science Credit for Agricultural Science Classes

Effect: (n = 140)	Strongly Agree %	Agree %	Neutral %	Disagree %	Strongly Disagree %
Granting science credit will:					
Increase enrollment in my program	35.6	56.0	5.6	2.8	0
Benefit students.	37.1	52.1	7.9	2.9	0
Enhance program's image.	44.3	38.6	11.4	5.7	0
Cause me to work more closely with science teachers.	31.4	56.0	7.1	5.7	0
Increase importance of ag. science program within school.	27.9	52.9	15.0	4.3	0
Increase student interest in ag. science.	29.3	51.4	12.1	7.1	0
Cause more high-ability students to enroll in ag. science.	22.9	35.7	25.0	16.4	0
Caure more low-ability students to enroll in ag. science	19.3	44.3	27.1	9.3	0
Require me to increase science content in ag. science courses.	17.2	56.4	12.1	14.3	0
Result in higher student achievement in science.	15.7	43.6	24.3	15.0	1.4
Cause ag. science courses to be thought of as "watered down" science courses	10.7	22.1	15.0	49.3	2.9
Prevent me from teaching important vocational skills.	14.3	11.4	3.6	67.9	2.9
Make me feel like a "second rate" science teacher.	8.6	10.7	12.9	57.1	10.7
Weaken my FFA chapter.	3.6	20.0	9.3	60.0	7.1

result in agricultural science classes being thought of as "watered down" science courses. Additionally, 67.9% of the respondents did not think it would make them feel like a "second rate" science teacher. Furthermore, only two respondents (1.4%) strongly disagreed with any of the positive effects.

Methods of Granting Science Credit

For this category, teachers were asked to rate their level of support for five different methods of granting science credit for agricultural science courses. Two of the methods

Table 5. Levels of Support for Methods of Granting Science Credit for Agricultural Science Classes (n = 140).

Method	Support %	Neutral %	Oppose %
Grant science credit for *any one of a specified group* of agricultural science courses, with changes made to enhance science content of courses.	64.3	16.4	19.3
Award science credit for *any one of several new* agricultural science courses, specifically designed to teach science applications in agriculture.	55.0	26.4	18.6
Grant science credit for *any one of a specified group* of agricultural science courses, with no changes in course content.	34.3	42.9	22.8
Grant science credit for *all agricultural science courses,* with changes made to enhance the science content of the courses.	10.7	30.7	58.6
Grant science credit for *all agricultural science courses,* with no changes in course content.	16.4	16.4	67.2

were supported by 55% or more of the teachers. These methods involved granting science credit to specific courses, with changes made in content, and granting science credit for new courses specifically designed to teach science applications in agriculture.

Over 42% of the respondents indicated that they were neutral concerning granting science credit for *any one of a specified group* of agricultural science courses, with no changes in course content (Table 5). Statistically, the proportion of those who were neutral (.42) is not significantly different from the proportion supporting this method. However, the proportion of those supporting this method was significantly different from the proportion of those opposed to this particular method (.23).

Methods of Certifying Teachers

The teachers were given four different methods of certifying agricultural science teachers to offer science credit for agriculture classes. The methods are as follows:
Method #1—Grant an endorsement in science to all teachers currently holding valid agricultural science certification.
Method #2 - Grant an endorsement in science to only teachers holding valid agricultural science certification, *and* completing a special science education in-service workshop.
Method #3—Grant an endorsement in science to only teachers holding valid agricultural science certification, *and* scoring above a designated level on a science achievement test.
Method #4—Grant an endorsement in science to only teachers currently holding valid certificates in both agricultural science *and* science.

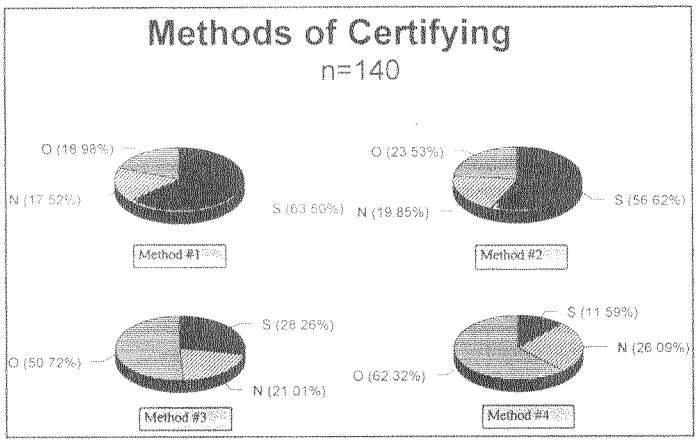

Figure 3. Pie Charts Comparing Levels of Support for the Four Methods of Certifying Agricultural Science Teachers to Offer Science Credit for Agricultural Science Courses. (S = Support, N = Neutral, O = Oppose) **Method numbers correspond with those listed in above.

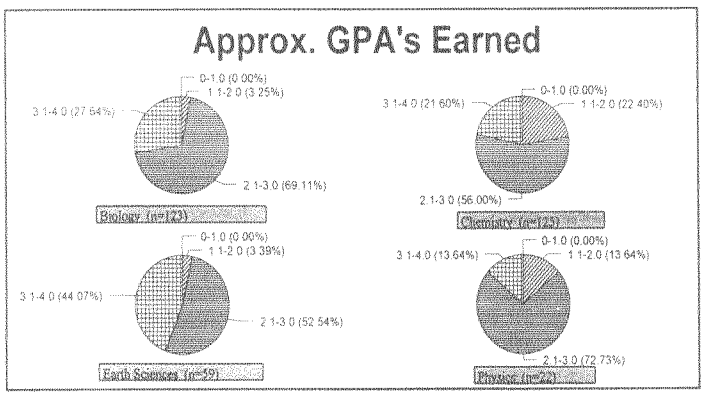

Figure 4. Approximate Grade Point Averages by Subject as Reported by Texas Agricultural Science Teachers (based on a 4.0 grading scale)

They were asked to rate their level of support for each method. The highest percentage (63.6%) of the teachers supported Method #1. Fifty five percent supported Method #2.

Statistically these proportions are not significantly different when compared using a 95% confidence interval. There is, however, a significant difference, with 95% confidence, between the proportion (.28) of those supporting Method #3, and the proportion (.11) of those supporting Method #4. (See Figure 3)

College-Level Science Course Work

The teachers were asked to provide the number of hours earned, approximate grade point average, and number of hours required on their degree plan for the following

Table 6. Post-Secondary Science Credit Hours Earned and Credit Hours Required on Degree Plan, As Reported by Texas Agricultural Science Teachers.

	Credit Hours Earned				Credit Hours Required			
Subject Area	n	X	SD	Mode	n	X	SD	Mode
Biology	135	11.7	7.36	8	110	9.58	5.30	6
Chemistry	135	8.78	3.93	8	116	7.80	3.50	8
Earth Sciences	130	3.30	4.60	0	126	2.60	3.89	0
Physics	140	1.09	2.61	0	137	0.27	1.15	0

subjects at the post-secondary level: Biology, Chemistry, Earth Sciences, and Physics. The number of responses varied greatly in this category.

As shown in Table 6, the mean number of hours completed in biology from 135 respondents was 11.70, while the mean number of hours required on the degree plan (n = 110) was 9.58. In the chemistry category, the mean number of hours completed (n = 135) was 8.78.

The teachers were given four ranges for approximate grade point average (0-1.0, 1.1-2.0, 2.1-3.0, and 3.1-4.0). The ranges are based on a 4.0 scale, with 0-1.0 in the F/D grade range, 1.1-2.0 in the D/C grade range, 2.1-3.0 in the C/B grade range, and 3.1-4.0 in the B/A grade range. Of the total responses for all four subjects (n = 329), 61.4% were in the 2.1-3.0 range. None of the respondents reported having a grade point average below the 1.1-2.0 range.

Course With Proper Content to be Granted Science Credit

The teachers were asked to circle classes, from a list provided, which they felt had the proper content to be granted as science credit. They were asked to circle as many as they felt had the proper content. The list was as follows:

1. AgSc 101—Introduction to World Agricultural Science and Technology
2. AgSc 102—Applied Agricultural Science and Technology
3. AgSc 231—Animal and Plant Production
4. AgSc 261—Introduction to Horticultural Sciences
5. AgSc 281—Energy & Environmental Technology
6. AgSc 335—Applied Entomology
7. AgSc 332—Animal Science
8. AgSc 333—Plant & Soil Science
9. AgSc 334—Equine Science
10. AgSc 362—Horticultural Plant Production
11. AgSc 323—Agriculture Power Technology
12. Other _____

There were 131 responses to this item. The respondents circled a total of 614 courses. As shown in Table 7, 79.4% of the respondents felt that AgSc 332 (Animal Science) had the proper content to be counted as science credit, while only 16% of the respondents felt that AgSc 101 (Introduction to World Agricultural Science and Technology) had the proper content.

Table 7. Classes With Proper Content to be Counted Toward Science Credit, as Perceived by Texas Agricultural Science Teachers. **Corresponding names for the course numbers in this table can be found above.

Course	n	% of Total Responses (n = 614)	% of Respondents (n = 131)
AgSc 101	21	3.4	16.0
AgSc 102	35	5.7	26.7
AgSc 231	86	14.0	65.6
AgSc 261	56	9.1	42.7
AgSc 281	41	6.7	31.3
AgSc 335	45	7.3	34.4
AgSc 332	104	16.9	79.4
AgSc 333	75	12.2	57.3
AgSc 334	54	8.8	41.2
AgSc 362	56	9.1	42.7
AgSc 323	28	4.6	21.4
Other	13	2.1	9.9

Courses provided in the "other" category included: Forestry, Introduction to Agricultural Mechanics, Agricultural Structures Technology, Agricultural Metal Fabrication Technology, Advanced Animal Science, Biotechnology, Fruit, Nut & Vegetable Production, Wildlife & Recreation Management, and Aquaculture.

Courses Currently Being Granted Science Credit

The teachers were asked to circle any classes, from the same list as in the last section, which they are teaching that are currently being granted science credit. There were 135 responses to this item. Animal Science is being granted science credit in two of the teachers' schools, Equine Science in one school, and Horticultural Plant Production in one school. Others provided in the responses were Wildlife (n = 2) and Recreation Management (n = 2), and Aquaculture (n = 1).

Comments

The respondents were also given an opportunity to write any comments concerning granting science credit for agricultural science courses. Some of the comments were as follows:

"I would like to give science credit for some of these courses because I believe it would enhance my program."

"I support this fully, and we are going to implement this in my school."

"I feel we need to leave agriculture where it is. I don't want to lose the identity of agriculture."

"This would increase the number of students enrolled in class, but could reduce the number of FFA members."

"My 1st thought is to let all ag. science teachers do this, 2nd thought is there are some that couldn't handle it, and we could get some bad feedback."

CONCLUSIONS AND LIMITATIONS

A more accurate study could be done with a higher response rate. The assumed reasons for the low response rate are lack of a self-addressed, stamped envelope in the survey, and the fact that the surveys were sent out during the 965454mpe odlkglfkgl;fdkgl;-dkgdl;kdg;ldl;busiest time of the year for Texas agricultural science teachers.

The response from those agricultural science teachers surveyed in Area X was extremely high in comparison to the other nine areas. This could be due to the teachers' close proximity to the university from which the survey came. This created an abnormal distribution among the ten areas, therefore possibly creating some bias.

With perceived support from guidance counselors, parents, administrators and students as well, these individuals, along with agricultural science teachers and science teachers should be involved in the process. Each group should be made aware of the advantages and disadvantages of granting science credit that would affect both students and teachers.

Although 63.6% of the teachers supported granting a science endorsement to all teachers holding a valid agricultural science certification, the best route would probably be to hold in-service workshops to enhance the science strength of the agricultural science teachers. Although teachers support granting science credit for agricultural science courses, there seems to be a lack of support for any extra education or effort on the part of the agricultural science teachers.

It would be in each teacher's best interest to take the Examination for the Certification of Educators in Texas (ExCet) in science and become certified, although there was little support for this method of certification.

With several agricultural science teachers already offering courses that are counted as science credit, a precedent could be created. If there are few negative effects on teachers and students, perhaps other school districts will follow the lead, and we will see more science credit being granted for agricultural science courses in the near future.

REFERENCES

Anderson, B.H. & Boddy, R. (1985). *The identification of science competencies included in the curriculum of secondary vocational education programs.* (ERIC Document Reproduction Service No. ED 259 219)

Budke, W. (1991, January). Agricultural science—Striving for excellence. *The Agricultural Education Magazine, 63* (7), 4,11.

Conners, J. and Elliot, J. (1995). The influence of agriscience and natural resources curriculum on students' science achievement scores. *Journal of Agricultural Education, 36* (3), 57-63.

Dormody, T.J. (1992). Exploring resource sharing between secondary school teachers of agricultural education and science departments nationally. *Journal of Agricultural Education*, (3) 23-31.

Dormody, T.J. (1993). Science credentialing and science credit in secondary agricultural education. *Journal of Agricultural Education, 34* (2), 63-70.

Hammonds, C. (1950). *Teaching Agriculture*. New York: McGraw-Hill .

Johnson, D.M. (1995, December). Arkansas agriculture teachers' opinions concerning science credit for agriculture. *Proceedings of the 22nd Annual National Agricultural Education Research Meeting, 22*, 129-140.

Johnson, D.M. & Newman, M.E. (1993). Perceptions of administrators, guidance counselors, and science teachers concerning pilot agriscience courses. *Journal of Agricultural Education, 34* (2), 46-54.

Newcomb, L., McCracken, J., & Warmbrod, J. (1993). *Methods of Teaching Agriculture*, 25-40.

Norris, R.J. & Briers, G.E. (1989). Perceptions of secondary agricultural science teachers toward proposed changes in agricultural curricula for Texas. *Journal of Agricultural Education, 30*, (1), 32-43, 59.

Scheaffer, R.L., Mendenhall, W., & Ott, R.L. (1996). *Elementary Survey Sampling Fifth Edition*, 95-106.

Texas Education Agency, (1990). *Basic curriculums for semester courses in agricultural science and technology.*

Texas Education Agency, Science Unit, (1996). *Science essential elements.*

Texas Education Agency, (1996). *Texas Teachers of Agricultural Science and Technology 1996-1997 Directory.*

Understanding Agriculture New Directions for Education. (1988). National Research Council. Washington, DC: National Academy Press.