SAE SCOPE AND STUDENT ACHIEVEMENT IN AGRIBUSINESS AND NATURAL RESOURCES EDUCATION

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An effective way to learn most practical skills is through first-hand experience. Nowhere has this principle been applied to a greater extent than in vocational agriculture. Supervised agricultural experience (SAE) programs have long satisfied the practical aspect of agricultural education by providing students with a wide variety of learning experiences. These programs continue to enjoy broad support from students, parents, and educators. Sutphin and Newcomb (1983) reported that 98% of respondents to a national survey of agricultural educators and administrators believe that SAE should be required of all high school vocational agriculture students. A recent national study of agricultural education recommended that all students participate in worthwhile SAEs while enrolled in vocational agriculture (National Research Council, 1988). Arrington and McGhee (1988) reported that over 50% of the 1983 vocational agriculture program completers in Florida believe there should be more emphasis on SAE in the program.

Relatively little investigation has focused on the relationship between the scope of SAE projects and student achievement. Morton (1978) found a positive relationship between SAE scope and student achievement gauged by written test scores. In a study limited to handicapped students, Potter (1984) found no significant relationship between SAE scope and student achievement. Noxel and Cheek (1988) found a positive relationship between SAE scope and student achievement for students enrolled in ornamental horticulture. Tylke and Arrington (1988) found no positive relationship between SAE scope and student achievement in livestock production. Considering the limited research conducted on SAE scope as related to student achievement, and the conflicting results thereof, more investigation needs to be conducted in this area.

Additional research should consider the unique situations within other states and other extraneous variables related to student achievement not measured in previous research. A comprehensive review of the literature suggested that in addition to SAE involvement, student performance on an achievement test can be related to: student interest in the subject area (Christensen, 1964; Neavill, 1973; Sjoberg, 1984); FFA involvement (Cheek & McGhee, 1985; Long & Israelsen, 1983; McGhee & Cheek, 1988; Potter, 1984; Smith, 1983); years of previous enrollment in vocational agriculture (Morton, 1978); parental involvement and expectations (Caroselli, 1980; Christensen, 1964; Gigliotti & Brookover, 1975; Seginer, 1983); cumulative grade point average (Christensen, 1964; Morton, 1978); and teacher effectiveness (Dunkin & Biddle, 1974; Rosenshine & Furst, 1971).

Purpose and Objectives

The purpose was to determine the relationship between the scope of SAE, as measured by total income and Productive Man Work Units (PMWU), and the level of achievement of students enrolled in two different high school vocational agriculture classes in Florida: 1) Fundamentals of Agribusiness and Natural Resources (Fundamentals), a ninth-grade course, and 2) Applied Principles of Agricultural Occupations (Applied Principles), a tenth-grade course. The primary research hypothesis was: A positive relationship exists between the scope of an SAE and student achievement on tests designed to measure technical knowledge in both Fundamentals of Agribusiness and Natural Resources or Applied Principles of Agricultural Occupations.

In addition to the primary hypothesis, the following alternative hypotheses were considered, A positive relationship exists between student achievement and the following variables, cumulative grade-point average, parental expectations and encouragement, number of years of participation in vocational agriculture, student involvement in FFA, student interest in agriculture, and teacher effectiveness.

Procedures

Population and Sample: The population consisted of public high schools in northeast and central Florida offering either Fundamentals or Applied Principles. Most vocational agriculture students in the state complete these classes prior to specializing in other agricultural areas. Fundamentals is designed to be taught at the 9th grade level for one period of instruction per day for the entire school year. Students who enroll may have completed Orientation and Exploration of Agribusiness

Journal of Agricultural Education
Volume 31, Number 2, pp.55-61
DOI: 10.5032/jae.1990.02055

and Natural Resources Occupations in the seventh and eighth grade. Applied Principles of Agribusiness and Natural Resources Occupations is primarily designed to be taught at the tenth grade level and students who enroll should have completed Fundamentals of Agribusiness and Natural Rsources Occupations in the ninth grade. Applied Principles consists of three components with each component designed to utilize one-third of the school year. All students complete the common core component consisting of competencies common to all agricultural/agribusiness occupations in addition to two specialized components. A purposive sample of nine of the 23 schools teaching Fundamentals was utilized and twelve of the 14 schools teaching Applied Principles comprised that sample.

The study utilized an ex-post facto design where the independent variable (SAE scope) had already occurred. The investigation began with the measurement of the dependent variable, student achievement. Data were collected through on-site administration of the instruments by the researchers. All students enrolled in either Fundamentals or Applied Principles in the schools comprised the samples. Students who were absent on the day data were collected completed the instruments when they returned to school so that 100% of the students in the sample schools were included in the study. Ninety-eight Applied Principles students responded and 249 Fundamentals students responded.

Instrumentation : Four instruments were used; multiple choice tests designed to measure technical knowledge in the two classes; a questionnaire regarding the type and scope of their SAE; a demographic questionnaire designed to collect information related to FFA involvement, length of enrollment in vocational agriculture, interest in agriculture, teacher effectiveness, and parental expectations and encouragement; and a grade-point-average form to be completed by the guidance counselor at each school.

Items for the Fundamentals achievement test were selected from a test-item bank developed for that class by McGhee and Cheek (1983). These items had an average Kuder-Richardson reliability coefficient of .80. Items for the Applied Principles test were also selected from a series of test-item banks developed by Cheek and McGhee (1983a, 1983b, 1983c, 1983d, 1983e, 1983f) and had an average Kuder-Richardson reliability coefficient of .88.

Data related to each student's SAE program were collected by means of a written questionnaire which was administered with the achievement test. Students were asked to provide information relating to the type and scope of their SAE. An SAE scope score was subsequently calculated based on this information.

Data Analysis

Achievement tests were scored and students were assigned raw scores for each of the independent variables. SAE scope was calculated according to the formula:

$$S = I/100 + PMWU/5$$

Where: **S** = scope for the SAE program
I = total income for the 1984-5 school year
PMWU = estimated productive man work units for the 1984-5 school year.

Income was defined as the net income of a student's ownership projects and net receipts from a student's placement work experience. A PMWU was defined as the work accomplished by one person in a 10-hour work day with typical levels of production practices and equipment. This formula was used because historically several researchers have devised this system for determining SAE scope. The formula recognizes that income is not the only indicator of the scope of an SAE project. McMillion and Auville (1976) examined factors associated with the success of supervised farming programs of Virginia high schools using a similar formula called productive man work days to measure SAE scope. Morton (1978) used the PMWU formula to determine SAE scope scores in order to study the relationship between quality of SAE program and student achievement. Later, Arrington (1981), using the same PMWU formula, determined SAE scope scores to examine the relationship of length of teacher contract to SAE scope and FFA chapter activity level.

Results

Characteristics of Students: Student achievement, the dependent variable, was measured using multiple-choice tests designed to measure technical knowledge. For the 98 Applied Principles students, test scores ranged from 10 (29%) to 32 (91%). The mean test score was 18.63 and the standard deviation was 4.30. For the Fundamentals students, scores ranged from 9 (22.5%) to 38 (95%). The mean score was 26.8 and the standard deviation was 6.6.

Supervised agricultural experience scope ranged from 0 to 62.5 for Applied Principles students and 0 to 79.7 for Fundamentals students. For both groups, approximately one-half of the students had scope scores of .03 or less. These data are summarized in Tables 1 and 2.

Table 1
Supervised Agricultural Experience Scope for Applied Principles

SAE Scope	Frequencies N	%	Cum. %
0.00 - 0.02	44	44.9	44.9
0.03 - 0.69	5	5.1	50.0
0.7 - 11.5	25	22.5	75.5
11.6 - 62.5	24	24.5	100.0
Total	98	100.0	
M = 8.04	Min. = 0.00		
SD = 12.77	Max. = 62.5		

Table 2
Supervised Agricultural Experience Scope for Fundamentals

SAE Scope	Frequencies N	%	Cum. %
0.00 - 0.03	137	55.0	55.0
0.04 - 2.73	51	20.5	75.5
2.74 - 79.7	61	24.5	100.0
Total	249	100.0	
M = 3.45	Min. = 0.00		
SD = 9.07	Max. = 79.7		

An appropriate SAE for both Fundamentals and Applied students would involve any experiences that afforded the student an opportunity to apply competencies taught in the course for which they are enrolled. The types of SAEs for both groups were similar. Most ownership programs involved small scale horticulture, crops, or livestock projects. Animals and plants for local fairs were common. Most placement SAEs were on farms or ornamental nurseries.

The average cumulative GPA for the Applied Principles students was 2.3 and for the Fundamentals students it was 2.2. Approximately 9% of the Applied Principles students had a B average or higher while 27.3% of the Fundamentals students had a B average or higher.

For FFA involvement, each student responded to questions pertaining to offices held, attendance at conventions or conferences, and judging team participation. Each activity was assigned a point value and responses were totaled to yield an FFA involvement score. Involvement scores ranged from 0 to 23 for Fundamentals and 0 to 45 for Applied Principles. Roughly 30% of Applied Principles students and 55% of Fundamentals students had little or no involvement in FFA.

Student interest in agriculture was measured with a series of questions using a five-point scale (5 = high interest, 1 = low interest). The mean interest score for Applied Principles was 3.76 with a

standard deviation of .99. Over three-fourths of the Applied Principles students had interest scores above 3.33. The mean interest score for Fundamentals students was 3.44 with a standard deviation of .92. Approximately one-half of the Fundamentals students had interest scores above 3.33.

Parental encouragement and expectations was determined by asking students to indicate whether they strongly disagreed, disagreed, neither agreed nor disagreed, agreed, or strongly agreed with several value statements about their parents' encouragement and expectations for them. Using a five-point scale, a higher score indicated a higher level of encouragement. Means of 3.7 for both groups suggests that most students were receiving some encouragement from their parents. Encouragement scores ranged from 2.25 to 4.75 for Applied Principles and 1.0 to 5.0 for Fundamentals.

Students' ratings were used to determine teacher effectiveness. Teacher effectiveness scores were calculated by averaging each student's rating of six teacher-behavior criteria, yielding one composite score per student. The possible range of scores was 1 to 5, with a higher scoreindicating a more effective teacher. The mean teacher effectiveness scores were 4.08 and 3.93 for Applied Principles and Fundamentals respectively. Over 75% of both groups rated their teacher 3.5 or higher.

Fundamentals students had been previously enrolled in vocational agriculture for an average of 1.36 years. For Applied Principles students the average was 2.66. It should be noted that while Fundamentals is typically taught for ninth graders and Applied Principles for tenth graders, in Florida students could have enrolled in pre-vocational agriculture programs in the grades 6-8.

Relationship Between the Major Variables: Pearson product moment correlation coefficients and step-wise multiple regression analysis were used to test each of the hypotheses. Tables 3 and 4 present correlation coefficients for all possible pairs of variables. For the Fundamentals students, the analysis indicated statistically significant positive relationships between the dependent variable, student achievement, and the following independent variables: FFA involvement (.14), interest in agriculture (.22), parental encouragement (.24), teacher effectiveness (.21), and GPA (.38). In the Applied Principles group, achievement was significantly related to SAE (.30), FFA involvement (.25), interest in agriculture (.37), and GPA (.24). These data are summarized in Tables 3 and 4.

Table 3
Pearson Product Moment Correlation Coefficients (Fundamentals)

Variable	ACH	SAE	FFI	YPE	INT	PIE	TEF
SAE Scope	-.016						
FFA Involvement	.139*	.206*					
Years Previously Enrolled	-.069	.132*	.074				
Interest in Agriculture	.224*	.250*	.392*	.115*			
Parental Involvement and Expectations	.244*	.128*	.250*	.028	.335*		
Teacher Effectiveness	.214*	.088	.229*	-.011	.458*	.448*	
GPA	.381*	-.058	.020	-.058	-.032	.202*	.015

*p < .10; ACH = Student Achievement; SAE = SAE Scope; FFI = FFA Involvement; YPE = Years Previously Enrolled; INT = Interest in Agriculture; PIE = Parental Involvement and Expectations; TEF = Teacher Effectiveness.

Step-wise multiple regression analysis was used to enter each independent variables into the multiple regression equation. This analysis partials out the effects of a single variable at each step, while other variables are statistically controlled. Tables 5 and 6 summarize the multiple regression analysis.

Three variables were significant in explaining variance in student achievement for the Applied Principles group: interest in agriculture, GPA, and SAE scope. These three variables accounted for 20% of the variance in student achievement. Only two variables significantly explained variance in student achievement for Fundamentals: GPA and interest in agriculture. They accounted for 6% of the variance in student achievement.

Table 4
Pearson Product Moment Correlation Coefficients (Applied Principles)

	ACH	SAE	FFI	YPE	INT	PIE	TEF
SAE Scope	.304*						
FFA Involvement	.249*	.439*					
Years Previously Enrolled	.082	.323*	.369*				
Interest in Agriculture	.373*	.236*	.282*	.042			
Teacher Effectiveness	.104	.072	.239*	.146	.321*		
Parental Involvement and Expectations	-.013	.154	-.068	.125	-.040	.220*	
GPA	.245*	.184	.164	.116	.110	.204*	.204*

*$p < .10$; ACH = Student Achievement; SAE = SAE Scope; FFI = FFA Involvement; YPE = Years Previously Enrolled; INT = Interest in Agriculture; PIE = Parental Involvement and Expectations; TEF = Teacher Effectiveness.

Table 5
Step-wise Regression of the Independent Variables on Achievement (Applied Principles)

Variable	R[a]	F	Prob. > F
Interest	.12	11.53	.001
GPA	.17	5.58	.021
SAE	.20	3.20	.07

Table 6
Step-wise Regression of the Independent Variables on Achievement (Fundamentals)

Variable	R[a]	F	Prob. > F
GPA	0.1277	26.9902	0.0001
Interest	0.1845	14.5538	0.0002

Conclusions

Participation in SAE in the schools sampled was low.

The primary research hypothesis that SAE scope was positively related to student achievement was accepted for Applied Principles and rejected for Fundamentals.

The hypothesis that student achievement was positively related to GPA was accepted for both Applied Principles and Fundamentals.

The hypothesis that student achievement was positively related to parental expectations and encouragement was accepted for Fundamentals and rejected for Applied Principles.

The hypothesis that student achievement was positively related to FFA involvement was accepted for both Applied Principles and Fundamentals.

The hypothesis that student achievement was positively related to interest in agriculture was accepted for both Applied Principles and Fundamentals.

The hypothesis that student achievement was positively related to teacher effectiveness was accepted for Fundamentals and rejected for Applied Principles.

The hypothesis that student achievement was positively related to years of enrollment in agriculture was rejected for both Applied Principles and Fundamentals.

Recommendations

Further research should be conducted in this area utilizing pre-enrollment and after-completion data to further determine SAE's impact on learning. Teachers should continue to encourage students to participate in SAE and FFA, which have been shown to be related to student achievement. SAE scope scores were very low in both groups. Efforts must focus on identifying strategies to assist teachers with implementing SAE at the local level.

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