Correlation of Secondary Agricultural Education Students' Science Achievement to FFA and Supervised Agricultural Experience Participation

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Abstract

The purposes of this study were to describe the science achievement of secondary agricultural education students both regular education and special education to determine if FFA and Supervised Agricultural Experience (SAE) participation held a relationship with students' performance on science achievement when compared to students who did not participate in FFA and SAE. The FFA activity level of regular education and special education agricultural education concentrators did not hold a statistically significant relationship with science achievement on the Georgia High School Graduation Test (GHSGT) The SAE activity level of regular education and special education agricultural education concentrators did not hold a statistically significant relationship with science achievement on the GHSGT Even though the FFA and SAE data did not show statistical significance, these components were integral parts of agricultural education programs that reiterated classroom concepts to improve academic performance.

Introduction

McLure and McLure (2000) reported that after-school activities involving science improved ACT Science Reasoning test scores. An integral part of agricultural education programs is participation in the student organization, FFA. Through participation in FFA, students develop analytical and communication skills required to be successful in science-based careers. For example, one FFA event that combines these two skills is the Agriscience Fair career development event (CDE). To compete in this event. students utilize the scientific method to independently design and conduct agriculturally related experiments by determining hypotheses, conducting research, gathering and analyzing data, synthesizing conclusions, and making recommendations. After completing experiments, students visually and orally communicate the scientific findings on display boards and explain their experiments to panels of judges (National FFA Organization, 2011a).

Supervised Agriculture Experience (SAE) is another integral component of agricultural education and is defined as extensions of classroom instruction utilizing applicable situations in traditional and non-traditional settings (Newcomb, McCracken, Warmbrod, & Whittington, 2004; Phipps, Osborne, Dyer, & Ball, 2008; Talbert, Vaughn, Croom, & Lee, 2007). As a further illustration, one of the eight types of SAEs is research and experimentation (Roberts and Harlin, 2007). Conducting experiments by following the scientific method reinforces agricultural education standards and science standards. Students select areas of interest to gain hands-on experience in Agriscience. What is more, SAEs provide autonomous opportunities for students to extend their knowledge in particular areas of Agriculture (Croom, 2008). Therefore, it is reasonable to assume that there may be some relationship between student involvement in the FFA and with SAEs to their achievement on standardized exams in science.

Review of Literature

Ricketts, Duncan, and Peake (2006) researched Georgia schools with complete agricultural education programs as identified by instructional classrooms and laboratories, FFA activities, and SAE programs. The instrumentation included scores on Georgia High School Graduation Test (GHSGT) science section, passing rate on the first attempt, number of agricultural education courses passed, and teachers ranked engagement level in FFA and SAE programs. The data were analyzed using descriptive statistics of means, standard deviations, percentages, and frequencies. Inferential statistics were used to verify if agricultural education courses were related to student achievement in science. The relevant conclusions were that students attained higher (GHSGT) science scores because of involvement in agricultural education classes, FFA activities, and SAE programs. Further, the first time passing rate of agricultural education students was twice as high as career preparatory students. Also, agricultural education classes and FFA involvement were related to scientific comprehension and application.

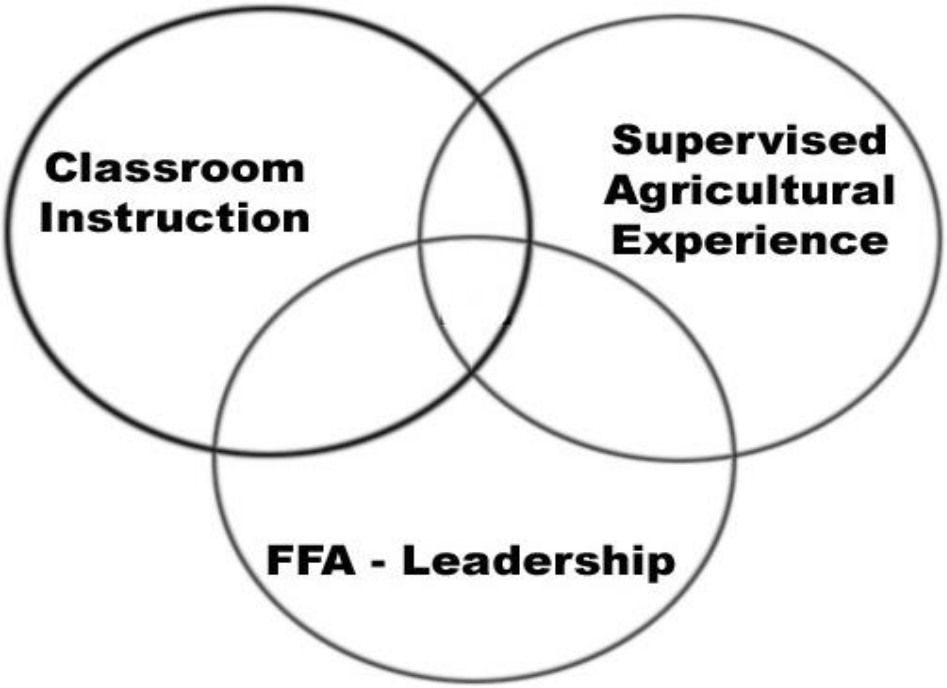
It is widely accepted in agricultural education literature that an integral part of classroom instruction is SAE involvement. SAE offers students opportunities to practice informal learning outside of the classroom at school laboratories, job placements, and students' homes. Applying academic and agricultural theories learned through classroom instruction allowed opportunities for students to research and implement ideas that they wished to pursue (Roberts and Harlin, 2007). As previously mentioned, the study by McLure and McLure (2000) found that ACT Science scores improved as the number of outside classroom science activities increased. The study listed outside classroom activities as: created independent scientific research paper, performed independent scientific experiments, participated in science foundation summer camp, received recognition for scientific experiment, and participated in school, regional or state scientific contest. The study found that with each additional activity completed, the ACT Science scores increased.

To examine the foundations of SAE, Roberts and Harlin (2007) researched the philosophical and historical origins of the project method or SAE. The review of literature focused on project purposes, classifications, processes, settings, individual or groups, and the teachers' roles within each category. The authors concluded that modern SAEs have evolved from attaining expertise with agriculture skills to include preparation for non-agriculture careers with employability skills and that SAEs are utilized for experiential learning. Further, Shelley-Tolbert, Conroy, and Dailey (2000), concluded that experiential learning through SAEs and leadership opportunities through FFA activities must remain in science oriented agricultural education in order for students to transfer academic knowledge to real world applications.

Conceptual/Theoretical Framework

Agricultural education contains three equal segments: classroom/laboratory instruction, FFA, and SAE. Classroom/ laboratory instruction occurs during the school day where instruction is provided in the following areas in Georgia secondary public schools: Agribusiness Management, Agricultural Mechanics, Agriscience, Animal Science, Plant Science/Horticulture, Forestry/ Natural Resources, and Veterinary Science (Georgia State Department of Education,

2011). In response to connecting agriculture curriculum to academic subjects, in 2007, the Georgia Department of Education Agricultural Education Department implemented Georgia Performance Standards for agricultural education courses and cross referenced science, social studies, English, and mathematics standards that were associated with each agricultural education standard (Georgia Department of Education, 2011).



National FFA (2011)

With the aforementioned connections to science achievement with agriscience education, it would seem logical that there may be a relationship between the level of involvement a student holds in the FFA and with their SAE and their performance on a standardized exam of science knowledge.

This study was developed to help meet the goals of the National research agenda for Agricultural Education. According to Doerfert, a "key outcome" identified by the agenda included "Accurate and reliable data that describe the quality and impact of educational programs and outreach efforts at all levels [that] will be distributed to respective decision groups (e.g. students, parents, administration, industry, policy makers)" (p. 24) . This research represents an attempt to fulfill this aspect of the agenda.

Purposes and Objectives

The purposes of this study were to describe the science achievement of secondary agricultural education students both regular education and special education to determine if FFA and SAE participation held a relationship with students' performance on science achievement when compared to students who did not participate in FFA and SAE.

1. Describe the relationship between FFA involvement and science achievement of regular education and special education agricultural education students.
2. Describe the relationship between SAE participation and science achievement of regular education and special education agricultural education students.

Methodology

The research design of this quantitative study was descriptive, correlational, and assessed group differences. The treatment group was the group of students who were in the eleventh grade during the academic year 2009-2010, had passed at least one secondary agricultural education course, and whose agricultural education instructors responded to the request by Georgia's State Director of Agricultural Education. The treatment group was subdivided into two groups based on number of agricultural education courses passed. The students that passed one or more secondary agricultural education course were labeled as participants and the students that passed three or more secondary agricultural education courses were labeled as concentrators (Georgia Department of Education, 2010).

To determine if students were agricultural education participants or agricultural education concentrators, agricultural education instructors listed the total number of secondary agricultural education courses passed. The instructors were asked to assist school counselors, testing coordinators or assistant principals in gathering information about number of agricultural education courses passed and recorded information on the chart provided. From this information, the researcher used *Predictive Analytical SoftWare (PASW) 18.0* computer software program to categorize students into agricultural education participant or agricultural education concentrator.

To determine the GHSGT science scores and student classification (special education participant or not), agricultural education instructors listed the GHSGT scores and classification for each agricultural education student. The instructors were asked to assist school counselors, testing coordinators, or assistant principals in gathering information about the GHSGT science scores to record on the information chart.

In addition to the GHSGT science scores, SAE and FFA rating scales were used to determine the intensity level of SAE and FFA involvement for the agricultural education students in the study. The rating scales were completed by the agricultural education instructors concerning the students' participation levels. The following guidelines were issued for the SAE participation level on a scale from one to five. A student with 10 or less hours per semester was a level one, 11 to 20 hours per semester was a level two, 21 to 30 hours per semester was a level three, 31 to 40 hours per semester was a level four, and a student that works 50 or more hours per semester on an SAE was a level five.

Along with the SAE ranking, agricultural education teachers rated students' FFA participation on a scale of one to five by following these guidelines. A student that participates in one FFA activity per semester was a level one, two activities per semester was a level two, three FFA activities per semester was a level three, four activities per semester was a level four, and five or more activities per semester was a level five. The following examples of FFA

activities were listed to further guide the agricultural education instructors: chapter meetings, officer meetings, CDEs, leadership camps, and livestock competitions.

The dependent variable was the student scores on the science portion of the GHSGT taken spring 2010. The independent variables were SAE involvement, FFA participation, and special education status of eleventh grade agricultural education students that completed the science portion of the 2009-2010 GHSGT.

In addition to statistical significance analysis, effect size was calculated. According to Kotrlik, Williams, and Jabor (2011), Cohen *d* was calculated to estimate effect size on *t* tests and compared to the following values: .20 small effect size, .50 medium effect size, and .80 large effect size. Just as Cohen *d* was calculated to determine effect size for *t* tests, *Eta-squared* was calculated to estimate effect size for ANOVA and compared to the following values: .10 small effect size, .25 medium effect size, and .40 large effect size (Kotrlik, Williams, & Jabor, 2011).

Findings

The percentage of concentrator regular education students with high FFA involvement in each GHSGT science score category was: below proficiency 3%, basic proficiency 39%, advanced proficiency 44%, and honors 14% (Table 1).

Table 1
Descriptive Statistics for GHSGT Science Exam Scores of Regular Education and FFA Levels of Overall Agricultural Education Students (n=3,665), Agricultural Education Participants (n=2,345), and Concentrators (n=1,320)

GHSGT Category	Overall and Low FFA Level Percentage	Overall and High FFA Level Percentage	Participant and Low FFA Level Percentage	Participant and High FFA Level Percentage	Concentrator and Low FFA Level Percentage	Concentrator and High FFA Level Percentage
Below	02	03	02	03	02	03
Basic	41	42	43	43	39	39
Advanced	45	42	43	41	46	44
Honors	12	13	12	13	13	14
n	2740	925	1745	600	995	325
M	240	239	239	238	241	240

The percentage of concentrator special education students with high FFA involvement in each GHSGT science score category was: below proficiency 22%, basic proficiency 60%, advanced proficiency 16%, and honors 2% (Table 2).

Table 2
Descriptive Statistics for GHSGT Science Exam Scores of Special Education and FFA Levels of Overall Agricultural Education Students (n=556), Agricultural Education Participants (n=347), and Concentrators (n=209)

Category	Overall and Low FFA Level Percentage	Overall and High FFA Level Percentage	Participant and Low FFA Level Percentage	Participant and High FFA Level Percentage	Concentrator and Low FFA Level Percentage	Concentrator and High FFA Level Percentage
Below	21	21	23	22	18	22
Basic	58	53	58	57	59	60
Advanced	17	22	17	19	17	16
Honors	04	04	02	02	06	02
n	407	149	249	98	158	51
M	213	223	212	223	216	227

In addition to FFA involvement, SAE activities were examined. The agricultural education instructors ranked the students' intensity levels on a scale of one to five using the following guidelines. A student with 10 or less hours per semester was a level one, 11 to 20 hours per semester was a level two, 21 to 30 hours per semester was a level three, 31 to 40 hours per semester was a level four, and a student that works 50 or more hours per semester on an SAE was a level five. These rankings were compiled into two categories: participants and concentrators.

The percentage of concentrator regular education students with high SAE intensity in each GHSGT science score category was: below proficiency 2%, basic proficiency 38%, advanced proficiency 46%, and honors 14% (Table 3).

Table 3
Descriptive Statistics for GHSGT Science Exam Scores of Regular Education and SAE Levels of Overall Agricultural Education Students (n=3,665), Agricultural Education Participants (n=2,345), and Concentrators (n=1,320)

GHSGT Category	Overall and Low SAE Level Percentage	Overall and High SAE Level Percentage	Participant and Low SAE Level Percentage	Participant and High SAE Level Percentage	Concentrator and Low SAE Level Percentage	Concentrator and High SAE Level Percentage
Below	02	02	02	03	02	02
Basic	42	41	42	42	39	38
Advanced	43	45	43	43	46	46
Honors	13	12	13	12	13	14
n	2149	1516	1392	953	757	563
M	239	240	239	239	240	241

A total of 556 students were special education students with 298 (54%) classified as low SAE intensity with a GHSGT science mean score of 224. The percentage of special education students in each GHSGT science score category was: below proficiency 20%, basic proficiency 56%, advanced proficiency 18%, and honors 6%. The percentage of concentrator special education students with high SAE intensity in each GHSGT science score category was: below proficiency 22%, basic proficiency 59%, advanced proficiency 18%, and honors 0.9% (Table 4).

Table 4
Descriptive Statistics for GHSGT Science Exam Scores of Special Education and SAE Levels of Overall Agricultural Education Students (n=556), Agricultural Education Participants (n=347), and Concentrators (n=209)

GHSGT Category	Overall and Low SAE Level Percentage	Overall and High SAE Level Percentage	Participant and Low SAE Level Percentage	Participant and High SAE Level Percentage	Concentrator and Low SAE Level Percentage	Concentrator and High SAE Level Percentage
Below	20	22	21	22	16	22
Basic	56	58	56	57	59	59
Advanced	18	18	19	19	15	18
Honors	06	02	04	02	10	.9
n	298	258	198	149	102	107
M	224	213	222	213	230	212

To further analyze the descriptive information, SAE rankings and FFA rankings were explored for all regular education agricultural education. For all regular education students, 2,149 students had a low SAE ranking with 1,953 (91%) with a low FFA ranking with a GHSGT science mean score of 239.33 and 196 (9%) had a low SAE ranking with a high FFA ranking with a GHSGT science mean score of 239.87. The 1,516 regular education students with high SAE level, 787 (52%) had a high SAE ranking with low FFA ranking with a GHSGT science mean score of 240.50 and 729 (48%) had a high SAE ranking and high FFA ranking with a GHSGT science mean score of 238.47.

Concentrator special education students had the following descriptive SAE and FFA information. For concentrators, 102 students had a low SAE ranking with 98 (96%) with a low FFA ranking with a GHSGT science mean score of 218 and 4 (4%) had a low SAE ranking with a high FFA ranking with a GHSGT science mean score of 244. The 107 special education participants with high SAE level, 60 (56%) had a high SAE ranking with low FFA ranking with a GHSGT science mean score of 214 and 47 (44%) had a high SAE ranking and high FFA ranking with a GHSGT science mean score of 211 (Table 5).

Table 5

GHSGT Science Exam Scores of Regular and Special Education with SAE and FFA Levels of Overall Agricultural Education Students, Agricultural Education Participants and Agricultural Education Concentrators

Category	*n*	M	SD
Overall Regular Education	3665		
Low SAE Level and Low FFA Level	1953	239.33	28.28
Low SAE Level and High FFA Level	196	239.87	28.43
High SAE Level and Low FFA Level	787	240.50	26.40
High SAE Level and High FFA Level	729	238.47	27.71
Participant Regular Education	2345		
Low SAE Level and Low FFA Level	1237	238.59	28.68
Low SAE Level and High FFA Level	155	240.59	28.03
High SAE Level and Low FFA Level	508	239.96	26.82
High SAE Level and High FFA Level	445	237.22	26.83
Concentrator Regular Education	1320		
Low SAE Level and Low FFA Level	716	240.61	27.55
Low SAE Level and High FFA Level	41	237.12	30.10
High SAE Level and Low FFA Level	279	241.48	25.63
High SAE Level and High FFA Level	284	240.43	28.93
Overall Special Education	556		
Low SAE Level and Low FFA Level	271	215.12	26.05
Low SAE Level and High FFA Level	29	232.76	31.06
High SAE Level and Low FFA Level	136	212.54	22.07
High SAE Level and High FFA Level	120	213.88	25.49
Participant Special Education	347		
Low SAE Level and Low FFA Level	173	213.28	25.27
Low SAE Level and High FFA Level	25	231.04	29.99
High SAE Level and Low FFA Level	76	211.26	21.77
High SAE Level and High FFA Level	73	215.95	28.57
Concentrator Special Education	209		
Low SAE Level and Low FFA Level	98	218.36	27.19
Low SAE Level and High FFA Level	4	243.50	40.34
High SAE Level and Low FFA Level	60	214.17	22.53
High SAE Level and High FFA Level	47	210.66	19.65

Table 6

Relationship Between GHSGT Science Exam Scores of All Regular Education Agricultural Education Students (n=3,665), Number of Agricultural Education Courses Passed, FFA Participation, and SAE Activities.

Variable	Y_1	X_1	X_2	*M*	SD
GHSGT Science Score (Y_1)	1.000	-.014	.003	239.43	27.77
FFA (X_1)		1.000	.442**	1.25	.43
SAE (X_2)			1.000	1.41	.49

*p < .05, **p < .001

Students with FFA activities level of 1 (N=1,153) had a GHSGT science mean score of 237.56 with a standard deviation of 28.06. Students with FFA activities level of 2 (N=1,813) had a GHSGT science mean score of 236.38 with a standard deviation of 29.77. An ANOVA test did not reflect a statistically significant difference between the groups ($F_{(1, 1528)} = .481$, $p = .488$) at a *priori* alpha level of .05 (Table 7).

Table 7

GHSGT Science Exam Scores of Concentrators (n=1,529) and FFA Levels

Student Category	n	M	SD	*p*-value
Concentrator Low FFA Level	1153	237.56	28.06	
Concentrator High FFA Level	376	236.38	29.77	
Between Groups				.488

Calculating the effect size was not necessary due to lack of statistical significance. A point-biserial correlation test between FFA activities and GHSGT science achievement revealed a negative, "low" and no statistically significant relationship, ($\rho_{bi} = -.018$, $p = .244$) for regular education and special education agricultural education concentrators. As a result, the null hypothesis ($H_0 2$) was not rejected; therefore, the FFA activity level of agricultural education students did not have a statistically significant relationship with science achievement on the GHSGT (Table 8).

Table 8

Relationship Between Regular Education, Special Education Agricultural Education Concentrators (n=1,529), FFA Participation, and SAE Activities.

Variable	X_2	X_3	*M*	SD
FFA (X_2)	1.000	.509**	1.43	.50
SAE (X_3)		1.000	1.24	.43

**p < .001

Students with SAE activities level of 1 (N=859) had a GHSGT science mean score of 237.92 with a standard deviation of 28.53. Students with SAE activities level of 2 (N=670) had a GHSGT science mean score of 236.43 with a standard deviation of 28.42. An ANOVA test did

not reflect a statistically significant difference between the groups ($F_{(1, 1528)} = 1.037$, $p = .309$) at a *priori* alpha level of .05 (Table 9).

Table 9
GHSGT Science Exam Scores of Concentrators (n=1,529) and SAE Levels

Student Category	n	M	SD	*p*-value
Concentrator Low SAE Level	859	237.92	28.53	
Concentrator High SAE Level	670	236.43	28.42	
Between Groups				.309

Calculating the effect size was not necessary due to lack of statistical significance. A point-biserial correlation test between SAE participation and GHSGT science achievement revealed a negative, "low" and no statistically significant relationship, ($\rho_{bi} = -.026$, $p = .154$) for regular education and special education agricultural education concentrators. Therefore, the SAE activity level of agricultural education students did not have a statistically significant relationship with science achievement on the GHSGT (Table 10).

Table 10
Relationship Between GHSGT Science Exam Scores of Regular Education and Special Education Agricultural Education Concentrators (n=1,529), FFA Participation, and SAE Activities.

Variable	Y_1	X_1	X_2	*M*	SD
GHSGT Science Score (Y_1)	1.000	-.026	-.018	237.27	28.48
FFA (X_1)		1.000	.509**	1.43	.50
SAE (X_2)			1.000	1.24	.43

**p < .001

Conclusions and Recommendations

Within the treatment groups, FFA involvement and SAE intensity levels varied between regular/special education status, and number of agricultural education courses passed. A total of 2,345 students were participant regular education students with 1,745 (74%) classified as low FFA participation. High FFA levels from participant regular education students were 600 (26%). A total of 1,320 students were concentrator regular education students with 995 (75%) classified as low FFA participation. The number of concentrator regular education students with high FFA participation was 325 (25%).

A total of 347 students were participant special education students with 249 (72%) classified as low FFA participation. Participant special education students accounted for 98 (28%) classified as high FFA participation. A total of 209 students were concentrator special education students with 158 (76%) classified as low FFA participation. Concentrator special education with high FFA participation numbered 51 (24%).

A total of 2,345 students were participant regular education students with 1,392 (59%) classified as low SAE levels. High SAE levels for participant regular education totaled 953 (41%). A total of 1.320 students were concentrator regular education students with 757 (57%) classified as low SAE participation. High SAE participation by concentrator regular education students numbered 563 (43%).

A total of 347 students were participant special education students with 198 (57%) classified as low SAE participation. High SAE participation level contained 149 (43%). A total of 209 students were concentrator special education students with 102 (49%) classified as low SAE participation. High SAE levels by participant special education students numbered 107 (51%).

Regular education and special education agricultural education concentrators with low FFA activities level (N=1,153) had a GHSGT science mean score of 237.56 and regular education and special education agricultural education concentrators with high FFA activities level (N=376) had a GHSGT science mean score of 236.38. An ANOVA test was performed between the two groups and was not statistically significant ($F_{(1, 1528)} = .481$, $p = .488$) at a *priori* alpha level of .05. A point-biserial correlation test between FFA activities and GHSGT science achievement revealed a negative, "low" and no statistically significant relationship, ($\rho_{bi} = -.018$, $p = .244$) for regular education and special education agricultural education concentrators. Therefore, the FFA activity level of regular education and special education agricultural education concentrators did not have a statistically significant relationship with science achievement on the GHSGT. These findings did not parallel the results of a similar study conducted by Alfeld, Stone III, Aragon, Hansen, Zirkle, Conners, Spindler, Romine, and Woo (2007) which concluded that academic engagement of students increased as CTSO participation increased.

Regular education and special education agricultural education concentrators with low SAE activities level (N=859) had a GHSGT science mean score of 237.92 and regular education and special education agricultural education concentrators with high SAE activities level (N=670) had a GHSGT science mean score of 236.43. An ANOVA test was performed between the two groups and was not statistically significant ($F_{(1, 1528)} = 1.037$, $p = .309$) at a *priori* alpha level of .05. A point-biserial correlation test between SAE participation and GHSGT science achievement revealed a negative, "low" and no statistically significant relationship, ($\rho_{bi} = -.026$, $p = .154$) for regular education and special education agricultural education concentrators. Therefore, the SAE activity level of regular education and special education agricultural education concentrators did not have a statistically significant relationship with science achievement on the GHSGT. These findings did not parallel the results of a similar study conducted by McLure and McLure (2000) which concluded that ACT Science scores increased as the number of outside classroom science activities increased.

Even though no statistically significant difference was indicated between FFA activities and SAE participation with academic achievement, additional studies with different designs are needed to determine the relevance of these components of agricultural education. For example, research conducted with specific CDE participants and end of course tests (EOCT) for academic

subjects such as the nursery/landscape CDE participants and biology EOCTs. To research the relationship between SAE and academic achievement, students must be tested for career readiness skills in math, science, and reading to determine if these agricultural education activities improved their competencies.

Even though the FFA and SAE data did not show statistical significance, these components were integral parts of agricultural education programs that reiterated classroom concepts to improve academic performance (Phipps, Osborne, Dyer, & Ball, 2008). Experiential learning and informal learning allowed students relevant opportunities to practice critical thinking skills (Roberts & Harlin, 2007; Shelley-Tolbert, Conroy, & Dailey, 2000, Conroy & Walker, 2000). Youth organizations provided motivation for students to excel by linking course standards to competitive events (Threeton & Pellock, 2010).

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