

Science Achievement of Secondary Agricultural Education Students

by

Sara Vicky Clark

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Approved by

Brian A. Parr, Chair, Associate Professor of Curriculum and Teaching
Margaret E. Ross, Co-chair, Professor of Educational Foundations, Leadership and Technology
Donald R. Mulvaney, Associate Professor of Leadership Development, Growth and
Development of Farm Animals

Abstract

The purposes of this quantitative descriptive and correlational study were to describe the science achievements of secondary agricultural education students and determine if the number of agricultural education courses passed, FFA involvement, and SAE participation would statistically significantly improve students' performance on science achievement when compared to students who did not participate in secondary agricultural education programs. This study included high school juniors who completed the Georgia High School Graduation Test (GHS GT) science exam for the first time in spring, 2010. The control population was students in Georgia (N=97,364) and the treatment population was secondary agricultural education students (N=4,221) from 110 secondary agricultural education programs. One-way analysis of variance (ANOVA), one sample *t* tests, and point-biserial correlation tests were used to analyze the study's null hypotheses. This study found that regular education agricultural education concentrators (n=1,320) had a statistically significant higher GHS GT science mean score than regular education agricultural education participants (n=2,345). Additional findings involved agricultural education concentrators who received special education services (N=209). These students had a statistically significant higher GHS GT science mean score than non-agricultural education students who received special education services for the state of Georgia (N=7,399). A low and statistically significant correlation was observed between the number of agricultural education courses passed and GHS GT science scores of regular education agricultural education students (n=3,665).

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Chapter 1

Introduction

In 2001, Congress revised the Elementary and Secondary Act of 1965 to create the No Child Left Behind Act (NCLB) which President Bush signed in January 2002 (Linn, Baker, & Betebenner, 2002). The amended educational law required states to be accountable for academic achievement to measure adequate yearly progress (AYP) and each individual state devised assessments and proficiency standards for each core academic area (Reeves, 2003). Although reading and mathematics were the first academic areas tested, states were required to have science standards in place by 2005-2006 school year and administer science assessments by 2007-2008 school year. The testing minimum requirements translated into at least once in each grading interval of third through fifth, sixth through ninth, and tenth through twelfth. Although science testing was required, NCLB did not require science to be used for calculating AYP. Individual states adopted different policies and Georgia provided local systems the option of selected science as an additional indicator to be used to determine AYP (Judson, 2010).

As a result of NCLB mandates, each state began developing standards, assessments, and proficiency levels and 20 states administered mandatory graduation tests in 2004 (Gayler, 2004). However, standards, testing instruments and ages of students tested varied by states. Both Georgia and Alabama tested juniors in academic subjects of writing, English/language arts, mathematics, social studies, and science. Juniors taking the Georgia High School Graduation Test (GHS GT) and Alabama's High School Graduation Exam were required to pass all five

standardized tests as a graduation requirement (Alabama Department of Education, 2003, Georgia Department of Education, 2011a). Rather than administering comprehensive exams during their junior year, Tennessee chose another avenue. Students were required to pass Tennessee's Gateway exams which were end-of-course assessments in algebra I, English II, and biology I to fulfill graduation requirements (Tennessee Department of Education, 2004). Instead of testing juniors, Florida and South Carolina assessed sophomores. Florida's graduation test, Florida Comprehensive Assessment Test (FCAT), assessed students in the areas of reading and mathematics while South Carolina utilized the High School Assessment Program (HSAP) that measured achievement in English language arts and mathematics (Florida Department of Education, 2010, South Carolina Department of Education, 2010).

After the passage of NCLB, educators became more focused on academic performance and techniques to improve test scores. One technique suggested was to connect agricultural education to academic subjects to reiterate academic course objectives (Martin, Fritzsche, & Ball, 2006). NCLB held academic and career and technology educators across the nation accountable for student achievement in core academic subjects by the year 2014.

In 1917, Senators Smith and Hughes authored a bill that created Vocational Agriculture curriculum in public secondary schools across the United States. At the turn of the century, the purpose of agriculture classes was to train young boys about new production agriculture techniques (Croom, 2008). Since the Smith-Hughes Act, the focus of agricultural education has expanded to include more than training for farm employment to include academic instruction. In 1988, the National Research Council, Board on Agriculture, Committee on Agricultural Education in Secondary Schools recommended changing the curriculum to include more science

related applications to prepare students for both science-based post-secondary opportunities and employment opportunities (Boone, Gartin, Boone, & Hughes, 2006).

In addition to agricultural education leaders, science educators recommended that scientific principles be taught in elective courses that bridge the gap from educational settings to authentic applications (American Association for the Advancement of Science, 1993; Warnick, Thompson, & Gummer, 2004). Hands-on activities and developing scientific research improve students' thoughts about science (Ornstein, 2006) and participating in after school activities that involve science applications express proficiency in science (Holloway, 2002). Applying science theories beyond the time spent in formal class improved ACT Science Reasoning exam scores (McLure and McLure, 2000). Gerber, Cavallo, and Marek, 2001, believed that the bulk of science comprehension events take place outside the traditional classroom.

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, 2011b). 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, 2011c). Teaching methods include hands-on activities that promote problem solving and inquiry-based opportunities for students to apply and reflect on educational standards (Parr and Edwards, 2004). In Georgia, secondary

students are required to pass four science courses. The Georgia Department of Education awards science credit and the University of Georgia Board of Regents approved the following agricultural education courses as fourth science courses: General Horticulture/Plant Science, Animal Science Technology/Biotechnology, Equine Science, and Plant Science and Biotechnology (Georgia Department of Education, 2011d).

McLure and McLure (2000) study 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 and one FFA event that combines these two skills is the Agriscience Fair career development event (CDE). Students utilize the scientific method to independently design and conduct agriculturally related experiments by determining hypothesis, 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 the third 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; Talbert, Vaughn, Croom, & Lee, 2007; Phipps, Osborne, Dyer, & Ball, 2008). One of 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.

SAEs provide autonomous opportunities for students to extend their knowledge in particular areas of Agriculture (Croom, 2008).

Statement of the Problem

Limited amounts of empirical studies have been conducted concerning science achievement on statewide mandatory standardized science exams utilizing secondary agricultural education students. In addition, limited studies have been conducted concerning associations with FFA and SAE participation and statewide mandatory standardized science exams.

Purposes

The purposes of this quantitative descriptive, assessment of group differences, and correlational study were to describe the science achievement of secondary agricultural education students and determine if the number of agricultural education courses passed, FFA involvement, and SAE participation would statistically significantly improve students' performance on science achievement when compared to students who did not participate in agricultural education.

Research Questions

1. What was the relationship between number of agricultural education courses passed and science achievement of regular education agricultural education participants and concentrators?
2. What was the relationship between FFA involvement and science achievement of regular education and special education agricultural education concentrators?
3. What was the relationship between SAE participation and science achievement of regular education and special education agricultural education concentrators?
4. How did science achievement of special education agricultural education concentrators compare to non-agricultural special education students?

5. How did science achievement of regular education agricultural education concentrators compare to non-agricultural regular education students?

Null Hypotheses

- H₀1: The science achievement of regular education agricultural education participants will not differ statistically significantly (i.e., $p > .05$) from regular education agricultural education concentrators ($H_0: \mu_1 = \mu_2$).
- H₀2: The science achievement of regular education and special education agricultural education concentrators who have a medium to high intensity level in FFA activities will not differ statistically significantly (i.e., $p > .05$) from students who have a low intensity level in FFA activities ($H_0: \mu_1 = \mu_2$).
- H₀3: The science achievement of regular education and special education agricultural education concentrators who have a medium to high intensity level in SAE activities will not differ statistically significantly (i.e., $p > .05$) from students who have a low intensity level in SAE activities ($H_0: \mu_1 = \mu_2$).
- H₀4: The science achievement of special education students who are agricultural education program concentrators will not differ statistically significantly (i.e., $p > .05$) from special education non-agricultural education students in GHSGT science scores ($H_0: \mu_1 = \mu_2$).
- H₀5: The science achievement of regular education students who are agricultural education program concentrators will not differ statistically significantly (i.e., $p > .05$) from regular education non-agricultural education students in GHSGT science scores ($H_0: \mu_1 = \mu_2$).

Assumptions

The following assumptions relate to this study:

1. The GHSGT science exam was considered to yield valid scores for measuring science achievement.
2. Agricultural education teachers accurately recorded the GHSGT science scores of agricultural education students.
3. Agricultural education teachers correctly identified and reported number of agricultural education courses passed.
4. Agricultural education teachers correctly assessed and reported agricultural education students' performance concerning FFA and SAE participation.
5. Agricultural education teachers correctly reported the special education and regular education status of agricultural education students.

Delimitations of the Study

The delimitations of the study included GHSGT science test scores from the junior class of 2009 – 2010 and GHSGT science test scores from agricultural education students in the junior class of 2009-2010.

Limitations

1. The ranking of FFA and SAE intensity levels were reported by individual agricultural education teachers and was subjective although guidelines were given for ranking purposes.
2. The GHSGT science exam was the standardized testing instrument used to assess science achievement.

3. Each individual agricultural education teacher requested the GHSGT science exam scores and number of agricultural education courses passed from guidance counselors, recorded and submitted information.

Operational Definitions

Agricultural Education – One of the Career and Technical Education programs available for public school students in 6th through 12th grades. The program contains three equal segments: classroom/laboratory instruction, FFA, and SAE. Agricultural Education is referred to as Agriscience Education or Vocational Agriculture (Phipps, Osborn, Dyer, & Ball, 2008).

Agricultural Education Concentrator – A high school student who has passed three or more secondary Agricultural Education courses (Georgia Department of Education, 2010a).

Agricultural Education Courses – Career and Technical Education courses offered in secondary public schools in the career cluster areas of Agribusiness Management, Agricultural Mechanics, Agriscience, Animal Science, Plant Science/Horticulture, Forestry/ Natural Resources, and Veterinary Science (Georgia State Department of Education, 2011b).

Agricultural Education Program Participant – A high school student who has passed one or more secondary Agricultural Education courses (Georgia Department of Education, 2010a).

Agriscience Fair – A career development event that exhibits agriscience experiments in Botany, Zoology, Engineering, Microbiology, or Environmental Science at the local, state, and national levels. Students conduct experiments utilizing the scientific method, display scientific findings, and participate in interviews (National FFA Organization, 2011a).

American College Testing Program (ACT) – A college entrance exam that measures academic knowledge and is utilized to predict college readiness (ACT, 2011).

Career Development Event (CDE) – FFA activities that provide assessment of problem solving and analytical skills in relevant career areas such as Agricultural Mechanics, Nursery/Landscape, and Extemporaneous Public Speaking (National FFA Organization, 2011b).

Classroom and Laboratory Instruction – Delivering educational exercises by utilizing school classrooms and numerous specialized facilities such as horticulture, animal science, and agricultural mechanics (Croom, 2008).

Georgia High School Graduation Test (GHSGT) – A standardized assessment instrument completed by 11th grade students in the academic areas of writing, English/language arts, mathematics, social studies, and science. Starting in 2004, all high school juniors enrolled in Georgia’s public school systems were required to pass all of these standardized tests as a graduation requirement (Georgia Department of Education, 2011a).

Georgia High School Graduation Test Score Categories – Categories developed by the Georgia Department of Education in order to label scores. Below proficiency is a score below 200, basic proficiency is a score between 200 and 234, advanced proficiency is a score between 235 and 274, and honors is a score above 275. Advanced proficiency and honors categories are the highest performance stage and these scores indicate the students are prepared for college or employment (Georgia State Department of Education, 2011e).

Georgia Performance Standards – Educational objectives written by Georgia Department of Education personnel and teachers for all public school courses. The agricultural education performance standards were cross referenced with science, social studies, English, and mathematics standards (Georgia Department of Education, 2011c).

Individualized Education Plan (IEP) – All public school students that receive special education services are required to have individualized educational plans to enhance and coordinate learning strategies (National Center for Learning Disabilities, 2012).

National FFA Organization (FFA) - The youth organization that provides skill development in the areas of leadership, motivation, and employment and is an integral part of agricultural education (Phipps, Osborn, Dyer, & Ball, 2008).

No Child Left Behind Act – An educational reform act signed into law in 2001. The legislative action held all public schools in the United States accountable by using standardized tests to measure adequate yearly progress (Reeves, 2003).

Supervised Agricultural Education (SAE) – An integral segment of agricultural education is applying classroom instruction to relevant situations outside of the classroom in planned programs of study supervised by agricultural education instructors (Talbert, Vaughn, Croom, & Lee, 2007).

Chapter 2

Review of Literature

Introduction

The purpose of this review of literature is to form the foundation for the importance of this research study concerning science achievement of agricultural education students. The foundational topics included are: (1) Introduction; (2) Agricultural Education Philosophy; (3) Teaching Strategies and Academic Achievement; (4) Supervised Agricultural Education and Academic Achievement; (5) Youth Organizations and Academic Achievement; (6) Diverse Needs of Learners and Academic Achievement; (7) Conceptual/Theoretical Foundation, and (8) Summary.

The first piece of the foundation is to link academic achievement to learning activities provided by CTE and more specifically agricultural education. One measurement of academic achievement for thousands of high school students is the college entrance exam, ACT Science Reasoning test. The study consisted of 997,069 secondary students who took the ACT Science Reasoning test to determine if the number of science courses completed and if science activities outside of regular class hours influenced ACT Science Reasoning test scores. The data were gathered from the self-reporting Course/Grade Information Section and Student Profile section of the ACT assessment which was analyzed by means, percentages, effect sizes, and *t* tests. The study concluded that the ACT Science score improved as the number of outside classroom science activities increased (McLure and McLure, 2000). An additional report by Maurer (2000) of the National Dissemination Center for Career and Technical Education concluded that

the National Science Education Standards stressed the need for problem-solving activities to teach students critical thinking skills and stated that using relevant applications that connect science to work-related situations in order to raise student achievement was plausible through CTE.

With the passing of NCLB in 2001, schools were held accountable for academic achievement of students in the areas of math, English, science, and social studies (Reeves, 2003). With the focus on core academic subjects, a perception study was conducted by Martin, Fritzsche, and Ball (2006) on 15 Illinois secondary agricultural education teachers and five agricultural education in-service professors to determine the effects of NCLB on secondary agricultural education programs. Four questionnaires provided data which were analyzed using descriptive statistics to determine means, standard deviations, frequencies, and percentages. According to the study, NCLB legislation had influenced secondary agricultural education programs to integrate academic material into the curriculum in order to justify non-academic subjects. The authors recommended additional research to be conducted concerning academic achievement of secondary agricultural education students.

In other studies with reference to academic achievement, Palmer and Gaunt (2007) surveyed 451 seniors in Michigan to determine information concerning academic performance, families' income levels, and social living arrangements of CTE students and non-CTE students. The authors found that non-CTE students reported higher grade achievement than CTE students. The data were analyzed using the Mann-Whitney test and found to be statistically significant. They concluded that the academic achievement of CTE students was below non-CTE students.

With the advancements of science and technology, education and science experts agreed that science instruction must be improved in all grades. In 2007, a congressional report *Rising*

above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future completed by the National Academy of Sciences, concluded in the areas of science and technology that the United States is falling behind the rest of the industrialized world. One response to this congressional report was made by the National Academies Committee on a Leadership Summit to Effect Change in Teaching and Learning. The committee was a combination of leaders from science, engineering, medicine, and research in which they recommended that agriculture be integrated into science, technology, engineering, and mathematics (STEM) curriculum creating STEAM (National Academies, 2009).

Agricultural Education Philosophy

In order to apply academic concepts to real-life situations, agricultural education provides training for the whole person with three overlapping components. The components are: classroom and laboratory instruction, supervised agricultural experience (SAE) program, and FFA. Each part of agricultural education compliments and reinforces a complete education for high school students. Classroom and laboratory instruction allows students to investigate and integrate academic theories with agriculture applications. The SAE program provides an avenue for students to apply what they have learned from the classroom to relevant situations. The FFA is the component that offers leadership training, community involvement techniques, incentives for scholastic improvement, and recognition (Phipps, Osborne, Dyer & Ball, 2008).

To determine the establishment and development of the three interrelated branches, classroom and laboratory instruction, FFA, and SAE from colonial America to modern times, Croom (2008) reviewed historical documents and legislative acts. He concluded that SAE was the first component to develop, followed by formal instruction, and the creation of The National

FFA Organization. In addition, he concluded that each of the components were equally important for educating agricultural education students.

In order to determine if student achievement was related to agricultural education program participation, tests were conducted using standardized test scores. Chiasson and Burnett (2001) researched state mandated exit exam science scores of 11th grade students from Louisiana in 1998. The data source was the Louisiana Department of Education. The data were analyzed using descriptive statistics of means, standard deviations, percentages, frequencies, and *t* tests to determine statistical significance. The relevant conclusions were that on the science section of the exam that agricultural education students obtained higher scores and had a higher pass rate than non-agricultural education students.

By the same token, 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 was used to verify if agricultural education courses are 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. Two, the first time passing rate of agricultural education students was twice as high as career preparatory students. Three, agricultural education classes and FFA involvement were related to scientific comprehension and application.

An additional study involving Georgia students was conducted by Rich, Duncan, Navarro, and Ricketts (2009). They investigated 51 Georgia middle schools with agricultural education programs and 51 middle schools with no agricultural education programs. The study utilized science scores from the state created instrument Criterion-Referenced Competency Test (CRCT) to compare the two groups of schools. The unit of analysis was school scores rather than individual scores. Student demographics, enrollment, and CRCT science test scores were provided by the Georgia Department of Education. The data were analyzed using descriptive statistics of means, standard deviations, percentages, and frequencies. In addition to descriptive statistics, means were compared with paired samples *t* tests and Cohen *d* was used to determine effect size. The relevant conclusion was that middle schools with agricultural education programs had significantly higher percentages of students meeting or exceeding the standards than middle schools without agricultural education programs.

In like manner, another student achievement study was conducted by Theriot and Kotrlik (2009). They studied scores from the 2005 science portion of the Graduate Exit Exam (GEE) of 11th grade students in Louisiana. The data source was collected and tabulated by the Louisiana Department of Education. The data were analyzed using descriptive statistics of means, standard deviations, percentages, and frequencies. In addition to descriptive statistics, inferential *t* tests were used to conduct the analyses for comparison of agricultural education and non-agricultural education student achievement using *t* test and Cohen *d* was used to determine effect size. Forward multiple regression analyses, Pearson product-moment correlation coefficients, variance inflation factor, multicollinearity, R^2 change, and ANOVA were used to conduct the analyses for explaining variance in science GEE scores. The relevant conclusion was that the science

achievement scores of agricultural education students were at least equal to the science achievement scores of non-agricultural education students.

To expand the scope nationwide and include all CTE areas, Levesque, Wun, and Green (2010) analyzed science achievement and number of science courses of the 2005 graduating class. About 9,000 public school students' transcripts were analyzed for core science credits and the 12th grade national assessment of educational progress (NAEP) science test scores were the instruments utilized for gathering data. The study grouped students as regular education and CTE graduates. The CTE students were subdivided as concentrators and non-concentrators into 13 occupational program areas such as: agriculture, business, health, and manufacturing. The report concluded that agriculture concentrators scored higher than or not measurable different from non-concentrators who passed similar amounts of foundation science courses and that agriculture concentrators scored the same as all high school graduates on the NAEP science test.

Teaching Strategies and Academic Achievement

A variety of teaching methods are utilized in agricultural education and other CTE classrooms and many research studies have been conducted to investigate inquiry-based, experiential learning, problem-solving, and integrated academics within CTE curriculum in regards to academic achievement. To begin the discussion on teaching techniques, Roberts (2006) conducted a philosophical study to review experiential learning theories from various educational fields and created templates to guide agricultural education teachers. The study examined John Dewey, Laura Joplin, and David. A. Kolb's educational learning theories and compared these theories with Lloyd J. Phipps and Edward W. Osborne's theories within agricultural education. The relevant conclusions were experiential learning techniques were

widespread in secondary agricultural education and common techniques were discovered amid experiential learning, problem-solving, and inquiry-based learning.

Following this study, Roberts joined with Anna Ball in 2009 to concentrate on reviewing literature concerning whether agricultural science was used as content or as context for teaching high school students. They executed a philosophical study about the history of early educational pioneers, John Dewey and David Snedden, and how debate continued on the purpose of agricultural education. The relevant conclusions were that modern agricultural education taught agriculture content for employment skills and taught academic skills using agriculture as context. In order to determine if inquiry-based, experiential learning, problem-solving, and integrated curriculum, increased student academic achievement, educational leaders across the country investigated teaching techniques.

Inquiry-based Teaching Strategies

The first teaching method discussed is inquiry-based instruction. Myers and Dyer (2006) performed research on secondary students in Florida enrolled in introductory agricultural education courses to reveal how inquiry laboratory exercises affected content comprehension and proficiency with science processes. The subject material was delivered using three modes of laboratory instruction: without laboratory experimentation, with predetermined laboratory experimentation, and exploratory laboratory experimentation. The instrumentation included pre-tests and post-tests of the Test on Integrated Process Skill to assess science process skill abilities. The data were analyzed using descriptive statistics of means, standard deviations, percentages, and frequencies. In addition to descriptive statistics backward regression analysis, MANCOVA, Hotelling's Trace, and multivariate analysis of covariance were calculated. The relevant conclusions were that students who completed exploratory experimentation performed at higher

levels in science process skills than students who participated in predetermined laboratory activities.

Another study published by Grady, Dolan, and Glasson (2010) utilized qualitative research to determine if scientific inquiry was implemented in secondary agriscience. One teacher and 15 students in grades 8 through 10 were studied as they participated in Partnership for Research and Education in Plants (PREP). To gather data, pre-determined code categories were used to group the teacher's and students' actions and comments. The relevant conclusion was that integrating science into agriscience enhanced the students' knowledge about science.

Additional findings published by Thoron and Myers (2011) conducted a quasi-experimental study in 15 agriscience classes taught by National Agriscience Teacher Ambassador Academy (NATAA) graduates in seven high schools to determine the effect of inquiry-based instruction versus subject matter instruction on student achievement in content knowledge. A total of seven units were taught with pre-tests and post-tests on content knowledge were the instruments used to gather data which was analyzed using Kuder-Richardson 20. The authors concluded that students receiving inquiry-based instruction had higher post-test scores than students receiving subject matter instruction.

Along with student performance, the perceptions of teachers were analyzed by Thoron, Myers, & Abrams, (2011). They conducted a qualitative study with 13 NATAA participants who were divided into two focus groups to determine their actions associated with executing inquiry-based instruction. One of the findings found that the perception of the NATAA participants indicated that agricultural education teachers through the use of inquiry-based instruction can be viewed as contributors to student achievement on state mandated academic assessments.

Integrated Curriculum Teaching Strategies

A second teaching method discussed in the literature was integrating academic content with agricultural education curriculum. A perception study was carried out in Oregon by Thompson and Balschweid (2000) and they surveyed agricultural education teachers by using an adapted version of Integrating Science Survey Instrument which was created by Dr. Thompson. The data were analyzed using descriptive statistics of means, standard deviations, percentages, and frequencies and Cronbach's alpha for validity. The relevant conclusions of the study were that teachers believed that students obtained more scientific knowledge by integrating science and agricultural education and the teachers felt confident in teaching scientific principles.

In addition to investigating the views of agricultural education teachers, researchers studied the perceptions of science education teachers in regards to their opinions about science achievement and agricultural education. The study was conducted by Warnick, Thompson, and Gummer (2004) and they surveyed secondary education science teachers to gain their insight about agriculture curriculum. The conclusion of the study was that the science teachers believed that students acquired more science connections utilizing integrated curriculum with the applied science of agriculture.

An additional perception study was conducted by Boone, Gartin, Boone, and Hughes (2006) with 95 West Virginia agricultural education teachers. A Likert scale survey instrument was used and the data were analyzed using descriptive statistics of means, standard deviations, percentages, frequencies, Pearson product moment correlation, Cramers V, Kendall's tau B, Kendall's tau C, and Chi-square with Phi Coefficient. The relevant conclusion of the study was that teachers had knowledge about biotechnology topics within agriculture, that biotechnology

issues were appropriate for classroom instruction, and that they agreed it was their job to educate students about biotechnology.

Along with teacher perception studies, Parr, Edwards, and Leising (2006) conducted research concerning teaching modes. They compared a traditional curriculum to a math-enhanced curriculum and used pre-tests and post-tests to assess student achievement in secondary agricultural education programs in Oklahoma in which the study used two instruments. The first instrument was the Terra Nova CAT Basic Battery test and it was utilized as a pre-test to confirm the uniformity of groups concerning general mathematics aptitude. The second instrument was the ACCUPLACER which is an elementary algebra test and it was utilized as a post-test to determine math achievement. The unit of analysis was classroom scores rather than individual scores. The data were analyzed using descriptive statistics of means, standard deviations, percentages, and frequencies. In addition to descriptive statistics, one-way analysis of variance (ANOVA) was conducted. The relevant conclusions were that by integrating math skills and technical skills, student achievement on standard math exams did increase more than students who received traditional curriculum in power and technology. The researchers concluded that math concepts that are introduced or practiced using relevant examples are more likely to be retained by students.

The next study expanded to include not only agricultural education but other areas of CTE. Stone, Alfeld, Pearson, Lewis, and Jensen (2006) from the National Research Center for Career and Technical Education conducted an experiment with 131 teachers and nearly 3,000 students in agricultural mechanics, auto technology, business and marketing, health, and information technology. Teachers were randomly selected to teach math standards that were integrated into the CTE curriculum or to teach the traditional CTE curriculum. Students were

assessed with three exams with pre-tests and post-tests. The three exams were ACCUPLACER, TerraNova, and WorkKeys. The authors concluded that students that received the integrated math curriculum scored higher on post-tests than students that received traditional curriculum. In addition, technical skills test results were higher for the students receiving the embedded math curriculum. Even though the conclusions from these two studies were specific to math skills, the conclusions are applicable to other academic areas such as science.

Furthermore, Myers and Washburn (2008) conducted a study with Florida agricultural education teachers. Instruments utilized Likert scales to assess instructors' perceptions about secondary science. The data were analyzed using descriptive statistics of means, standard deviations, percentages, and frequencies and Cronbach's alpha for validity. The relevant conclusion was that agricultural education teachers believed that by integrating science with problem-solving opportunities in agriculture that student achievement would increase in science.

However, Parr, Edwards, and Leising (2009) study found that teaching math enhanced agricultural power and technology (APT) course did not significantly improve math knowledge exam scores or math problem-solving skills. The study was implemented by 38 agricultural education teachers in Oklahoma which were randomly assigned to teach the APT course utilizing traditional curriculum or APT math enhanced curriculum for one semester. Students were assessed before and after treatment with the Terra Nova CAT Basic Battery Examination and WorkKeys Applied Mathematics Assessment.

As reported earlier, Roberts and Ball (2009) investigated theories and conceptual models about whether modern agricultural education courses taught agriculture content or if agriculture was the context for learning academic theories. They concluded that agricultural education integrated academic material to teach agriculture content.

Another perception study was conducted by Myers, Thoron, and Thompson (2009) involving NATAA teachers to determine their attitudes about integrating science with agricultural education. The 25 teachers completed surveys which were analyzed using descriptive statistics of means, standard deviations, percentages, and frequencies. The relevant conclusions were that teachers believed that integrating science and agriculture benefited students by improving motivation through the use of relevant content which helped prepare the students for other science courses.

To broaden the scope of teachers' perceptions, Washburn and Myers (2010) studied Florida's secondary agricultural education teachers. The instrument utilized a Likert scale to appraise the perceived level of proficiency to teach scientific concepts. The data were analyzed using descriptive statistics of means, standard deviations, percentages, and frequencies and Cronbach's alpha for validity. The relevant conclusions were that teachers believed that agriculture should be taught by incorporating science and they felt confident in teaching scientific principles. In addition teachers believed that incorporating science in an applied manner improved student learning and increased enrollment in agricultural education classes.

Experiential Learning Teaching Strategies

A third teaching method utilized by agricultural education teachers was experiential learning. The first perception study was completed by Conroy and Walker (2000) and the research consisted of approach surveys, scheduled interviews, and focus groups that involved interviewing agricultural education teachers and students in Arizona, Indiana, Louisiana, Texas, New York, Washington, interviewing students attending the National FFA Convention, and utilizing questionnaires from agricultural education teachers across the United States. The instrumentation included open-ended questions to gather data concerning perceptions of

academic integration activities, and how aquaculture was connected to math, science, or other academic subjects. The data were analyzed using descriptive statistics of means, standard deviations, percentages, and frequencies and Cronbach's alpha for validity. The relevant conclusions were that aquaculture curriculum offered experiential science and mathematics instruction that intensified knowledge retention by delivering academic principles utilizing multiple perspectives.

An additional study concerning aquaculture curriculum was conducted by Balschweid and Thompson (2002). They surveyed all Indiana secondary agricultural education teachers about their perceptions about aquaculture curriculum and academic applications. The relevant conclusions were that aquaculture curriculum offers experiential science and mathematics instruction that intensified knowledge retention by delivering academic principles utilizing multiple perspectives.

Another study concentrated on reviewing written literature. Knobloch (2003) conducted an interpretive qualitative study following the life history method to investigate the agricultural education doctrines of experiential learning and verify if the doctrines are related to the theories of authentic learning. The agricultural education doctrines examined were learning through authentic contexts, learning by doing, learning through projects, and learning through problem-solving. The theories of authentic learning included solving problems using logic, actively using and describing information through solving problems, transferring knowledge, and centered around authentic situations. The relevant conclusion was that principles in both experiential learning that was utilized in agricultural education and authentic learning that was utilized in science education aligned with each other. Throughout classroom instruction, students were

provided with genuine contextual opportunities to enhance academic knowledge through experiential learning and problem-solving tasks.

Problem-solving Teaching Strategies

Problem-solving teaching methods are utilized in agricultural education as confirmed by a study reviewing literature conducted by Parr and Edwards (2004). They examined doctoral dissertations, national commission reports, professional journal publications, magazines articles, books, research conference presentations, internet publications, and other educational resources to investigate science education and agricultural education tenets by analyzing inquiry-based and problem-solving techniques for teaching and learning as influencers of student achievement. The relevant conclusion was that problem-solving process was equivalent to inquiry-based teaching and learning methods.

Problem-based learning (PGL) is one method utilized in constructive instruction that encompasses using relevant situations that develops critical thinking skills (Burriss & Garton, 2007). Their quasi-experimental, non-equivalent comparison group study used pre-tests and post-tests as content instruments and Watson-Glaser Critical Thinking Appraisal (WGCTA) as critical thinking instruments. The study consisted of 12 programs that involved 140 Missouri high school students enrolled in Ag Science II or Natural Resource/Conservation class and covered a unit about Quail Management. Students were divided into two groups with 77 students in the PGL treatment group and 63 students in the supervised study treatment group. The data were analyzed using descriptive statistics of means, standard deviations, percentages, frequencies, and ANCOVA. The relevant conclusions were that the PGL treatment group scored higher critical thinking skills but lower on the content testing instrument.

Afterwards, Myers and Washburn (2008) conducted a study with Florida agricultural education teachers. Instruments utilized Likert scales to assess instructors perceived level of proficiency to teach secondary science. The data were analyzed using descriptive statistics of means, standard deviations, percentages, and frequencies and Cronbach's alpha for validity. The relevant conclusion was that agricultural education teachers believed that by integrating science with problem-solving opportunities in agriculture that student achievement would increase in science.

To further explore problem-solving teaching methods, Pate and Miller (2011) conducted an experiment with 68 secondary agricultural education and industrial education students to determine the influences of teacher produced self-questioning activities administered during electricity lessons with Ohm's Law problem-solving activities. Teacher developed post-tests were utilized for assessment and provided data to calculate means and standard deviations. A one-tailed t test determined statistical significance between the two groups and a moderate effect size was established by Cohen d test. The researchers concluded that student achievement improved utilizing regulatory self-questioning activities during problem-solving exercises and connected technical skill attainment and science competencies utilizing relevant applications.

Contextual Learning Teaching Strategies

Many studies concluded that presenting information using agricultural education as a context for academic courses improved student knowledge and retention of content (Balschweid, 2002; Balschweid & Huerta, 2008; Edwards, 2004; Myers, Wilson & Curry, 2011; Thompson & Balschweid, 2000; Thoron, & Thompson, 2009; Warnick, Thompson, & Gummer, 2004). The first study was conducted from 1993 through 1999 by Balschweid (2002). He completed a case study about secondary biology students that utilized animal agriculture as the context rather than

traditional biology to teach the standards. An attitude survey using the Likert scale was developed by the researcher. The data were analyzed using descriptive statistics of means, standard deviations, percentages, and frequencies and Cronbach's alpha for validity. The relevant conclusion was that using agriculture rather than traditional biology as the content increased students' knowledge about the relationship between agriculture and science.

In addition, Edwards (2004) reviewed 42 sources of agricultural education, 13 sources of career and technical education, and 26 sources of general education literature researching academic success, cognitive education, and instructional approach. From the review, he concluded that academic skills acquired by students through relevant contextual applications have been linked to increased achievement.

A few years later, Balschweid and Huerta (2008) studied 15 Indiana agricultural education teachers to determine their perceptions about teaching a new high school course, Advanced Life Science: Animals. The qualitative phenomenological interview method was utilized to gather and extract information from the teachers utilizing open-ended questions. The data were analyzed using an open coding system and conceptual labels were developed for placing answers in categories. The relevant conclusion was that these teachers were confident in teaching upper level science concepts and they believed that teaching scientific principles using relevant situations was beneficial to students.

The other studies pertaining to contextual learning, Thompson and Balschweid (2000), Warnick, Thompson, and Gummer (2004), and Myers, Thoron, and Thompson (2009), were discussed in the previous section and all had several similarities. Dr. Thompson was involved in each study, two studies used Oregon teachers, and all studies utilized an adapted version of Integrating Science Survey Instrument. All of the studies had positive conclusions concerning

agricultural education curriculum improving comprehension and retention of academic principles. Another teacher perception study was performed by Scales, Terry, and Torres (2009) to determine Missouri's secondary agricultural education teachers' perception of teaching science related concepts. As with the other studies, the majority of agricultural education teachers felt confident teaching science.

Wilson and Curry, Jr (2011) conducted a review of articles published within the last 20 years in peer reviewed journals and records from American Association of Agricultural Educators (AAAE) research meetings. The purpose of the review was to identify research concerning integrating science and agricultural education in the areas of student achievement, retention, attitudes, college plans, science process skills, and knowledge transfer as well as teacher attitudes, science process skills, confidence levels, and professional development. In addition to reporting on past research the review identified research deficiencies. Two of the recommendations for future research were that more empirical research was required rather than perception studies and more experimental studies must be conducted instead of descriptive studies to assess student achievement of agricultural education students in academic courses.

Supervised Agricultural Experience and Student Academic Achievement

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.

Another study, Shelley-Tolbert, Conroy, and Dailey (2000), collected data from 20 attendees at the National FFA Convention. The participants were high school students, college students, a United States Department of Education employee, a United States Department of Agriculture employee, and university faculty members. In addition to these interviewees, six New York agricultural education stakeholders were included in the study. The qualitative-descriptive study gathered data from semi-structured interview questions and 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.

Ramsey and Edwards (2004) reviewed professional journals, magazines, national commission reports, research conference papers, books, and Internet resources in the areas of informal learning, science achievement, and agricultural education applications to both informal learning and science achievement. The authors concluded that educators believe that learning outside the classroom is important to science achievement and that agricultural education offers many opportunities for informal learning through SAEs and FFA activities. However, the authors suggested the need for empirical studies to be conducted to provide data to support the perception that agricultural education participation increased academic achievement.

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.

Retallick (2010) conducted a mixed method study about teacher perception of SAEs with 34 Iowa agricultural education teachers. Data were collected from focus groups and phone interviews which were placed into three categories. The survey instrument was analyzed to calculate demographic percentages. One of Retallick's recommendations was to utilize SAEs to extend experiential learning to connect academic principles to relevant experiences.

Youth Leadership and Academic Achievement

As mentioned earlier, 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.

In addition, Holloway (2002) completed a review of literature investigating extracurricular activities and student motivation and concluded that organized activities outside of the classroom influenced attitudes within the classroom. He stated that participating in extracurricular activities influenced minorities and women to have positive attitudes towards science.

Expanding the studies relating to youth organizations and academic attainment, Guest and Schneider (2003) focused on academic achievement, educational aspirations, and participation in extracurricular activities involving sports and non-sporting activities. Data were collected from 12 sites across the United States from middle and high school students over a

period of five years from a longitudinal study by the Alfred P. Sloan Study of Youth and Social Development. Grade point average (GPA) determined the data for academic achievement which was self-reported by students and verified by teachers. Participation levels of extracurricular activities outside of sports were measured by survey questions answered by students. The researchers found a positive association between academic achievement and the level of participation in extracurricular activities outside of sports.

Ramsey and Edwards (2004) concluded that educators believe that learning outside the classroom is important to science achievement and that agricultural education offers many opportunities for informal learning through SAEs and FFA activities.

In support of earlier findings, Alfeld, Stone III, Aragon, Hansen, Zirkle, Conners, Spindler, Romine, and Woo (2007) conducted a one year quasi-experimental study involving 1,797 secondary students in California, Georgia, Illinois, Kentucky, Minnesota, Missouri, Ohio, Oklahoma, Tennessee, and Texas. The eight career and technical student organizations (CTSO) included in the study were Business Professional of America (BPA), Distributive Education Clubs of America (DECA), Future Business Leaders of America (FBLA), Family, Career, and Community Leaders of America (FCCLA), Future Farmers of America (FFA), Health Occupations Students of America (HOSA), Vocational Industrial Clubs of America (SkillsUSA), and Technology Student Association (TSA). Students who participated were classified into three groups: students enrolled in CTE courses, students enrolled in CTE courses and members of CTSOs, and students enrolled in general education courses and not enrolled in CTE courses. One of the purposes of the study was to determine if participating in CTSO activities increased student academic achievement and Hierarchical Linear Modeling software was used to analyze the data. The researchers concluded that CTSO students began and ended the academic school

year with higher degrees of academic engagement than students enrolled in only CTE courses. Another conclusion was the academic engagement of students increased as CTSO participation increased.

Investigating another aspect, Threeton and Pellock (2010) conducted a study to determine if SkillsUSA Occupational Health and Safety (OHS) national competition paralleled Pennsylvania's 11th Grade Academic Standards. The qualitative study was conducted at the national SkillsUSA competition by interviewing 11 SkillsUSA advisors who were competing at the national level. After analyzing the remarks, the researchers concluded that all advisors had identified reading and reading comprehension as necessary skills for OHS competition. To check for alignment with academic standards, a focus group of eight Pennsylvania CTE teachers were asked to analyze the OHS competition and academic standards. The researchers concluded that OHS competition preparation aligns with two reading competencies; therefore, by preparing for OHS competition, students used relevant career scenarios to connect to academic standards.

Diverse Needs of Learners and Academic Achievement

Serving the needs of all students is an important factor to consider when educating young people in our public education system. Since congress passed NCLB in 2001, school systems are held accountable for adequate academic achievement of students with special needs (Linn, Baker, & Betebenner, 2002). Eisenman (2000) conducted a review of literature spanning 1992 through 1997 concerning special needs students and integrated academic standards with CTE curriculum. She reported a deficiency of studies and recommended more studies be performed. She suggested criteria for additional research such as including special needs students in integrated curriculum studies, clear program elements, and measurable student achievement.

Dormody, Seevers, Andreasen, and VanLeeuwen (2006) surveyed 69 New Mexico secondary agricultural education teachers to identify the obstacles they encounter when instructing students with individualized education plans (IEP). Mailed surveys were utilized to gather data concerning number of students with IEPs, FFA, and SAE participation and the data were analyzed with *t* tests, Pearson, and point biserial correlation coefficients to determine percentages and correlations. The authors determined that 19% of the students enrolled in agricultural education programs in New Mexico were classified as special needs. The teachers ranked students with low mental capabilities, physically handicapped, and behavioral disabilities as the most taxing in a course involving extensive laboratory activities.

Easterly III and Myers (2011) conducted research over a period of 10 to 12 weeks to determine if the achievement in content knowledge of special needs students was impacted by inquiry-based instruction. A one group research design was conducted with 170 secondary agricultural education students where 20.6% of these students had IEPs. The lessons which were taught by 10 NATAA teachers utilized inquiry-based instruction and data were collected from pre-tests and post-tests from each of the seven units about soil properties. The data were analyzed using analysis of covariance tests and the authors concluded that the inquiry-based instruction provided was a supportive technique of instruction for special needs students.

Conceptual/Theoretical Framework

The conceptual/theoretical framework for this study is built on contextual learning and constructivism philosophy of teaching that educational pioneer, John Dewey, first brought to the forefront of educational debates over 100 years ago (Dewey, 1959). Dewey believed that a holistic approach between all disciplines was essential to student learning (Roberts & Ball,

2009). According to Doolittle and Camp (1999) and Crawford (2001) constructivism has these characteristics:

- lessons are presented utilizing genuine situations;
- collaboration between students is encouraged;
- subject matter is pertinent;
- new material is connected in context to previous skills attained;
- students practice new concepts or skills and transfer information to other situations or other academic areas; and
- teachers act as facilitators.

Constructivism emphasizes acquiring new skills and knowledge within the context of previous experiences, relevant situations, and other academic subjects which is contextual learning (Bransford, J., Brown, A., & Cocking, R., 2000; Crawford, 2001). According to Roberts and Ball (2009), “agriculture as a context for learning is anchored theoretically in constructivism” (p. 85). In 1988, the National Research Council (NRC) published the book, *Understanding Agriculture: New Directions for Education* which accentuated the importance of integrating agricultural education with science courses to teach academic theories using relevant agriculture principles. Up to this point, vocational education’s primary goal was to train students for production agriculture careers. The NRC recommended expanding the curriculum of teaching job skills to include teaching agricultural science principles associated with nontraditional as well as traditional agriculture. A few years following the NRC recommendation, the 1991 Secretary’s Commission on Achieving Necessary Skills (SCANS) issued this proclamation:

We believe, after examining the findings of cognitive science, that the most effective way of learning skills is “in context,” placing learning objectives within a real environment rather than insisting that students first learn in the abstract what they will be expected to apply (p. xv).

With this change in policy, agricultural education began integrating academic objectives to increase academic achievement of students (Parr, Edwards, Leising, 2009).

Summary

The purposes of this quantitative descriptive, assessment of group differences, and correlational study were to describe the science achievement of secondary agricultural education students without IEPs and with IEPs. Likewise, the study will determine if the number of agricultural education courses passed, FFA involvement, and SAE participation were related to students’ performance on science achievement when compared to students who did not participate in agricultural education. The GHSGT science exam was the standardized testing instrument used to assess science achievement and the GHSGT science test scores from the junior class of 2009 – 2010 and GHSGT science test scores from agricultural education students in the junior class of 2009-2010 were utilized for data. The IEP status, number of agricultural education courses passed, rankings of FFA and SAE intensity levels were reported by individual agricultural education teachers and were subjective although guidelines were given for ranking purposes.

The review of literature described key elements of how agricultural education approaches holistic learning to increase student academic achievement through classroom instruction, SAE involvement, and FFA participation (Chiasson & Burnett, 2001; Levesque, Wun, & Green, 2010; Rich, Duncan, Navarro, & Ricketts, 2009; Ricketts, Duncan, & Peake, 2006; Theriot & Kotrlik,

2009). Engaging activities utilizing inquiry-based, (Grady, Dolan, & Glasson, 2010 ; Myers & Dyer, 2006; Thoron & Myers, 2011; Thoron, Myers, & Abrams, 2011) integrated, (Boone, Gartin, Boone, & Hughes, 2006; Myers & Washburn, 2008; Parr, Edwards, & Leising, 2006; Parr, Edwards, & Leising, 2009; Roberts & Ball, 2009; Stone, Alfeld, Pearson, Lewis, & Jensen, 2006; Thompson & Balschweid, 2000; Warnick, Thompson, & Gummer, 2004) experiential learning, (Balschweid & Thompson, 2002; Conroy & Walker, 2000; Knobloch, 2003) problem-solving, (Burriss & Garton, 2007; Myers & Washburn, 2008; Parr & Edwards, 2004; Pate & Miller, 2011) and contextual learning teaching methods (Balschweid, 2002; Balschweid & Huerta, 2008; Edwards, 2004; Myers, Thoron, & Thompson, 2009; Scales, Terry, & Torres, 2009; Thompson & Balschweid, 2000; Warnick, Thompson, & Gummer, 2004; Wilson & Curry, Jr, 2011) provided learning opportunities to meet the needs of diverse students enrolled in secondary public schools. Simultaneously, SAE activities provided opportunities for informal learning with students practicing skills and testing academic theories outside of the classroom (McLure & McLure, 2000; Ramsey & Edwards, 2004; Retallick, 2010; Roberts & Harlin, 2007; Shelley-Tolbert, Conroy, & Dailey, 2000). Rounding out the holistic approach was participating in FFA activities that reiterated classroom instruction and motivated students to excel in competitive career development events that linked real world critical thinking skills to academic standards (Alfeld, Stone III, Aragon, Hansen, Zirkle, Conners, Spindler, Romine, & Woo, 2007; Guest & Schneider, 2003; Holloway, 2002; Ramsey & Edwards, 2004; Shelley-Tolbert, Conroy, & Dailey, 2000; Threton & Pellock, 2010). Throughout each of these learning opportunities, educating students with special needs was a concern that was addressed (Dormody, Seevers, Andreasen, & VanLeeuwen, 2006; Easterly III & Myers, 2011; Eisenman, 2000; Linn, Baker, & Betebenner, 2002). Within the three

components, SAE, FFA, and classroom instruction, each element had opportunities for completing authentic contextual operations to enhance academic achievement of all students.

Chapter 3

Methodology

Introduction

The purposes of this quantitative descriptive, assessment of group differences, and correlational study were to describe the science achievement of secondary agricultural education students and determine if the number of agricultural education courses passed, FFA involvement, SAE participation, and special education status were related to students' performance on science achievement when compared to students who did not participate in secondary agricultural education programs. The instrument utilized to measure science achievement was the state mandated standardized science portion of the Georgia High School Graduation Test (GHS GT). The following research questions served as a guide.

Research Questions

1. What was the relationship between number of agricultural education courses passed and science achievement of regular education agricultural education participants and concentrators?
2. What was the relationship between FFA involvement and science achievement of regular education and special education agricultural education concentrators?
3. What was the relationship between SAE participation and science achievement of regular education and special education agricultural education concentrators?
4. How did science achievement of special education agricultural education concentrators compare to non-agricultural special education students?

5. How did science achievement of regular education agricultural education concentrators compare to non-agricultural regular education students?

Null Hypotheses

- H₀1: The science achievement of regular education agricultural education participants will not differ statistically significantly (i.e., $p > .05$) from regular education agricultural education concentrators ($H_0: \mu_1 = \mu_2$).
- H₀2: The science achievement of regular education and special education agricultural education concentrators who have a medium to high intensity level in FFA activities will not differ statistically significantly (i.e., $p > .05$) from students who have a low intensity level in FFA activities ($H_0: \mu_1 = \mu_2$).
- H₀3: The science achievement of regular education and special education agricultural education concentrators who have a medium to high intensity level in SAE activities will not differ statistically significantly (i.e., $p > .05$) from students who have a low intensity level in SAE activities ($H_0: \mu_1 = \mu_2$).
- H₀4: The science achievement of special education students who are agricultural education program concentrators will not differ statistically significantly (i.e., $p > .05$) from special education non-agricultural education students in GHSGT science scores ($H_0: \mu_1 = \mu_2$).
- H₀5: The science achievement of regular education students who are agricultural education program concentrators will not differ statistically significantly (i.e., $p > .05$) from regular education non-agricultural education students in GHSGT science scores ($H_0: \mu_1 = \mu_2$).

The assumption was made that the GHSGT science exam was the instrument utilized to measure science achievement and considered to yield valid scores. According to Steve Cramer, Associate Director of Test Scoring and Reporting Services, the Kuder-Richardson-20 reliability

index of the science portion of the spring 2010 GHSGT was .937 (S. Cramer, personal communication, December 29, 2011). In addition to the Kuder-Richardson-20 test, the Cronbach's alpha index was 0.92 (Georgia State Department of Education, 2010b). Another assumption dealt with reporting by agricultural education teachers. It was assumed that the agricultural education teachers correctly assessed and reported number of agricultural education courses passed by the students, the IEP status of the agricultural education students, and the agricultural education students' performance concerning FFA and SAE participation.

Institutional Review Board

Auburn University's research compliance board is compelled by federal regulations to approve all research pertaining to human subjects. To fulfill these requirements, the researcher submitted a complete Institutional Review Board (IRB) application to the Auburn University's Office of University Research and IRB in addition to required documents necessary for thorough assessment of the research proposal. The IRB concluded that the human subjects involved in the study would receive safe and humane treatment and approved the study (Appendix 1).

Population

The student population of the study included the junior class of 2009-2010 that participated in the GHSGT science assessment throughout the state of Georgia. According to the Student Population Summary for GHSGT Science for 2009 – 2010 (Appendix 2) provided by Dr. Melodee Rose, Director of Assessment Research and Development Division for the Georgia Department of Education, 97,364 first time test takers completed the GHSGT in the spring of 2010 (M. Rose, personal communication, June 15, 2011). As identified by the Georgia Agricultural Education Annual Summary Report, Georgia had 180 secondary agricultural education programs for the academic school year of 2009-2010 (Georgia Department of

Education, 2010c). John Bridges, Georgia's State Director of Agricultural Education, requested from the secondary agricultural education instructors the individual agricultural education students' GHSGT science test scores, IEP status, number of agricultural education courses passed, SAE involvement ranking, and FFA participation ranking for their students who were enrolled in the junior class of 2009-2010 (Appendix 3). As a result of his request, 110 secondary agricultural education programs compiled and submitted the information which included 4,221 agricultural education students (Appendix 4). The agricultural education students' individual GHSGT science test scores, IEP status, number of agricultural education courses passed, SAE involvement ranking, and FFA participation ranking along with the entire student population GHSGT science test scores were the units of analysis (Appendix 3).

Design of the Study

Sample

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, 2010a).

Measures

The 70 questions on the science portion of the GHSGT measured students' competency in cells and heredity, ecology, structure and properties of matter, energy transformation, forces, waves, and electricity, and characteristics of science assessed in content domains. The GHSGT was considered to yield valid scores since Georgia high school teachers and curriculum specialists selected the knowledge and skills assessed on the graduation tests which were based on state-adopted curriculum (Georgia State Department of Education, 2009). Steve Cramer, Associate Director of Test Scoring and Reporting Services, revealed that the Kuder-Richardson-20 reliability index of the science portion of the spring 2010 GHSGT was .937 (S. Cramer, personal communication, December 29, 2011). In addition to the Kuder-Richardson-20 test, the Cronbach's alpha index was 0.92 (Georgia State Department of Education, 2010b).

Measures of Student Achievement

The science portion of the 2009-2010 GHSGT was the instrument utilized to determine if relationships existed between number of agricultural education courses passed and science achievement of agricultural education participants and concentrators. Two, the science portion of the 2009-2010 GHSGT was the instrument utilized to determine if relationships existed between FFA involvement and science achievement of agricultural education concentrators. Third, the science portion of the 2009-2010 GHSGT was the instrument utilized to determine if relationships existed between SAE participation and science achievement of agricultural education concentrators. Fourth, the science portion of the 2009-2010 GHSGT was the instrument utilized to determine if relationships existed between science achievement of special education agricultural education concentrators and non-agricultural special education students. Fifth, the science portion of the 2009-2010 GHSGT was the instrument utilized to determine if

relationships existed between science achievement of regular education agricultural education concentrators and non-agricultural regular education students.

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 (Appendix 3). 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. As defined by the Georgia Department of Education, an agricultural education program participant is a high school student who has passed one or more secondary agricultural education courses and an agricultural education concentrator is a high school student who has passed three or more secondary agricultural education courses (Georgia Department of Education, 2010a).

To determine the GHSGT science scores and IEP status, agricultural education instructors listed the GHSGT scores and IEP status 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 and IEP status for each agricultural education student to record on the information chart (Appendix 3).

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 concentrators 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 (Appendix 3).

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 (Appendix 3).

The science portion of the 2009-2010 GHSGT was the instrument utilized to determine if relationships existed between science achievement of regular education and special education agricultural education concentrators compared to non-agricultural regular education and special education students. The GHSGT science scores of regular education and special education agricultural education were listed by the agricultural education instructors on the information chart (Appendix 3). The GHSGT science scores for the state of Georgia of first time test takers regular education and special education students were compiled on the Student Population Summary for GHSGT Science for 2009 – 2010 (Appendix 2) provided by Dr. Melodee Rose, Director of Assessment Research and Development Division for the Georgia Department of Education.

Treatment

As a result of NCLB mandates, each state began developing standards, assessments, and proficiency levels and 20 states administered mandatory graduation tests in 2004 (Gayler, Chudowsky, Hamilton, Kober, & Yeager, 2004). In Georgia, eleventh grade students were assessed in academic subjects of writing, English/language arts, mathematics, social studies, and science. Juniors taking the GHS GT in the academic school year 2009-2010 were required to pass all five standardized tests as a graduation requirement (Georgia Department of Education, 2011a).

The treatment tested in this study was secondary agricultural education courses passed, SAE involvement, and FFA participation of eleventh grade agricultural education students that completed the science portion of the 2009-2010 GHS GT. To estimate the appropriate sample size for a one-tailed t test, an online calculator was used (Soper, 2010). With the anticipated effect size (Cohen's d) of 0.5, desired statistical power level of 0.8, and probability level of 0.05, the minimum total sample size was 102. The treatment group included the agricultural education students from 110 agricultural education programs in Georgia who responded to John Bridges, Georgia's State Director of Agricultural Education, written and verbal requests for GHS GT research study information (Appendix 4). The control group was the first time test takers of the junior class of 2009-2010 which were assessed on the science portion of the GHS GT and included the treatment group of 4,221 agricultural education students' scores from the 110 agricultural education programs.

The GHS GT science portion has four performance level divisions to classify student achievement. The score levels are divided into "below proficiency (below 200), "basic

proficiency” (200 - 234), “advanced proficiency” (235 - 274), and “honors” (275 or above) (Georgia State Department of Education, 2011e).

The control group consisted of 97,364 students and was subdivided into 89,965 regular education students and 7,399 special education students. All students had a GHS GT science mean score of 238 with 10 percent below proficiency, 34 percent basic proficiency, 41 percent advanced proficiency, and 16 percent honors. Regular education students had a GHS GT science mean score of 241 with 7 percent below proficiency, 33 percent basic proficiency, 42 percent advanced proficiency, and 17 percent honors. Special education students had a GHS GT science mean score of 207 with 42 percent below proficiency, 37 percent basic proficiency, 17 percent advanced proficiency, and 3 percent honors (Appendix 2).

The dependent variable was the student scores on the science portion of the GHS GT taken spring 2010. The independent variables were the number of secondary agricultural education courses passed, SAE involvement, FFA participation, and IEP status of eleventh grade agricultural education students that completed the science portion of the 2009-2010 GHS GT.

Data Analysis

To guide this investigation concerning student achievement, six research questions were identified and developed at the onset. *Predictive Analytical SoftWare (PASW) 18.0* and *Microsoft Excel 2007* were computer software programs utilized to statistically analyze data gathered for this study. Research questions one through three focused on several key areas of agricultural education programs to determine if relationships were evident between these key areas and student performance on the science portion of the GHS GT. The key areas of agricultural education analyzed were: number of agricultural education courses passed, FFA participation, and SAE activities. Furthermore, research question four concentrated on determining if

relationships were exhibited between agricultural education concentrators who received special education services and their performance on the science portion of the GHSGT when compared to non-agricultural education students who received special education services and their performance on the science portion of the GHSGT. Equally important, research question five studied if relationships were exhibited between agricultural education concentrators who were regular education students and their performance on the science portion of the GHSGT when compared to non-agricultural education students who were regular education students in regards to their performance on the science portion of the GHSGT.

Research questions one through three concentrated on determining if relationships were evident between the main areas of agricultural education programs and student achievement as measured by the science portion of the GHSGT. The dependent variable was science scores of agricultural education students which was interval data. The independent variables for the three questions were number of agricultural education courses passed, FFA participation, and SAE activities which were nominal data. The statistical test utilized to analyze the means of GHSGT science score was analysis of variance (ANOVA) general linear model (GLM) because only one independent variable and one dependent variable were analyzed using independent samples (Huck, 2008). An additional test utilized to determine if relationships existed between these variables was point-biserial correlation coefficient (Ary & Jacobs, 1976).

Research question four focused on determining if relationships were exhibited between agricultural education concentrators who received special education services and their performance on the science portion of the GHSGT when compared to non-agricultural education students who received special education services and their performance on the science portion of the GHSGT. The dependent variable was science scores of agricultural education students which

was interval data. The independent variable was special education status which was nominal data. The statistical test utilized to determine the relationship by analyzing the means of GHSGT science scores was one sample t test (Ross and Shannon, 2008).

Research question five focused on determining if relationships were exhibited between agricultural education concentrators who were regular education students and their performance on the science portion of the GHSGT when compared to non-agricultural education students who were regular education students and their performance on the science portion of the GHSGT. The dependent variable was science scores of agricultural education students which was interval data. The independent variable was regular education status which was nominal data. The statistical test utilized to determine the relationship by analyzing the means of GHSGT science scores was one sample t test (Ross and Shannon, 2008).

In addition to statistical significance analysis, effect size was calculated, but the computer program, PASW, did not calculate effect size. 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. Dr. Margaret Ross, Auburn University statistics professor, recommended this formula to calculate effect size using PASW output data: mean difference divided by standard deviation (Ross, personal communication, February 14, 2012). 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. The formula utilized for calculating *Eta-squared* using PASW output was sum of squares between divided by sum of squares total (Kotrlik, Williams, & Jabor, 2011).

Chapter 4

Findings

Introduction

The purposes of this quantitative descriptive, assessment of group differences, and correlational study were to describe the science achievement of secondary agricultural education students and determine if the number of agricultural education courses passed, FFA involvement, SAE participation, and special education status were related to students' performance on science achievement when compared to students who did not participate in agricultural education programs. The instrument utilized to measure science achievement was the state mandated standardized science portion of the Georgia High School Graduation Test (GHS GT). The following research questions served as a guide.

Research Questions

1. What was the relationship between number of agricultural education courses passed and science achievement of regular education agricultural education participants and concentrators?
2. What was the relationship between FFA involvement and science achievement of regular education and special education agricultural education concentrators?
3. What was the relationship between SAE participation and science achievement of regular education and special education agricultural education concentrators?
4. How did science achievement of special education agricultural education concentrators compare to non-agricultural special education students?

5. How did science achievement of regular education agricultural education concentrators compare to non-agricultural regular education students?

Null Hypotheses

- H₀1: The science achievement of regular education agricultural education participants will not differ significantly (i.e., $p > .05$) from regular education agricultural education concentrators ($H_0: \mu_1 = \mu_2$).
- H₀2: The science achievement of regular education and special education agricultural education concentrators who have a medium to high intensity level in FFA activities will not differ significantly (i.e., $p > .05$) from students who have a low intensity level in FFA activities ($H_0: \mu_1 = \mu_2$).
- H₀3: The science achievement of regular education and special education agricultural education concentrators who have a medium to high intensity level in SAE activities will not differ significantly (i.e., $p > .05$) from students who have a low intensity level in SAE activities ($H_0: \mu_1 = \mu_2$).
- H₀4: The science achievement of special education students who are agricultural education program concentrators will not differ significantly (i.e., $p > .05$) from special education non-agricultural education students in GHSGT science scores ($H_0: \mu_1 = \mu_2$).
- H₀5: The science achievement of regular education students who are agricultural education program concentrators will not differ significantly (i.e., $p > .05$) from regular education non-agricultural education students in GHSGT science scores ($H_0: \mu_1 = \mu_2$).

The previous research questions and null hypotheses provided the foundation for reporting the results and conclusions obtained concerning this investigation about student

achievement. This chapter describes in detail information concerning each of the research questions and null hypotheses.

General Description of Study's Participants

The student population of the study included the junior class of 2009-2010 that participated in the GHSGT science assessment throughout the state of Georgia. According to the Student Population Summary for GHSGT Science for 2009 – 2010 (Appendix 2) provided by Dr. Melodee Rose, Director of Assessment Research and Development Division for the Georgia Department of Education, 97,364 first time test takers completed the GHSGT in the spring of 2010 (M. Rose, personal communication, June 15, 2011). As identified by the Georgia Agricultural Education Annual Summary Report of 2010, Georgia had 180 secondary agricultural education programs for the academic school year of 2009-2010 (Georgia State Department of Education, 2010c) John Bridges, Georgia's State Director of Agricultural Education, requested from the secondary agricultural education instructors the individual agricultural education students' GHSGT science test scores, IEP status, number of agricultural education courses passed, SAE involvement ranking, and FFA participation ranking for their students who were enrolled in the junior class of 2009-2010 (Appendix 3). As a result of his request, 110 secondary agricultural education programs compiled and submitted the information which included 4,221 agricultural education students (Appendix 4). The agricultural education programs in Georgia were divided into north, central, and south region. The north region had 82 secondary agricultural education programs and 49 schools reported information with a return rate of 60%. The central region had 52 secondary agricultural education programs and 39 schools reported information with a return rate of 77%. The south region had 21 secondary agricultural education programs and 48 schools reported information with a return rate of 44% (Appendix 4).

The overall return rate for the state was 61% (Georgia State Department of Education, 2010c, Appendix 4). The agricultural education students' individual GHSGT science test scores for spring 2010, IEP status, number of agricultural education courses passed, SAE involvement ranking, and FFA participation ranking along with the entire student population's GHSGT science test scores were the units of analysis.

The following section describes the 97,364 students who completed the GHSGT science portion for the first time in the spring of 2010. The regular education student population totaled 89,965 (92.5%) with a GHSGT science mean score of 241 (Table 1). The percentage of regular education students in each GHSGT science exam GHSGT science score category was: below proficiency 7%, basic proficiency 33%, advanced proficiency 42%, and honors 17% (Table 2). The special education student population totaled 7,399 (7.5%) with a GHSGT science mean score of 207 (Table 1). The percentage of special education students in each GHSGT science score category was: below proficiency 42%, basic proficiency 37%, advanced proficiency 17%, and honors 3% (Table 2).

Table 1

Descriptive Statistics for GHSGT Science Exam Population of Students: General population (n=97,364) and Agricultural Education (n=4,221)

GHSGT Category	General Population Percentage	Agricultural Education Population Percentage
Regular Education	92.5	87
Special Education	7.5	13

Table 2

Descriptive Statistics for GHSGT Science Exam Scores of Regular and Special Education

Students: Regular Education General Population (n=89,965), Regular Education Agricultural Education (n=3,665), Special Education General population (n=7,399) and Special Education Agricultural Education (n=556)

GHSGT Category	Regular Education General Population	Regular Education Agricultural Education Population	Special Education General Population	Special Education Agricultural Education Population
Below	07	02	42	20
Basic	33	41	37	58
Advanced	42	44	17	18
Honors	17	13	03	04

The following section describes the 4,221 agricultural education students who completed the GHSGT science portion for the first time in the spring of 2010. The regular education student population totaled 3,665 (87%) with a GHSGT science mean score of 239 (Table 1). The percentage of regular education students in each GHSGT science score category was: below proficiency 2%, basic proficiency 41%, advanced proficiency 44%, and honors 13% (Table 2). The special education student population totaled 556 (13%) with a GHSGT science mean score of 215 (Table 1). The percentage of special education students in each GHSGT science score category was: below proficiency 20%, basic proficiency 58%, advanced proficiency 18%, and honors 4% (Table 2).

To further describe the agricultural education students, the number of agricultural education courses was explored. Agricultural education students who had passed one or two classes were classified as participants. A total of 2,692 (64%) were participants with 2,345 (87%) classified as regular education with a GHSGT science mean score of 239 (Table 3). The

percentage of regular education students in each GHS GT science score category was: below proficiency 2%, basic proficiency 43%, advanced proficiency 43%, and honors 12% (Table 4). The special education student population totaled 347 (13%) with a GHS GT science mean score of 215 (Table 4). The percentage of special education students in each GHS GT science score category was: below proficiency 22%, basic proficiency 56%, advanced proficiency 19%, and honors 3% (Table 4).

Table 3

Descriptive Statistics for GHS GT Science Exam for Agricultural Education Participants

GHS GT Category	n	Percentage of population
Total	2,692	100
Regular Education	2,345	87
Special Education	347	13

Table 4

Descriptive Statistics for GHS GT Science Exam Score Percentages of Regular Education

Agricultural Education Overall (n=3,665), Regular Education Participants (n=2,345), Regular Education Concentrators (n=1,320) Special Education Agricultural Education Overall (n=556), Special Education Agricultural Education Participants (n=347), and Special Education Concentrators (n=209)

GHS GT Category	Regular Education Overall	Regular Education Participant	Regular Education Concentrator	Special Education Overall	Special Education Participant	Special Education Concentrator
Below	02	02	02	20	22	19
Basic	41	43	39	58	56	60
Advanced	44	43	46	18	19	16
Honors	13	12	13	04	03	05

Agricultural education students who have passed three or more classes were classified as concentrators. A total of 1,529 (36%) students were concentrators with 1,320 (86%) classified as regular education with a GHSGT science mean score of 241 (Table 5). The percentage of regular education students in each GHSGT science score category was: below proficiency 2%, basic proficiency 39%, advanced proficiency 46%, and honors 13% (Table 4). The special education student population totaled 209 (14%) with a GHSGT science mean score of 216. The percentage of special education students in each GHSGT science score category was: below proficiency 19%, basic proficiency 60%, advanced proficiency 16%, and honors 5% (Table 4).

Table 5

Descriptive statistics for GHSGT science exam for agricultural education concentrators

GHSGT Category	n	Percentage of population
Total	1,529	100
Regular Education	1,320	86
Special Education	209	14

Another characteristic that was examined was FFA activities which were scored by the agricultural education instructors, on a scale of one to five using the following guidelines. A student that participated 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 (Appendix 3). These rankings were compiled into two categories. Students who

were ranked with one or two were labeled as 1 or low participation and students who were ranked three, four, or five were labeled as 2 or high participation.

The FFA ranking was explored according to special or regular education and participant or concentrator. A total of 3,665 students were regular education students with 2,740 (75%) classified as low FFA involvement with a GHS GT science mean score of 240. The percentage of regular education students with low FFA involvement in each GHS GT science score category was: below proficiency 2%, basic proficiency 41%, advanced proficiency 45%, and honors 12%. High FFA involvement for regular education numbered 925 (25%) with a GHS GT science mean score of 239. The percentage of regular education students with high FFA involvement in each GHS GT science score category was: below proficiency 3%, basic proficiency 42%, advanced proficiency 42%, and honors 13%. A total of 2,345 students were participant regular education students with 1,745 (74%) classified as low FFA involvement with a GHS GT science mean score of 239. The percentage of participant regular education students in each GHS GT science score category was: below proficiency 2%, basic proficiency 43%, advanced proficiency 43%, and honors 12%. Participant regular education students with high FFA levels were 600 (26%) with a GHS GT science mean score of 238. The percentage of participant regular education students with high FFA levels in each GHS GT science score category was: below proficiency 3%, basic proficiency 43%, advanced proficiency 41%, and honors 13%. A total of 1,320 students were concentrator regular education students with 995 (75%) classified as low FFA involvement with a GHS GT science mean score of 241. The percentage of concentrator regular education students with low FFA involvement in each GHS GT science score category was: below proficiency 2%, basic proficiency 39%, advanced proficiency 46%, and honors 13%. Concentrator regular education students with high FFA involvement with 325 (25%) had a

GHSGT science mean score of 240. 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 6).

Table 6

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
<i>n</i>	2740	925	1745	600	995	325
<i>M</i>	240	239	239	238	241	240

A total of 556 students were special education students with 407 (73%) classified as low FFA involvement with a GHSGT science mean score of 213. The percentage of special education students with low FFA involvement in each GHSGT science score category was: below proficiency 21%, basic proficiency 58%, advanced proficiency 17%, and honors 4%. High FFA involvement of special education students totaled 149 (27%) with a GHSGT science mean score of 223. The percentage of special education students with high FFA involvement in each GHSGT science score category was: below proficiency 21%, basic proficiency 53%, advanced proficiency 22%, and honors 4%. A total of 347 students were participant special education students with 249 (72%) classified as low FFA involvement with a GHSGT science mean score

of 212. The percentage of participant special education students and low FFA involvement in each GHS GT science score category was: below proficiency 23%, basic proficiency 58%, advanced proficiency 17%, and honors 2%. Participant special education students accounted for 98 (28%) classified as high FFA involvement with a GHS GT science mean score of 223. The percentage of participant special education students and high FFA involvement in each GHS GT science score category was: below proficiency 22%, basic proficiency 57%, advanced proficiency 19%, and honors 2%. A total of 209 students were concentrator special education students with 158 (76%) classified as low FFA involvement with a GHS GT science mean score of 216. The percentage of concentrator special education students with low FFA involvement in each GHS GT science score category was: below proficiency 18%, basic proficiency 59%, advanced proficiency 17%, and honors 6%. Concentrator special education with high FFA involvement numbered 51 (24%) with a GHS GT science mean score of 227. The percentage of concentrator special education students with high FFA involvement in each GHS GT science score category was: below proficiency 22%, basic proficiency 60%, advanced proficiency 16%, and honors 2% (Table 7).

Table 7

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
<i>n</i>	407	149	249	98	158	51
<i>M</i>	213	223	212	223	216	227

In addition to FFA involvement, SAE activities were researched. 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 (Appendix 3). These rankings were compiled into two categories. Students who were ranked with one or two were labeled as 1 or low intensity and students who were ranked three, four, or five were labeled as 2 or high intensity.

The SAE ranking was investigated according to special or regular education and participant or concentrator. A total of 3,665 students were regular education students with 2,149 (59%) classified as low SAE intensity with a GHSGT science mean score of 239. The percentage of regular education students with low SAE intensity in each GHSGT science score category

was: below proficiency 2%, basic proficiency 42%, advanced proficiency 43%, and honors 13%. High SAE intensity for regular education totaled 1,516 (41.4%) with a GHS GT science mean score of 240. The percentage of regular education students with high SAE intensity in each GHS GT science score category was: below proficiency 2%, basic proficiency 41%, advanced proficiency 45%, and honors 12%. A total of 2,345 students were participant regular education students with 1,392 (59%) classified as low SAE levels with a GHS GT science mean score of 239. The percentage of participant regular education students with low SAE levels in each GHS GT science score category was: below proficiency 2%, basic proficiency 42%, advanced proficiency 43%, and honors 13%. High SAE levels for participant regular education totaled 953 (41%) classified with a GHS GT science mean score of 239. The percentage of participant regular education students with high SAE levels in each GHS GT science score category was: below proficiency 3%, basic proficiency 42%, advanced proficiency 43%, and honors 12%. A total of 1,320 students were concentrator regular education students with 757 (57%) classified as low SAE intensity with a GHS GT science mean score of 240. The percentage of concentrator regular education students with low SAE intensity in each GHS GT science score category was: below proficiency 2%, basic proficiency 39%, advanced proficiency 46%, and honors 13%. High SAE intensity by concentrator regular education students numbered 563 (43%) with a GHS GT science mean score of 241. The percentage of concentrator regular education students with high SAE intensity in each GHS GT science score category was: below proficiency 2%, basic proficiency 38%, advanced proficiency 46%, and honors 14% (Table 8).

Table 8

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
<i>n</i>	2149	1516	1392	953	757	563
<i>M</i>	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%. High SAE intensity by special education students totaled 258 (46%) with a GHSGT science mean score of 213. The percentage of special education students with high SAE intensity in each GHSGT science score category was: below proficiency 22%, basic proficiency 58%, advanced proficiency 18%, and honors 2%. A total of 347 students were participant special education students with 198 (57%) classified as low SAE intensity with a GHSGT science mean score of 222. The percentage of participant special education students with low SAE intensity in each GHSGT science score category was: below proficiency 21%, basic proficiency 56%, advanced proficiency 19%, and honors 4%. High SAE intensity level contained 149 (43%) with a GHSGT science mean score of 213. The percentage

of participant special education students with high SAE intensity in each GHS GT science score category was: below proficiency 22%, basic proficiency 57%, advanced proficiency 19%, and honors 2%. A total of 209 students were concentrator special education students with 102 (49%) classified as low SAE intensity with a GHS GT science mean score of 230. The percentage of concentrator special education students with low SAE intensity in each GHS GT science score category was: below proficiency 16%, basic proficiency 59%, advanced proficiency 15%, and honors 10%. High SAE intensity level contained 107 (51%) classified as high SAE intensity with a GHS GT science mean score of 212. The percentage of concentrator special education students with high SAE intensity in each GHS GT science score category was: below proficiency 22%, basic proficiency 59%, advanced proficiency 18%, and honors 0.9% (Table 9).

Table 9

Descriptive Statistics for GHS GT 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)

GHS GT 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
<i>n</i>	298	258	198	149	102	107
<i>M</i>	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 GHS GT science mean score of 239.33 and 196 (9%) had a low SAE ranking with a high FFA ranking with a GHS GT 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 GHS GT science mean score of 240.50 and 729 (48%) had a high SAE ranking and high FFA ranking with a GHS GT science mean score of 238.47.

For participant regular education, 1,392 students had a low SAE ranking with 1,237 (89%) with a low FFA ranking with a GHS GT science mean score of 238 and 155 (11%) had a low SAE ranking with a high FFA ranking with a GHS GT science mean score of 240. The 953 regular education participants with high SAE level, 508 (53%) had a high SAE ranking with low FFA ranking with a GHS GT science mean score of 240 and 445 (47%) had a high SAE ranking and high FFA ranking with a GHS GT science mean score of 237 (Table 10).

Concentrator regular education students had the following descriptive SAE and FFA information. For concentrators, 757 students had a low SAE ranking with 716 (95%) with a low FFA ranking with a GHS GT science mean score of 240 and 41 (5%) had a low SAE ranking with a high FFA ranking with a GHS GT science mean score of 237. The 563 regular education participants with high SAE level, 279 (50%) had a high SAE ranking with low FFA ranking with a GHS GT science mean score of 241 and 284 (50%) had a high SAE ranking and high FFA ranking with a GHS GT science mean score of 240 (Table 10).

Equally important was the special education data in regards to SAE rankings and FFA rankings. For special education students, 300 students had a low SAE ranking with 271 (90%) with a low FFA ranking with a GHS GT science mean score of 215 and 29 (10%) had a low SAE ranking with a high FFA ranking with a GHS GT science mean score of 232. The 256 special

education participants with high SAE level, 136 (53%) had a high SAE ranking with low FFA ranking with a GHSGT science mean score of 213 and 120 (47%) had a high SAE ranking and high FFA ranking with a GHSGT science mean score of 214 (Table 10).

For special education participants, 198 students had a low SAE ranking with 173 (87%) with a low FFA ranking with a GHSGT science mean score of 213 and 25 (13%) had a low SAE ranking with a high FFA ranking with a GHSGT science mean score of 231. The 149 special education participants with high SAE level, 76 (51%) had a high SAE ranking with low FFA ranking with a GHSGT science mean score of 211 and 73 (49%) had a high SAE ranking and high FFA ranking with a GHSGT science mean score of 216 (Table 10).

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 10).

Table 10

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	<i>n</i>	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

Selected Relationships between Study's Participants and GHSGT Science Exam

Research Question One

Research question one focused on determining the relationship between number of agricultural education courses passed and science achievement of regular education agricultural education participants and concentrators. The null hypothesis was the science achievement of regular education agricultural education participants will not differ significantly (i.e., $p > .05$) from regular education agricultural education concentrators. The regular education agricultural education participants were students who had passed one or two agricultural education courses and were labeled as 1 (N=2,345). The regular education agricultural education concentrators were students who had passed three or more agricultural education courses and were labeled as 2 (N=1,320). The science portion of GHSGT was the instrument utilized for measuring science achievement. Agricultural education participants (N=2,345) had a GHSGT science mean score of 238.77 with a standard deviation of 27.89 (Table 11). Agricultural education concentrators (N=1,320) had a GHSGT science mean score of 240.65 with a standard deviation of 27.53. An ANOVA test did reflect a statistically significant difference between the groups ($F_{(1, 3664)} = 3.883$, $p = .049$) at a *priori* alpha level of .05. To determine the effect size, *Eta-squared* was calculated. The effect size was .1% which was small (Table 11). A point-biserial correlation test did reveal a “low” (Davis, 1971), but positive and statistically significant relationship between the number of agricultural education courses passed and GHSGT science scores, ($\rho_{bi} = .033$, $p = .024$) of all regular education students (Table 12). As a result, the null hypothesis (H_0) was rejected; therefore, the number of agricultural education courses passed did have a statistically significant relationship with science achievement on the GHSGT.

Table 11

GHSGT Science Exam Scores of Regular Education Participants (n=2,345) and Concentrators (n=1,320)

Student Category	n	M	SD	p-value
Participant Regular Education	2345	238.77	27.89	
Concentrator Regular Education	1320	240.65	27.53	
Between Groups				.049

$\text{Eta}^2 = 0.001$

Table 12

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	X ₃	M	SD
GHSGT Science Score (Y ₁)	1.000	.033*	-.014	.003	239.43	27.77
Number of agricultural education courses passed (X ₁)		1.000	-.011	.020	1.36	.48
FFA (X ₂)			1.000	.442**	1.25	.43
SAE (X ₃)				1.000	1.41	.49

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

Research Question Two

Research question two dealt with determining the relationship between FFA involvement and science achievement of regular education and special education agricultural education concentrators. The null hypothesis was the science achievement of regular education and special education agricultural education concentrators who have a medium to high intensity level in FFA activities will not differ significantly (i.e., $p > .05$) from regular education and special education agricultural education concentrators who have a low intensity level in FFA activities. The

agricultural education instructors ranked the students' participation levels on a scale of one to five using the following guidelines. A student that participated 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 (Appendix 3). These rankings were compiled into two categories. Students who were ranked with one or two were labeled as 1 (N=2,408). Students who were ranked three, four, or five were labeled as 2 (N=1,813). The science portion of GHSGT was the instrument utilized for measuring science achievement. 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 13). 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) failed to be rejected; therefore, the FFA activity level of agricultural education students did not have a statistically significant relationship with science achievement on the GHSGT (Table 14).

Table 13

GHS GT 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

Table 14

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

Variable	Y ₁	X ₂	X ₃	M	SD
GHS GT Science Score (Y ₁)	1.000	-.026	-.018	237.27	28.48
FFA (X ₂)		1.000	.509**	1.43	.50
SAE (X ₃)			1.000	1.24	.43

**p < .001

Research Question Three

Research question three concentrated on determining the relationship between SAE participation and science achievement of regular education and special education agricultural education concentrators. The null hypothesis was the science achievement of regular education and special education agricultural education concentrators who have a medium to high intensity level in SAE activities will not differ significantly (i.e., $p > .05$) from regular education and special education agricultural education concentrators who have a low intensity level in SAE activities. The agricultural education instructors ranked the students' participation 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 is 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 worked 50 or more hours per semester on an SAE was a level five (Appendix 3). These rankings were compiled into two categories. Students who were ranked with one or two were labeled as 1 (N=859). Students who were ranked three, four, or five were labeled as 2 (N=670). The science portion of GHS GT was the instrument utilized for measuring science achievement. Students with SAE activities level of 1 (N=859) had a GHS GT science mean score of 237.92 with a standard deviation of 28.53. Students with SAE activities level of 2 (N=670) had a GHS GT 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 15). Calculating the effect size was not necessary due to lack of statistical significance. A point-biserial correlation test between SAE participation and GHS GT 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. As a result, the null hypothesis (H_03) failed to be rejected; therefore, the SAE activity level of agricultural education students did not have a statistically significant relationship with science achievement on the GHS GT (Table 16).

Table 15

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

Table 16

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 ₂	X ₃	M	SD
GHSGT Science Score (Y ₁)	1.000	-.026	-.018	237.27	28.48
FFA (X ₂)		1.000	.509**	1.43	.50
SAE (X ₃)			1.000	1.24	.43

**p < .001

Research Question Four

Research question four investigated how science achievement of special education agricultural education concentrators compared to non-agricultural special education students.

The null hypothesis was the science achievement of special education students who are agricultural education program concentrators will not differ statistically significantly (i.e., $p > .05$) from special education non-agricultural education students in GHSGT science scores.

Agricultural education instructors identified students who received special education services (Appendix 3). The students who had an IEP were labeled as 1 (N=1,320) and were considered special education students. The students who did not have an IEP were labeled as 2 (N=3,665)

and were considered regular education students. The science portion of GHS GT was the instrument utilized for measuring science achievement. Agricultural education concentrators who received special education services (N=209) had a GHS GT science mean score of 215.91 with a standard deviation of 24.94. Non-agricultural education students who received special education services for the state of Georgia (N=7,399) had a GHS GT science mean score of 207. A one sample *t* test did reflect a statistically significant difference between the groups ($t_{(208)} = 5.163, p < .001$) at a *priori* alpha level of .05. The Cohen *d* test was calculated and found to be .357 which was between a small and medium effect size. As a result, the null hypothesis (H₀₄) was rejected; therefore, special education students who were agricultural education concentrators did have a statistically significant relationship with science achievement on the GHS GT (Table 17).

Table 17

GHS GT Science Exam Scores of Special Education Concentrators (n=209) and Non-agricultural Education Students (n=7,399)

Student Category	n	M	SD	<i>t</i> -value	<i>p</i> -value
Special Education Concentrator	209	215.91	24.94	5.165	<.001

Cohen *d* = .357

Research Question Five

Research question five studied how science achievement of regular education agricultural education concentrators compared to non-agricultural regular education students. The null hypothesis was the science achievement of regular education students who are agricultural education program concentrators will not differ statistically significantly (i.e., $p > .05$) from regular education non-agricultural education students in GHS GT science scores. Agricultural education instructors identified students who received special education services (Appendix 3).

The students who had an IEP were labeled as 1 (N=556) and were considered special education students. The students who did not have an IEP were labeled as 2 (N=3,665) and were considered regular education students. The science portion of GHSGT was the instrument utilized for measuring science achievement. Agricultural education concentrators who were regular education students (N=1,320) had a GHSGT science mean score of 240.65 with a standard deviation of 27.53. Non-agricultural education students who were regular education for the state of Georgia (N=89,965) had a GHSGT science mean score of 241. A one sample *t* test did not reflect a statistically significant difference between the groups ($t_{(1319)} = -.462, p = .644$) at a *priori* alpha level of .05. As a result, the null hypothesis (H_0) failed to be rejected; therefore, regular education students who were agricultural education concentrators did not have a statistically significant relationship with science achievement on the GHSGT (Table 18).

Table 18

GHSGT Science Exam Scores of Regular Education Concentrators (n=1,320) and Non-agricultural Education Regular Education Students (n=89,965)

Student Category	n	M	SD	<i>t</i> -value	<i>p</i> -value
Regular Education Concentrator	1320	240.65	27.53	-.462	.644

Chapter 5

Summary, Conclusions, Recommendations, Implications, and Discussion

Summary

The purposes of this quantitative descriptive, assessment of group differences, and correlational study were to describe the science achievement of secondary agricultural education students and determine if the number of agricultural education courses passed, FFA involvement, and SAE participation would statistically significantly improve students' performance on science achievement when compared to students who did not participate in agricultural education.

Assumptions

The following assumptions relate to this study. One, the science section of the Georgia High School Graduation Test (GHSGT) was considered to yield valid scores for measuring science achievement. Two, agricultural education teachers accurately recorded the GHSGT science scores of agricultural education students. Three, agricultural education teachers correctly identified and reported number of agricultural education courses passed. Four, agricultural education teachers correctly assessed and reported agricultural education students' performance concerning FFA and SAE participation. The final assumption dealt with agricultural education teachers correctly reporting the special education and regular education status of agricultural education students. To guide this study, research questions were developed.

Research Questions

1. What was the relationship between number of agricultural education courses passed and science achievement of regular education agricultural education participants and concentrators?
2. What was the relationship between FFA involvement and science achievement of regular education and special education agricultural education concentrators?
3. What was the relationship between SAE participation and science achievement of regular education and special education agricultural education concentrators?
4. How did science achievement of special education agricultural education concentrators compare to non-agricultural special education students?
5. How did science achievement of regular education agricultural education concentrators compare to non-agricultural regular education students?

Null Hypotheses

- H₀1: The science achievement of regular education agricultural education participants will not differ statistically significantly (i.e., $p > .05$) from regular education agricultural education concentrators ($H_0: \mu_1 = \mu_2$).
- H₀2: The science achievement of regular education and special education agricultural education concentrators who have a medium to high intensity level in FFA activities will not differ statistically significantly (i.e., $p > .05$) from students who have a low intensity level in FFA activities ($H_0: \mu_1 = \mu_2$).
- H₀3: The science achievement of regular education and special education agricultural education concentrators who have a medium to high intensity level in SAE

activities will not differ statistically significantly (i.e., $p > .05$) from students who have a low intensity level in SAE activities ($H_0: \mu_1 = \mu_2$).

H₀₄: The science achievement of special education students who are agricultural education program concentrators will not differ statistically significantly (i.e., $p > .05$) from special education non-agricultural education students in GHSGT science scores ($H_0: \mu_1 = \mu_2$).

H₀₅: The science achievement of regular education students who are agricultural education program concentrators will not differ statistically significantly (i.e., $p > .05$) from regular education non-agricultural education students in GHSGT science scores ($H_0: \mu_1 = \mu_2$).

Population

The student population of the study included the junior class of 2009-2010 that participated in the GHSGT science assessment throughout the state of Georgia. According to the Student Population Summary for GHSGT Science for 2009 – 2010 (Appendix 2) provided by Dr. Melodee Rose, Director of Assessment Research and Development Division for the Georgia Department of Education, 97,364 first time test takers completed the GHSGT in the Spring of 2010 (M. Rose, personal communication, June 15, 2011). As identified by the Georgia Agricultural Education Annual Summary Report, Georgia had 180 secondary agricultural education programs for the academic school year of 2009-2010 (Georgia State Department of Education, 2010c). John Bridges, Georgia's State Director of Agricultural Education, requested from the secondary agricultural education instructors the individual agricultural education students' GHSGT science test scores, IEP status, number of agricultural education courses passed, SAE involvement ranking, and FFA participation ranking for their students who were enrolled in the junior class of 2009-2010 (Appendix 3). As a result of his request, 110 secondary agricultural education programs compiled and submitted the information which

included 4,221 agricultural education students (Appendix 4). The agricultural education students' individual GHSGT science test scores, IEP status, number of agricultural education courses passed, SAE involvement ranking, and FFA participation ranking along with the entire student population GHSGT science test scores were the units of analysis (Appendix 3).

Design of the Study

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. Students that passed one or more secondary agricultural education course were labeled as participants and students that passed three or more secondary agricultural education courses were labeled as concentrators (Georgia State Department of Education, 2010a).

The 70 questions on the science portion of the GHSGT measured students' competency in cells and heredity, ecology, structure and properties of matter, energy transformation, forces, waves, and electricity, and characteristics of science assessed in content domains. The GHSGT was considered to yield valid scores since Georgia high school teachers and curriculum specialists selected the knowledge and skills assessed on the graduation tests which were based on state-adopted curriculum (Georgia State Department of Education, 2009). Steve Cramer, Associate Director of Test Scoring and Reporting Services, revealed that the Kuder-Richardson-20 reliability index of the science portion of the Spring 2010 GHSGT was .937 (S. Cramer,

personal communication, December 29, 2011). In addition to the Kuder-Richardson-20 test, the Cronbach's alpha index was 0.92 (Georgia State Department of Education, 2010b).

Treatment

As a result of NCLB mandates, each state began developing standards, assessments, and proficiency levels and 20 states administered mandatory graduation tests in 2004 (Gayler, Chudowsky, Hamilton, Kober, & Yeager, 2004). In Georgia, eleventh grade students were assessed in academic subjects of writing, English/language arts, mathematics, social studies, and science. Juniors taking the GHSGT in the academic school year 2009-2010 were required to pass all five standardized tests as a graduation requirement (Georgia Department of Education, 2011a).

The treatment tested in this study was secondary agricultural education courses passed, SAE involvement, and FFA participation of eleventh grade agricultural education students that completed the science portion of the 2009-2010 GHSGT. To estimate the appropriate sample size for a one-tailed t test, an online calculator was used (Soper, 2010). With the anticipated effect size (Cohen's d) of 0.5, desired statistical power level of 0.8, and probability level of 0.05, the minimum total sample size was 102. The treatment group included the agricultural education students from 110 agricultural education programs in Georgia who responded to John Bridges, Georgia's State Director of Agricultural Education, written and verbal requests for GHSGT research study information (Appendix 4). The control group was the first time test takers of the junior class of 2009-2010 which were assessed on the science portion of the GHSGT.

The GHSGT science portion has four performance level divisions to classify student achievement. The score levels are divided into "below proficiency (below 200), "basic

proficiency” (200 - 234), “advanced proficiency” (235 - 274), and “honors” (275 or above) (Georgia State Department of Education, 2011e).

The control group consisted of 97,364 students and was subdivided into 89,965 regular education students and 7,399 special education students. All students had a GHSGT science mean score of 238 with 10 percent below proficiency, 34 percent basic proficiency, 41 percent advanced proficiency, and 16 percent honors. Regular education students had a GHSGT science mean score of 241 with 7 percent below proficiency, 33 percent basic proficiency, 42 percent advanced proficiency, and 17 percent honors. Special education students had a GHSGT science mean score of 207 with 42 percent below proficiency, 37 percent basic proficiency, 17 percent advanced proficiency, and 3 percent honors (Appendix 2).

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

Measures of Student Achievement and Data Collection

The science portion of the 2009-2010 GHSGT was the instrument utilized to determine what relationships existed between number of agricultural education courses passed and science achievement of agricultural education participants and concentrators. Two, the science portion of the 2009-2010 GHSGT was the instrument utilized to determine what relationships existed between FFA involvement and science achievement of agricultural education concentrators. Third, the science portion of the 2009-2010 GHSGT was the instrument utilized to determine what relationships existed between SAE participation and science achievement of agricultural education concentrators. Fourth, the science portion of the 2009-2010 GHSGT was the

instrument utilized to determine what relationships existed between science achievement of regular education and special education agricultural education concentrators compared to non-agricultural regular education and special education students. Fifth, the science portion of the 2009-2010 GHSGT was the instrument utilized to determine what relationships existed between science achievement of agricultural education program concentrators compared to agricultural education program participants.

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 record on the information chart (Appendix 3). From this information, the researcher used PASW computer software program to categorize students into agricultural education participant or agricultural education concentrator. As defined by the Georgia Department of Education, an agricultural education program participant is a high school student who has passed one or more secondary agricultural education courses and an agricultural education concentrator is a high school student who has passed three or more secondary agricultural education courses (Georgia Department of Education, 2010a).

To determine the GHSGT science scores and IEP status, agricultural education instructors listed the GHSGT scores and IEP status 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 and IEP status for each agricultural education student to record on the information chart (Appendix 3).

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 concentrators 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 (Appendix 3).

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 (Appendix 3).

The science portion of the 2009-2010 GHSGT was the instrument utilized to determine what relationships existed between science achievement of regular education and special education agricultural education concentrators compared to non-agricultural regular education and special education students. The GHSGT science scores of regular education and special education agricultural education were listed by the agricultural education instructors on the information chart (Appendix 3). The GHSGT science scores for the state of Georgia of first time test takers regular education and special education students were compiled on the Student Population Summary for GHSGT Science for 2009 – 2010 (Appendix 2) provided by Dr.

Melodee Rose, Director of Assessment Research and Development Division for the Georgia Department of Education (M. Rose, personal communication, June 15, 2011).

Data Analysis

To guide this investigation concerning student achievement, six research questions were identified and developed at the onset. *Predictive Analytical SoftWare (PASW) 18.0* and *Microsoft Excel 2007* were computer software programs utilized to statistically analyze data gathered for this study. Research questions one through three focused on several key areas of agricultural education programs to determine if relationships were evident between these key areas and student performance on the science portion of the GHSGT. The key areas of agricultural education analyzed were: number of agricultural education courses passed, FFA participation, and SAE activities. Furthermore, research question four concentrated on determining if relationships were exhibited between agricultural education concentrators who received special education services and their performance on the science portion of the GHSGT when compared to non-agricultural education students who received special education services and their performance on the science portion of the GHSGT. Equally important, research question five studied whether relationships were apparent between agricultural education concentrators who were regular education students and their performance on the science portion of the GHSGT when compared to non-agricultural education students and their performance on the science portion of the GHSGT.

Research questions one through three concentrated on determining if relationships were evident between the main areas of agricultural education programs and student achievement as measured by the science portion of the GHSGT. The dependent variable was science scores of agricultural education students which was interval data. The independent variables for the three

questions were number of agricultural education courses passed, FFA participation, and SAE activities which were nominal data. The statistical test utilized to analyze the means of GHSGT science score was analysis of variance (ANOVA) general linear model (GLM) because only one independent variable and one dependent variable were analyzed using independent samples (Huck, 2008). An additional test engaged to determine if relationships existed between these variables was point-biserial correlation coefficient (Ary & Jacobs, 1976).

Research question four focused on determining if relationships were exhibited between agricultural education concentrators who received special education services and their performance on the science portion of the GHSGT when compared to non-agricultural education students who received special education services and their performance on the science portion of the GHSGT. The dependent variable was science scores of agricultural education students which was interval data. The first independent variable was number of agricultural education courses passed which was nominal data and the second independent variable was special education status which was nominal data. The statistical test utilized to determine the relationship by analyzing the means of GHSGT science scores was one sample *t* tests (Ross and Shannon, 2008). An additional test engaged to determine if relationships existed between these variables was point-biserial correlation coefficient (Ary & Jacobs, 1976).

Research question five focused on determining if relationships were exhibited between agricultural education concentrators who were regular education and their performance on the science portion of the GHSGT when compared to non-agricultural education students who were regular education and their performance on the science portion of the GHSGT. The dependent variable was science scores of agricultural education students which was interval data. The first independent variable was number of agricultural education courses passed which was nominal

data and the second independent variable was special education status which was nominal data. The statistical test utilized to determine the relationship by analyzing the means of GHSGT science scores was one sample *t* tests (Ross and Shannon, 2008).

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. *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.

Results

The control group consisted of 97,364 secondary school students in the eleventh grade that completed the GHSGT science exam for the first time in the spring of 2010. The regular education student population totaled 89,965 (92.5%) with 6,298 (7%) in the GHSGT science exam category of below proficient and the special education student population totaled 7,399 (7.5%) with 3,107 (42%) in the GHSGT science exam category of below proficient.

The treatment group consisted of 4,221 agricultural education secondary school students in the eleventh grade that completed the GHSGT science exam for the first time in the spring of 2010. The regular education student population totaled 3,665 (87%) with 73 (2%) in the GHSGT science exam category of below proficient and the special education student population totaled 556 (13%) with 72 (20%) in the GHSGT science exam category of below proficient. Agricultural education participants numbered 2,692 (64%) including 2,345 (64%) regular education with 47 (2%) in the GHSGT science exam category of below proficient and 347 (13%) special education with 76 (22%) in the GHSGT science exam category of below proficient. Agricultural education concentrators totaled 1,529 including 1,320 (86%) regular education with

26 (2%) in the GHSGT science exam category of below proficient and 209 (14%) special education with 39 (19%) in the GHSGT science exam category of below proficient.

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%).

Conclusions

Research Question One

Research question one focused on determining the relationship between number of agricultural education courses passed and science achievement as measured by GHSGT of regular education agricultural education participants and concentrators. This study found that regular education agricultural education concentrators (n=1,320) had a higher GHSGT science mean score of 240.65 than regular education agricultural education participants (n=2,345) with a GHSGT science mean score of 238.77. An ANOVA test was performed between the two groups and was statistically significant ($F_{(1, 3664)} = 3.883, p = .049$) at a *priori* alpha level of .05 although the effect size was .1 which was small. A point-biserial correlation test did reveal a low, but positive and statistically significant relationship between the number of agricultural education courses passed and GHSGT science scores of all regular education students. As a result, the null hypothesis (H_0) was rejected; therefore, the number of agricultural education courses passed did have a statistically significant relationship with science achievement on the GHSGT. These findings were comparable to results depicted by Levesque, Wun, and Green (2010) that concluded agricultural education concentrators scored higher than or not measurable different from non-concentrators on the national assessment of education progress (NAEP) science test. An additional study conducted by Ricketts, Duncan, and Peake (2006) found that agricultural education students attained higher GHSGT science scores because of involvement in agricultural education courses.

Research Question Two

Research question two dealt with determining the relationship between FFA involvement and science achievement as measured by GHSGT of regular education and special education agricultural education concentrators. The null hypothesis was the science achievement of regular education and special education agricultural education concentrators who have a medium to high intensity level in FFA activities will not differ statistically significantly (i.e., $p > .05$) from regular education and special education agricultural education concentrators who have a low intensity level in FFA activities. 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. As a result, the null hypothesis (H_02) failed to be rejected; 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.

Research Question Three

Research question three concentrated on determining the relationship between SAE participation and science achievement as measured by GHSGT of regular education and special education agricultural education concentrators. The null hypothesis was the science achievement of regular education and special education agricultural education concentrators who have a medium to high intensity level in SAE activities will not differ statistically significantly (i.e., $p > .05$) from regular education and special education agricultural education concentrators who have a low intensity level in SAE activities. 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. As a result, the null hypothesis (H_03) failed to be rejected; 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.

Research Question Four

Research question four investigated how science achievement on GHSGT of special education agricultural education concentrators compared to non-agricultural special education students. The null hypothesis was the science achievement of special education students who are agricultural education program concentrators will not differ statistically significantly (i.e., $p > .05$) from special education non-agricultural education students in GHSGT science scores. Agricultural education concentrators who received special education services (N=209) had a GHSGT science mean score of 215.91. Non-agricultural education students who received special education services for the state of Georgia (N=7,399) had a GHSGT science mean score of 207. A one sample t test was performed between the two groups and was statistically significant ($t_{(208)} = 5.163, p < .001$) at a *priori* alpha level of .05. The Cohen d test revealed a small to medium effect size (.357). As a result, the null hypothesis (H_{04}) was rejected; therefore, special education students who were agricultural education concentrators did have a statistically significant relationship with science achievement on the GHSGT. These findings were comparable to results depicted by Easterly III and Myers (2011) which concluded that inquiry-based instruction in agricultural education was a supportive technique of instruction for special needs students.

Research Question Five

Research question five studied how science achievement on GHSGT of regular education agricultural education concentrators compared to non-agricultural regular education students. The null hypothesis was the science achievement of regular education students who are agricultural education program concentrators will not differ statistically significantly (i.e., $p > .05$) from regular education non-agricultural education students in GHSGT science scores.

Agricultural education concentrators who were regular education students (N=1,320) had a GHSGT science mean score of 240.65 and non-agricultural education students who were regular education for the state of Georgia (N=89,965) had a GHSGT science mean score of 241. A one sample *t* test was performed between the two groups and was not statistically significant ($t_{(1319)} = -0.462, p = .644$) at a *priori* alpha level of .05. Calculating the effect size was not necessary due to lack of statistical significance. As a result, the null hypothesis (H_0) failed to be rejected; therefore, regular education students who were agricultural education concentrators did not have a statistically significant relationship with science achievement on the GHSGT. Although the hypothesis failed to be rejected, the scores of non-agricultural education students and agricultural education students had less than one point difference. These findings were comparable to results depicted by Theriot and Kotrlik (2009) which found that on the graduate exit exam (GEE) of Louisiana, science achievement of agricultural education students were at least equal to the science achievement scores of non-agricultural education students. However, the findings were not similar to research conducted earlier by Chiasson and Burnett (2001) which found that on the science portion of the GEE agricultural education students obtained higher scores than non-agricultural students.

Recommendations

This study determined that secondary special education students enrolled in three or more agricultural education courses improved science achievement on the standardized GHSGT exam. Therefore, additional research is recommended for examining other areas of academic achievement such as math and English, as well as determining if other career and technical programs have a positive outcome on academic achievement.

This study was inconclusive about academic achievement of regular education agricultural education students. Although the mean test scores of regular education for the entire state of Georgia were higher than agricultural education concentrators, the failure rate was lower for agricultural education concentrators than Georgia students. Another area of concern was the low percentage of agricultural education students in the honors GHS GT category. Therefore, additional research is recommended for examining these discrepancies.

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.

Further investigations must extend beyond Georgia to determine relationships between agricultural education students and student academic achievement across the nation. Standardized assessments are delivered as graduation exams, EOCTs, and career readiness exams whereas each state can replicate this study to determine if classroom instruction, FFA and SAE enhances student academic achievement.

Practices

As a result of regular education agricultural education concentrators scoring statistically significantly higher on the science portion of the GHS GT than regular education agricultural participants, agricultural education students should be encouraged to pass three or more

secondary agricultural education courses. Likewise, special education agricultural education concentrators scored statistically significantly higher than non-agricultural education special education students on the science GHSGT. Special education students must be advised to pass three or more agricultural education courses.

Limitations

This study had the following limitations. One, the ranking of FFA and SAE intensity levels were reported by individual agricultural education teachers and were subjective although guidelines were given for ranking purposes. Two, the GHSGT science exam was the standardized testing instrument used to assess science achievement. Three, each individual agricultural education teacher requested the GHSGT science exam scores and number of agricultural education courses passed from guidance counselors, recorded and submitted information. Four, the test is generalized to eleventh grade students from Georgia. Five, only 110 out of 180 secondary agricultural education programs were represented in the data.

Implications

The implications were that science achievement of regular education and special education agricultural education concentrators were improved with involvement in secondary agricultural education programs by participating and passing three or more agricultural education courses. Since congress passed NCLB, school systems are held accountable for adequate academic achievement of all students (Linn, Baker, & Betebenner, 2002). According to research, teaching strategies taught in agricultural education programs such as problem solving (Pate & Miller, 2011), inquiry- based (Myers & Dyer, 2006; Thoron & Myers, 2011), integrated curriculum (Parr, Edwards, & Leising, 2006; Stone, Alfeld, Pearson, Lewis, & Jensen, 2006), and contextual learning (Balschweid, 2002) improved academic performance.

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). Youth organizations provided motivation for students to excel by linking course standards to competitive events (Threton & Pellock, 2010).

Major Contributions of this Study

Few empirical studies existed concerning academic achievement on standardized state-wide tests of secondary agricultural education students (Chiasson & Burnett, 2001; Levesque, Wun, & Green, 2010; Ricketts, Duncan, & Peake, 2006; Theriot & Kotrlik, 2009). Many recent studies suggested more empirical research be conducted about academic achievement of regular education and special education students (Eisenman, 2000; Ramsey & Edwards, 2004; Wilson & Curry, Jr, 2011). This study utilized data generated from every public high school in Georgia and 110 public high school agricultural education programs with a focus on determining if agricultural education programs had a relationship with academic achievement. The major contribution of this study was to provide data that supported the claims that agricultural education programs contributed to the academic education of all students.

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Appendix 1

Dear Ms. Clark,

Your revisions to your protocol entitled "Science Achievement of Secondary Students That Have Completed the Agriscience Courses" have been reviewed. The protocol has now been approved as "Exempt" under federal regulation 45 CFR 46.101(b)(4).

This e-mail serves as official notice that your protocol has been approved. Please conduct your study at your convenience. A formal approval letter will not be sent unless you notify us that you need one.

By accepting this approval, you also accept your responsibilities associated with this approval. Details of your responsibilities are attached. Please print and retain.

Your protocol will expire on February 10, 2012. Put that date on your calendar now. About three weeks before that time you will need to submit a final report or renewal request. (You may want to consider sending yourself a reminder e-mail to be received early next January.)

If you have any questions, please let us know.

Best wishes for success with your research!

Susan

Office of Research Compliance
307 Samford Hall
Auburn University, AL 36849
(334) 844-5966
hsubjec@auburn.edu

Appendix 2

STUDENT POPULATION SUMMARY Science Spring 2010

Date Printed: 12MAY10

Groups	N Tested	Stdnd Admin	Cond* Admin	Mean Scale Score	% Below Prof	% Basic Prof	% Adv Prof	% Honors
All Students	107078	107078	0	235	13	34	38	15
All Regular Program Students	97504	97504	0	239	10	34	40	16
English Language Learners (ELL)	1614	1614	0	206	42	43	13	3
ELL-Monitored	467	467	0	230	12	45	35	8
Section 504	447	447	0	236	12	36	36	15
Migrant Certified	100	100	0	222	24	37	33	6
Other Regular Program Students	94996	94996	0	239	9	34	41	16
All Special Ed	9574	9574	0	203	48	35	14	3
Visually Impaired	39	39	0	228	8	56	28	8
Deafness/Hard of Hearing	136	136	0	196	60	26	11	3
Deaf/Blind	7	7	0	-	-	-	-	-
Spec Learning Disabilities	4480	4480	0	205	43	40	15	2
Mild Intellectual Disability	1003	1003	0	177	89	9	1	0
Traumatic Brain Injury	41	41	0	203	44	37	20	0
Mod/Sev/Prof Intell. Dis.	20	20	0	175	90	10	0	0
Autism	330	330	0	226	31	29	22	18
Orthopedic Impairments	63	63	0	215	32	38	24	6
Speech/Language Disability	148	148	0	210	39	40	16	5
Emotional/Behavioral Disorder	1406	1406	0	203	49	34	14	3
Other Health Impairments	1918	1918	0	208	41	38	17	4
Gender								
Female	54980	54980	0	233	13	38	38	12
Male	51957	51957	0	238	13	31	38	17
Ethnic Group								
Asian/Pacific Islander	3648	3648	0	253	6	22	43	30
Black/Non-Hispanic	42377	42377	0	223	21	43	30	6
Hispanic	8685	8685	0	229	17	39	34	10
Native American/Alaskan Native	306	306	0	231	15	35	40	10
White/Non-Hispanic	49275	49275	0	246	6	27	45	21
Multiracial	2621	2621	0	240	9	34	41	17
Diploma Endorsement Sought								
Tech Prep/Vocational	15787	15787	0	210	34	46	18	2
College Preparatory	46318	46318	0	241	9	32	42	17
Dual Seal	9730	9730	0	240	8	34	42	16
Special Education	700	700	0	175	90	8	2	0
All Students with Accommodations	9833	9833	0	202	50	36	12	2
ELL Accommodated	1263	1263	0	204	45	42	11	2
ELL-Monitored Accommodated	134	134	0	228	17	41	34	8
All Special Education Accommodated	7910	7910	0	200	53	34	11	2
Section 504 Accommodated	177	177	0	228	16	42	31	11
All Grade 11 First Time Test Takers	97364	97364	0	238	10	34	41	16
Grade 11 First Time Regular Program	89965	89965	0	241	7	33	42	17
Grade 11 First Time Special Education	7399	7399	0	207	42	37	17	3
Grade 11 First Time ELL	1181	1181	0	210	36	45	16	3
PTNA	60							
Invalidations, inc PIV	15							

For privacy and reliability reasons, scores are reported only for groups with 10 or more students.
 *-Students with Conditional Administrations do not contribute to the Mean Scale Score and Percents.
 Percent Proficient and Advanced may not correspond to AYP reports.

Appendix 3

Agricultural Education Courses and Georgia High School Graduation Test						
Student initials These students are seniors and have completed agricultural education courses during their high school career.	Highest score achieved on the Science portion of GHSQT test	Number of test attempts	Did student have an IEP?	Number of agricultural education courses passed	SAE participation On a scale of 1 (lowest) to 5 (highest), rate the level of SAE.	FFA participation On a scale of 1 (lowest) to 5 (highest), rate the level of FFA participation.

School _____

Teacher completing chart _____

Region _____ Area _____

Below are the directions for completing the form. Only one list of students per school should be completed.

1. Assisting the counselors, testing coordinators, or assistant principals, identify the seniors who have passed any agricultural education courses in their high school careers.
2. List initials or other identifying code on form.
3. Record highest GHSGT science score.
4. Record total number of agricultural education courses passed throughout high school.
5. Record if student has an IEP.
6. Determine Supervised Agricultural Experience (SAE) participation level on a scale from one to five. For example, a student with 10 or less hours per semester is a level one, 11 to 20 hours per semester a level two, 21 to 30 hours per semester a level three, 31 to 40 hours per semester a level four, and a student that works 50 or more hours per semester on an SAE is a level five.
7. Determine FFA participation on a scale from one to five. For example, a student that participates in one FFA activity is a level one, two FFA activities is a level two, three FFA activities is a level three, four activities is a level four, and five or more activities is a level five. (Examples of FFA activities are chapter meetings, CDEs, leadership camps, livestock competitions, etc....)
8. Submit the information using **one** of the following options:
 - a. complete the electronic survey at this web address
<https://spreadsheets.google.com/viewform?formkey=dDJKMHptVkFualZNNjV0MUtxQmXNZIE6MQ>
 - b. fill out the attached chart and email to sclark@gcbe.org
 - c. mail the attached chart to Sara Clark, 7340 Fairmount Highway, Calhoun, GA 30701.

Appendix 4

Schools that have completed GHSGT and Agricultural Education information

Return rate of total number of schools in Georgia with secondary agricultural education programs was $110/180 = 61\%$.

North Region

Return rate of total number of schools in north region with secondary agricultural education programs was $49/82 = 60\%$.

Schools

Adairsville

Alcovy

Alexander

Arabia Mountain

Banks

Cass

Chattooga County

Cherokee County

Creekside

Dawson

East Hall

East Jackson

Elbert

Etowah

Fannin

Floyd County

Forsyth

Franklin

Gordon Lee

Haralson County

Hart

Jackson

Jefferson High

Lafayette

Lakeview-Ft. Oglethorpe

Loganville

Monroe Area

Newton County

North Forsyth

North Murray

Northwest Whitfield

Oglethorpe County

Paulding County

Pepperell

Pope

Rabun

Ridgeland

Rockdale

Rockmart

Sonoraville

Southeast Whitfield

Stephens County

Towns

Union

Walnut Grove

Washington-Wilkes

White

Winder – Barrow

Woodland

Central Region

Return rate of total number of schools in central region with secondary agricultural education programs was $40/52 = 77\%$.

Schools

Bryan

Central Education Center

Claxton

Crawford

Dooly

Dutchtown

Eagles Landing

East Laurens

Evans

Fayette County

Glascock

Harris

Henry

Hephzibah

Houston
Jasper County
Jefferson County
Jenkins County
Johnson County
Locust Grove
Manchester
Northside
Ola
Peach County
Perry
Pike
Portal
Putnam
Schley County
Screven
Southeast Bulloch
Stockbridge
Tattnall
Thomson
Toombs County
Treutlen
Troup
Union Grove
Warner Robins

West Laurens

South Region

Return rate of total number of schools in south region with secondary agricultural education programs was $21/48 = 44\%$.

Schools

Americus/Sumter South

Bacon County

Baconton

Cario

Charlton

Coffee

Colquitt

Crisp

Early County

Echols

Fitzgerald

Irwin

Lanier

Lee

Liberty

Lowndes

Telfair

Ware

Wayne County

Webster County

Windsor Forest