THE SELECTIVE EFFECT OF GEORGIA MIDDLE SCHOOLS AGRICULTURAL EDUCATION CURRICULUM ON STUDENT PERFORMANCE IN THE SCIENCE CRCT

by

JAMIE STEVENS

(Under the Direction of Dennis Duncan)

ABSTRACT

"As a part of the overall educational program, agriculture education is designed to provide students with competencies to make them aware of and prepared for the world of work. Agriculture is a dynamic, rapidly changing industry that has an exciting future" (Georgia Department of Education, b, 2005-2007, ¶1).

To determine the effect that Agricultural Education curriculum has in middle schools student performance in science, this descriptive study compared science knowledge among middle school students in Georgia who were enrolled in schools with and without Agricultural Education programs. To quantify the science knowledge and skills of students, the researchers used the state's annual Criterion-Referenced Competency Test (CRCT) (science), mandatory for all students in middle schools. This quantitative study evaluated the relationship between fifty-one Georgia middle schools with an agricultural education curriculum versus fifty-one without an agricultural education curriculum. The post-test evaluation tool focused on science standards as measured by the annual CRCT. The researcher observed that middle school science and agriculture education standards are similar. This research was conducted to determine the extent to which agricultural education curriculum in Georgia middle schools enhance student performance on an annual science comprehension test.

INDEX WORDS: Agricultural Education, CRCT, Supervised Agricultural Experience Program, National FFA Organization, Career Development Event, Curriculum Integration

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This project gave me an inside look to determine if agricultural education on the middle school level has any effect on our students. After teaching Georgia's agricultural education for four years, I feel that students have benefited from the curriculum, integration of science, Career Development Events, Supervised Agricultural Experiences, and leadership activities of the National FFA Program. This study presented an opportunity to uncover personal bias concerning the benefits of agricultural education.

I want to thank the agricultural education and leadership professors who have contributed to my learning: Dr. Jason Peake, Dr. Brian Parr, Dr. Maria Navarro, Dr. John Ricketts, Dr. Richard Rohs, and Dr. Dennis Duncan. I owe a special thanks to Dr. Dennis Duncan, Dr. Maria Navarro, and Dr. John Ricketts for there support and assistance in completing this document. Without their patience and sincerity, I would have been lost throughout the process.

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CHAPTER 1

INTRODUCTION

Purpose of the Study

According to the US Environmental Protection Agency September 2007 report, 98 percent of United States citizens do not live on a farm or 99 percent do not engage in agriculture production (¶1). This departure from the land has contributed to the gradual decline of agricultural literacy in America. Lack of knowledge supports the need for agricultural education in today's schools.

> Traditionally, students have been strongly encouraged at the high school level to consider careers and choose courses that would fortify occupations of interest. Today, Administrators and Educators across the nation realize that developing students' interest must be addressed earlier—at the middle school level. Agricultural educators believe this to be true and are working to grow middle school agriculture education (Gibbs, 2005, p 1).

The Georgia Middle School Agricultural Education Curriculum was developed to inform students about the agricultural industry. A committee for middle school improvement programs and the Georgia Department of Education (2005) designed the middle school curriculum to integrate other academic discipline for sixth, seventh, and eighth grade to develop more relevance to careers in the real world (p. 3). Agricultural literacy is important for everyone, those planning a career in agriculture as well as every consumer (GA Middle School Ag Ed Program Guide, Jan 2005, p. 2). Currently, Georgia has fifty-one middle school programs in grades six through eight to explore agriculture and related careers using three components: (1) classroom and laboratory, (2) Supervised Agricultural Experience Program (SAEP), and (3) National FFA Organization leadership activities. The agricultural education program at the middle school level interests students to learn more, provides real-life connections in classroom

and laboratory experiences, and promotes the idea that success in the future starts now (Gibbs, 2005, p 7).

Once agricultural education had been incorporated into middle school connection classes, educators requested integration of academic and applied concepts. Connecting what students learn through interdisciplinary links in school, real-world connections, and connections to the real world of work has been recommended by the American Association for the Advancement of Sciences. Research findings have supported that the integration of science into an agriculture curriculum is a more meaningful way to teach science. Students taught by integrating agricultural and scientific principles demonstrated higher achievement versus students taught by traditional approaches (Balschwied and Thompson, 2000, p. 1). Students demonstrated higher achievement when taught an integrated agricultural science curriculum, when compared to students instructed by traditional methods.

Rationale

The researcher's observations of sixth through eighth grade science Georgia Performance Standards, in comparison to the middle school agricultural education curriculum, suggest middle school science and agricultural education acquire similar skills and knowledge. The question is whether the assimilation of knowledge and skills translates into student performance on a comprehension test.

Problem Statement

To what extent does an agricultural education curriculum in Georgia middle schools enhance student performance on an annual science comprehension test?

Purpose

The researcher proposes to evaluate the relationship between Georgia middle schools with an agricultural education curriculum versus those without an agricultural education curriculum using the annual CRCT education model bringing focus on science standards taught in agricultural education.

Null Hypothesis

There will be no difference in passing rates on the science component of the CRCT for Georgia middle schools with agricultural education curriculum versus those without agricultural education curriculum.

Alternative Hypothesis

Georgia middle schools with agricultural education curriculums will suggest having a higher percentage passing rate in the science comprehension test (CRCT) than Georgia middle schools without an agricultural education curriculum.

Scope of the Study

The scope of this study will include fifty-one Georgia middle schools with an agricultural education curriculum and fifty-one Georgia middle schools without an agricultural education curriculum. The fifty-one GA middle schools without an agricultural education curriculum will be chosen by similarities in socio-economical indicators to the fifty-one GA middle schools with agricultural education curriculums. Data sets from the 2004-2006 academic calendar years were retrieved from the Georgia Department of Education website.

Assumptions

The following assumptions will be made concerning this study:

1. The instruction provided by all Georgia middle schools will be similar in quality.

2. The teachers will not purposefully influence the outcome of the experiment.
3. All agricultural teachers at the middle school level are certified to teach agricultural education.
4. The economic and social status of all schools in this study will be comparable.

Limitations of the Study

The limitations of this study are due to the small size of the study group. Also, this study will be based on 102 Georgia middle schools that were pre-assembled. Therefore, this study cannot be generalized to any population other than the ones participating.

Significance of the Study

Georgia government recently placed financial limitations on adding agricultural education to public schools. Several schools are attempting to add an agricultural education program, but, without financial support from state grants, the schools cannot afford to successfully initiate an agricultural education program. If the effects of the middle school agricultural education program positively influence core educational objectives, then middle schools may choose to adopt the agricultural education program into the academic, intra-curricular programs. This study may also provide significant evidence that financial funding is needed to develop agricultural education programs in middle schools throughout the state of Georgia.

Definitions of Terms

1862 Morrill Act –An Act donating Public Lands to the several States and Territories which may provide Colleges for the Benefit of Agriculture and the Mechanic Arts. Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there be granted to the several States, for the purposes hereinafter mentioned, an amount of

public land, to be apportioned to each State a quantity equal to thirty thousand acres for each senator and representative in Congress to which the States are respectively entitled by the apportionment under the census of eighteen hundred and sixty: Provided, That no mineral lands shall be selected or purchased under the provisions of this act. (U.S. Statutes at Large 12, 1862, p. 503)

Agricultural Education – "the total structure and content of agricultural education at a school; includes classroom and laboratory instruction, supervised agricultural experience (SAE) programs, FFA leadership activities and more" (Committee for Middle School Improvement Progress and the GA Department of Education, 2005, p. 5)

Average Yearly Progress – (AYP) "is a measurement defined by the United States federal No Child Left Behind Act that allows the U.S. Department of Education to determine how every public school and school district in the country is performing academically" (Wikipedia, 2007, ¶1)

Career Development Event – (CDE) competitive activities that recognize student achievements and prepare students for careers in the agriculture, food, fiber, and natural resources industry (National FFA Organization, b, 2006, 1)

CRCT – (Criterion-Referenced Competency Test) is designed to measure the student's level of skills and knowledge described in the Georgia Performance Standards (GPS) and the Quality Core Curriculum (QCC) (GA Department of Education, c, 2005-2006, ¶1)

Curriculum – any educational experience planned and guided by the school (Smith, 2000, ¶2)

Curriculum Integration – helps students make connections between academic and technical information, to help them discover the answer to "Why do I have to learn this?" (Zirkle, 2004, p. 1)

Georgia Performance Standards (GPS) - instructional objectives that prescribe a more in-depth study of knowledge and skills (Paulding County School District, 2005, p. 1)

Hatch Act of 1887 – gave federal land grants to states in order to create a series of agricultural experiment stations that became connected with land-grant state colleges and universities founded under the Morrill Act of 1862 (Wikipedia, 2007, ¶1)

Middle School Agricultural Education Programs - There is a broad spectrum of career opportunities in the agricultural industry and the many related fields. The middle school program is intended to give students an overview of these opportunities. (Committee for Middle School Improvement Progress and the GA Department of Education, 2005, p. 5)

Middle School Students - students in sixth through eighth grade

National FFA Organization – is an intra-curricular organization dedicated to making a positive difference in the lives of students by developing their potential for premier leadership, personal growth, and career success through agricultural education (National FFA Organization, a, 2007, p. 1)

Smith-Hughes Act of 1917 – an act to provide for the promotion of vocational education; to provide for cooperation with the States in the promotion of such education in agriculture and the trades and industries; to provide for cooperation with the States in the preparation of teachers of vocational subjects; and to appropriate money and regulate its expenditure. (Federal Bureau of Vocational Education, 1917, p. 1)

Smith-Lever Act of 1914 – is a United States federal law that established a system of cooperative extension services in order to inform people about modern agriculture and home economic development (Wikipedia, 2007, ¶1)

Supervised Agricultural Experience – (SAE) is a planned practical agricultural activity which supports skill and competency development, career success and application of specific agricultural and academic skills a student has learned through classroom instruction in agricultural education (National FFA Organization, c, 2007, p. 3-4)

United State Department of Agriculture - (USDA) is a United States Federal Executive Department that develops and executes policy on farming, agriculture, and food (Wikipedia, 2007, ¶1)

CHAPTER 2

REVIEW OF LITERATURE

Introduction

The objective for this chapter is to present a review of the literature for this research study. This review will highlight the importance of middle school agricultural education programs and identify the relationship between agricultural education and science courses at the middle school level. The review is divided into the following sections: (1) History of Agricultural Education, (2) Agricultural Education Curriculum, (3) Development of GA Agricultural Education, (4) Georgia Agricultural Education Program, and (5) Integration of Science and Agricultural Education.

> "Today, nearly 70 percent of inner city fourth graders are unable to read at a basic level on national reading tests. Our high school seniors trail students in Cyprus and South Africa on international math tests. And nearly a third of our college freshmen find they must take a remedial course before they are able to even begin regular college level courses." (Bush, George W. Presidents, p. 1)

History of Agricultural Education

Benjamin Franklin promoted teaching agriculture in every town as early as 1749 (Shelby-Tolbert, Conroy, & Dailey, 2000, p. 51). Beginning in the early 1800's, government officials elicited strong support for more agricultural instruction in the education system nationally (Hillison, 1989, p 7). Between 1821 and 1823, the first high school agriculture program was opened at Gardiner, Maine, followed by others in both Maine and Massachusetts (Shelby-Tolbert, Conroy, & Dailey, 2000, p. 51). Congress developed the Department of Agriculture for the distribution of agricultural information in 1862. Later that year, James Morrill's restructured

Morrill Act was passed initiating federal government's policy to develop schools for agricultural vocational education areas at the post secondary level. According to Herren and Hillison (1996), the road to establishing land grant universities was bumpy (p. 26). Agricultural education teachers almost began at normal schools instead of land grant universities. "This decision was one which placed agricultural education teachers closer to their agricultural subject matter specialist and not as close to the pedagogical specialist," (Herren & Hillison, 1996, p. 26). With the increased knowledge of the agricultural industry, a need for more detailed scientific research evolved. As part of the scientific revolution in agriculture, the Hatch Act of 1887 was passed to begin experiment stations in the United States (Wikipedia, March 2007).

Government support continued to increase throughout the late 1800s and early 1900s. In 1914, the Smith-Lever Act created an agricultural club for student and agricultural support for the community through the Cooperative Extension Service. The importance of agricultural knowledge and skill led to more learning to students through classroom experience. In a response for more technical knowledge and skill, the Smith-Hughes Act of 1917 financed vocational agricultural education in high schools throughout the United States (Federal Bureau of Vocational Education, 1917, p. 1). The development of agricultural technology led to the use of modern farming methods, creation of larger farms and ranches, and increased the need for more agricultural science and education The Cooperative Extension Service and Agricultural Education were united in 1928 with Memorandum of Understanding Agricultural Education and Extension. This act guided responsibilities of each learning group to limit discretions (Jardine, W, & Davis, J, 1928, p. 2).

"The earliest reported eighth grade program was in Virginia in 1926. Seventh grade programs started in Vermont in 1930. Sixth grade programs started in Mississippi in 1974,"

(Rossetti and McCaslin, 2002, p 23). According to Rossetti and McCaslin's 2002 journal, *A Status Report on Middle Grade Agricultural Education and FFA Programs in the United States,* fourteen states officially created a core curriculum for middle school agricultural education. Eighteen states had middle school agricultural education but did not have a core curriculum at that time (p. 24). Even though few states or counties instruct students on agricultural education at the middle school level, the numbers of middle schools in the United States with agricultural education program are on a continual incline. According to Fritz and Moody's journal, *Assessment of Junior High/Middle School Agricultural Education Programs in Nebraska,* "although the respondents that did not have a junior high/middle school program wanted to add the program, the 'school class schedule' was the most frequently identified deterrent" (1997, p. 61).

Agricultural Education Curriculum

Agricultural education is dedicated to making a positive difference in the lives of students by developing their potential for premier leadership, personal growth and career success through agricultural education (National FFA Organization, 2006). It provides students with skills and agricultural knowledge needed to succeed in the workforce. "Agricultural education exposes students to a wide range of career choices. Agriculture is the largest industry in the United States involving twenty–two percent of the U.S. workforce," (GA Middle School Ag Ed Program Guide, Jan 2005, p. 6).

Agricultural education programs provide the education and training needed to serve the needs of the vast industry called agriculture (Martin, 2007, ¶ 35). Agricultural education consists of three intra-curricular components expressed in a Cornell University study by Shelby-Tolbert, Conroy, and Dailey (2000): 1) classroom and laboratory, 2) Supervised Agricultural

Experiences (SAE), and 3) FFA leadership activities (p. 52-53). Classroom and laboratory experiences introduce students to basic concepts and theories of agriculture and agribusiness. Students learn concepts and theories of agriculture and agribusiness within the classroom environment. This knowledge is transposed to laboratory experiences where students learn "hands-on" how the skills are practical and applicable (GA Dept of Ed, 2005-2006).

Through classroom and laboratory experiences, students gain applicable knowledge and skills needed in Supervised Agricultural Experiences (SAE). In SAE's, students learn and work in real-life situations where they receive on-the-job training. SAE's can evolve from home projects, employment in the agricultural industry to entrepreneurship experiences in production or agribusiness (GA Dept of Ed, 2005-2006).

Concepts, theories, and on-the-job skills are achieved in dealing with classroom, laboratory, and SAE. Students will also obtain intrapersonal and leadership skills through activities and events in the FFA organization. FFA promotes improvement in student performance through its awards programs in participation with school meetings and event, community service projects, and career development events (CDE). CDE's are an extension of the middle school agricultural curriculum that provide competitive activities to recognize student achievements and prepares students for careers in agricultural industry (National FFA Organization, 2006). Agricultural educators stress the problem solving and decision making approach to teaching so that students are better equipped to manage constant changes in agriculture and life (GA Dept of Ed, 2005-2006). Robert Martin (2007, ¶ 47) philosophically described agricultural educators as problem solvers that believe the world can be experienced through senses. "Therefore, learning to solve current, life-like problems is the best way to equip a person to effectively solve problems in the future" (Martin, 2007, ¶ 47).

Development of Georgia Middle School Agricultural Education

The theory base supporting this study is summarized best in Principle Six of the Caine and Caine (1994) *Brain Based (Compatible) Learning* framework. According to Caine and Caine, who's theory is similar to much of the empiricist conjectures relied upon by Agricultural Education (Dewey, 1938; Rogers, 1969; Kolb, 1984; Doolittle & Camp, 1999; 3 Roberts, 2006), the brain is designed to make sense of the world through experience with the big picture (agriculture) and by paying attention to the details of individual parts (science concepts).

A study provided by the Georgia Rural Development Council reinforced the need for middle school agriculture education programs in GA. In the February 2005 issue of *Techniques: Connecting Education and Careers*, polling almost 4,000 young students in 157 counties in GA revealed that 90 percent felt that agriculture was important, 60 percent have not had the opportunity to participate in leadership programs, 67 percent wished there were more after school activities available, and 60 percent wanted to learn skills needed to start a business (Gibbs, 2005, p 2). These results would not only increase interest in and basic knowledge of agriculture, but the February 2005 issue of *Techniques* reported the results would help to determine that agricultural education at this level could decrease the dropout rate, increase interest in science, math, and leadership, assist in integrating career connections and academics, involve more students in personal leadership development; and provide real-life experiences for students (Gibbs, 2005, p 2).

Georgia Agricultural Education Program

Customarily, students have been encouraged by educators at the high school level to consider careers and choose courses that would reinforce occupations of interest. Today, administrators and educators across the nation realize that cultivating students' interest must be

addressed earlier—at the middle school level. Agricultural educators believe this to be true and are working to expand middle school agricultural education (Gibbs, 2005, p 1).

In Rossetti and McCaslins's 2002 report, 30 states reported having middle school agricultural education programs (Rossetti and McCaslin, 2002, p 24). According to the Georgia Department of Education, agricultural education classes are available to any student in high school that provides an agricultural education program. As of 2005-2006 academic school year, Agricultural Education was taught in 175 high schools throughout Georgia. The Georgia agricultural education curriculum is designed to explore and stimulate interest in the agricultural industry among students enrolled in grades 6-12 (GA Dept of Ed, 2005-2006).

Integration of Science and Agricultural Education

"A sound science education is a prerequisite to preparation for the responsibilities of citizenship, the rigors of higher education and the demands of a competitive global economy," (Hogue & Ross, 2005, p. 5). Since the National Research Council recommended all students have an understanding of basic science concepts in 1988 through the publication of Understanding Agriculture: New Directions for Education, agricultural educators have experienced increased pressure to incorporate more science-based instruction (Shelby-Tolbert, Conroy, & Dailey, 2000, p. 51). This recommendation drove the creation and implementation of Agri-science in all areas of the curricula.

Shelby-Tolbert, Conroy, & Dailey (2000) performed a qualitative study funded by the National Science Foundation to examine necessary changes in agricultural education at the high school level, focusing on changes need to integrate agriculture and science for further experiential learning (54). Results showed efforts had been made to increase science-based instruction into the agricultural education program as a result of changing industry needs.

Participants in the study viewed agriscience as incorporating many of the biological and physical science concepts and theories that were taught in the traditional high school biology curriculum in a manner that included agricultural examples. Students are getting the strong science base, plus the practical application. (Shelby-Tolbert, Conroy, & Dailey, 2000, p. 55)

The results from the 2000 GA Rural Development Council study on the interest and need for agricultural education on the middle school level included two ties with academics and connection courses: increased interest in science, math, and leadership, and integration of career connections and academics. The American Association for the Advancement of Science recommended connecting what students learn through interdisciplinary links in school, real-world connections, and connections to the real world of work (Balschweid and Thompson, 2000, p. 1).

In *Integrating Science into Agriculture Programs: Implications for Addressing State Standards and Teacher Preparation* Programs, Thompson and Balschweid (2000) discussed how Oregon teachers perceived the impact of integrating science into agricultural education programs (p. 74). Thompson and Balschweid discovered teachers felt content with aligning science lessons in the agriculture program. Results from the five point Liker-type scale showed that "nothing" was the most common answer received when agricultural teachers in Oregon were asked what had to be in order to develop a more integrated science curriculum (Thompson and Balschweid, 2000, p. 76).

Agricultural Education, or Agri-science, in Georgia middle schools provides students with basic science concepts for applied learning. Middle school agriculture incorporates the three science courses taught on the middle school level: earth science, life science, and physical science. All three areas are directly linked to agriculture. Earth science is the study of soil; life

science is the study of plants, animals, and the environment; physical science is the study of simple machines, energy, and matter. The overall objective of agricultural education is to increase student knowledge about agriculture, while incorporating academia into those practical lessons.

Osborn and Dyer (1998) developed a five part questionnaire asking Illinois science teachers about the programs and the programs relationships. Results of the study indicated approximately one-half of the science teachers reported some collaboration with agriculture teachers. The greatest relationship transpired in the areas of sharing laboratory and teaching materials. "Science teachers felt that high school agriculture courses are beneficial for higher achieving students; stronger ties should be made between agriculture and science curricula; agriculture programs should become more science based; applied agricultural science courses make scientific principles more meaningful; and selected agriculture courses are appropriate for lab science credit." (p. 8-13)

Chiasson and Burnett (2001) developed a statewide study in Louisiana to determine if agriscience course made an impact on science achievement of high school students. (p. 42) This Louisiana studied view the science scores on the graduation test of 11th grade students (GEE). Results showed agriscience students participating in a complete program of agriscience education had higher scores than non-agriscience students in the science portion of the exam. Particularly, agriscience students scored higher on the scientific method, biology, earth science, and physics areas of the graduation tests. (Chiasson & Burnett, 2001, 64-68)

A Georgia study was developed by assistant professors at the University of Georgia to describe the science achievement of participants in complete programs of agriscience in Georgia. Ricketts, Duncan, and Peake (2006) created a secondary purpose to compare science

achievement of agriscience students to the science achievement of College Preparatory, Technology/Career Preparatory, and Average Student (state average). Results proved a low, but positive relationship between students who participated in agriscience and science scores on the GHSGT; the number of courses in agriscience a student participated in and first time passing rate of the GHSGT; level of FFA engagement and GHSGT science scores; and level of SAE engagement and GHSGT science scores. The study determined that students achieved higher science scores due to participating in an agriscience courses or activities, in comparison with those who did not participate. (Ricketts, Duncan, and Peake, 2006, p. 52-53)

CHAPTER 3

METHODOLOGY

Introduction

The purpose of this study is to compare science CRCT scores in middle schools with agricultural education programs to middle schools without agricultural education programs. The study results may support middle school agricultural education programs in Georgia by providing CRCT science statistics, thereby verifying the value of science integration. A quantitative, true- experimental design was chosen to provide stronger indications of causal effects of the project between the academic years of 2004-2006. Only two years were accessible due to lack of data throughout Georgia during the 2003-2004 academic year.

The methodology of group is a nonrandomized control group post-test design. The use of intact classes from the fifty-one middle schools with agricultural education programs does not provide for random selection. Fifty-one schools without agricultural education programs will be chosen for socio-economic similarities resulting in no randomized grouping. Therefore, this study cannot be generalized to any population other than those participating.

The schools will be classified into two separate groups. The experimental group will receive science instruction through integration in agricultural education. The control group will receive science instruction through traditional methods.

Instruction Review Board

Federal regulations and the University of Georgia policy require review and approval of all research involving human subjects before the study can begin. Approval from the University of Georgia IRB office has been received.

Population

The target population for this study consisted of Agricultural Education students enrolled in the fifty-one middle schools with Agricultural Education programs in Georgia, and all the students enrolled at fifty-one schools without Agricultural Education programs during the 2004-2005 and 2005-2006 academic years.

Sampling

At the end of spring semester 2006, fifty-one middle schools in Georgia provided their students with at least one course in Agricultural Education during the academic year. The fifty-one schools with Agricultural Education programs used in the study were a census of these schools. The list of schools was prepared using information from Georgia Agricultural Education webpage and information from the University of Georgia Agricultural Leadership, Education, and Communication department.

The fifty-one schools without Agricultural Education were selected by purposeful sampling (nonrandom): If there was a county with both a middle school with an Agricultural Education program and one without an Agricultural Education program, then the school without the Agricultural Education program was also selected (the other school had already been sampled as one of the fifty-one schools with an Agricultural Education program). The remaining schools without Agricultural Education programs were chosen to match as much as possible with

the remaining schools with Agricultural Education based on selected demographic and socioeconomic characteristics (percentage of students with disabilities, limited English proficiency, migrants, and free lunch).

Target Population and Sampling Frame

Most (but not all) students in schools with Agricultural Education programs were enrolled in Agricultural Education classes. [State] Agricultural Education programs in middle schools are pursuing many of the same aims stated by Frick (1993), and most have integrated middle school Agricultural Education into the general school curriculum. The result is that in [State] middle schools with Agricultural Education programs, Agricultural Education classes are incorporated into the class rotation for all students, and most students in the schools take agriculture classes. There are, however, exceptions to this rule, and not all students in these schools take Agricultural Education classes (band, chorus, or title students in some schools), thus making target population and sampling frames not equivalent.

Instrumentation

The No Child Left Behind Act (NCLB) of 2001 increased testing requirements for students of all ages and enacted the theories of standards-based education reform. The act requires states to individually develop criterion-based assessments. Along with the development of standards, Georgia developed the Criterion Referenced Competency Test (CRCT). (Wikipedia, Nov. 2007, p. 1)

A state created instrument, CRCT, designed to measure the students' level of skills and knowledge from the yearly curriculum is utilized as a post-test to determine treatment effect. Only results from the CRCT science test were reviewed. No direct contact will be made with

any of the studied groups. All information will be gathered through the GA Department of Education school report card webpage.

The test development process began with determining the purpose of the test through state legislature or the Georgia Department of education. "The CRCT program is designed to measure student acquisition of the knowledge, concepts, and skills set forth in the state curriculum. The testing program serves a dual purpose: 1) diagnosis of individual student and program strengths and weaknesses as related to instruction of the Georgia Performance Standards and 2) a measure of the quality of education in the state" (Cox, 2007, p 3). Once the purpose of the CRCT was established, a committee of Georgia educators was formed to review the curriculum and develop assessment.

Before the test was written, documentation identifying item format, content scope and limits, and cognitive complexity was created. The test was then written by qualified, professional assessment specialists employed specifically for creating Georgia tests. The Georgia committees reconvened to review the test for curriculum alignment, suitability, and potential bias (Cox, 2007, p 1).

Validity and Reliability

This study relies on the ability of the post-test and demographic information collected to establish homogeneity within the groups from the Georgia Department of Education website. To assess how well students acquired scientific knowledge and skills in both control and experimental group, a state summative test, CRCT, was utilized. The CRCT was developed and evaluated by a panel of experts for face and content validity.

> "Georgia law, as amended by the A+ Education Reform Act of 2000, requires that all students in grades one through eight take the CRCT in the content areas of reading,

> English/language arts, and mathematics. Students in grades three through eight are also assessed in science and social studies. The CRCT only assesses the content standards outlined in the GPS/QCC (Georgia Department of Education, a, 2005-2007, ¶ 2)

Reliability and accuracy were based on viewing assessments of summative, post test applied by other states. Procedures used in administering the CRCT were developed according to educational research as the most fundamental. "Key factors taken into consideration include number of answer choices, breaks during testing, and having certain aspects of the assessment read to students by the teacher" (Georgia Department of Education, a, 2005-2007, ¶ 7).

Data Collection

Data collection includes percentage of students that did not meet, met, or exceed knowledge on the CRCT science post-test in grades six through eight, school population of 6th through 8th graders, and school demographics through the Georgia Department of Education school report card webpage. The researcher averaged the experimental and control group data to develop a comparison between individual groups without identifying a specific school.

Data Analysis

Microsoft Excel was used to determine the average of science did not meet/met/exceed rate, overall student body in grade six, seven, and eight, and school demographics. Create a Graph website ™ was used to visually express the relationship between groups (Kids Learning with NCES Zone, 2007).

CHAPTER 4

RESULTS

Experimental Group

The experimental group was established through research into the Georgia Agricultural Education webpage with assistance from the University of Georgia Agricultural Education Department. At the end of spring semester 2006, fifty-one schools provided middle school students with at least one course in agricultural education throughout the academic year. These schools were individually researched through the Georgia Department of Education report card webpage to determine the individual school fall and spring semester grade level population within the school, demographic population of enrollment, and grade level science percentage for CRCT results for the academic years of 2005-2006 and 2004-2005. The school data were randomly labeled in numerical order.

Control group

Once data was collected and averages calculated for the demographics of the experimental group, fifty-one schools without an agricultural education program were chosen throughout Georgia. The researcher based participation of control group schools on similarities from demographics with the experimental group schools. If more than one middle school was located within a county, a school without an agricultural program was automatically included as a control group.

Georgia's agricultural education school system is divided into three regions (north, central, and south) with state directors managing each area. This division provides teachers with more assistance in intra-curricular instruction and allows more student exposure to Career Development Events. The researcher attempted to select equal numbers of control group schools and experimental group schools in each region. Once fifty-one non-agricultural education schools were chosen, the schools were individually researched through the Georgia Department of Education website to determine the individual school fall and spring semester grade level population within the school, demographic population of enrollment, and grade level science percentage for CRCT results for the academic years of 2004-2005 and 2005-2006. School data were randomly labeled in numerical order.

To build the "comparison" group, Georgia middle schools without an Agricultural Education program, the researcher chose middle schools based on similar demographics as the schools identified as having an Agricultural Education programs. Schools were prioritized first by location (same county as a middle school with an Agricultural Education program) and then selected by similar student demographics. The demographics used for this purposeful sampling were 1) percentage of students with disabilities; 2) percentage of students with limited English proficiency; 3) percentage of students receiving free lunch; and 4) percentage of students from migrant families. Figure 1 shows the level of similitude the two groups in the two school years studied regarding the demographics used for sampling purposes.

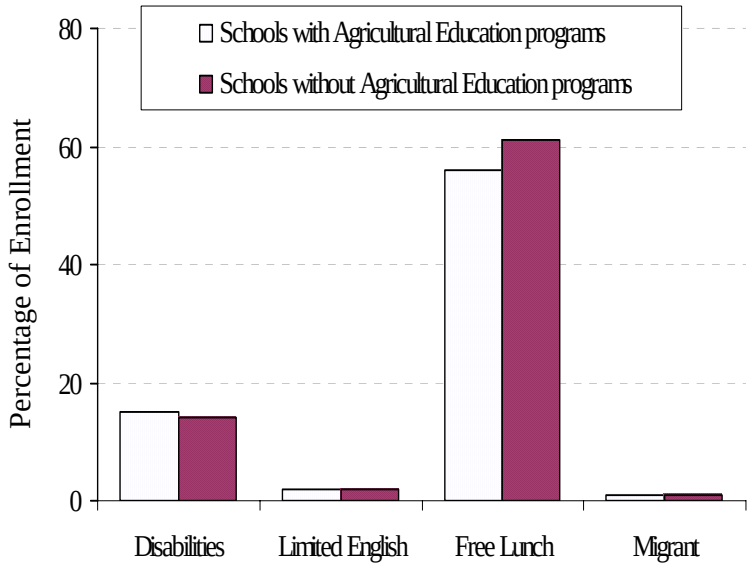

Figure 1. Two-year averages (2004-2005 and 2005-2006) and comparison between schools with Agricultural Education programs and schools without Agricultural Education programs of selected demographics used for purposeful sampling (percentage of students with disabilities, percentage of students with limited English, percentage of students receiving free lunch, and percentage of students from migrant families).

Race was not one of the selected demographic characteristics used for purposeful sampling. Given the correlation between economic status (e.g., percentage of students enrolled that receive free lunch) by and race often found in Georgia's schools, the researchers were also interested in comparing racial percentages between the two groups. Figure 2 compares the racial distribution between schools with Agricultural Education programs and schools without Agricultural Education programs.

By selecting for specific characteristics, one could indirectly be selecting for or against other characteristics. The researcher was particularly interested in analyzing how enrollment numbers compared among the two groups. Enrollment numbers by grade and academic year are shown in Table 1.

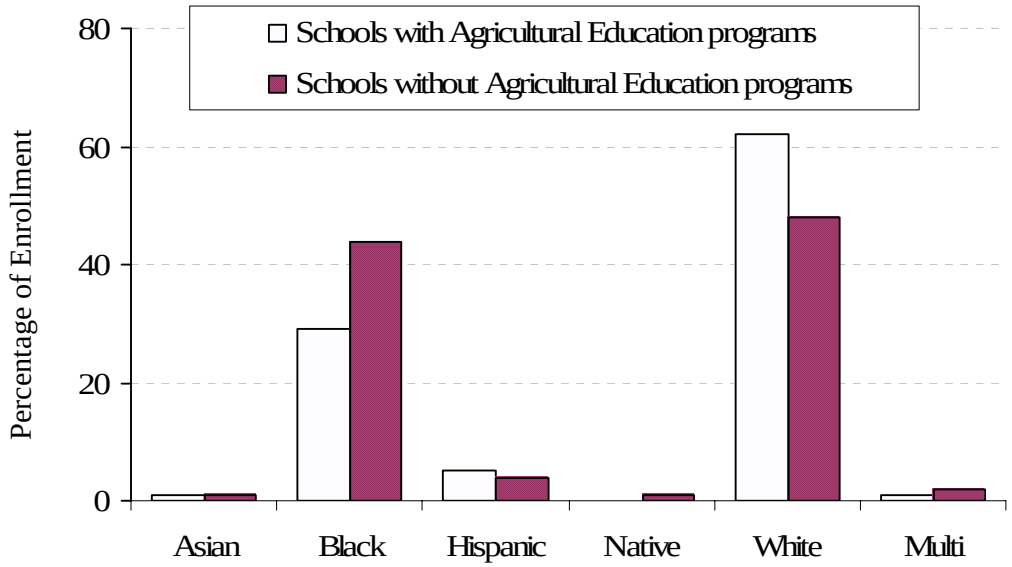

Figure 2. Two-year averages (2004-2005 and 2005-2006) and comparison between schools with Agricultural Education programs and schools without Agricultural Education programs of percentage of students that are considered Asian, Black, Hispanic, Native, White, or Multi-racial.

Table 1

Student Enrollment Average Numbers by Grade Level in Schools With and Without Agricultural Education Programs During School Years 2004-2005 and 2005-2006

	Student enrollment		
	6th grade	7th grade	8th grade
		2004-2005	
Schools with Ag. Education Programs	235	262	257
Schools without Ag. Education Programs	248	267	225
		2005-2006	
Schools with Ag. Education Programs	253	256	261
Schools without Ag. Education Programs	221	227	228

Table 2 shows the Means (*M*) and Standard Deviations (*SD*) of percentage of students that did not meet standards (below), met standards (met), and exceeded standards (exceeds) in the results of the CRCT tests, by grade level, and year

To compare differences between CRCT students' scores between the schools with Agricultural Education programs and the selected schools without agricultural education programs, the researcher compounded a new variable, "meeting or exceeding standards," which was the sum of the percentage of students meeting or exceeding standards.

In 2005-2006, middle schools with Agricultural Education programs had 64% of sixth graders, 64% of seventh graders and 80% of eighth graders that met or exceeded standards in the CRCT science test. In middle school without Agricultural Education programs these percentages were as follows: 59% of sixth graders, 60% of seventh graders, and 75% of eighth graders.

In 2004-2005, middle schools with Agricultural Education programs had 85% of sixth graders, 87% of seventh graders and 78% of eighth graders that met or exceeded standards in the CRCT science test. In middle school without Agricultural Education programs these percentages were as follows: 83% of sixth graders, 83% of seventh graders, and 74% of eighth graders.

To compare percentages of students meeting standards in schools with Agricultural Education programs versus schools without Agricultural Education programs, the researchers did a series of paired sample t-tests (95% confidence interval), grouping variables by grade level and year. Table 3 shows the results of this analysis. In all cases, the mean percentage of students meeting or exceeding standards in the CRCT test was higher in the schools with Agricultural Education programs than in the schools without Agricultural Education programs. In the case of the academic year 2005-2006 this difference was significant for 6^{th} and 8^{th} grade and for 7^{th} and 8^{th} grade in the 2004-2005 academic year.

Table 2

Means and Standard Deviations of Percentage of Students that Did Not Meet, Met, and Exceeded Standards in the Results of the CRCT tests, by Grade Level, and Year

	Mean					
	Schools with Agricultural Education			Schools without Agricultural Education		
	6th grade	7th grade	8th grade	6th grade	7th grade	8th grade
			2005-2006			
Below	35.7174	35.7800	20.3800	41.3878	40.8200	25.4400
Meets	52.9348	46.0000	65.3400	49.3061	44.4400	63.0200
Exceeds	11.2609	18.0200	14.8200	9.5714	15.2000	11.4400
			2004-2005			
Below	14.3830	13.2400	21.9800	17.0208	16.8600	26.4600
Meets	71.1915	71.8400	69.1600	70.9583	69.9000	66.5000
Exceeds	13.8298	14.9800	8.7000	11.7500	13.0600	7.0600
	Standard Deviation					
	Schools with Agricultural Education			Schools without Agricultural Education		
	6th grade	7th grade	8th grade	6th grade	7th grade	8th grade
			2005-2006			
Below	12.25591	13.04355	8.24841	15.77553	15.10195	11.12299
Meets	7.00286	5.84843	4.90984	10.54001	7.78581	6.61319
Exceeds	7.72136	10.54919	8.17834	7.03562	10.29166	7.05709
			2004-2005			
Below	7.75032	5.81890	9.92521	8.67986	8.21152	11.95094
Meets	6.36785	6.21834	6.24127	6.91886	6.81909	8.04642
Exceeds	9.17065	8.11019	5.49304	9.12677	9.42080	6.18890

Table 3

Paired Samples T-Tests to Compare Percentages of Students Meeting or Exceeding Standards in the Science CRCT Test in Middle Schools with Agricultural Education Programs versus Schools Without Agricultural Education Programs

	Paired differences						
			95% Confidence Interval of the Difference				
	M	SD	Lower	Upper	t	df	Sig. (2-tailed)
			2005-2006				
6th grade	6.78	19.56	.90	12.66	2.324	44	.025
7th grade	4.38	20.96	-1.58	10.34	1.478	49	.146
8th grade	5.70	15.45	1.31	10.09	2.608	49	.012
			2004-2005				
6th grade	2.96	11.31	-.44	6.35	1.753	44	.087
7th grade	3.86	10.77	.80	6.92	2.535	49	.014
8th grade	4.30	15.02	.03	8.57	2.024	49	.048

CHAPTER 5

CONCLUSIONS

In this study, fifty-one Georgia Middle Schools with Agricultural Education programs were compared with fifty-one Georgia Middle Schools without Agricultural Education programs. The study focused on comparing the CRCT science test scores between the two groups. The CRCT test scores were used because in Georgia the middle school science curriculum and performance standards (tested in the CRCT) are integrated into the Agricultural Education curriculum.

Analysis of the data collected from the Georgia Department of Education website, the researchers concluded that the percentages of students meeting or exceeding the standards were significantly higher in middle schools with Agricultural Education programs than in schools without Agricultural Education programs.

The results of the study suggest that there may be some relationship between participation in Agricultural Education and science CRCT scores. However, whether or not the difference in test scores was caused by the Agricultural Education program and not other linked factors, could not be determined through this study due to the limitations of the study (target population and sampling frame not equal, sampling error, and confounding factors).

Sampling error and confounding factors

This study uses 51 schools that had Agricultural Education programs in 2005-2006 and assumes that these schools also had Agricultural Education programs in 2004-2005. This is not true: Georgia is systematically increasing the number of schools with Agricultural Education Programs every year. In fact, not all the 51 middle schools in the census of schools with Agricultural Education programs offered necessarily Agricultural Education courses during both academic years of the study, and in all grades studied.

The researchers chose a purposeful sampling process (according to location and selected demographic characteristics) to have comparable schools. The process followed did not yield equivalent groups*:* Although sampling was purposeful to minimize differences among school groups studied (other than being schools with or without Agricultural Education programs), there are many confounding factors and not all differences among schools were balanced with the purposeful sampling.

Lack of Data

The study began with focusing on data from the past three academic years, 2003-2004, 2004-2005, and 2005-2006. After data was collected from the 102 Georgia Middle Schools, a majority of the schools reported no data for the 2003-2004 academic year in various areas since assessment in science was first administered in spring 2002 (Georgia Department of Education, a, 2005-2007, p 3). With lack of data, the researcher chose to eliminate the 2003-2004 results and focus solely on the two academic years, 2004-2005 and 2005-2006.This decision narrowed the results, but limited the provided insufficient data. Two years does not truly explain the impact, if any, that agricultural education had on student performance in science. Therefore, it is proposed that a longitudinal study of this nature be conducted to determine if there is a

substantial difference between students who enroll in agricultural education and those who do not.

School Schedule

Another aspect that may have affected the final results was the actual number of students able to have an agricultural connections class during their middle school years. At Lee County Middle School, all students are given a chance to take six physical education classes and six connection classes per year. Unfortunately, those interested in band, chorus, or title (extra help in specified subject) are only allowed to take six physical education classes. This removes approximately 600 students from student body not participating in agricultural education for science integration.

Closing

"In 2005, the average science score of students was higher at grade four than in previous assessment years, but was not measurably different at grade eighth, and was lower at grade twelve than in 1996" (National Center for Educational Statistics, 2007, ¶ 1). The National Center for Educational Statistics determined science results for 1996, 2000, and 2005 through United States Department of Education, National Assessment of Educational Progress (NAEP), 1996, 2000, and 2005 Science Assessment, and NAEP Data Explorer. According to *Learning Outcome* average science scores for Georgia public school fourth and eighth graders were 142 in 1996 and 2000, and 144 in 2005 (National Center for Educational Statistics, 2007, tab 13-1). This study shows no significant change was noted in Georgia's overall science scores on the eighth grade level over a nine year span. Therefore, the integration of science into agricultural education on the middle school level may demonstrate benefits with a longitudinal study of this nature.

Agricultural Education at the middle school level has been questioned throughout the United States. This study did not show a significant difference, but did possess several limiting factors that could have altered the results. Perhaps a longitudinal approach with fewer assumptions is a potential direction for future research that could extend the findings of this study.

The researchers recommend further research to establish whether or not student participation in Agricultural Education curriculum has an effect in CRCT test scores in [State] middle schools. It would be ideal for the researchers to set up a pre-test / post-test, (random) control group design. If this is not possible, the researchers may use a pre-test post-test non-equivalent control group design. The pre-test would help in better balancing for other confounding factors. One of the limitations of this study was that the target population and the sampling frame were not equal. It is important that when collecting data for the population "students taking Agricultural Education classes in middle school," the researchers only collect data of students in fact taking these classes. This study analyzed averages of school test scores because individual student test scores were not available. A nested study (by schools and type of Agricultural Education classes) using individual student test scores would add information to the analysis. Also, a longitudinal study would be interesting, to see if changes of individual students through time are affected in different ways by participation in science or Agricultural Education classes (the CRCT test of one year could serve as pre-test score for the next year).

Many researchers indicate that integrations of science into agriculture curriculum is a more effective way to teach science, and that students taught by integrating agricultural and scientific principles demonstrate higher achievement versus students taught by traditional approaches (Balschweid & Thompson, 2000, p. 1). The study described in this paper, and the

studies that have derived from it, may help further advance the knowledge about the benefits and challenges of Agricultural Education programs.

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APPENDIX

The data from this study on CRCT science results from 102 Georgia Middle Schools with or without Agricultural Education was found through school report cards located on the Georgia Department of Education Website: http://reportcard2006.gaosa.org/k12/cMap5.aspx

APPENDIX 2

Co-Requisite-Content – 6th Grade Science Standards

S6E1. Students will explore current scientific views of the universe and how those views evolved.

a. Relate the Nature of Science to the progression of basic historical scientific models (geocentric, heliocentric) as they describe our solar system, and the Big Bang as it describes the formation of the universe.

b. Describe the position of the solar system in the Milky Way galaxy and the universe.

c. Compare and contrast the planets in terms of

- Size relative to the earth
- Surface and atmospheric features
- Relative distance from the sun
- Ability to support life

d. Explain the motion of objects in the day/night sky in terms of relative position.

e. Explain that gravity is the force that governs the motion in the solar system.

f. Describe the characteristics of comets, asteroids, and meteors.

S6E2. Students will understand the effects of the relative positions of the earth, moon and sun.

a. Demonstrate the phases of the moon by showing the alignment of the earth, moon, and sun.

b. Explain the alignment of the earth, moon, and sun during solar and lunar eclipses.

c. Relate the tilt of the earth to the distribution of sunlight throughout the year and its effect on climate.

S6E3. Students will recognize the significant role of water in earth processes.

a. Explain that a large portion of the Earth's surface is water, consisting of oceans, rivers, lakes, underground water, and ice.

b. Relate various atmospheric conditions to stages of the water cycle.

c. Describe the composition, location, and subsurface topography of the world's oceans.

d. Explain the causes of waves, currents, and tides.

S6E4. Students will understand how the distribution of land and oceans affects climate and weather.

a. Demonstrate that land and water absorb and lose heat at different rates and explain the resulting effects on weather patterns.

b. Relate unequal heating of land and water surfaces to form large global wind systems and weather events such as tornados and thunderstorms.

c. Relate how moisture evaporating from the oceans affects the weather patterns and weather events such as hurricanes.

S6E5. Students will investigate the scientific view of how the earth's surface is formed.

a. Compare and contrast the Earth's crust, mantle, and core including temperature, density, and composition.
b. Investigate the contribution of minerals to rock composition.
c. Classify rocks by their process of formation.
d. Describe processes that change rocks and the surface of the earth.

e. Recognize that lithospheric plates constantly move and cause major geological events on the earth's surface.
f. Explain the effects of physical processes (plate tectonics, erosion, deposition, volcanic eruption, gravity) on geological features including oceans (composition, currents, and tides).
g. Describe how fossils show evidence of the changing surface and climate of the Earth.
h. Describe soil as consisting of weathered rocks and decomposed organic material.
i. Explain the effects of human activity on the erosion of the earth's surface.
j. Describe methods for conserving natural resources such as water, soil, and air.

S6E6. Students will describe various sources of energy and with their uses and conservation.

a. Explain the role of the sun as the major source of energy and its relationship to wind and water energy.
b. Identify renewable and nonrenewable resources.

APPENIDIX 3

Co-Requisite – Content - 7th grade Science Standards

S7L1. Students will investigate the diversity of living organisms and how they can be compared scientifically.

a. Demonstrate the process for the development of a dichotomous key.
b. Classify organisms based on physical characteristics using a dichotomous key of the six kingdom system (archaebacteria, eubacteria, protists, fungi, plants, and animals).

S7L2. Students will describe the structure and function of cells, tissues, organs, and organ systems.

a. Explain that cells take in nutrients in order to grow and divide and to make needed materials.
b. Relate cell structures (cell membrane, nucleus, cytoplasm, chloroplasts, and mitochondria) to basic cell functions.
c. Explain that cells are organized into tissues, tissues into organs, organs into systems, and systems into organisms.
d. Explain that tissues, organs, and organ systems serve the needs cells have for oxygen, food, and waste removal.
e. Explain the purpose of the major organ systems in the human body (i.e., digestion, respiration, reproduction, circulation, excretion, movement, control, and coordination, and for protection from disease).

S7L3. Students will recognize how biological traits are passed on to successive generations.

a. Explain the role of genes and chromosomes in the process of inheriting a specific trait.
b. Compare and contrast that organisms reproduce asexually and sexually (bacteria, protists, fungi, plants & animals).
c. Recognize that selective breeding can produce plants or animals with desired traits.

S7L4. Students will examine the dependence of organisms on one another and their environments.

a. Demonstrate in a food web that matter is transferred from one organism to another and can recycle between organisms and their environments.
b. Explain in a food web that sunlight is the source of energy and that this energy moves from organism to organism.
c. Recognize that changes in environmental conditions can affect the survival of both individuals and entire species.
d. Categorize relationships between organisms that are competitive or mutually beneficial.

e. Describe the characteristics of Earth's major terrestrial biomes (i.e. tropical rain forest, savannah, temperate, desert, taiga, tundra, and mountain) and aquatic communities (i.e. freshwater, estuaries, and marine).

S7L5. Students will examine the evolution of living organisms through inherited characteristics that promote survival of organisms and the survival of successive generations of their offspring.

Georgia Department of Education Kathy Cox, State Superintendent of Schools 8/29/2006 2:52 PM Page 7 of 8 a. Explain that physical characteristics of organisms have changed over successive generations (e.g. Darwin's finches and peppered moths of Manchester).

b. Describe ways in which species on earth have evolved due to natural selection.

c. Trace evidence that the fossil record found in sedimentary rock provides evidence for the long history of changing life forms.

APPENDIX 4

Co-Requisite – Content – 8th Grade Science Standards

S8P1. Students will examine the scientific view of the nature of matter.

a. Distinguish between atoms and molecules.
b. Describe the difference between pure substances (elements and compounds) and mixtures.
c. Describe the movement of particles in solids, liquids, gases, and plasmas states.
d. Distinguish between physical and chemical properties of matter as physical (i.e., density, melting point, boiling point) or chemical (i.e., reactivity, combustibility).
e. Distinguish between changes in matter as physical (i.e., physical change) or chemical (development of a gas, formation of precipitate, and change in color).
f. Recognize that there are more than 100 elements and some have similar properties as shown on the Periodic Table of Elements.
g. Identify and demonstrate the Law of Conservation of Matter.

S8P2. Students will be familiar with the forms and transformations of energy.

a. Explain energy transformation in terms of the Law of Conservation of Energy.
b. Explain the relationship between potential and kinetic energy.
c. Compare and contrast the different forms of energy (heat, light, electricity, mechanical motion, and sound) and their characteristics.
d. Describe how heat can be transferred through matter by the collisions of atoms (conduction) or through space (radiation). In a liquid or gas, currents will facilitate the transfer of heat (convection).

S8P3. Students will investigate relationship between force, mass, and the motion of objects.

a. Determine the relationship between velocity and acceleration.
b. Demonstrate the effect of balanced and unbalanced forces on an object in terms of gravity, inertia, and friction.
c. Demonstrate the effect of simple machines (lever, inclined plane, pulley, wedge, screw, and wheel and axle) on work.

S8P4. Students will explore the wave nature of sound and electromagnetic radiation.

a. Identify the characteristics of electromagnetic and mechanical waves.
b. Describe how the behavior of light waves is manipulated causing reflection, refraction diffraction, and absorption.
c. Explain how the human eye sees objects and colors in terms of wavelengths.
d. Describe how the behavior of waves is affected by medium (such as air, water, solids).
e. Relate the properties of sound to everyday experiences.
f. Diagram the parts of the wave and explain how the parts are affected by changes in amplitude and pitch.

S8P5. Students will recognize characteristics of gravity, electricity, and magnetism as major kinds of forces acting in nature.

a. Recognize that every object exerts gravitational force on every other object and that the force exerted depends on how much mass the objects have and how far apart they are.

b. Demonstrate the advantages and disadvantages of series and parallel circuits and how they transfer energy.

c. Investigate and explain that electric currents and magnets can exert force on each other.