Online Journal for Workforce Education and Development

Volume 5
Issue 3 *Fall 2011*

Article 4

January 2012

Science, Math, Social Studies, and Language Arts Achievement of High School Students in Complete Programs of Agriscience Education

Dennis W. Duncan
University of Georgia, dwd@uga.edu

John C. Ricketts
Tennessee

Todd Shultz
University of Georgia

SCIENCE, MATH, SOCIAL STUDIES, AND LANGUAGE ARTS ACHIEVEMENT OF HIGH SCHOOL STUDENTS IN A COMPLETE PROGRAM OF AGRISCIENCE EDUCATION IN GEORGIA: A BASELINE STUDY

Dennis Duncan, Ph.D.
University of Georgia

John C. Ricketts, Ph.D.
Tennessee State University

Todd Shultz, M.A.L
University of Georgia

Introduction

Even though agriculture is the oldest of the sciences and represents the application for most of the knowledge base in the life sciences, research has shown that a substantial portion of the U.S. citizenry knows very little about the agricultural industry (National Academy of Sciences, 1988). Consequently, for the first time in history, today's generation could potentially grow up illiterate about the agricultural industry. Because the nation depends on the agricultural industry for food, shelter, and clothing, it is imperative that our citizenry have a clear understanding of the importance of agriculture.

Throughout the past decade educational reformers have consistently agreed that there needs to be more of a connection between the basic skills such as science and mathematics and the real world. In 1999 the National Science Board issued a report entitled *Preparing Our Children*. In this publication a central theme for educational reform was that content based science should be implemented in our public school system. For example, the paper indicated that the National Science Board believed that "mathematics and science curricula in U.S. high schools lacks coherence, depth, and continuity; they cover too many topics in a superficial way." The Board pointed out that most innovative science curriculum seeks coherence, integration, and movement from concrete ideas to abstract concepts. Furthermore, they stress inquiry - a connectivity among disciplines, a concern for societal implications and a scientific way of knowing.

Similarly, the American Association for the Advancement of Science (1998) conducted a study called *Project 2061: Science for all Americans*. This report reiterated much of the same concepts detailed by the National Science Board and made a strong recommendation that "students develop a set of cogent views of the world as illuminated by the concepts and principles of science."

Theoretical Framework

Doolittle and Camp's (1999) exposition of constructivist philosophy provides the theoretical basis of this current study. These researchers summarized the crux of constructivism with the following tenets of the philosophy:

1. Knowledge is not passively accumulated, but rather is the result of active cognizing by the individual;
2. Cognition is an adaptive process that functions to make an individual's behavior more viable given a particular environment;
3. Cognition organizes and makes sense of one's experience, and is not a process to render an accurate representation of reality; and
4. Knowing has roots both in biological/neurological construction, and in social, cultural, and language-based interactions (Constructivism Section, p. 2).

Research by educational scholars (Chiasson & Burnett, 2001; Doolittle & Camp, 1999; Enderlin & Osborne, 1992; Enderlin, Petrea, & Osborne, 1993; Ricketts, Duncan, & Peake, 2006; Ross, 2001; Whent & Leising, 1988) indicates that states wishing to develop a world-class school system should also teach agriculture – the world's oldest science. This can be accomplished by offering a complete agriscience education program.

A Cornell study by Shelley-Tolbert, Conroy, and Dailey (2000) articulated the components of a complete Agriscience Education Program to be (1) classroom and laboratory instruction, (2) experiential learning through supervisory experiences, and (3) leadership

activities (p. 52-53). The classroom and laboratory instruction component should involve instructional strategies such as problem solving (Dyer & Osborne, 1996; Parr & Edwards, 2004), experiential learning (Knobloch, 2003; Mabie & Baker, 1996), and teaching agricultural content and science concepts through the use of contextual learning (Balschweid, 2002; Edwards, Leising, & Parr, 2002; Roegge & Russell, 1990). The experiential learning and leadership activities components of this model provide for enhanced contextual, informal, and social learning through engagement in Supervised Agricultural Experiences (SAE) (Cheek, Arrington, Carter, & Randell, 1994; Dyer & Osborne, 1996) and the FFA (Cheek, et al., 1994; Edwards, et al., 2002).

Several studies (Theriot & Kotrlik (2009); Rich, Duncan, Navarro, & Ricketts (2009); Ricketts, Duncan, & Peake, 2006; Chiasson & Burnett, 2001; Enderlin & Osborne, 1992; Enderlin, Petrea, & Osborne, 1993; Roegge & Russell, 1990; Ross, 2001; Whent & Leising, 1988) have determined the level of achievement in science that students gain through agriscience. Whent and Leising (1988) compared agriscience students to students in general science classes and concluded that agriscience students achieved slightly better on biology tests than did bioscience students. Roegge and Russell (1990) also determined that students who were subjected to lessons that integrated biological with agricultural principles demonstrated higher overall achievement in biology in comparison to students who were taught science traditionally. Ricketts, Duncan, and Peake (2006) found that nearly 78% of students that had completed at least two agriscience courses in a complete agriscience program passed the science portion of the Georgia High School Graduation Test (GHSGT) on their first attempt in comparison to 68% for the state average, and only 38% for technology/career prep students.

In addition to the real-world connection between academics and society, accountability is at the forefront of today's public K-12 educational systems. Statewide standardized tests are one means in which states are assessing their school systems, students, and educators. The No Child Left Behind Act (NCLB) of 2001 had a major impact on the testing of students and how educators increased focus on teaching students how to pass the test (Ricketts, Duncan & Peake, 2006).

With harsh criticisms, one may question if standardized tests are appropriate in measuring and evaluating student's knowledge. Though standardized tests may frustrate students by challenging them with difficult questions, it provides them with skills they possess (Woglom, Parr & Morgan, 2005). In addition, students who are very motivated or competitive work harder to achieve higher scores. Furthermore, contrary to popular belief, it would be very difficult for teachers to teach the test. There are many different forms of the test making it impossible for the teachers to know all of the tests content (Woglom, Parr & Morgan, 2005).

Purpose and Objectives

The purpose of this descriptive and comparative study is to describe the academic achievement of FFA members in a complete program of agriscience at Jackson County Comprehensive High School (JCCHS). To achieve these purposes the following objectives were drafted to guide this study:

1. Compare agriscience students'/FFA members' academic achievement in Language Arts to achievement rates of all JCCHS students;
2. Compare agriscience students'/FFA members' academic achievement in Math to achievement rates of all JCCHS students;

3. Compare agriscience students'/FFA members' academic achievement in Social Studies to achievement rates of all JCCHS students; and
4. Compare agriscience students'/FFA members' academic achievement in Science to achievement rates of all JCCHS students.

Procedures

This study is a static – group comparison design that analyzed pass/fail rates on the Georgia High School Graduation Test (GHSGT) for senior agriscience/FFA and non-agriscience students enrolled at JCCHS during the academic year. The target population for this census study were all senior agriscience students/FFA members (N=66) participating in the comprehensive agriscience education program at JCCHS, and all seniors at JCCHS (N=352). For this study, a comprehensive agriscience education program may be defined as the following:

> *A program which provides ample opportunity for students to participate in FFA and SAE activities in addition to engaging in interactive classroom and laboratory activities at a level that meets minimum standards for agriscience education programs according to the State Standards for Agricultural Education Program (State Department of Education, 2005) as administered by the State Department of Education.*

The GHSGT was considered valid since teachers in every state high school were involved in developing items that were relevant to state standards and tested the appropriate levels of cognitive difficulty (State Department of Education, 2004, p. 62). Jackson County certainly qualifies as a complete program of agriscience education.

At the time of this study, JCCHS had six agriculture teachers and two middle school feeder programs that offered all aspects of agriculture. The FFA program at JCCHS is one of Georgia's best and SAE is part of the grading scale in all agriscience courses.

The Student Achievement Roster at JCCHS for the GHSGT was acquired with the cooperation of the high school counseling office. The GHSGT was administered in the spring and was correlated to the membership roster of the Jackson County FFA Chapter to obtain the students who where members of the FFA Chapter.

Students were tested on Language Arts, Math, Social Studies, and Science. The results were listed as pass plus, pass, fail, or test not attempted. The [state]HSGT was considered valid since teachers in every state high school were involved in developing items that were relevant to state Language Arts, Math, Social Studies, and Science standards and tested the appropriate levels of cognitive difficulty (State Department of Education, 2004, p. 62).

There were some possibilities of threats with the internal validity of the study. Different characteristics of the students are not controlled in this study. There were no controls for the groups on gender, ethnicity, or educational achievement level within each of the groups. In addition, other factors such as financial stability of the member's family, and availability for paid membership within the FFA organization, could be a threat to validity.

Findings

As identified in Table 1, senior agriscience students/FFA members at JCCHS had a higher percentage in achieving at the highest level (Pass Plus) of Language Arts on the GHSGT than the remaining student population at JCCHS.

Table 1

A comparison of agriscience students/FFA members to all JCCHS students in language arts academic achievement according to the GHSGT

Academic Area	Sr. Agriscience Students/FFA Members (N=62)			All Sr. JCCHS Students (N=304)		
	P+	P	F	P+	P	F
Language Arts	71%	24%	5%	68%	28%	4%

As indicated in Table 2, on average, senior agriscience students/FFA members at JCCHS had a lower percentage achieving at the Pass Plus level of Math on the GHSGT than the remaining student population at JCCHS. Senior agriscience students/FFA members also had a higher failing rate than the remaining student population at JCCHS.

Table 2
A comparison of agriscience students/FFA members to all JCCHS students in Math academic achievement according to the GHSGT

Academic Area	Sr. Agriscience Students/FFA Members (59)			All Sr. JCCHS Students (N=308)		
	P+	P	F	P+	P	F
Math	54%	39%	7%	58%	36%	5%

Senior agriscience students/FFA members were more likely to pass the Social Studies portion of the GHSGT (Table 3). While 3% fewer were in the Pass Plus Category, only 8% of agriscience students/FFA members failed the Social Studies portion of the GHSGT compared to 15% of the remaining senior students at JCCHS.

Table 3
A comparison of agriscience students/FFA members to all JCCHS students in Social Studies academic achievement according to the GHSGT

Academic Area	Sr. Agriscience Students/FFA Members (N=63)			All Sr. JCCHS Students (N=334)		
	P+	P	F	P+	P	F
Social Studies	35%	57%	8%	38%	48%	15%

As shown in Table 4, senior agriscience students/FFA members were also more likely to pass the Science portion of the GHSGT. Again, 3% fewer were in the Pass Plus category, but there was a 10% difference in Fail rates between agriscience students/FFA members (24%) and the remaining JCCHS student population (34%).

Table 4
A comparison of agriscience students/FFA members to all JCCHS students in Science academic achievement according to the GHSGT

Academic Area	Sr. Agriscience Students/FFA Members (N=66)	All Sr. JCCHS Students (N=349)

	P+	P	F	P+	P	F
Science	15%	61%	24%	18%	48%	34%

Conclusions/Recommendations/Implications

As evidenced by past research conducted by Enderlin and Osborne (1991), Mabie and Baker (1996), Conroy and Walker (1998), Rich, et al. (2009), Ricketts, et al. (2006), and Chiasson and Burnett (2001) students at all levels of education (elementary, middle, or high school) achieved higher science scores due to participating in an agriscience course(s) or activity, in comparison with those who did not participate. Senior agriscience students/FFA members in this study were more likely to pass the science portion of the test in comparison to all seniors at JCCHS.

Previous research by Parr, Edwards, and Leising (2006) concluded that a math-enhanced Agricultural Power and Technology curriculum and aligned instructional approach did significantly affect ($p < .05$) student performance on a mathematics placement test used to determine a student's need for mathematics remediation at the postsecondary level ($p = .017$). The results of this county-wide study did not align with Parr, Edwards, and Leising's study. Agriscience students/FFA members at JCCHS scored slightly lower and failed at a higher rate on the GHSGT (math portion) test in comparison to all seniors.

The researchers postulate that further research needs to be conducted to identify the correlations between agriscience participation and performance on Language Arts and Social Studies standardized tests. The senior agriscience students/FFA members in this study scored higher than their peers at JCCHS on the Social Studies and Language Arts portions of the test. They not only scored higher, fewer senior agriscience students/FFA members failed the two portions of the GHSGT.

With the increasing pressure on public school systems to implement and/or improve state mandated tests in science, math, social studies, and language arts and improve students' performance on such tests, agriscience courses should be emphasized to increase students' knowledge and skills as they relate to the aforementioned subjects. It is recommended that other public school systems perform similar studies to determine the impact of secondary agriscience programs on student performance. Positive results need to be shared at local, state, and national levels with those who have an impact on secondary education. With increasing pressure from state and national leaders to reduce and/or eliminate Perkins funding for vocational/technical education, it is the role as educators to share the positive impact agriscience education is having on young people across the country.

References

American Association for the Advancement of Science. (1998). *Project 2061: Science for all Americans.* Retrieved from http://www.aaas.org/

Balschweid, M. A. (2002). Teaching biology using agriculture as the context: Perceptions of high school students. *Journal of Agricultural Education, 43*(2), 56-67.

Cheek, J. G., Arrington, L. R., Carter, S., & Randell, R. S. (1994). Relationship of supervised agricultural experience program participation and student achievement in agricultural education. *Journal of Agricultural Education, 35*(2), 1-5.

Chiasson, T. C., & Burnett, M. F. (2001). The influence of enrollment in agriscience courses on the science achievement of high school students. *Journal of Agricultural Education, 42*(1), 61-71.

Conroy, C., & Walker, N. (1998). *National Aquaculture Curriculum Evaluation Phase Final Report*. Ithaca, NY: Cornell.

Doolittle, P. E., & Camp, W. G. (1999). Constructivism: The career and technical education perspective. *Journal of Vocational and Technical Education, 16*(1).

Dyer, J. E., & Osborne, E. W. (1996). Developing a model for supervised agricultural experience program quality: A synthesis of research. *Journal of Agricultural Education, 37*(2), 24-33.

Edwards, C., Leising, J., & Parr, B. (2002). Improving student achievement in science: An important role for secondary agricultural education in the 21st century. Unpublished manuscript, Oklahoma State University.

Enderlin, K. J., & Osborne, E. W. (1991). *Achievement and retention of middle school science students in a laboratory oriented agriculture plant science unit of study.* Paper presented at the Central States 45th Annual Research Conference in Agricultural Education, Springfield, IL.

Enderlin, K. J., & Osborne, E. W. (1992). *Student achievement, attitudes, and thinking skill attainment in an integrated science/agriculture course.* Paper presented at the Nineteenth Annual national Agricultural Education Research Meeting, St. Louis, MO.

Enderlin, K. J., Petrea, R. E., & Osborne, E. W. (1993). *Student and teacher attitude toward and performance in an integrated science/agriculture course.* Paper presented at the 47th Annual Central Region Research Conference in Agricultural Education, St. Louis, MO.

Knobloch, N. A. (2003). Is experiential learning authentic? *Journal of Agricultural Education, 44*(4), 22-34.

Mabie, R., & Baker, M. (1996). A comparison of experiential instructonal strategies upon the science process skills of urban elementary students. *Journal of Agricultural Education, 37*(2).

National Academy of Sciences. (1988). *Understanding agriculture: New directions for education*. Retrieved from http://www.nap.edu/openbook.php?record_id=766&page=R1

Parr, B., & Edwards, C. (2004). Inquiry-based instruction in secondary agricultural education: Problem solving - an old friend revisited. *Journal of Agricultural Education, 45*(4).

Parr, B.A., Edwards, M.C., & Leising, J.G. (2006). Effects of a math-enhanced curriculum and instructional approach on the achievement of agricultural power and technology students as measured by an examination to determine student need for postsecondary remediation in mathematics: An experimental study. *Journal of Agricultural Education, 47*(3), 81-93.

Rich, J., Duncan, D.W., Navarro, M. & Ricketts, J.C. (2009). Examining Differences in Middle School Student Achievement on a Criterion-Referenced Competency Test (CRCT) in Science. *Journal of Agricultural Education 50* (4), DOI: 10.5032/jae.2009.04014

Ricketts, J. C., Duncan, D.W., & Peake, J. B. (2006). Science Achievement of High School Students in Complete Programs of Agriscience Education, *Journal of Agriculture Education, 47*(2), 48-55.

Roegge, C. A., & Russell, E. B. (1990). Teaching applied biology in secondary agriculture: Effects on student achievement and attitudes. *Journal of Agricultural Education, 31*(1), 27-31.

Ross, G. A. (2001). *Comparison of grading performance of agriscience students to non-agriscience students in upper level science classes at McEwen High School*. Unpublished master's thesis, Middle Tennessee State University, Murfreesboro, TN.

Shelley-Tolbert, C. A., Conroy, C. A., & Dailey, A. L. (2000). The move to agriscience and its impact on teacher education in agriculture. *Journal of Agricultural Education, 41*(4), 51-61.

State Department of Education (2005). *State Standards for Agricultural Education Program*, from http://aged.ces.uga.edu/program_info.htm

State Department of Education (2004). *State Student Assessment Program: Student Assessment Handbook.* (2004). Atlanta, GA: Office of Curriculum and Instruction.

Theriot, P. J. & Kotrlik, J. K. (2009). Effect of Enrollment in Agriscience on Students' Performance in Science on the High School Graduation Test. *Journal of Agricultural Education 50* (4), DOI: 10.5032/jae.2009.04072

Whent, L. S., & Leising, J. (1988). *A descriptive study of the basic core curriculum for agricultural students in California.* Paper presented at the 66th Annual Western Region Agricultural Education Research Seminar, Fort Collins, CO.

Woglom, C., Parr, B. & Morgan, J. (2005). A Comparison of Commonwealth Accountability Standardized Test Scores Between High School Agricultural Education/Career and Technical Education Students and The Kentucky State Standards, *Journal of Southern Agricultural Education Research*, *55*(1), 33-45.