Ohio Secondary Agricultural Educator Perceptions of Integrating Science

Thesis

Presented in Partial Fulfillment of the Requirements for
The Degree of Master of Science in the
Graduate School of The Ohio State University

By
Jenny Dee Cherry, B.S.
Graduate Program in Agricultural & Extension Education

The Ohio State University
2011

Thesis Committee:
Dr. Robert J. Birkenholz, Advisor
Dr. Jeff King
Abstract

This study was a descriptive survey of Ohio secondary agricultural educator perceptions of science integration in their curriculum. Science has been a foundational basis for agricultural education since the program was first developed. Secondary agriculture teachers have been encouraged to teach the knowledge and skills needed for students to become successful and productive workers and citizens. However, it was not clear how many agricultural education teachers were currently teaching a science-based curriculum.

The purpose of this study was to determine the perceptions of Ohio secondary agricultural educators regarding the integration of science concepts into their agricultural education curriculum. Respondents were asked to report their perceptions regarding the integration of science and barriers to integrating science concepts. Respondents were also asked to provide information about several demographic characteristics. Demographic characteristics were analyzed to determine if any were related to the teacher’s perceptions of several constructs related to science integration.

A survey instrument was emailed to a randomly-selected sample of the population of all Ohio secondary agricultural educators. Non-respondents received a series of follow up emails messages to prompt their response. Phone calls and follow up emails were also made to a random sample of non-respondents. Items comprising the science integration constructs requested respondents to report their perception for each item using a Liker-
type response scale from 1 (very strongly agree) to 6 (very strongly disagree). Means and standard deviations were computed for each perception item. Correlations were also computed to assess the relationship between demographic characteristics and respondent perceptions. Generalizations of the findings from this study were limited to the respondents.

Agricultural education respondents agreed that science concepts were easier for students to understand when they were integrated into the agricultural education program. Respondents also agreed that professional development workshops should be provided on science integration, and that science integration in the agricultural education curriculum would help students meet OGT (Ohio Graduation Test) requirements. Significant relationships were identified between the high school enrollment and the Agriculture and Science, Barriers Towards the Integration of Science, and Student Enrollment constructs.

Science integration should be encouraged in Ohio secondary agricultural education programs. Overall respondents perceived that science integration in secondary agricultural education was beneficial for students. Teachers also need to learn more about how to integrate science successfully and how students can benefit. Instructional resources should also be provided to encourage teachers to integrate science concepts based upon state academic content standards.
Dedication

This thesis is dedicated to my family for all of their support through this endeavor and to my advisors and committee chair who assisted me Dr. Robert J. Birkenholz, Dr. Larry Miller, and Dr. Jeff King.
Vita

May 28th, 1987..........................Born, Zanesville, Ohio

May 2009..................................B.S. Agricultural Education
                                 Purdue University

2009 – 2011..............................Graduate Associate,
                                 The Ohio State University

Fields of Study

Major Field: Agricultural and Extension Education
Table of Contents

List of Tables ........................................................................................................................................... ix
List of Figures ............................................................................................................................................. x

Chapter 1
Introduction .................................................................................................................................................. 1
Need for the Study ..................................................................................................................................... 5
Statement of the Problem ......................................................................................................................... 6
Purpose of the Study ................................................................................................................................ 7
Assumptions ............................................................................................................................................... 7
Limitations ............................................................................................................................................... 8

Chapter 2
Emergence of Science Integration ........................................................................................................... 9
Science Integration ................................................................................................................................. 10
Teacher Perceptions ............................................................................................................................... 13
Curriculum Development ....................................................................................................................... 13
Secondary Agricultural Education Program ............................................................................................ 15
Science Integration into Secondary Agricultural Education Programs .............................................. 16
Summary ................................................................................................................................................ 18

Chapter 3
Research Design ....................................................................................................................................... 20
Appendix

A. Survey Instrument.................................................................58

B. IRB Exemption Letter..............................................................62
List of Tables

Table 1. Conventions for Describing the Magnitude of Relationships......................25
Table 2. Agriculture and Science Construct..........................................................30
Table 3. Teaching Integrated Science Construct....................................................31
Table 4. Teacher Preparation Programs Construct..................................................32
Table 5. Student Enrollment Construct....................................................................33
Table 6. Program Support Construct........................................................................34
Table 7. Meeting State Standards Construct............................................................34
Table 8. Barriers to Integrating Science Construct....................................................36
Table 9. Gender Profile of Respondents...................................................................37
Table 10. Years of Agricultural Education Teaching Experience.............................37
Table 11. Number of Agricultural Education Workshops Attended..........................38
Table 12. Relationships Between Demographic Characteristics and Science Integration Constructs.................................................................39
List of Figures

Figure 1. Conceptual Model.................................................................21
Chapter 1: Introduction

Agricultural education in the United States was first taught in schools in 1825. However, agriculture has long been a foundation of American society prior to the creation of agricultural education in the public school system. A major goal of early Americans was food production and educating future generations on food production. Agriculture was a necessity of life, and each family was responsible for raising enough food to support their household. In Ohio, early settlers raised wheat, corn, and other grain crops. Crops were so much a staple commodity at the time that it was common to base daily wages in bushels of wheat.

Ohio ranked second in wheat production, and first in corn production by 1849. Not only was agriculture necessary for food production, but farmers also raised hemp to make rope and cloth. Much of the industrialization that occurred during the 1800’s was based in agriculture. Specifically in Ohio, one of the first major industries was tobacco processing, and pork processing also became a major industry in Cincinnati during that era.

A national effort to renew agricultural literacy came about in 1860, which resulted in the development of strategic plans for agricultural education. This was prompted by the beginning of the Civil War and the recognition that geographic regions needed to be capable of feeding themselves and generating sufficient food to sustain the war effort. A major shift occurred from producing products for cash to producing food to feed the
troops. Farmers were challenged to create more food with less labor on the farms. By the end of the Civil War in 1865, farmers were producing more crops on land that was of less value. They had to once again begin shifting the focus of their farm production to more of a cash crop (CBS Interactive, 2010).

The formation of the U.S. Department of Agriculture by Abraham Lincoln occurred in 1862, for the purpose of gathering and distributing agricultural information (Food Safety and Inspection Service, 2007). During the Civil War, many people were needed to provide labor on farms, while the usual farm hands were fighting the war. At the time, many people needed to be educated to take responsibility for many farming roles. Agricultural education at the time was primarily focused on training people to raise crops to feed the troops. The railroad boom during the 1860’s benefited farmers by transporting crops and meat to other parts of the country. Using refrigerated cars made the meat packing industry a year-round business. Success was fairly short-lived though when an economic depression occurred in 1873 (USDA-NIFA). The Department of Agriculture was again crucial at this time by providing concerned citizens with assistance. The Department of Agriculture helped to ensure continued food production and distribution to those who needed it, assisted with loans for small landowners, and contributed to the education of rural youth.

Agricultural education became even more popular in secondary schools after the Smith-Hughes Vocational Education Act of 1917. This federal legislation provided funding to schools for vocational agriculture programs for rural farm boys and home economics programs for rural farm girls. Even with technological advancements, the major concern was teaching the boys to raise livestock and crops, and the girls valuable
homemaking skills such as cooking, and sewing. The Smith-Hughes Act promoted vocational agriculture to train people “who have entered upon or who are preparing to enter upon the work of the farm” (North Carolina State University, p. 6).

The secondary student organization now known as FFA was founded in 1928, and was originally named the Future Farmers of America. The original name of the organization expressed the interest of the youth involved. “The Future Farmers of America brought together students, teachers and agribusiness to solidify support for agricultural education. Today, the National FFA Organization remains committed to the individual student, providing a path to achievement in premier leadership, personal growth and career success through agricultural education. Now, the organization is expanding the nation's view of "traditional" agriculture and finding new ways to infuse agriculture into the classroom.” (National FFA Organization, 2010, p. 1)

The content of agriculture has changed since secondary agricultural education programs were first introduced. When agricultural education began, it was mainly a science-based curriculum. Educators perceived a need to incorporate science into the classroom at the time, in order to be able to provide education for further advancements in the field. The Convention of Friends of Agricultural Education stated in 1871, “All the knowledge of stockbreeding, as studied by the student, is, or ought to be, founded upon progress in physiology and anatomy, and a knowledge of zoology is very important as a foundation for progress in stockbreeding” (Hatch, 1871, p. 84). After the Smith-Hughes Act was passed, agricultural education shifted towards a more vocational curriculum. Agricultural education focused more on the hands-on or vocational skills necessary for
students to become productive citizens, while the other school classes were focused on teaching more classical subjects.

Changes in the focus of agricultural education were due in large part to the state of the U.S. economy at the time. Agriculture and vocational education had a large role in training 7.5 million people for jobs in defense and war production during World War II. Since then, agricultural educators have modified the curriculum to meet the demands of society. Technological advances over the years have also prompted agriculture education to adapt to meet changing demands. Most recently, in 1958 U.S. policy makers called for more science, math, foreign language, and discipline in the classroom, as a result of the Russian Sputnik space mission. Over time, agriculture has continued to change its focus based on societal needs as well as in response to technological advancements (King & Miller, 2009). The Vocational Education Amendments of 1963 broadened the focus beyond farming when vocational education was expanded to provide knowledge and skills for off-farm agricultural occupations.

Program objectives for agricultural education outlined by the U.S. Office of Education in 1965 were to prepare students for competence in production agriculture, prepare students for competence in off-farm agriculture, understand career opportunities, have satisfactory placement and advancement in agriculture, develop human relations abilities, and develop abilities for effective leadership.

The industrial era had somewhat faded by 1970, and a “Back to Basics” movement emerged, coinciding with a push for competency tests in reading, writing, and mathematics skills. Agricultural education programs also experienced sweeping changes to meet the needs of society and technology, as suggested by the National FFA
Organization, “Today, the National FFA Organization remains committed to the individual student, providing a path to achievement in premier leadership, personal growth and career success through agricultural education. Now, the organization is expanding the nation’s view of “traditional” agriculture and finding new ways to infuse agriculture into the classroom” (National FFA Organization, 2010, p. 1).

Need for the Study

Secondary agriculture teachers have been encouraged to teach students the skills they need to become successful and productive workers and citizens. Many secondary agricultural education programs throughout the U.S. have begun to incorporate science, mathematics, and language into their curriculum. Some agricultural education programs have also been able to award students with science credit for completing an agricultural education course that incorporates a science-based curriculum. However, in Ohio, it is not clear how many secondary agricultural education teachers have incorporated science concepts into the curriculum. Since the majority of secondary agriculture classes offered across the state of Ohio are not mandatory for students (i.e., electives), agriculture teachers generally have much more freedom in determining the scope and content of the courses they teach.

Although agricultural education teachers are generally able to make curriculum decisions, it is believed that some may have chosen not to integrate science concepts in their program. However, there is no clear evidence to explain why some teachers integrate science concepts, while others do not. Therefore, teacher educators, state supervisors, and professional development specialists need to better understand the
barriers that may inhibit secondary agricultural education teachers from integrating science concepts in their curriculum.

Statement of the Problem

Although Ohio agricultural educators may be free to do so, it is not clear that they have changed their curriculum to emphasize science concepts in order to keep pace with industry and employment demands. Most school systems in Ohio allow agricultural educators to make decisions regarding curriculum content. Little is known about how many schools in Ohio are integrating science concepts into their agricultural education curriculum. This study is designed to survey Ohio secondary agricultural educators to assess their perceptions of science integration in the secondary agricultural education programs in Ohio.

Purpose of the Study

The purpose of this study is to determine the perceptions of Ohio Agricultural Educators regarding the integration of science concepts in their secondary agricultural education curriculum. The following research questions were addressed in this study:

1. What are the perceptions of Ohio agricultural educators regarding the integration of science concepts in the secondary agricultural education curriculum?
2. What are barriers to integrating science concepts in the secondary agricultural education curriculum as perceived by Ohio agricultural educators?
3. What are the demographic characteristics of Ohio agricultural educators?
4. How are Ohio agricultural educator perceptions of integrating science concepts in the curriculum related to demographic characteristics?

Assumptions

1. Technology changes have increased the emphasis on science in many areas of modern society. The industry of agriculture is no exception; therefore, it is assumed that the secondary agricultural education curriculum should be modified to incorporate teaching science content in order to adapt to the technological changes in agriculture.

2. Subject matter content in secondary agricultural education curriculum provides a suitable context for incorporating the teaching of science concepts. According to the Ohio Department of Education’s Agricultural and Environmental Systems content standards, the seven core areas include: animal science, biotechnology, business operations, engineering, environmental science, food science, and plant science. The majority of these areas are based on many of the science concepts that are included in the state science content standards (Ohio.gov, 2008).

3. The perceptions of respondents regarding perceived barriers to integrating science concepts in agricultural education programs are assumed to be accurate. This study relied on respondents providing accurate information regarding what they perceived as barriers to integrating science concepts into their secondary agricultural education program.
Limitations

1. This study is limited in scope to secondary agricultural education programs and instructors in Ohio.

2. The results of study are limited in terms of generalizability to the respondents who provided useable data.
Chapter 2: Review of Literature

The purpose of this study was to determine the perceptions of Ohio agricultural educators toward the integration of science into their agricultural education programs. Chapter 1 presented background information about how agricultural education has developed and changed over time, described the need for science integration in the secondary agricultural education curriculum, the need for the study, and described the problem of changing the curriculum to meet the demands of society and industry.

This chapter presents information about the concept of integrating science into the agricultural education curriculum by reviewing literature on science education, teacher perceptions, curriculum development, and secondary agricultural education programs. This chapter will also present previous research on this topic completed in other states. Information presented in this chapter includes material from refereed journal articles, professor lectures, and non-refereed publications.

Emergence of Science Integration

The integration of science has not been stressed enough in agricultural education, according to The National Research Council in a 1988 publication titled: Understanding Agriculture: New Directions for Education. The council recommended that applied science courses in agriculture be offered as optional elective science courses,
incorporating more agriculture into the curriculum and providing for more effective teaching of science. The recommendation emerged after The National Research Council charged that agricultural education curriculum content had failed to keep pace with modern agriculture (National Academy Press, 1988). A study published in 2001 by Dailey, Conroy, and Shelley-Tolbert revealed that people from all aspects of agricultural education agreed that the program should incorporate more science-based instruction. The study also suggested that the image of vocational education needed to be changed (2001). Incorporating science into the agricultural content was suggested as an opportunity to create a new image for agricultural education that could, potentially, attract more students.

Science Education

Previous studies, (Warnick, Thompson, & Gummer, 2004; Balschweid & Thompson, 2002; Thompson & Balschweid, 2000; Dyer & Osborne, 1999; Thompson & Schumacher, 1997) have acknowledged that agricultural educators express positive attitudes towards the incorporation of science concepts into agricultural classes. Findings also suggested that agricultural teachers believe integrating science into agriculture curriculum is a more effective way to teach science. A study by Dailey, Conroy, and Shelly-Tolbert (2001) found that secondary agricultural education programs facilitate the transfer of academic content and skills to other disciplines to better prepare students for higher education.

High school science achievement scores have been declining in the U.S. for several years, and the integration of science into the agricultural education curriculum has
been suggested as a way to assist students to better understand science concepts. According to the National Science Board “U.S. 15-year-olds scored below most selected nations in 2006, and U.S. standing among selected nations dropped below its 2000 rank in both mathematics and science” (Emeagwali, 2010, p. 10).

Connors and Elliot (1995, p. 57) stated that, “Over the past several years, poor science test results have increased the demand for improved science education for American students. New and innovative methods of presenting scientific information is needed to improve student achievement and enthusiasm for learning science. One solution to the dilemma has been to increase the interest of students in science by using agricultural and natural resource concepts to teach science.” Not only does agricultural education need to incorporate science to improve its curriculum, but science education may also benefit from using the context of agriculture to improve student achievement scores.

A study about teaching biology, with agriculture as the context, found that over 90% of the students enrolled in the class reported that they agreed that participating in the class helped them understand the relationship between science and agriculture (Balschweid, 2001). In a study of science teachers by Warnick, Thompson, and Gummers (2004), the results indicated that teachers believed the connection between disciplines was made stronger through an integrated curriculum in agriculture, and they viewed agriculture as an applied science. Even principals agreed that students were more aware of the connection between agriculture and science, and that science concepts were easier to understand through integration (Thompson, 2001).
The National Research Council published a report entitled “New Biology for the 21st Century, ensuring the United States leads the biological revolution” that states, “life sciences have the potential to provide a set of tools and solutions that can significantly increase the options available to society for dealing with problems. Integration of the biological sciences with physical and computational sciences, mathematics, and engineering promises to build a wider biological enterprise with the scope and expertise to address a broad range of scientific and societal problems” (National Academy of Sciences, 2009, p. 10). Assuming that science can be learned more readily when taught in the content of other disciplines, integrating science into agriculture will advance the scientific knowledge of society.

“For the last several years, concern has been brewing about America’s underinvestment and underperformance in science, technology, engineering and mathematics—the fields collectively known as STEM” (Hyslop, 2010, p. 16). To more effectively meet the concern for underperformance in these categories, students should be introduced to the content earlier and more often. Agricultural education is one area where integrating science as well as other areas of STEM can be readily accomplished (Hyslop, 2010). STEM achievement will not be maintained without support from Career and Technical Education (CTE) programs according to Hyslop. “CTE has long been a leader in the integration of high-level academics and technology. For example, CTE courses in agriculture, nutrition and health care have always contained strong science components, in many places earning students core academic credits” (Hyslop, 2010, p. 18).

The Ohio legislature passed the Ohio Core in 2007, the Ohio core is a program developed to better prepare students for college by promoting a curriculum that is more
academically rigorous for secondary students. The Ohio Core also increased the minimum requirements for high school graduation (ODE, 2007). One of the components of the Ohio Core includes teaching science courses as inquiry-based lab experiences. A second component of the Ohio Core recommended offering college preparation courses on the high school campus (Herzog, 2010).

Teacher Perceptions

Beginning in 1991-1992 agricultural education programs in Michigan were restructured into agriscience and natural resources programs. Connors and Elliot (1994) surveyed teachers during the change to determine their perceptions of the new curriculum, and their attitudes towards the concept of agriscience. The survey involved a census of all Michigan agriscience and natural resource teachers (ANR), and found no significant difference in the percent of ANR objectives taught between programs that had completed the restructuring and programs that had not completed the restructuring. In addition, the respondents strongly agreed that high school science credit should be awarded for ANR courses. Overall, the Michigan agriscience and natural resources and horticulture teachers in the survey had a positive attitude towards agriscience and recommended the curriculum for all high school students (Connors & Elliot, 1994).

Curriculum Development

Caine and Caine (1991) addressed the question “Why are we struggling in our ability to educate?” (p. 13). They provided the theoretical/conceptual model that
supported integrating science into agriculture called brain-based learning. Caine and Caine stated:

Literature, mathematics, history, and science are often seen as separate disciplines unrelated to the life of the learner. And much of what we presently accept as teaching is based on the mistaken belief that students can be taught reading and writing as separate from meaning and purpose, and that somehow what happens in the classroom is unaffected by the real world children and adults inhabit. Brain-based learning, on the other hand, rests on the fact that various disciplines relate to each other and share common information that the brain can recognize and organize (1991, p. 13).

Herzog (2010, p. 27) stated that “No longer can we use curriculum that meets the needs of only 10 percent of our students. In order to maintain competitive position in high tech industries and attract new business we must have a system where all students develop a confidence in learning math, science and highly developed problem solving abilities.”

The integration of science is thought to eliminate the vocational and hands-on learning in agricultural education. However, science integration still allows for various learning techniques. Agricultural education, with science integration, could still incorporate inquiry, hands-on learning, problem-based learning, and other teaching techniques (Daily, Conroy, & Shelley-Tolbert, 2001).
Secondary Agricultural Education Program

In the 1970s and 1980s, decreasing enrollments in university and high school agriculture programs prompted many college recruiting efforts to target urban students with less agricultural background. Since then, programs have changed to suit a wider variety of audiences instead of the traditional farmers. Osborne and Dyer surveyed Illinois agriscience students’ attitudes towards agriculture and agricultural education programs. Students in the survey were enrolled in Biological Science Applications in Agriculture (BSAA) courses. Parents of the students were also surveyed. Overall, both groups rated the quality of high school agriculture and science programs as high. The highest rated items for the students were “(1) agriculture is one of Illinois’ most important industries, (2) there are numerous opportunities for employment in agriculture, (3) agriculture is a scientific area of study, and (4) the field of agriculture incorporates many applications of scientific principles” (Osborne & Dyer, 2000, p. 54). Parents also agreed that agriculture was one of Illinois’ most important industries and that it involved a blend of scientific principles and agriculture practices. Overall students and parents “. . . agreed that high school agriculture courses prepare students for college and employment after high school, that most high school students should take some course work in agriculture, college-bound students should be encouraged to enroll in agriculture courses, stronger ties should be made between high school science and agriculture curricula, and science applications in agriculture are best taught by agriculture teachers . . . ” (Osborne & Dyer, 2000, p. 55).
Science Integration into Secondary Agricultural Education Programs

A survey of 253 state, regional, and national winners of the National Future Farmers of America AgriScience Teacher of the Year Award Program in 1988-1995 reported by Thompson and Schumacher (1997, p. 10) concluded overall that, “Agriscience teachers believed integration science assists students in better understanding science concepts and their application to agriculture.” Teacher respondents in this study also reported that total program enrollment, as well as the number of high ability students, will likely increase as more science is integrated into their agricultural education program.

Thompson and Balschweid concluded that, in Oregon, “. . . increased high school graduation requirements have put pressure on agricultural programs by limiting opportunities for students to enroll in elective courses.” (2000, p. 73). This was a result of changing college entrance requirements, which was challenging agricultural education to offer more than just a traditional “vocational” program. (2000). Increased graduation requirements were suggested as one reason for the decline in enrollment in agricultural education in many other states as well. Students in need of a science credit would not have to enroll in a general science course if science credit was available through enrollment in an agricultural education course. Students could have an opportunity to achieve both objectives by enrolling in one course.

Balschweid and Thompson (2002) offered conclusions about the attitudes of Indiana Agricultural Science and Business teachers towards the integration of science. Using the survey instrument developed by Thompson, they found that Indiana Agricultural Science and Business teachers believed they were prepared to teach
integrated biological and physical science concepts, but required some extra preparation time. Seventy percent of the responding teachers had already attended a workshop on integrating science and forty percent had a science endorsement on their teaching license. Over half of the responding teachers reported that their students received science credit from approved Agricultural Science and Business courses. Balschweid and Thompson concluded that there were positive attitudes towards science integration among Indiana Agricultural Science and Business instructors.

Dormody (1993) studied science credentialing in agricultural education classrooms. Dormody sampled the entire population of agricultural educators in the United States during the 1999-91 school year. He found that agriculture teachers that are able to give science credit are more likely to teach non-agricultural science courses than teachers not giving science credit. He also found that science credentialing was more likely to benefit the agriculture programs rather than the science department. Dormody also concluded that “Agricultural educators should not be worried that science credentialing or science credit will be catalysts for consolidating agriculture teachers and programs with science departments. While there will be exceptions, in most cases, science credentialing and science credit will be used to benefit agriculture programs” (1993, p. 69). Dormody also suggested that the benefits of image-enhancement and recruitment from science credentialing for agricultural education programs were worth considering (Dormody, 1993).
Summary

Much research has been reported on the integration of science into the agricultural education program. Research has shown that science integration is a benefit to students and schools. Study by Myers, Washburn, and Dyer tested agricultural educators on their integrated science knowledge. Respondents scored 89% correct on the science knowledge test. The teachers possessed the knowledge needed to perform and apply integrated process skills necessary for science integration (Myers, Washburn, & Dyer, 2004). The teachers reported that they had acquired the knowledge they needed to integrate science concepts at the post-secondary level.

Agricultural education in Ohio needs to promote the integration of science in order to help students and schools meet current demands of society and the agricultural industry. Research has shown that students have higher achievement rates when subject matter concepts are combined. Science concepts merge well with agricultural education curriculum and content topics.

Science integration can increase program enrollment as well as give students another opportunity to meet their high school graduation requirements. It can help to reduce the perception that agriculture courses are only an elective option and enable the program to contribute more directly to meeting graduation requirements for some students.
Chapter 3: Methods

Chapter 1 presented information about how the agricultural industry and agricultural education programs have evolved over time. The first chapter described the need for science integration in the secondary agricultural education curriculum. Secondary agricultural educators have been faced with the problem of changing the curriculum to meet the demands of society and the agricultural industry. The purpose of this study was to determine the perceptions of agricultural educators in Ohio towards science integration in their curriculum.

Chapter 2 provided information about the concept of integrating science into the agricultural education curriculum by analyzing the major components necessary. Science education, teacher perceptions, curriculum development, and secondary agricultural education programs were main focus areas. The second chapter also presented an overview of previous research on science integration in secondary agricultural education in other states.

Chapter 3 presents the design of this research study, a conceptual model, and the research objectives for this study. The chapter describes the selection of respondents, procedures, data collection process, and how the data were analyzed and reported.
Research Design

This study was planned and conducted as a type of descriptive research. Descriptive research enables the researcher to become familiar with the current status of an event or phenomenon. The purpose of this descriptive study was to explore and describe the perceptions of Ohio agricultural educators towards the concept of science integration. This study was also designed to investigate relationships among selected demographic characteristics and respondent perceptions of the importance of and barriers to integrating science concepts in their secondary agricultural education curriculum.

The type of research is a correlational internet survey. The questionnaire used was a revision of the Elements of the Integrating Science Survey Instrument developed by Thompson (1996). Statements were added and/or altered to fit the Ohio population. Five errors can occur in the conduct of survey research: (1) sampling, (2) selection, (3) frame, (4) non-response, and (5) measurement. Procedures employed to control each of these types of errors will be discussed in the appropriate sections of this chapter.

Conceptual Model

The conceptual model for this study is shown in Figure 1. Agricultural education teachers are believed to have at least three major influences that affect whether or not they integrate science concepts in their secondary agricultural education program. Education, experience, and perceptions are the three major sources of influence. The instructor’s educational background could be a factor that influences whether or not they integrate science. Teachers who have had more science classes as part of their own education may be more likely to integrate science. Agricultural educators may also have
had different experiences in their student teaching experience or teaching career that affect whether or not they are in favor of integrating science.

This study focused solely on the agricultural education teacher’s perception of integrating science into their agricultural education program. Teachers’ perceptions may also be influenced by many different factors, but whether or not they are in favor of integrating science, and how they perceive the integration of science, is a starting point to determine if science integration in secondary agricultural education programs in Ohio is able to keep up with the demands of industry and the workforce.

**Variables**

In this study, the independent variables were the demographic characteristics of the teachers in the survey. The demographic characteristics include: years of teaching experience, gender of the teacher, age of the teacher, size of the high school, highest degree achieved by the teacher, and participation in agricultural education professional development workshops by the teacher. The dependent variables in this study were the

---

**Figure 1: Conceptual Model**
teacher respondent’s perceptions of constructs related to integrating science concepts in secondary agricultural education programs.

Questions

The following research questions were addressed:

1. What are the perceptions of Ohio agricultural educators regarding the integration of science concepts in the secondary agricultural education curriculum?
2. What are barriers to integrating science concepts in the secondary agricultural education curriculum as perceived by Ohio agricultural educators?
3. What are the demographic characteristics of Ohio agricultural educators?
4. How are Ohio agricultural educator perceptions of integrating science concepts in the curriculum related to demographic characteristics?

Control Factors

Sampling error will be known due to the selection of a random sample of the population, which will result in a representative sample of sufficient size for 95% confidence and 5% risk. Non-response error will be examined by comparing the responses of early and late respondents, on the main characteristic of interest (perceptions), based on the assumption that data from late respondents are more similar to non-respondents (Miller & Smith, 1983). Non-respondents were assumed to mirror late respondents if no significant differences were found, if so, then non-response error would not be considered a threat in this study. Demographic characteristics of the sample will be
summarized to describe the agricultural educator respondents, and to determine if there was a relationship between the respondents’ perceptions of science integration, and their demographic characteristics. High response rates will be encouraged by using follow up emails and phone calls to a random sample of non-respondents.

Population and Sample

The population frame for this study included all (N=525) Ohio secondary agricultural educators from a listing (November 2009) compiled by the Ohio Department of Education and provided to the Ohio State University. Selection error was minimized because the frame of teachers was created based on the list of Ohio secondary agricultural educators with duplicates eliminated. The list of agricultural educators was organized by high school in each school district throughout Ohio. Use of an accurate and up-to-date list helped to control frame error.

The sample was assumed to be representative of the population due to random selection, and therefore, will have a known error rate between the sample population and the target population. The population size was 525. Using Harriott’s table to determine sample size, the sample needed to encompass 217 randomly selected individuals from the target population (1969). This procedure was expected to control for sampling error. Out of the 217 randomly selected individuals, 200 were found to have valid email addresses at the time of the study.
Instrumentation

The instrument used in this study was a revision of the Elements of the Integrating Science Survey Instrument developed by Thompson (1996). Analysis of the data collected using the original questionnaire revealed a reliability coefficient of 0.898. Thompson revealed similar internal consistencies when using the same survey instrument. The original questionnaire consisted of Likert-type (summated rating scale) items with a response scale ranging from 1 (very strongly agree) to 6 (very strongly disagree). Responses were categorized to aid in interpretation as $\leq 1.50 = \text{very strongly agree}$, $1.50-2.49 = \text{strongly agree}$, $2.50-3.49 = \text{agree}$, $3.50-4.49 = \text{disagree}$, $4.50-5.49 = \text{strongly disagree}$, $\geq 5.50 = \text{very strongly disagree}$.

Internal consistency was assessed by computing a Cronbach’s alpha coefficient to assess reliability of the data collected on the perception scale. Measurement error was controlled through the use of a valid and reliable instrument.

Data Collection

Selected teacher subjects were sent a pre-notification email message informing them of a forthcoming questionnaire. Thereafter, sample subjects were sent the questionnaire electronically to facilitate timely data collection. Respondents were allowed four weeks to complete the first online questionnaire since it was during the summer months and email messages may not have been checked by the potential respondents on a regular basis. After the four week time period, a second questionnaire was emailed to those who had not responded to the first instrument. A final, follow-up email was sent to a randomly selected group of non-respondents. Phone calls to the non-respondents were
made as well as emails with questions from the questionnaire in order to facilitate early and late response comparisons.

**Data Analysis**

Results of the descriptive analysis were reported by research question. Correlations were computed to determine if the demographic characteristics were related to teacher perceptions of science integration and perceived barriers. Correlation coefficients calculated were appropriate to the scale of measurement for each demographic characteristic. When interpreting correlations, the following Davis’ (1971) convention was used:

<table>
<thead>
<tr>
<th>R</th>
<th>Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Perfect</td>
</tr>
<tr>
<td>0.70 – 0.99</td>
<td>Very High</td>
</tr>
<tr>
<td>0.50 – 0.69</td>
<td>Substantial</td>
</tr>
<tr>
<td>0.30 – 0.49</td>
<td>Moderate</td>
</tr>
<tr>
<td>0.10 - 0.29</td>
<td>Low</td>
</tr>
<tr>
<td>0.01 – 0.09</td>
<td>Negligible</td>
</tr>
</tbody>
</table>

Table 1. Conventions for Describing the Magnitude of Relationships.


Data for each research question were analyzed separately. Research question one was: What are the perceptions of Ohio agricultural educators regarding the integration of science concepts in the secondary agricultural education curriculum? Question 1 involved instrument items from part two of the questionnaire (see appendix A). Item numbers corresponding to research question one were 1-13, and 23-42. Each of these items
involved the use of a Likert-type response scale ranging from a one, very strongly agree to a six, very strongly disagree. Responses to the items were categorized to aid interpretation in which: 

\[ \begin{align*} 
&\leq 1.50 = \text{very strongly agree}, \\
&1.50 - 2.49 = \text{strongly agree}, \\
&2.50 - 3.49 = \text{agree}, \\
&3.50 - 4.49 = \text{disagree}, \\
&4.50 - 5.49 = \text{strongly disagree}, \\
&\geq 5.50 = \text{very strongly disagree}. 
\end{align*} \]

Research question two: What are the barriers to integrating science concepts in the secondary agricultural education curriculum as perceived by Ohio agricultural educators? Question two consisted of items in part two of the questionnaire (see appendix A). Item numbers corresponding to the second research question were 14-22. Each of the items were addressed using a Likert-type response scale with answers ranging from a one, very strongly agree to a six, very strongly disagree. Responses to the items were categorized to aid interpretation in which:

\[ \begin{align*} 
&\leq 1.50 = \text{very strongly agree}, \\
&1.50 - 2.49 = \text{strongly agree}, \\
&2.50 - 3.49 = \text{agree}, \\
&3.50 - 4.49 = \text{disagree}, \\
&4.50 - 5.49 = \text{strongly disagree}, \\
&\geq 5.50 = \text{very strongly disagree}. 
\end{align*} \]

Research question three: What are the demographic characteristics of Ohio agricultural educators? Question three consisted of items in part one of the questionnaire (see appendix A). Item numbers corresponding to this research question were 1-7. The items included open-ended questions and were grouped together if similar answers were provided. Demographic items included: gender, years of agricultural education teaching experience, age, number of students in high school, highest degree attained, number of agricultural education workshops attended, and number of agricultural education courses that students could earn science credit upon completion.
Research question four: How are Ohio agricultural educator perceptions of integrating science concepts in the curriculum related to demographic characteristics?

This research question utilized all of the items included in the questionnaire (see appendix A). Research question four compared data from parts one and two to determine if there was a relationship between the teacher respondent’s perceptions, and selected demographic characteristics.
Chapter 4: Findings

Secondary agricultural educators teach many subject areas that coincide with concepts taught in the science department (Dailey, Conroy, & Shelley-Tolbert, 2001). Agricultural education courses are considered as elective courses. Due to increasing graduation requirements and changing demands of society and the agricultural industry, awarding science credit through some agricultural education course may be justified. In order for agricultural education programs to contribute to the overall mission of the school system, they must change as society and industry changes. This study examined Ohio secondary agricultural education program teacher’s attitudes towards science integration.

This chapter presents findings related to the following research questions that were developed to guide the study:

1. What are the perceptions of Ohio agricultural educators regarding the integration of science concepts in the secondary agricultural education curriculum?

2. What are barriers to integrating science concepts in the secondary agricultural education curriculum as perceived by Ohio agricultural educators?

3. What are the demographic characteristics of Ohio agricultural educators?

4. How are Ohio agricultural educator perceptions of integrating science concepts in the curriculum related to demographic characteristics?
Findings for Research Question One

Research question one pertained to the perceptions of secondary agricultural educators regarding integrating science concepts into their curriculum. Out of the 200 surveys sent to the random sample of agricultural educators, 48 individuals completed the survey and 6 more non-respondents were contacted afterwards via phone and email, which resulted in a 27% response rate. The following tables present summarized data provided by respondents towards integrating science into their curriculum.

Item means presented in Table 2 range from agree to strongly agree. Items that prompted stronger agreement from respondents also had less variability based on the higher standard deviations. Answers that focused more around agree have more variation of answers when looking at the standard deviation. For the overall construct of Agriculture and Science most respondents strongly agreed with the underlying items comprising the construct. Teacher respondent means for items comprising the Agriculture and Science construct ranged from 1.00 to 4.33.
### Agriculture and Science Items

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean ($M^d$)</th>
<th>Standard Deviation ($SD$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science concepts are easier to understand for students when science is integrated into the agricultural education program.</td>
<td>2.09</td>
<td>0.71</td>
</tr>
<tr>
<td>Students are better prepared in science after they complete a course in agricultural education that integrated science.</td>
<td>2.18</td>
<td>0.72</td>
</tr>
<tr>
<td>Students are more aware of the connection between scientific principles and agriculture when science concepts are an integral part of their instruction in agricultural education.</td>
<td>2.27</td>
<td>0.86</td>
</tr>
<tr>
<td>People pursuing a career in agriculture must have a greater understanding of biological science than ten years ago.</td>
<td>2.29</td>
<td>0.94</td>
</tr>
<tr>
<td>People pursuing a career in agriculture must have a great understanding of physical science than ten years ago.</td>
<td>2.40</td>
<td>0.86</td>
</tr>
<tr>
<td>Students learn more about agriculture when science concepts are an integral part of their instruction.</td>
<td>2.56</td>
<td>1.16</td>
</tr>
<tr>
<td>Students are more motivated to learn when science is integrated into the agricultural education program.</td>
<td>2.93</td>
<td>1.32</td>
</tr>
<tr>
<td><strong>Overall Construct</strong></td>
<td><strong>2.39</strong></td>
<td><strong>0.74</strong></td>
</tr>
</tbody>
</table>

Table 2. Agriculture and Science Construct

*Responses were coded 1 = very strongly agree, 2 = strongly agree, 3 = agree, 4 = disagree, 5 = strongly disagree, 6 = very strongly disagree*

Table three reveals that most of the items comprising the Teaching Integrated Science Construct produced means in the agree category. One item had a mean that was in the neutral range between agree and disagree categories (I have integrated more science in the advanced courses than the introductory courses in agricultural education). Each of the items revealed relatively little variation in the respondent’s answers based on the standard deviations. Overall, items produced means indicating that respondents generally agreed with the underlying items. Teacher respondent means for the items comprising the construct ranged from 1.00 to 4.00.
# Teaching Integrated Science Items

<table>
<thead>
<tr>
<th></th>
<th>$M^a$</th>
<th>$SD$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrating science into the agricultural education program requires more preparation time than before emphasizing integrated science concepts.</td>
<td>2.53</td>
<td>0.94</td>
</tr>
<tr>
<td>I am prepared to teach integrated biological science concepts.</td>
<td>2.62</td>
<td>0.83</td>
</tr>
<tr>
<td>I am prepared to teach integrated physical science concepts.</td>
<td>2.80</td>
<td>0.89</td>
</tr>
<tr>
<td>I teach integrated science concepts in agricultural education that focus more on the biological science concepts than the physical science concepts.</td>
<td>2.89</td>
<td>0.90</td>
</tr>
<tr>
<td>Integrating science into agriculture classes has increased our school’s ability to teach student to solve problems.</td>
<td>2.89</td>
<td>0.97</td>
</tr>
<tr>
<td>I have integrated more science in the advanced courses than the introductory courses in agricultural education.</td>
<td>3.59</td>
<td>0.93</td>
</tr>
<tr>
<td><strong>Overall Construct</strong></td>
<td><strong>2.87</strong></td>
<td><strong>0.60</strong></td>
</tr>
</tbody>
</table>

Table 3. Teaching Integrated Science Construct

*aResponses were coded 1 = very strongly agree, 2 = strongly agree, 3 = agree, 4 = disagree, 5 = strongly disagree, 6 = very strongly disagree

Means for items in Table 4, comprising Teacher Preparation Programs construct ranged from strongly agree to agree with a fairly consistent variation in overall responses.

For the overall construct, respondents produced a mean categorized as strongly agree.

Teacher respondent means for items comprising the construct ranged from 1.00 to 3.83.
Table 4. Teacher Preparation Programs Construct

<table>
<thead>
<tr>
<th>Teacher Preparation Programs Items</th>
<th>$M^d$</th>
<th>$SD$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher preparation programs should provide inservice for teachers in the field on how to integrate science into their agricultural education program.</td>
<td>2.45</td>
<td>0.76</td>
</tr>
<tr>
<td>Teacher preparation programs in agriculture should provide instruction for undergraduates on how to integrate science.</td>
<td>2.60</td>
<td>0.73</td>
</tr>
<tr>
<td>Teacher preparation in agriculture should place student teachers with a cooperating teacher that integrates science into the agricultural education program.</td>
<td>2.65</td>
<td>0.95</td>
</tr>
<tr>
<td>Teacher preparation programs should require that students conduct their early field experience program with a teacher that integrates science into the agricultural education program.</td>
<td>2.76</td>
<td>0.86</td>
</tr>
<tr>
<td>Teacher preparation programs should have a follow-up inservice activity which requires agricultural education teachers to cooperate with a science teacher in their district to integrate science into the curriculum.</td>
<td>2.84</td>
<td>0.91</td>
</tr>
<tr>
<td>Teacher preparation programs in agriculture should require students to take more basic science courses.</td>
<td>2.86</td>
<td>0.93</td>
</tr>
<tr>
<td>Overall Construct</td>
<td>2.67</td>
<td>0.70</td>
</tr>
</tbody>
</table>

Table 4. Teacher Preparation Programs Construct

$^a$ Responses were coded 1 = very strongly agree, 2 = strongly agree, 3 = agree, 4 = disagree, 5 = strongly disagree, 6 = very strongly disagree

Table 5 presents the data regarding the Student Enrollment construct based on the perceptions of teachers towards student enrollment in the secondary agricultural education programs. Student Enrollment item means focused around the agree category. Overall means for the Student Enrollment items produced relatively little variation; however, respondent’s perceptions to two items did reveal some variation. Teacher respondent’s means for the Student Enrollment construct ranged from 1.00 to 6.00.
### Student Enrollment Items

<table>
<thead>
<tr>
<th>Description</th>
<th>$M^a$</th>
<th>$SD$</th>
</tr>
</thead>
<tbody>
<tr>
<td>High ability students are more likely to enroll in agricultural education courses that integrate science.</td>
<td>3.00</td>
<td>1.30</td>
</tr>
<tr>
<td>Low ability students are more likely to enroll in agricultural education courses that integrate science.</td>
<td>3.02</td>
<td>1.09</td>
</tr>
<tr>
<td>Total program enrollment in agricultural education will increase if more science is integrated into the curriculum.</td>
<td>3.02</td>
<td>1.36</td>
</tr>
<tr>
<td>Average ability students are more likely to enroll in agricultural education courses that integrate science.</td>
<td>3.02</td>
<td>1.07</td>
</tr>
<tr>
<td>Integrating science into the agricultural education program more effectively meets the needs of special population students (i.e. learning disabled).</td>
<td>3.09</td>
<td>1.01</td>
</tr>
</tbody>
</table>

**Overall Construct**

<table>
<thead>
<tr>
<th></th>
<th>$M^a$</th>
<th>$SD$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.04</td>
<td>0.92</td>
</tr>
</tbody>
</table>

*Table 5. Student Enrollment Construct*

*Responses were coded 1 = very strongly agree, 2 = strongly agree, 3 = agree, 4 = disagree, 5 = strongly disagree, 6 = very strongly disagree*

Table 6 item means for the Program Support construct were all classified in the agree category. More variability in respondent answers on items that produced means below the 3.0 agree scale. Means that were nearer the midpoint on the response scale appeared to produce less variation in respondent’s answers. Teacher respondent’s means for the Program Support construct range from 1.00 to 6.00.
Program Support Items | $M^a$ | $SD$
---|---|---
Local administrator support will increase if teachers integrate more science into the agricultural program. | 2.89 | 1.13
School counselor support will increase if teachers integrate more science into the agricultural program. | 2.93 | 1.15
Science teacher support will increase if teachers integrate more science into the agricultural program. | 3.09 | 1.02
Community support will increase if teachers integrate more science into the agricultural program. | 3.14 | 1.00
Parental support will increase if teachers integrate more science into the agricultural program. | 3.14 | 0.93
Other teacher support will increase if teachers integrate more science into the agricultural program. | 3.30 | 0.93
**Overall Construct** | **3.08** | **0.85**

Table 6. Program Support Construct

*Responses were coded 1 = very strongly agree, 2 = strongly agree, 3 = agree, 4 = disagree, 5 = strongly disagree, 6 = very strongly disagree*

---

Table 7 presents the data associated with teacher perceptions of how integration of science will help students meet state standards. Means for Meeting State Standards range from strongly agree to agree with a fairly consistent variation shown in the standard deviations. Teacher respondent’s means for items comprising the Meeting State Standards construct ranged from 1.00 to 5.00.

Table 7. Meeting State Standards Construct

*Responses were coded 1 = very strongly agree, 2 = strongly agree, 3 = agree, 4 = disagree, 5 = strongly disagree, 6 = very strongly disagree*
Findings for Research Question Two

Research question two pertained to the barriers agricultural educators perceived regarding the integration of science concepts into the secondary agricultural education curriculum. Data in Table 8 presents a summary of the responses regarding barriers to integrating science in secondary agricultural education.

In Table 8, eight of the items for the construct of Barriers to Integrating Science produced means in the agree category. One item (The lack of appropriate equipment is a barrier to integrating science into the agricultural education program) produced a mean in the strongly agree category. Each of the items in the Barriers to Integrating Science Construct produced a fairly consistent variation in respondent’s answers. Teacher respondent’s means for items comprising the Barriers to Integrating Science construct range from 1.00 to 5.22.
<table>
<thead>
<tr>
<th>Barriers to Integrating Science Items</th>
<th>$M^a$</th>
<th>$SD$</th>
</tr>
</thead>
<tbody>
<tr>
<td>The lack of appropriate equipment is a barrier to integrating science into the agricultural education program.</td>
<td>2.49</td>
<td>1.25</td>
</tr>
<tr>
<td>The lack of adequate federal, state, or local funds is a barrier to integrating science in the agricultural education program.</td>
<td>2.77</td>
<td>1.34</td>
</tr>
<tr>
<td>The lack of science competence among teachers in agricultural education is a barrier to integrating science in agricultural education.</td>
<td>3.11</td>
<td>1.13</td>
</tr>
<tr>
<td>The lack of agriscience inservice workshops/courses for agricultural education teachers is a barrier to integrating science into the agricultural education program.</td>
<td>3.16</td>
<td>1.08</td>
</tr>
<tr>
<td>The lack of an integrated science curriculum is a barrier to integrating science into agricultural education programs.</td>
<td>3.32</td>
<td>1.03</td>
</tr>
<tr>
<td>The lack of a science teacher who is willing to help integrate science concepts has been a barrier to integrating science in the agricultural education program.</td>
<td>3.34</td>
<td>1.12</td>
</tr>
<tr>
<td>The lack of close proximity to high-technology firms is a barrier to integrating science into agricultural education programs.</td>
<td>3.36</td>
<td>1.09</td>
</tr>
<tr>
<td>The lack of student preparation in science (prior to enrolling in agricultural education) is a barrier to integrating science into agricultural education programs.</td>
<td>3.44</td>
<td>1.16</td>
</tr>
<tr>
<td>The lack of agriscience jobs in the local community is a barrier to integrating science into agricultural education programs.</td>
<td>3.49</td>
<td>0.84</td>
</tr>
<tr>
<td><strong>Overall Construct</strong></td>
<td><strong>3.16</strong></td>
<td><strong>0.78</strong></td>
</tr>
</tbody>
</table>

Table 8. Barriers to Integrating Science Construct

$^a$Responses were coded $1 = $very strongly agree$, 2 = strongly agree$, $3 = $agree$, $4 = $disagree$, $5 = $strongly disagree$, $6 = $very strongly disagree$ 

Findings for Research Question Three

Research question three examined the demographic characteristics of the responding agricultural educators. Of the 48 respondents, 25 were male (52.1%) and 23 were female (47.9%), see table 9.
<table>
<thead>
<tr>
<th>Gender</th>
<th>%</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>52.1%</td>
<td>25</td>
</tr>
<tr>
<td>Female</td>
<td>47.9%</td>
<td>23</td>
</tr>
</tbody>
</table>

Table 9. Gender Profile of Respondents

To determine the level of teaching experience, respondents were asked to indicate their teaching experience within a range of years that they have been teaching (see table 10). Fourteen of the respondents (29.2%) had been teaching five years or less, thirteen of the respondents (27.1%) had been teaching five to ten years, eight of the respondents (16.7%) had been teaching eleven to twenty years, and thirteen of the respondents (27.1%) had been teaching for over twenty years.

<table>
<thead>
<tr>
<th>How many years of agricultural education teaching experience do you have?</th>
<th>%</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td>29.2%</td>
<td>14</td>
</tr>
<tr>
<td>6-10</td>
<td>27.1%</td>
<td>13</td>
</tr>
<tr>
<td>11-20</td>
<td>16.7%</td>
<td>8</td>
</tr>
<tr>
<td>20+</td>
<td>27.1%</td>
<td>13</td>
</tr>
</tbody>
</table>

Table 10. Years of Agricultural Education Teaching Experience

The average age of all the respondents was 38 years and the average population of their high schools was 579 students. One teacher respondent had an associate’s degree with a career tech license which accounted for 2% of the respondents, 35% of the respondents (n = 15 teachers) had a bachelor’s degree and the remaining 27 respondents (63%) had a master’s degree. Fifty percent (n = 24) of the responding teachers had attended over 10 agricultural education workshops (see Table 11).
Table 11. Number of Agricultural Education Workshops Attended

<table>
<thead>
<tr>
<th>Number of agricultural education workshops attended</th>
<th>%</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4.2%</td>
<td>2</td>
</tr>
<tr>
<td>1-3</td>
<td>20.8%</td>
<td>10</td>
</tr>
<tr>
<td>4-6</td>
<td>16.7%</td>
<td>8</td>
</tr>
<tr>
<td>7-10</td>
<td>8.3%</td>
<td>4</td>
</tr>
<tr>
<td>10+</td>
<td>50.0%</td>
<td>24</td>
</tr>
</tbody>
</table>

Teachers were asked to report the number of courses they were currently offering for science credit in their agricultural education program. One respondent (2%) offered science credit to special education courses. Eighteen of the respondents (40%) offered no science credit for students completing their agricultural education courses. Three of the respondents (7%) offered one course for science credit, nineteen of the respondents (43%) offered two courses for science credit, two respondents (4%) offered three courses for science credit, one teacher (2%) offered five courses for science credit, and one teacher (2%) offered seven courses for science credit. Overall 58% of the respondents offered at least one secondary agricultural education course for science credit.

Findings for Research Question Four

Question four was focused on determining if significant relationships existed between respondent’s perceptions of science integration constructs and their demographic characteristics. Respondent means for each construct were correlated with each demographic characteristic and the results are presented in Table 12.

In Table 12, most of the coefficients compared for the science integration construct and the demographic characteristics revealed no significant relationship. However, the number of students enrolled in the high school was found to be significant
when correlated with the Agriculture and Science, Barriers to Science Integration, and Student Enrollment constructs.

<table>
<thead>
<tr>
<th>Science Integration Constructs</th>
<th>Demographic Characteristics</th>
<th>Gender (p)</th>
<th>Years Teaching (p)</th>
<th>Age (p)</th>
<th>Degree (p)</th>
<th>Number of Students (p)</th>
<th>Workshops Attended (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture and Science</td>
<td>0.42</td>
<td>-0.01</td>
<td>-0.41</td>
<td>0.06</td>
<td>0.34</td>
<td>0.03*</td>
<td>-0.21</td>
</tr>
<tr>
<td></td>
<td>0.78</td>
<td>0.93</td>
<td>0.79</td>
<td>0.69</td>
<td>0.03</td>
<td></td>
<td>0.17</td>
</tr>
<tr>
<td>Teaching Integrated Science</td>
<td>-2.76</td>
<td>0.16</td>
<td>0.11</td>
<td>0.17</td>
<td>0.22</td>
<td></td>
<td>-0.12</td>
</tr>
<tr>
<td></td>
<td>0.07</td>
<td>0.31</td>
<td>0.46</td>
<td>0.29</td>
<td>0.16</td>
<td></td>
<td>0.45</td>
</tr>
<tr>
<td>Barriers to Science Integration</td>
<td>0.02</td>
<td>0.25</td>
<td>0.09</td>
<td>0.17</td>
<td>0.39</td>
<td>0.01*</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>0.92</td>
<td>0.10</td>
<td>0.57</td>
<td>0.30</td>
<td>0.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher Preparation</td>
<td>-0.13</td>
<td>0.12</td>
<td>0.16</td>
<td>0.15</td>
<td>0.22</td>
<td>-0.09</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.40</td>
<td>0.45</td>
<td>0.29</td>
<td>0.34</td>
<td>0.17</td>
<td></td>
<td>0.58</td>
</tr>
<tr>
<td>Student Enrollment</td>
<td>0.05</td>
<td>-0.19</td>
<td>-0.10</td>
<td>0.12</td>
<td>0.39</td>
<td>0.01*</td>
<td>-0.02</td>
</tr>
<tr>
<td></td>
<td>0.75</td>
<td>0.90</td>
<td>0.52</td>
<td>0.45</td>
<td>0.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program Support</td>
<td>0.42</td>
<td>0.16</td>
<td>0.09</td>
<td>0.19</td>
<td>0.26</td>
<td>-0.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.79</td>
<td>0.31</td>
<td>0.58</td>
<td>0.23</td>
<td>0.94</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting State Standards</td>
<td>-0.21</td>
<td>0.17</td>
<td>0.18</td>
<td>0.24</td>
<td>0.22</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.17</td>
<td>0.26</td>
<td>0.24</td>
<td>0.13</td>
<td>0.16</td>
<td></td>
<td>0.58</td>
</tr>
</tbody>
</table>

Table 12. Relationships Between Demographic Characteristics and Science Integration Constructs.

*Correlation is significant at the 0.05 level (2-tailed)

Major Findings

Based on the results of this study the following major findings were revealed:

1. Respondents agreed that science concepts were easier for students to understand when integrated into the agriculture curriculum.

2. Agricultural educator respondents generally agreed they were prepared to teach science concepts.
3. Respondents agreed that professional development inservice workshops should be provided on science integration.

4. Although respondents generally agreed that Student Enrollment would benefit from the integration of science, the responses varied widely.

5. Respondents generally agreed that program support would increase with science integration.

6. Many respondents strongly agreed that integrating science integration in the agricultural education curriculum would help students meet OGT requirements.

7. Respondents overall agreed with many of the barriers associated with integrating science, although the responses varied widely.

8. There was a significant relationship between the number of students enrolled in high school and the respondent’s perception of the Agriculture and Science construct. As the number of students in the high school increased, the more the respondents disagreed with the items comprising the Agriculture and Science construct.

9. There was a significant relationship between the number of enrolled students in high school and the Barriers Towards Integration of Science construct. As the number of students in the high school increased, the more the respondents disagreed with the items comprising the Barriers Towards Integration of Science construct.

10. There was a significant relationship between the number of students enrolled in high school and the Student Enrollment construct. As the number of
students enrolled in the high school increased, the more the respondents disagreed with the items comprising the Student Enrollment construct.

Summary

Findings of this study were presented and summarized in this chapter. Four research questions provided the organizing framework for the findings presented. Findings included the proportion of agricultural teacher education programs that integrate science, teacher’s perceptions towards integrating science, barriers towards integrating science, and demographic characteristics of the teacher respondents.
Chapter 5: Summary

Agriculture has always been a foundational cornerstone of society; as food production is a basic necessity of life. When agriculture was first introduced as a subject in school systems, it was mainly a science-based curriculum. Agricultural education has changed curriculum over the years to focus on meeting the demands of society and agricultural education industry. However, we are at a time where farms are becoming larger and fewer in number and technology and science continue a rapid pace of change.

Secondary agricultural educators are often allowed to make curriculum content decisions, but there is no clear documentation to explain why some teachers integrate science concepts, while others do not. It is also not clear if Ohio secondary agricultural education teachers are adapting their curriculum to meet demands of society and the agricultural industry. This study surveyed Ohio agricultural educators to determine their perception of science integration in the secondary agricultural education programs. The study also examined the demographic characteristics of respondents to determine if those characteristics were related to their perceptions of science integration. Generalizations from this study were limited to the agricultural education teacher respondents.

Overall, this study found that overall respondents agreed with the concept of integrating of science into the agricultural education program. Over half of the respondents reported that they provide students with science credit for completing an agricultural education course. A significant relationship was found between school size
and the Agriculture and Science, Barriers to Science Integration, and Student Enrollment constructs in the secondary agricultural education program. In general, as the size of the school increased, secondary agricultural education teacher respondents were more likely to disagree with the Agriculture and Science, Barriers to Science Integration, and Student Enrollment constructs.

**Major Findings**

Based on the results of this study the following major findings were revealed:

1. Respondents agreed that science concepts were easier for students to understand when integrated into the agriculture curriculum.

2. Agricultural educator respondents generally agreed they were prepared to teach science concepts.

3. Respondents agreed that professional development inservice workshops should be provided on science integration.

4. Although respondents generally agreed that Student Enrollment would benefit from the integration of science, the responses varied widely.

5. Respondents generally agreed that program support would increase with science integration.

6. Many respondents strongly agreed that integrating science integration in the agricultural education curriculum would help students meet OGT requirements.

7. Respondents overall agreed with many of the barriers associated with integrating science, although the responses varied widely.
8. There was a significant relationship between the number of students enrolled in high school and the respondent’s perception of the Agriculture and Science construct. As the number of students in the high school increased, the more the respondents disagreed with the items comprising the Agriculture and Science construct.

9. There was a significant relationship between the number of enrolled students in high school and the Barriers Towards Integration of Science construct. As the number of students in the high school increased, the more the respondents disagreed with the items comprising the Barriers Towards Integration of Science construct.

10. There was a significant relationship between the number of students enrolled in high school and the Student Enrollment construct. As the number of students enrolled in the high school increased, the more the respondents disagreed with the items comprising the Student Enrollment construct.

Discussion

Based on the responses collected from secondary agriculture teachers in Ohio, science concepts are easier to understand for students when integrated into the secondary agricultural education curriculum. Reviewing the seven items that comprised the Agriculture and Science construct, it appeared that the items that respondents more strongly agreed to also had lower standard deviations. Conversely, items that had lower means had larger standard deviations. Nevertheless, all item were classified in the strongly agree response category. The teachers’ perception of the Agriculture and Science
construct was significantly related to the number of students enrolled in the high school. As the number of students in the high school increased, the more the respondents disagreed with the Agriculture and Science construct. This could mean that as high school size increases, students may have more options to enroll in science courses, so respondents may perceive that integrating science into the agricultural education curriculum did not add to student motivation or assist in their learning process.

Agricultural educator respondents also generally agreed that they were prepared to teach science concepts. The item that appeared to have less consistency than the other items in the teaching integrated science construct was the statement “I have integrated more science in the advanced courses than the introductory courses in agricultural education.” Means for this statement were closer to the disagree category with a 0.93 standard deviation. This could mean that teachers perceive that they integrate the same amount of science in advanced as in their introductory courses, or that they are integrating even more science in their introductory courses than the advanced courses.

Respondents agree that professional development inservice workshops should be provided for secondary agricultural education teachers on science integration. The item that varied the most from the others in the construct Teacher Preparation Programs was the statement, “Teacher preparation programs should provide inservice for teachers in the field on how to integrate science into their agricultural education program.” The item had a substantially lower mean than the other statements and one of the lowest standard deviations. It is important that teachers are provided information and assistance about how to integrate science into the classroom. Agricultural educators may not fully
understand how to integrate science concepts in the secondary agricultural education curriculum.

Although respondents generally agreed that student enrollment would benefit from the integration of science, their answers revealed more variability based on the standard deviations. Each item comprising the Student Enrollment construct produced similar mean scores and standard deviations. Respondent means ranged from 1.00 to 6.00 suggesting that some teachers strongly agreed and some strongly disagreed.

A significant relationship was found when Student Enrollment was correlated with the number of students enrolled in the high school. As high school population size increased, teachers were less likely to agree that student enrollment in the secondary agricultural education program will benefit from science integration. As school size increases more science classes may be available to students which may cause agriculture teachers to believe that science integration in their classroom would not result in an increase in student enrollment.

Respondents tended to agree that agricultural education program support would increase with science integration. The item with the highest mean (less agreement) in the construct was the statement, “Other teacher support will increase if teachers integrate more science into the agricultural program.” The statement may have the least agreement because respondents were already asked if science teacher support would increase, so the support of other teachers (e.g. language, math, social studies, etc.) most likely would not be affected by science integration. Standard deviations for items comprising the construct were fairly high and responses ranged from 1.00 to 6.00 which suggests that teachers had very different views on the statements.
Many respondents strongly agree that science integration in the agricultural education curriculum would help students meet OGT (Ohio Graduation Test) requirements. Teachers expressed less agreement about the remaining two items comprising the Meeting State Standards construct. Nevertheless, teachers agree that integrating science would help align agricultural education programs with emerging education standards and that state standards would be an asset to those programs.

Respondents overall agreed with many of the barriers associated with the integration of science, but revealed a rather large variation in their answers based on the standard deviations. Large standard deviations were observed for each item in this construct so teachers revealed a large amount of variability in their perceptions. The only item with a mean classified as strongly agree was the statement about the lack of appropriate equipment being a barrier to integrating science. A significant relationship was also found between the barriers to integrating science construct when examined in relation to the number of students in the high school. As the number of students in the high school increased, respondents were less likely to agree with barriers to integrating science. Larger schools may have more equipment, and surrounding technology firms (especially if they are located in larger cities) which may result in fewer perceived barriers.

Conclusions

Based on the data collected in this study agricultural educators agree with concept of integrating science into the secondary agricultural education curriculum. Teachers believe that the integration of science will help their students succeed and motivate them
to learn more about science. The number of students enrolled in respondent’s high school revealed a significant relationship with the Agriculture and Science construct. Respondents from larger high schools were more likely to disagree with the statements in the Agriculture and Science construct. Respondents also agree that science integration improves Student Enrollment, Program Support, and Meeting State Standards. Respondents also agreed with several perceived Barriers to Science Integration

Most of the agricultural educator respondents perceived that they were competent to teach science concepts. Respondents also appeared to recognize that students interested in pursuing careers in agriculture must have an understanding of biological and physical science. Teachers, who recognize the need for science integration in the classroom, may do so knowing that they are providing students with knowledge and skills needed to meet career demands.

Respondents in this study disagreed that they have integrated more science in their advanced courses than in their introductory agricultural education courses. This could imply that teachers are integrating as much or more science in the introductory courses than the advanced courses.

Teacher respondents agree that teacher education programs should include instruction about science integration in the secondary agricultural education program. Teachers also agree that inservice education programs should be provided on how to integrate science into agricultural education. Undergraduates students preparing for secondary agricultural education teaching positions should also be provided with instruction on the integration of science and be mentored by teachers who integrate science into their curriculum. Respondents also agreed that undergraduates should be
required to take more science courses, even though current teachers also agreed that they had sufficient knowledge to integrate science into their curriculum.

Overall, respondent means were interpreted in the agree category for Student Enrollment; however, the range of responses reflected some variability. The total number of students enrolled in the respondent’s high school produced a significant correlation with the Student Enrollment construct. Respondents from larger high schools tended to disagree that student enrollment would benefit from the integration of science. Conversely, respondents from smaller schools were more likely to agree that program enrollment would increase as a result of science integration.

Overall respondents agree that program support will increase with the integration of science. Respondents did vary widely on their perceptions of this construct. Respondents were more likely to agree that local administrator support would increase and less likely to agree that other teacher support would increase as a result of science integration. Agricultural educators also agreed that science integration will help align their curriculum with state standards. They strongly agreed that science integration will help students meet OGT requirements. Students must pass the OGT to graduate from an Ohio high school. Since teachers agree that science integration will help students meet OGT requirements, the state should promote science integration in the agricultural education curriculum. Teachers were less likely to agree that state standards will be an asset to their agricultural education program. This could reflect that agricultural educators may enjoy the freedom and flexibility to decide what is taught in their classrooms, rather than responding to the need to focus on state curriculum content standards.
Teachers agreed that there are several barriers associated with integrating science into the secondary agricultural education program. They strongly agreed that the lack of appropriate equipment is a barrier to integrating science, but there was wide variability among respondents on this item. This may be explained by the variety of schools that the respondents represented. Some schools may lack sufficient funding to purchase appropriate scientific equipment while other schools may not have a problem with securing appropriate equipment. Response means were undecided (between agree and disagree) in response to the statement regarding the lack of agriscience jobs in the local community as a barrier to integrating science into agricultural education. This potential barrier may vary widely by school location (e.g. urban or rural settings), and the size of the community. Student population in the respondent’s high schools also revealed a significant relationship with the barriers associated with integrating science. This suggests that respondents from larger schools perceived fewer barriers associated with science integration in the secondary agricultural education program.

Implications

Integrating science concepts into the secondary agricultural education program will have a far-reaching impact on student success. Students will be more highly motivated and more easily learn science concepts when taught in an agricultural context. In addition, if science integration is implemented into the agriculture curriculum, students may be able to receive science credit (for high school graduation and potentially college credit) for taking the courses. Graduation requirements will then be easier to achieve for students who are able to enroll in an agriculture course while coincidently earning
science credit. Students will also be more knowledgeable about science and better prepared to meet the demands of the high technology workplace.

Agricultural education programs may also realize an increase in program enrollment. Lower ability students may enroll in the courses in order to receive science credit for a class that is easier to learn about and understand science concepts. Higher ability students may also appreciate learning about more advanced science concepts provided in the agricultural education courses. All secondary agricultural education students should be better prepared to enter the more technologically-advanced workforce and enhance the agriculture industry.

As more and more agriculture programs pursue science integration and science credentialing, they might also seek opportunities to award college credit. However, the science concepts taught in secondary agricultural education courses must be equivalent to that taught in college courses in order to justify the academic credit.

**Recommendations**

Science integration should be an important priority for secondary agricultural education programs in Ohio. In order for teachers to integrate science, curriculum resources need to be developed to enhance the integration of science concepts while also reinforcing hands-on learning activities. Secondary agricultural education teachers may be more willing to incorporate science concepts if they understand that it is not changing their teaching style, but enhancing overall program effectiveness.

Teachers also need to be exposed to more information about how to integrate science successfully and how it can benefit students. Teachers may also benefit from
learning more about current agriculture trends and jobs to assist them with their curriculum. Teachers and programs that are successful with science integration and science credentialing should be recognized and used as a resource for undergraduate students’ learning experiences and mentor other agricultural education teachers that need assistance to integrate science into their own programs. Professional development inservice training should be provided for teachers on how to integrate science and components of science integration.

Graduate students in agricultural education should be provided with training on science integration and encouraged to complete more science courses. Science integration needs to be stressed in agricultural education programs in order to motivate students to learn about science, help meet OGT requirements, and promote student enrollment in agricultural education programs in smaller high schools.

Funding support needs to be provided for schools to integrate science instruction in the secondary agricultural education program to provide the necessary equipment. Resource materials should also be provided for teachers the integrate science concepts based on the state science academic content standards since teachers perceive state standards as a barrier. This will assist teachers in science integration and focus on science concepts that are directed toward meeting state standards.

**Suggestions for Further Research**

This study provides preliminary insight into Ohio secondary agricultural educator’s perceptions of science integration. Based upon the findings of this study, the following suggestions for further research are offered:
1. What courses are agricultural educators able to integrate science?

2. What science knowledge and skills do agricultural educators possess?

3. Where do secondary agricultural educators acquire the content knowledge and skills they need to integrate science into their curriculum?

4. How do agricultural educator programs prepare teacher candidates to integrate science into their curriculum?

Summary

Agricultural education has had a solid foundation in science since the program was first introduced into secondary schools in the early 1900’s. Throughout the history of the program, agricultural education has evolved to adapt to changes in society and industry. Technological advances based on scientific principles in the agricultural industry continue to emerge, and half of the respondents to this survey reported incorporating science into their courses. All secondary agricultural education programs in Ohio should provide science integration in order for agricultural education to continue to meet the demands with society and the agricultural industry.

Preparing highly educated and qualified teachers has always been a focus of post-secondary agricultural teacher preparation programs. These programs should provide more instruction about science integration education for future teachers. Teachers are expected to possess content knowledge in all areas that they teach. Therefore, future teachers in secondary agricultural education should be expected to complete advanced courses in agriculture as well as physical and biological science.
References Cited


Herzog, K. J. (2010). We STEM, do you? Miami Valley Career Technology Center’s Answer to implementing STEM. Techniques. Published by the Association for Career and Technical Education.


Appendix A: Survey Instrument

Perceptions towards Science Integration Survey

The purpose of this survey is to identify characteristics and implications of integrating science into secondary agricultural education programs in Ohio. Integrating science has been defined as a process that develops and reinforces student understanding of science principles and concepts while incorporating relevant applications in agriculture.

Part 1
Included in this area are some demographic questions.

1. ______ Gender
2. ______ Years of agricultural education teaching experience
3. ______ Age
4. ______ Number of students in high school
5. ______ Highest degree attained
6. ______ Number of agricultural education workshops attended
7. ______ Number of agricultural education classes that students can also receive science credit for.

Please use the following rating scale for question 8:
6= very strongly supports 5=strongly supports 4=supportive 3=opposes 2=strongly opposes 1=very strongly opposes

8. ______ How supportive is the administration of your agricultural education program?

Part 2
Included in this area is a list of statements concerning the integration of science into the agricultural education program. As you read each statement, please respond to each item by sharing your beliefs about the item using the 1 to 6 scale described below.

1=very strongly agree 2=strongly agree 3=agree 4=disagree 5=strongly disagree 6=very strongly disagree

EXAMPLE
5 Integration of science into the agricultural education program is important

Agriculture and Science

1. ______ People pursuing a career in agriculture must have a greater understanding of biological science than ten years ago.
2. ___ People pursuing a career in agriculture must have a great understanding of physical science than ten years ago.
3. ___ Students learn more about agriculture when science concepts are an integral part of their instruction.
4. ___ Students are more aware of the connection between scientific principles and agriculture when science concepts are in integral part of their instruction in agricultural education.
5. ___ Students are more motivated to learn when science is integrated into the agricultural education program.
6. ___ Students are better prepared in science after they completed a course in agricultural education that integrated science.
7. ___ Science concepts are easier to understand for students when science is integrated into the agricultural education program.

Teaching Integrated Science
8. ___ I am prepared to teach integrated biological science concepts.
9. ___ I am prepared to teach integrated physical science concepts.
10. ___ I teach integrated science concepts in agricultural education that focus more on the biological science concepts than the physical science concepts.
11. ___ Integrating science into the agricultural education program requires more preparation time than before emphasizing integrated science concepts.
12. ___ I have integrated more science in the advanced courses than the introductory courses in agricultural education.
13. ___ Integrating science into agriculture classes has increased our school’s ability to teach student to solve problems.

Barriers to Integrating Science
14. ___ The lack of adequate federal, state, or local funds is a barrier to integrating science in the agricultural education program.
15. ___ The lack of appropriate equipment is a barrier to integrating science into the agricultural education program.
16. ___ The lack of agriscience inservice workshops/courses for agricultural education teachers is a barrier to integrating science into the agricultural education program.
17. ___ The lack of close proximity to high-technology firms is a barrier to integrating science into agricultural education programs.
18. ___ The lack of agriscience jobs in the local community is a barrier to integrating science into agricultural education programs.
19. ___ The lack of student preparation in science (prior to enrolling in agricultural education) is a barrier to integrating science into agricultural education programs.
20. ___ The lack of an integrated science curriculum is a barrier to integrating science into agricultural education programs.
21. ___ The lack of science competence among teachers in agricultural education is a barrier to integrating science in agricultural education.
22. ___ The lack of a science teacher who is willing to help integrate science concepts has been a barrier to integrating science in the agricultural education program.

Teacher Preparation Programs

23. ___ Teacher preparation programs in agriculture should require students to take more basic science courses.
24. ___ Teacher preparation programs in agriculture should provide instruction for undergraduates on how to integrated science.
25. ___ Teacher preparation in agriculture should place student teachers with a cooperating teacher that integrates science into the agricultural education program.
26. ___ Teacher preparation programs should provide inservice for teachers in the field on how to integrate science into their agricultural education program.
27. ___ Teacher preparation programs should have a follow-up inservice activity which requires Agricultural Education teachers to cooperate with a science teacher in their district to integrate science into the curriculum.
28. ___ Teacher preparation programs should require that students conduct their early field experience program with a teacher that integrates science into the agricultural education program.

Student Enrollment

29. ___ Integrating science into the agricultural education program more effectively meets the needs of special population students (i.e. learning disabled).
30. ___ High ability students are more likely to enroll in agricultural education courses that integrate science.
31. ___ Average ability students are more likely to enroll in agricultural education courses that integrate science.
32. ___ Low ability students are more likely to enroll in agricultural education courses that integrate science.
33. ___ Total program enrollment in agricultural education will increase if more science is integrated into the curriculum.

Program Support

34. ___ Local administrator support will increase if teachers integrate more science into the agricultural program.
35. ___ School counselor support will increase if teachers integrate more science into the agricultural program.
36. ___ Community support will increase if teachers integrate more science into the agricultural program.
37. ___ Parental support will increase if teachers integrate more science into the agricultural program.
38. ___ Science teacher support will increase if teachers integrate more science into the agricultural program.
39. ___ Other teacher support will increase if teachers integrate more science into the agricultural program.

Meeting State Standards

40. ___ Integrating science will support the Agricultural Education program by helping our students meet OGT requirements.
41. ___ Integrating science will help align Agricultural Education programs with emerging education standards.
42. ___ State standards will be an asset to what we are trying to do in our agricultural education program.
Appendix B. IRB Exemption Letter

Office of Responsible Research Practices
The Ohio State University
300 Research Administration Building
1960 Kenny Road
Columbus, OH 43210-1063
Phone (614) 688-8457
Fax (614) 688-0366
www.orrp.osu.edu

June 10, 2010

Protocol Number: 2010E0355
Protocol Title: THE FACTORS INFLUENCING PERCEPTIONS OF OHIO AGRICULTURAL EDUCATORS TOWARDS INTEGRATING SCIENCE; ROBERT BIRKENHOLZ, JERRY CHERRY, HUMAN & COMMUNITY RESOURCE DEVELOPMENT
Type of Review: Request for Exempt Determination

Dear Dr. Birkenholz,

The Office of Responsible Research Practices has determined the above referenced protocol exempt from IRB review.

Date of Exempt Determination: 06/03/2010
Qualifying Exemption Category: 2

Please note the following:

- Only OSU employees and students who have completed CITI training and are named on the signature page of the application are approved as OSU Investigators in conducting this study.
- No changes may be made in exempt research (e.g., personnel, recruitment procedures, advertisements, instruments, etc.). If changes are need, a new application must be submitted.
- Per university requirements, all research-related records (including signed consent forms) must be retained and available for audit for a period of at least three years after the research has ended.
- It is the responsibility of the Investigator to promptly report events that may represent unanticipated problems involving risks to subjects or others.

This determination is issued under The Ohio State University’s OHRP Federalwide Assurance #00006378. All forms and procedures can be found on the ORRP website – www.orrp.osu.edu. Please feel free to contact the ORRP staff contact listed below with any questions or concerns.

Cheri Pettey, MA, Certified IRB Professional
Senior Protocol Analyst—Exempt Research
Office of Responsible Research Practices
Ohio State University
1960 Kenny Road
Columbus, OH 43210
Phone: 614.688.0389
Fax: 614.688.0366
Email: pettey.6@osu.edu