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Priority Research Areas

Extension Education
Agricultural Communication
Teaching and Learning in Undergraduate and Graduate Academic Programs
Understanding the Food and Fiber System
(Agricultural Literacy)
Agricultural Leadership
Teacher Education and School-Based Agricultural Education

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Editor's Comments

The Journal of Southern Agricultural Education Research enters its ninth year with growth and maturity on the agenda. During the business meeting at the 2008 AAAE Southern Region Meeting, it was moved and approved to separate the Journal article selection process from the selection process of the Southern Region Agricultural Education Research Conference. As editor, I view this as a positive change that will allow for more diversity of the articles we publish as well as a move that will strengthen the standing of the Journal in academic circles. At the current time, a committee is working on creating the documents that will guide the submission, selection and publication for the future of the Journal. These changes will be presented at the 2009 SAERC. I look forward to this next step and welcome your comments and suggestions for improvement.

Following the procedures first implemented in 2004, articles found acceptable for publication in the Proceedings of the 2008 Southern Region AAAE Research Conference (SR-AAAERC), whose authors had indicated that they be considered for publication in the JSAER, were submitted to a second peer review process. Dr. Gary Moore, North Carolina State University, the Co-Chair of the SR-AAAERC, also served as Co-Editor and provided information to myself in a timely, efficient manner. The six members of the Southern Region AAAE Research Committee served as the Editorial Board for the 2008 JSAER. The members for 2008 were Anna Ball, Scott Burris, Tracy Kitchel, John Rayfield, Shane Robinson and Grady Roberts. They provided meaningful comments on each paper in a timely manner and were a great editorial board. I sincerely appreciate each ones dedication to the profession and willingness to invest their time and energy.

A total of 12 articles were submitted for consideration to the JSAER following their acceptance through the SR-AAAERC review process. Of these, five authors subsequently withdrew their manuscripts from consideration. The review procedure, adopted with Volume 55, allows JSAER reviews to "Accept with Major Revision," and "Accept with Minor Revision" in addition to the "Accept" and "Reject" options available to reviewers in Volumes 53 and 54. Given these options, the following decisions were made. Two articles were accepted without revision, two were accepted with Minor Revision, and three were accepted with Major Revision.

At the completion of the review process, 7 articles were selected for publication. The Editorial Board established a policy that the Editor would publish the total number of articles accepted in the JSAER divided by the total number of unique submissions to the SR-AAAERC. There were 58 articles submitted to the 2008 SR-AAAERC. Twenty-eight were published in the conference proceedings (48%), and 7 were published in Volume 58 of the JSAER for an official acceptance rate of 12%.

Respectfully,

Todd Brashears, Editor
Texas Tech University

EFFECTS OF A MATH-ENHANCED CURRICULUM AND INSTRUCTIONAL APPROACH ON STUDENTS' ACHIEVEMENT IN MATHEMATICS: A YEAR-LONG EXPERIMENTAL STUDY IN AGRICULTURAL POWER AND TECHNOLOGY

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Abstract

The purpose of this study was to empirically test the posit that students who participated in a contextualized, mathematics-enhanced high school agricultural power and technology curriculum and aligned instructional approach that included intensive teacher professional development would develop a deeper and more sustained understanding of selected mathematics concepts than those students who participated in the traditional curriculum and instruction. This study included teachers and students from 32 high schools in Oklahoma (16 experimental classrooms; 16 control classrooms). Students were enrolled in an agricultural power and technology course during the 2004-2005 school year. The experimental design employed was a posttest only control group; unit of analysis was the classroom. One-way analysis of variance (ANOVA) and analysis of covariance (ANCOVA) were used to test the study's null hypothesis. The level of students' achievement as measured by a traditional test of math knowledge revealed results that held practical significance and supported the use of the experimental treatment. So, those who are charged with providing professional development for secondary agricultural education teachers are encouraged to consider introducing the seven-element approach to their students and teachers.

Introduction

In an era of standards-based reform in education, many believe the best way to raise student academic achievement is through improved teaching (Birman, Desimone, Porter, & Garet, 2000). To that end, Porter and Brophy (1988) maintained that student learning can be improved only if teachers' practices are of high standard; however, they concluded many teachers are not prepared to implement practices that reflect high standards. What is more, professional development for teachers could serve to fill the gap between standards-based reform and pre-service teacher preparation (Birman et al., 2000). Unfortunately, many times the professional development provided to teachers does not adequately prepare them for the rigors of standards-based student achievement (Corcoran, 1995; Darling-Hammond, 1996; Hiebert, 1999; Little 1993; Sparks & Loucks-Horsley, 1989).

In an effort to identify effective professional development for teachers, Birman et al. surveyed a sample of more than 1000 teachers who participated in the Eisenhower Professional Development Program. These researchers identified the following six factors aligned with effective professional development: (a) *Form*, was the activity planned as a traditional workshop or a reform activity; (b) *Duration,* how many hours were devoted to professional development; (c) *Participation,* were participants from the same or different schools; (d) *Content focus,* to what extent did the professional development activity focus on improving teachers' subject matter knowledge in mathematics or science; (e) *Active learning,* were teachers actively engaged in significant examination of teaching and learning; and, (f) *Coherence,* were teachers encouraged to continue a professional dialog after the professional development session. Results from this study indicated that effective professional development should provide activities that are longer in duration, involve collective participation, afford opportunities for active learning, encourage a deepening of teachers' content knowledge and provide opportunities for continued coherence (Birman et al., 2000).

The issue of professional development that supports school mathematics reform was addressed by Borasi and Fonzi (2002) in a monograph prepared for the National Science Foundation. The authors identified five factors that must be present in professional development programs in order for those programs to meet the needs of teachers of mathematics. Those factors are:

> (1) be sustained and intensive; (2) be informed by what we know about how people learn best; (3) center around the critical activities of teaching and learning rather than focus primarily on abstractions and generalities; (4) foster collaboration; and (5) offer a rich set of diverse experiences. (p. 114)

Notably, a congruence of opinion exists between those who posited factors necessary for effective professional development of teachers in general (Birman et al., 2000) and those who directed their efforts specifically at teachers of mathematics (Borasi & Fonzi, 2002).

The format used to deliver effective professional development for teachers of mathematics may be as important as the factors necessary; what is more, this conclusion may hold for all teachers who strive to improve student achievement in mathematics. Summer institutes, study groups of teachers who meet on a regular basis, a series of workshops held during the school day or after school, and independent work done by the teacher are examples of effective formats for delivering professional development (Borasi & Fonzi, 2002). Moreover, most successful programs use a combination of formats based on the needs of the teachers involved (Borasi & Fonzi, 2002; Loucks-Horsley, Hewson, Love, & Stiles, 1998; Southern Region Educational Board, 2000).

Once the factors necessary for effective professional development are identified and put into practice, the question still remains, "Is professional development of teachers an effective means to improve student achievement?" To that end, Gordon (1999) found that professional development opportunities aimed at improving student achievement were prominent in successful schools. And, Kent (2004) concluded, "Therefore, linking improved teacher quality through effective professional development will ultimately lead to student success" (p. 432).

Harwell, D'Amico, Stein, and Gatti (2000) found similar results in a longitudinal study conducted in school District #2 in New York City. This study, conducted from 1988 to 1998, explored a variety of factors that influenced student achievement, particularly the role of teacher professional development. During the decade of observation, the percentage of District #2 students who achieved at or above grade level in mathematics rose from 66% to 82%. The researchers concluded that the professional development activities of the teachers may have had some effect.

Further, the use of intensive professional development was found to improve teacher self-efficacy years after the initial professional development session had occurred. For example, Watson (2006) found that teachers' self-efficacy regarding their use of the Internet remained high many years after the initial series of intense professional development sessions had concluded. What is more, some researchers (Mitchell, 2002; Wenger, 1998; White, 2002) have called for the use of "communities of practice" as a cost-effective method to deliver quality professional development for teachers.

Educational practitioners, researchers, and scholars (Gordon, 1999; Harwell et al., 2000; Kent, 2004) have posited that a significant relationship exists between the quality of professional development received by teachers and their future impact on student learning and achievement. However, in order to be effective, professional development must address the critical factors of form, duration, participation, content focus, active learning, and coherence (Birman et al., 2000). Accordingly, effective professional development can have a long term effect on how teachers view their self-efficacy (Watson, 2006). What is more, the use of communities of practice may be an effective way to provide valuable, sustainable, professional development for teachers, including agricultural educators who may be striving to improve their students' achievement in mathematics. Finally, some researchers (Chalmers & Keown, 2006; Mitchell, 2002; Wenger, 1988; White, 2002) have called for the use of "communities of practice" as a cost effective method to deliver quality professional development for teachers

Theoretical Framework

The underlying theoretical framework for this study relies on the model of teaching and learning developed by Dunkin and Biddle (1974) (Figure 1), that was derived from concepts first espoused by Mitzel (1960).

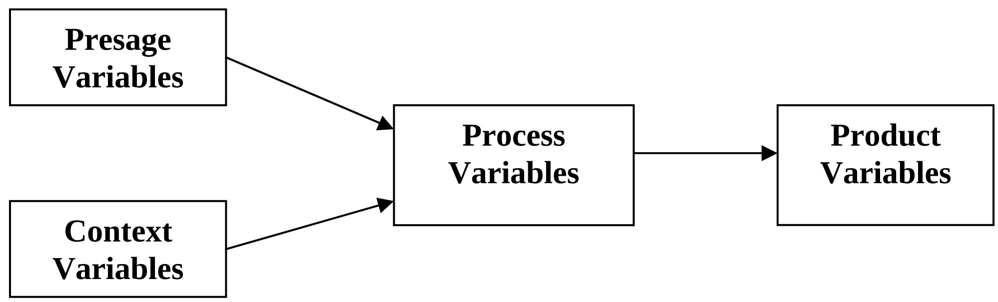

Figure 1. Model for the study of classroom teaching. (Taken from Parr, Edwards, and Leising, 2006, p. 83)

Dunkin and Biddle organized the variables that contribute to teaching and learning into four general classes. The characteristics of teachers that may be observed for their effects on the teaching process are called *presage variables*. Professional development for teachers would be classified as a significant presage variable along with other formative experiences, teacher properties, teacher-training experiences, and any other variable that may be controlled by teacher educators or school administrators are included as presage variables. *Context variables* are those conditions over which a teacher has little control. Pupil formative experiences, pupil properties, school and community contexts, and classroom contexts were variables identified by Dunkin and Biddle as context variables.

Process variables refer to those activities that take place in the classroom during the act of teaching. These variables include behaviors in the classroom demonstrated by the teacher and students, as well as the observable changes in pupil behavior. Finally, *product variables* describe the actual outcomes of teaching (i.e., student achievement in mathematics). The product variables of most interest are immediate pupil growth and long-term pupil effects (Dunkin & Biddle, 1974).

Park and Osborne (2004) used the Dunkin and Biddle model as theoretical support from which to explore the variables necessary to improve student reading, comprehension, critical thinking and motivation to read in the context of agriscience. After completing a review of literature, the researchers grouped the related literature into themes related to presage and context variables. This grouping of literature, based on variables described by Dunkin and Biddle, then allowed the researchers to posit a model for the study of reading in secondary agriscience. Park and Osborne made a strong case as to the utility of the Dunkin and Biddle model for examining the integration of academic and CTE courses, including effects that may be related to improving student academic achievement.

The model posited by Dunkin and Biddle is robust, and, therefore, provides a comprehensive and grounded approach for looking at many of the significant variables associated with the teaching and learning process. This model is also valuable as an aid to summarize research-based knowledge about the teaching and learning process, and it provides a transparent lens to view and interpret the results of this study.

Purpose

The purpose of this study was to empirically test the hypothesis that students who participated in a contextualized, mathematics-enhanced high school agricultural power and technology curriculum (i.e., an experimental curriculum and instructional approach) would develop a deeper and more sustained understanding of selected mathematical concepts than those students who participated in the traditional agricultural power and technology curriculum. The assumption was that students who received the experimental curriculum and instruction would be able to transfer their math learning to new and novel settings (Stone III, Alfeld, Pearson, Lewis, & Jensen, 2005) in their technical field and more broadly, including their performance on a standardized test of mathematics ability.

Research Questions and Null Hypothesis

The following research questions guided the study: (2) What were selected characteristics of students enrolled in and instructors teaching Agricultural Power and Technology in Oklahoma during the 2004-2005 school year? (b) What was the effect of a math-enhanced agricultural power and technology curriculum and aligned instructional approach on student performance as measured by a traditional test of student math ability? The following null hypothesis guided the study's statistical analyses: H_o There is no difference between the two study groups on math performance as measured by a conventional standardized test of math achievement.

Methods and Procedures

This year-long study was conducted as a result of a pilot study carried out during the spring 2004 semester (Parr, 2004). Accordingly, the investigation's research questions and null hypothesis echo those of the pilot study (Parr). Both studies were conducted as one replication of a larger study (Stone III et al., 2005); the pilot being one of six replications and this study one of five replications nationwide. All involved a different career and technical education curriculum area. The National Research Center for Career and Technical Education (NRCCTE) funded and facilitated coordination of the larger study.

This study utilized a posttest only control group experimental design (Campbell & Stanley, 1963). The volunteer teacher participants and their classrooms were randomly assigned to either the experimental or control groups. Accordingly, the resulting units of analysis were intact classrooms. The randomly assigned classrooms were pre-tested to determine level of equivalence regarding students' basic mathematical skills (Campbell & Stanley, 1963; Tuckman, 1999). The Terra Nova CAT Survey examination (25 items) was used as the pre-treatment measure to establish equivalence of groups prior to the experiment; the test had a reliability coefficient of 0.84 (Cronbach's alpha) (McGraw-Hill, 2000). The Terra Nova CAT Basic Battery (46 items) that was used as a post-treatment measure for evaluation of general math ability has a reliability coefficient of 0.91 (Cronbach's alpha) (McGraw-Hill, 2000).

The design of this study was chosen based on its robust nature and its adherence to the U.S. Department of Education's standards for considering funding of educational practices that are supported by research using experimental designs whereby participants are randomly assigned to treatment and control groups (U.S. Department of Education, 2003a). In addition, this study followed the guidelines set forth by the U.S. Department of Education (2003b) for evaluating whether an intervention is supported by rigorous evidence by using outcome measures that are considered "valid."

The treatment in this study consisted of the *Math-in-CTE* model developed by the NRCCTE. The model involved both a particular pedagogy and a prescribed process that can be expressed in the following mathematical equation: (Pedagogy)(Process) = Student Math Performance. This model is based on the basic assumption that occupations aligned to career and technical programs are rich in math content and thus Career and Technical Education (CTE) programs, including secondary agricultural education, should strive to enhance the math embedded in their existing curricula. This model was developed to assist CTE teachers, including agricultural education instructors, in identifying math in their curricula and to improve their instruction as it related to those math concepts. The goal of such instruction was for students to view math as they would any other tool (e.g., a saw, a tractor, a plow) necessary to complete a task in their occupational area (Stone III et al., 2005).

The pedagogical part of the NRCCTE model for this study consisted of 17, math-enhanced, agricultural power and technology lessons developed by the experimental agricultural education teachers and their math teacher partners during the pilot study (Parr, 2004). These lessons were refined further at additional professional development sessions provided for teachers during the summer of 2004, prior to the 2004-2005 school year (Young, 2006). All lessons were revised and improved to conform to the NRCCTE model for a math-enhanced lesson (Figure 2).

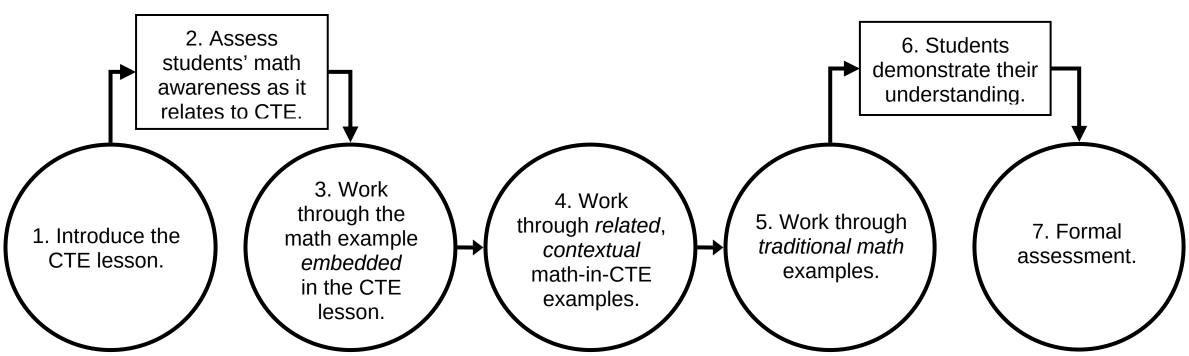

Figure 2. The NRCCTE Model: The seven-elements of a math-enhanced lesson (Stone III et al., 2005)

The development of math-enhanced agricultural power and technology lessons and the treatment's pedagogy (i.e., an aligned instructional approach) was just one aspect of the NRCCTE model. The study's treatment also included the creation of a process by which agricultural education teachers in the experimental group learned to develop and teach the math-enhanced agricultural power and technology lessons. This process consisted of sustaining the agriculture-math teacher partnerships (i.e., communities of practice), curriculum mapping, developing a scope and sequence for teaching the lessons, providing sustained professional development, and implementing the lessons. According to Dunkin and Biddle (1974), the abovementioned teacher professional development experiences were *presage* variables.

The experimental group agricultural education teachers and their math teacher partners participated in approximately 11 days of professional development over the course of this study The goal and objectives of the professional development component of this study's treatment were outlined at a Math-in-CTE Year 2 Planning Meeting held in Minneapolis, MN June 4-5, 2004 (National Research Center for Career and Technical Education, 2004):

> The overarching goal of the professional development aspect of the study is to prepare teachers to reinforce students' understanding and mastery of higher-level math concepts and skills by enhancing the math that already exists in the CTE curriculum. The professional development sessions will reinforce and build on the teachers' content and pedagogical knowledge. Math-enhanced lessons developed in year 1 of the study will be critiqued and improved. New lessons, based on the identification of mathematics concepts within specific CTE courses, will be developed in year 2 to further help teachers emphasize and enhance math as part of their CTE classroom instruction. (p. 9)

During the study, the control group teachers were asked to teach their agricultural power and technology classes using the same curriculum and teaching method(s) (i.e., "traditional instruction") they had used previously. Due to the nature of the study, the researcher had very limited contact with members of the control group. Control group teachers' students were made available for testing per the study's testing regimen, which was carried out by testing liaisons (Young, 2006).

Findings

Selected characteristics of participating students and teachers were summarized using frequencies and percentages calculated from the study's questionnaires. The pre-treatment measure used to determine the equivalency of groups regarding students' general mathematical ability was analyzed using one-way analysis of variance (ANOVA). Due to finding a significant difference (p = .047) between the experimental and control groups based on results of the pre-treatment measure, comparative analysis of the posttest mathematics achievement measure was conducted using the analysis of covariance (ANCOVA) procedure.

Selected Characteristics of Students and Teachers

The student pre-treatment questionnaire revealed that the student participants were mostly male (77.5%) and of European/Anglo descent (62.9%). However, one-in-four students reported their race as Native American. Most of the students were either 16 (29.5%) or 17 (31.4%) years of age at the time of the study, and were enrolled almost equally in the 12th (28.8%), 11th (31.9%), and 10th grades (32.1%). Approximately 7-in-10 (70.5%) students reported that their average grades for all courses were mostly B's and C's or higher. Except for one teacher participant, all were male (96.9%). Nearly 4 of 5 teachers (78.1%) reported they were of European/Anglo descent.

Pre-treatment Analysis

In the fall of 2004, the two groups of student participants were tested using the Terra Nova CAT™ Survey Edition (CTB/McGraw-Hill) examination to determine the equivalence of groups in regard to their general math ability. The control group mean score for this examination was 49.21 with a standard deviation of 8.23; the experimental group mean score was 43.44 with a standard deviation of 8.01 (Table 1). A comparison of this data using a one-way ANOVA indicated that a significant difference in mean scores existed between the groups on general math ability at an *a priori* determined alpha level of .05 (p = .047; Table 2); the control group students scored significantly higher on the examination.

Table 1

Descriptive Statistics for Student Math Performance by Group on the Terra Nova Survey Examination (Pre-treatment Measure)

	n	Mean	*SD*	Minimum	Maximum
Control	18	49.21	8.23	33.11	67.20
Experimental	16	43.44	8.01	28.67	57.25
Total	34	46.50	8.521	28.67	67.20

Note. The total number of classes that took the Terra Nova Basic Survey Examination differ when compared to the total number of agricultural education teachers who participated in the study (N = 32) due to the fact that two control group teachers taught two sections of agricultural power and technology. Thus, two sections (classes) were tested for each of those teachers.

Table 2

Comparative Analysis of Student Math Performance by Group Means as Measured by the Terra Nova Survey Examination (Pre-treatment Measure)

	SS	*df*	*MS*	*F*	*p*
Between Groups	282.208	1	282.208	4.271	.047*
Within Groups	2114.349	32	66.073		
Total	2396.557	33			

*$p < .05$.

The use of a pre-treatment measure to determine equivalency of groups regarding general math ability prior to administration of the treatment is a method of reducing experimental error using statistical means rather than experimental (Keppel, 1991). As a pre-treatment measure, the test becomes a covariate and is useful in further refining experimental error and to adjust treatment effects when differences between the experimental and control groups are determined prior to the treatment (Keppel, 1991). Due to finding a significant difference between the experimental and control groups on the pre-treatment measure, analysis of the posttest math examination was done using the analysis of covariance (ANCOVA) procedure.

Posttest Analysis

To address the study's null hypothesis, student participants in both the experimental and control groups were tested on their general math ability using the Terra Nova CAT™ Basic Battery (CTB/McGraw-Hill) Level 21/22 Form A examination after the treatment was completed. The control group mean score was 44.97 with a standard deviation of 14.72, and the experimental group mean score was 46.17 with a standard deviation of 11.07 (Table 3). Although the experimental group students scored higher, an ANCOVA comparison of this measure revealed no significant difference in general math ability between the groups following the treatment ($p = .125$) at an *a priori* determined alpha level of .05 (Table 4). The null hypothesis was not rejected based on this analysis. Equality of variances was assured with a Levene's Test ($\alpha = .696$). Effect size was also calculated using Keppel's (1991) formula for Omega squared ($\acute{\omega}^2 = .031$); a "small" effect (Cohen, 1977) was revealed.

Table 3

Descriptive Statistics for Student Math Performance by Group on the Terra Nova Basic Battery Examination

	n	Mean	*SD*	Minimum	Maximum
Control	18	44.97	14.74	19.57	76.09
Experimental	14	46.17	11.07	21.74	60.14
Total	32	45.50	13.06	19.57	76.09

Table 4

Comparative Analysis of Student Math Performance by Group as Measured by the Terra Nova Basic Battery Examination with Pre-treatment Measure as a Covariate

Source	*SS*	*df*	*MS*	*F*	*p*
Pre-treatment Measure	2079.080	1	2079.080	18.847	.000*
Between Groups	275.997	1	275.997	2.502	.125
Within Groups	3199.090	29	110.313		
Total	5289.569	31			

*p < .05.

Note. Degrees of freedom differ for the Terra Nova Basic Battery Examination when compared to the pre-treatment measure due to the random assignment of the three mathematics posttests to two classrooms in the experimental group with small numbers of students, which prevented all three measures being administered in those classrooms.

Conclusions

This study found that the student participants were mostly male and of European/Anglo descent. However, one-in-four students reported their race as Native American. Most of the students were either 16 or 17 years of age at the time of the study and were enrolled almost equally in the 10th, 11th, and 12th grades. Approximately, 70% of students reported that their average grades for all courses were mostly B's and C's or higher. Except for one participant all teachers were male, and nearly 80% reported they were of European/Anglo descent.

Within this particular population, a math-enhanced agricultural power and technology curriculum and aligned instructional approach did not result in a significant increase ($p < .05$) in student performance as measured by a traditional test of student math ability (i.e., Terra Nova CAT™ Basic Battery) ($p = .125$). Although no significant difference was detected for the study's null hypothesis, the post-treatment measure of student math achievement did show a positive effect in favor of the experimental group (Table 3). What is more, the comparison of students' Terra Nova CAT™ Basic Battery performance revealed results that held practical significance ($\acute{\omega}^2 = .031$).

Implications and Discussion

Although no significant differences were detected for the study's null hypothesis, the post-treatment measure of student math achievement did show a positive effect in favor of the experimental group (Table 3). It is important to note that experimental group agricultural education teachers and their math teacher partners participated in approximately 11 days of professional development over the course of this study. Moreover, a review of the agendas from those professional development sessions (Young, 2006) revealed congruence with five factors identified by Borasi and Fonzi (2002) necessary for professional development that supports school-based mathematics education reform.

One positive outcome of the intensive professional development associated with this study was the emergence of communities of practice. The construct "community of practice" as used in this study is consistent with the theory espoused by Wenger (1998) and described in educational practice by Yamagata-Lynch (2001). Although Yamagata-Lynch suggested that "community of practice" be used as a metaphor for analyzing current practices, she also promoted the idea of examining the advantages and disadvantages of using "communities of practice" as tools for crafting educational environments, including learning contexts that hold promise for improving student achievement. So, the identification of factors inherent to the design of this study that resulted in the transformation of teacher teams as described by Parr (2004) into communities of practice is worthy of additional inquiry.

Further, would the development of "communities" early in teachers' professional careers result in the establishment of communities of practice that, in turn, create vibrant and effective schools where the quality of student learning is exemplary? Using the concept of communities of practice as a tool for designing effective educational environments, research regarding the development of communities of practice among pre-service agricultural education teachers and pre-service academic teachers may be warranted.

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PERSPECTIVES OF SUCCESSFUL AGRICULTURAL SCIENCE AND TECHNOLOGY TEACHERS ON THEIR PREPARATION TO TEACH AGRICULTURAL MECHANICS

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Abstract

Mechanization is integral to American agricultural industry. Like the industry, technical knowledge and processes continue to evolve to better fit emerging physical conditions and economic circumstances. Instructional strategies have integrated project methods, problem-solving, and applications of mathematics and technical science as core elements of the secondary school curriculum. However, exigencies have led to dramatic reductions of course offerings by universities that are publicly responsible for the education and professional development of teachers.

This dilemma gave rise to the need to examine the perspectives of successful agricultural science and technology (AST) teachers and the education and experiences that are associated with their teaching success. Qualitative research methods were selected to investigate factors that enabled successful AST teachers to be more successful than were their peers. What factors motivate teachers to excel and what decision-rules influence how curriculum is selected, organized and delivered? Finally, this study focused on the recommendations of expert teachers regarding curricular improvements needed to prepare future teachers for this technical subject matter. Data were collected, analyzed, and reported using accepted qualitative protocols to develop emergent themes.

Successful AST teachers agreed that undergraduate course work did not adequately prepare them to teach the current curriculum. Unanimously, respondents expressed concern for the lack of scope, depth, and technical skills in agricultural mechanics or engineering technology being taught to future AST teachers. This concern about the pre-service curriculum led teachers to agree that three-week agricultural mechanics certification workshops are essential for successful instruction of agricultural mechanics. Furthermore, successful teachers recommended a formal mentoring program to assist in the professional development of AST teachers. Finally, the respondents recommended more quality workshops on the part of the state department of education, the professional teachers' organization, and the agricultural education community to improve the quality, scope, depth, and technical skills in secondary schools.

Introduction

McLean and Camp (2000) noted that "agricultural teacher educators have experienced significant pressure over the past 15 years to reform the process by which the teachers are prepared in the profession" (p. 25). Spurred on by a blue ribbon commission headed by Ross Perot, the passage of 1984 Texas Education Reform Bill (Texas House Bill 72), brought changes to curriculum and course content, as well as demanding more accountability. HB 72 established the Legislative Education Board to oversee the implementation of state-mandated education reforms and to reset public education policy.

Twelve teacher education programs in Texas offer course work designed to prepare teachers to instruct within the area of agricultural mechanics. These universities provide encouragement, advice, and expertise through in-service education and graduate courses after graduation; yet many teachers refuse to attempt instruction in the field of study, or omit units from course content to match their own knowledge and skill levels. Though this phenomenon occurs across all levels of experience, it is more prevalent among AST teachers with 10 years or less experience. This trend is compounded by a reduction of required instruction in agricultural mechanics during the undergraduate degree program. Hubert and Leising (2000) concluded that "research has shown that those teachers new to or preparing for the agricultural teaching profession often express anxiety for and a lack of preparedness to teach agricultural mechanics subject matter"(p. 18).

When observed in the schools, many AST teachers appear to lack competence in basic knowledge and skills included in the agricultural mechanics curriculum. Baker and Malle (1995) and McLean and Camp (2000) concluded that AST teachers are least competent in agricultural mechanics content when compared to other fields of study taught in high school agricultural sciences. These perceptions were confirmed by Hubert and Leising (2000) finding "numerous studies indicated that teacher knowledge of agricultural mechanics was in need of improvement both prior to and after accepting teaching positions" (p. 18).

Further evidence was found by the principal researcher while reviewing Texas FFA Career Development Event results. Younger or less experienced AST teachers do not successfully prepare students for the rigor of the event. Upon review of the 2003 Texas FFA Agricultural Mechanics CDE results, the principal researcher found competitive teams in the event (i.e., those in the top six placings) were coached by teachers who had an average tenure of 23.8 years.

Previously integrated into a four grade-level curriculum, agricultural mechanics units became nine stand-alone semester courses in an array of 42 approved semester courses. After several years of teaching or monitoring these courses, it was evident to teachers and college faculty alike that not all of the content of each course were included in "frequent" instruction. Current Texas AST teachers are expected to provide basic skills and knowledge in a broad range of topics. Units of instruction and course content vary from very basic to very specialized content areas.

Review of Literature

While Texas colleges and universities continue to amend degree plans to cope with changing legislation, demographics, and financial issues, Franklin (2001) found that universities are not adequately preparing teachers to instruct effectively in psychomotor skill instruction. He recommended "utilizing student teacher candidates to present demonstration skills in agricultural mechanic courses in college and university undergraduate courses can be a successful training experience that benefits both the student teachers and the college and university students" (p. 9-10). Baker and Malle (1995) concluded that the national average of eight semester hours of collegiate-level agricultural mechanics courses for an agricultural education certification did not prepare young people to teach in this highly technical discipline. Croom (2003) concluded that "the teaching profession is one of the most visible professions in the world" (p. 1). When any major component of the curriculum is deleted or ignored, the discrepancy quickly becomes apparent.

Dyer and Andreason (1999) concluded that the lack of preparation to teach within the field of study, coupled with a great anxiety for safety instruction to prevent possible litigation, has driven young teachers away from the agricultural mechanics curriculum. Dyer and Andreason noted voids in teacher preparation in laboratory safety. Foster, Bell, and Erskine (1995) stated "the findings of this study agree with the earlier reported position of Klein (1991). He stated that 'total teacher responsibility demands too much based upon traditional teacher training and the inherent teaching culture'" (p. 7).

Buriak and Harper (2001) agreed that more training is necessary to adequately prepare pre-service teachers. "Teaching is a craft. To learn a craft, apprentices observe, work, and practice with a master craftsman, usually over some extended period of time" (p. 2). Harper, Buriak and Hitching (2001) found when recently certified Illinois agricultural science instructors were given the Agriculture Single Subjects Assessment Test (ASSAT) they performed best on the "Agriculture and Society" portion with an 80% competency level. These same instructors scored lowest on the "Agricultural Mechanics" portion with a 46.97% competency level. Harper, Buriak, and Hitchings concluded that significant changes in the university curriculum coupled with the reduced scope of college-level instruction have made it too expensive for teachers to instruct effectively in our present competency-based agricultural mechanics curriculum model. Ullrich, Hubert, and Murphy (2001) revealed "an element of weakness in curricula utilized by the teacher, and in the teacher preparation programs failing to prepare these individuals for the challenge of integrating safety and health concepts throughout the curriculum" (p. 9).

Beginning in 2005, all Texas AST teachers are mandated by Texas Education Agency and the State Board for Educator Certification to pass an exit exam produced by National Evaluation Systems. Twelve percent of the examination questions relate to agricultural mechanics content and deal with theoretical concepts as well as technical skill knowledge (National Evaluation Systems, 2004). The NES exam requires comprehension and application in agricultural machinery; internal combustion engines; land leveling and measurement, plumbing tools and skills; power tools and maintenance; tool identification and safety; and wood and metal fabrication. Current Texas university degree plans for AST teacher certification do not develop the theory and understand of these topics, let alone develop minimum technical skills.

Theoretical Framework

There are many factors related to teacher success. Some teachers are confident and competent in their instructional abilities to teach agricultural mechanics. Therefore as researchers, we assumed a very pragmatic approach to the research questions. Pragmatists view experience and reasoning as major sources of knowledge. Outcomes and results are useful to clarify the stated or desired reality (Driscoll, 2000). The reality is that some teachers with similar education and preparation are much more successful in the instruction of agricultural mechanics in a high school curriculum than are their peers. Consequently, a systematic inquiry should recognize the interactions of economic, educational, physical, psychological, and social events that affect success. This research searched for reasons that explain teacher success from among current agricultural mechanics instructors. The inquiry sought consensus among successful teachers concerning how to better prepare future teachers to instruct in a technical subject.

Statement of Problem

One must ask if the present scope and sequence of todays university undergraduate courses and the current in-service and professional development activities effectively preparing AST teachers for success in teaching agricultural mechanics.

Research Questions

Research Question 1. What education and experiences enable certain teachers to develop successful agricultural mechanics programs? This question identified what formal education and related experiences teachers would explain their recognized success in teaching agricultural mechanics, be it formal education, previous course experience, industry experience, post-graduate workshops, advanced degrees or a combination of the mentioned experiences.

Research Question 2. What influences teachers to include certain portion of the agricultural mechanics curriculum? And what influences teachers to discard certain portions of the curriculum? Recognizing that some units of instruction are not attempted or taught within the curriculum, this question attempted to clarify why some teachers omit units from their instructional program.

Research Question 3. What steps should the agricultural education community take to increase quality instruction in agricultural mechanics in the future? This question probed ideas, perceptions, and recommendations of experts necessary to improve performance in teaching agricultural mechanics.

Assumptions

Four assumptions were identified during the planning and implementation of the research project. First, a qualitative study seeking to describe observations within case boundaries cannot be generalized to other populations. Second, a personal interview process is more likely to identify gestalt experiences and events that shape successful AST teachers careers. Third, a stepwise interview would achieve saturation of data required for sound qualitative research (Lincoln and Guba, 1985). Finally, interpretations of data through transcribed interviews and member checks would accurately capture the respondents' thoughts and experiences.

Delimitations

This study was delimited to recognized, successful instructors of high school agricultural mechanics throughout Texas, with no regard for geographic region, ethnicity, or gender. Therefore, this study was delimited to a pool of teachers with five or more years of teaching experience. Teaching experience included instruction in the general agricultural mechanics pre-employment laboratory, instruction in several agriculturally related courses, and/or consistent success in the Texas FFA Agricultural Mechanics CDE or Texas FFA Tractor Technician CDE.

Limitations

Experiences and events confirming success of the AST teacher were carefully defined. Successful instruction in the agricultural mechanics portion of AST curriculum included: (1) success in FFA CDE team preparation; (2) increased student enrollment in courses; and/or (3) the implementation of new agricultural mechanics courses into the curriculum.

Methodology

This qualitatively-designed inquiry encapsulated the perceptions of successful AST teachers (respondents) who were widely recognized in Texas for their successful instructional programs in agricultural mechanics. Qualitative research techniques included archival research, personal interviews, and member checking to provide for triangulation (Lincoln and Guba, 1985). This inquiry was conducted during the late spring and summer. This prolonged engagement and persistent observation were employed to increase trustworthiness (Erlandson, 1993). Interviews were confidentially conducted by the principal researcher after informed consent using IRB protocols.

Target Population and Pool Size

Erlandson (1993) concluded, "Purposive sampling requires a procedure that is governed by emerging insights about what is relevant to the study. . ." (p. 148). The pool was drawn using four criteria: (a) have coached an agricultural mechanics CDE team that competed in state-level contests at least three of the last five years, (b) have coached a tractor technician CDE team to compete in state-level contests at least three of the last five years, (c) have taught an agricultural mechanics pre-employment laboratory that had increased enrollment the last five years, and (d) have taught a successful agricultural mechanics program to include implementing a new TEA approved agricultural mechanics related course in the last five years.

Instrumentation

The qualitative research instrument was constructed by the researcher and approved by the Texas A&M University Institutional Review Board. The instruments focused on the education and previous industry experiences of the respondents, their independent perceptions of the teacher preparation certification as it related to agricultural mechanics, and the respondents' ideas on how teacher preparation could be improved. The respondents were asked to provide demographic data to verify they met the qualifications for the pool.

Data Collection and Analysis

Six interviews were conducted at local high schools beginning in June and concluding in August, four interviews were conducted during the Texas FFA state degree check, and 10 were completed during the Texas FFA Convention. All interviews were scheduled at the convenience of the respondent. The principal researcher conducted each interview privately with time allocated for a complete discussion. All conversations were audio taped to insure accuracy in the transcription of the findings as recommended for quality research (Berg, 1989). Transcriptions were provided to each respondent for verification of accuracy as a member check (Lincoln and Guba, 1985). To insure anonymity, respondents were sequentially coded using a notation (R1, . . . R 19) assigned at the onset of the transcription process and kept separately from names or other identifying information. Data were collected, recorded and analyzed by the principal researcher. Constant comparative analysis was used comparing each new interview with previous statements or themes to conceptualize the possible relationships. All quotations, inferences, or remarks used in the interviews were recorded confidentially. Finally, the principal researcher analyzed the responses to report all recurring themes.

Three basic research questions guided the interview: (1) What education or experiences enable certain teachers to develop successful agricultural mechanics programs? (2) What influences teachers to instruct in the portion of the agricultural mechanics curriculum they do teach? (3) What steps should the agricultural education community engage in to assure quality instruction in agricultural mechanics in the future?

Findings

Archival research through the Texas FFA CDE results and the Texas teachers' directory identified 26 successful AST teachers who met the research criteria and were recognized for high quality instruction and having substantial success with agricultural mechanics in their communities.

Nineteen experts were sequentially interviewed. Redundancy confirmed saturation of the data in the latter stage of interviews (Lincoln and Guba, 1985). Of the qualified respondents, the number of years teaching experience ranged from five to 32 years. Twelve were recognized early through archival research as successful in preparing agricultural mechanics CDE and/or tractor technician CDE teams among the top six in the state. Four AST respondents taught pre-employment laboratories. Three respondents had initiated new Texas Education Agency approved courses in agricultural mechanics during the last five years. Six of the respondents were Texas A&M University graduates, four from Texas A&I University (now Texas A&M University-Kingsville), four graduated from Tarleton State University, and two from Texas Tech University. The remaining three respondents completed undergraduate degrees at East Texas

State University (now Texas A&M University-Commerce), New Mexico State University, and Southwest Texas State University (now Texas State University), each with one graduate.

There were two themes that emerged early in the inquiry: (1) Current Texas university agricultural education degree plans do not offer enough agricultural mechanics courses to effectively prepare respondents. Consequently each successful respondent had obtained technical and pedagogical training elsewhere; and (2) AST teachers often omit topics of instruction from the state adopted curriculum due to a lack of familiarity, comfort or because of safety and liability issues.

Findings: Research Question 1

What education or experiences enable certain teachers to develop successful agricultural mechanics programs? Successful respondents held similar views concerning the education received by AST teachers to instruct in agricultural mechanics. Most of the respondents admitted that they did not receive enough instruction during their undergraduate programs to provide adequately for their students or the subject. "Did your undergraduate course work adequately prepare you to teach the current agricultural mechanics curriculum?" Thirteen of 19 interviewees answered the question with "no" (R1, 3, 4, 5, 6, 8, 10, 11, 12, 14, 15, 16, 17). All of the recognized instructors attributed previous industry experience, postgraduate education, or a three-week certification workshop as major factors contributing to their successes. None of the respondents professed to have become adequately acquainted with the field of study during their undergraduate programs that were similar to the current nine-hour program offered at most universities.

Undergraduate Curriculum

Five respondents viewed their education in agricultural mechanics to be adequate for them to instruct in the current curriculum. However, of the five (R2, 7, 9, 13, 18), all had at least 15 hours of agricultural mechanics instruction during their undergraduate degree. Their successes were attributed to advanced courses beyond minimum requirements, previous industry experiences, or the influence of key mentors within the community of practice.

Of those who answered the question with a "no," eight had attended a three-week pre-employment laboratory workshop with being the greatest influence on their successes (R1, 4, 5, 8, 12, 14, 15, 16). Six had previous industry experience and credited it as the largest factor contributing to their success, more so than any undergraduate coursework (R4, 7, 9, 11, 16, 17). R17 concluded, "My B.S. degree exposed me to about 30% of what I teach today."

Three-Week Short Course

To explain their successes in teaching agricultural mechanics, eight respondents (R1, 4, 5, 8, 12, 14, 15, 16) pointed to the three-week agricultural mechanics pre-employment laboratory certification workshop as the greatest single influence on their ability to teach agricultural mechanics. R1 characterized the experience as "without a doubt, the best career experience for me to improve my teaching was the three-week certification workshop with Dr. Billy Harrell."

Industry Experience

Four of the responders (R7, 9, 11, 16) cited previous industry experience before their undergraduate coursework as a major criterion for their success. R9 stated unequivocally that 15 hours of undergraduate course work prepared him to teach the curriculum. He then shared a caveat: "after returning back to college, I was a certified welder. I had worked offshore in the oil industry for four and a half years. I choose to attend Texas A&I University because of its location and the opportunity to continue work in that industry. I was very fortunate to have very good instructors . . . that actually took me to the next level." Industry experience was frequently referenced as an important factor (R7, 9, 11, 16)

Mentoring

All respondents described a mentoring process that was essential to them to become successful in the profession—whether that relationship was with former teachers, current university faculty, teaching peers, industry colleagues or family members. R3 observed "You've got to have somebody help you be creative with the material you're presenting and the way you're presenting it. . . . you don't get it at the universities" (R3, 4, 10, 13). R4 summed up the emerging theme; "I think the mentor relationship is imperative—it has to be there. . . . I've picked up the phone in the middle of the night and called Dr. Harrell and asked him how to solve a problem. . ." Nine of the 19 individuals (R1, 2, 4, 5, 6, 8, 9, 10, 12) recognized Dr. Billy Harrell at Sam Houston State University and relied on him for guidance and direction as much as technical support. Eight of the 19 individuals identified Dr. Lon Shell of Southwest Texas State University for his teaching and motivation of AST teachers (R3, 4, 5, 6, 10, 13, 14, 17). Six other Texas professors were recognized for their mentoring roles. Ten interviewees also included local business or industry personnel as mentors, motivators and enablers (R3, 6, 9, 11, 12, 13, 14, 16, 17, 18). Mentors make a difference.

Findings: Research Question 2

What influences teachers to instruct in the portion of the agricultural mechanics curriculum they do teach? Also perceived through the interviews was a theme that most instructors do not include all of the topics in the state adopted curriculum. When asked specifically, sixteen respondents stated very confidently that most of their peers do not teach all the recommended topics within the curriculum (R1, 2, 3, 4, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18). Only two individuals, when asked if they thought those peers adequately covered all topics in the curriculum, answered the question in a manner complimentary to their peers (R5, 9). Respondents recognized a variety of reasons for their peers not to teach the complete curriculum: allotted time, limited knowledge and confidence of the teacher, a lack of interest or effort and safety issues.

R10 noted that ". . . very few teachers in Texas cover agricultural mechanics the way it should be covered. And I feel very strongly on this, I feel that agricultural teachers cover what they know and what's easy and what's comfortable and are very scared of newer technology or something that they did not know or that they think the kids may not want to learn. Because it takes some classroom time or book time or lecture time to learn it, before you go out in the shop. Outside of welding, or electricity, or maybe some engines, teachers will balk at anything else." R17 agreed saying ". . . no. I think they are probably exposed to about 85% of the material and come away with about 60% of it."

Nine of the 19 respondents (R3, 4, 6, 7, 10, 13, 15, 17, 18) recognized a general lack of knowledge to allow the instructor to be comfortable teaching across the curriculum. R7 commented "students are pretty bright. I guess every school has them and I get a lot of students in the program that already have some background; they either grew up on a farm or their dad's a welder or whatever the case might be so they already have some skills. If you can't show them that you have those skills or can expose them to some new techniques or technology, I think your credibility is affected."

Three respondents (R1, 14, 16) concluded that a general lack of interest or effort by the instructor was the major shortcoming. R17 added ". . . no experience, and they don't feel capable." R18 agreed ". . . no background, they are scared and don't want people in town to know how little they do know." R14 summed up an emerging theme with "so many (teachers) fall into those traps . . . too intent on teaching a contest and building projects . . . or just doing fabrication. Some of the kids that are good at one thing, they just let them do that for everybody. I don't know how they have time to teach it all."

Findings: Research Question 3

What steps should the agricultural education community engage in to assure quality instruction in the agricultural mechanics discipline in the future? During the interview process, the very qualified respondents contributed several meaningful ideas for the agricultural education community to consider for future preparation of agricultural science instructors. Among these recommendations was the consistent theme that the universities must bolster the agricultural mechanics or engineering required for certification, that the pre-lab certification workshops must remain intact, and that a mentoring system would improve teacher success in agricultural mechanics.

Several respondents recommended more core courses in agricultural mechanics or engineering for certification to bolster pre-service teachers' confidence and credibility. R1 questioned if the current university instruction in agricultural mechanics is going in the right direction. "I doubt if they offer an adequate amount or if the instruction in the courses is working toward helping those teachers cover the TEKS they are going to have to teach." R3 commented . . . "not discrediting my fellow teaching partners . . . (but they) didn't get any agricultural mechanics in college. . . . They need some competency level to go out there and teach and a lot of our kids (young teachers) don't have it now." R5 confirmed that . . . "I have had several student teachers and I think some of them really come out lacking in some of the agricultural mechanics areas. There's a lot of them that seem to be lacking in basic things." R6 noted that "every one of the TEKS curriculums calls for a certain amount of safety and yet they (teachers) haven't had it themselves, and yet they are to be responsible for a (safe) lab environment." R15 agreed ". . . more preparation at the collegiate level." The respondents with the most formal education in the field of agricultural mechanics or engineering felt that beginning instructors were ill-prepared to the point of encountering personal liability issues.

Successful AST respondents unanimously recommended systematic mentoring for young teachers to nurture their professional development. Respondents valued a three-week short course for agricultural mechanics to certify beginning teachers for the technical and skill-oriented curriculum. At the same time, respondents requested professional development workshops for themselves as well as less experienced teachers.

Summary, Conclusions, And Recommendations

Baker and Malle (1995) and Harper, Buriak, and Hitchings (2001) warned about the lack of preparedness and confidence on the part of AST teachers induction into teaching agricultural mechanics. Harper, Buriak, and Hitchings (2001) concluded ". . . during the last twenty years, programs have diminished scope and many have undergone significant change" (p. 1). They went on to warn that when we ". . . couple this change with the reduction in engineering technology or mechanization credits required for certification . . . it is obvious that competency-based guidelines are too expensive and cannot be met by prospective teachers of agriculture" (p. 1).

Archival research found 28 AST teachers who were successful in their instruction of agricultural mechanics and met initial criteria as a successful group. Interview sampling was conducted until redundancy suggested saturation of the data (Lincoln and Guba, 1985). Findings were reported for each of the three basic research questions: (1) What education or experiences enable certain teachers to develop successful agricultural mechanics programs? (2) What influences teachers to instruct in the portion of the agricultural mechanics curriculum they do teach? and (3) What steps should the agricultural community engage in to assure quality instruction in agricultural mechanics in the future?

This inquiry validated other research literature (Baker and Malle, 1995; Buriak and Harper, 2001; Dyer and Andreason, 1999; Harper, Buriak, and Hitchings, 2001; Hubert and Leising, 2000; and McLean and Camp, 2000) that there is a lack of scope, depth, and technical instruction obtained in current Texas teacher education universities.

A successful teacher recommended a review of the strategic plan and the priorities for program development based on societal need. R6 recommended ". . . the agricultural education family as a whole needs to sit down and look at their curriculum and ask themselves what are we preparing our students for, what are we preparing them to do, what can we do to strengthen their competence level to go out and reach young people? They need to look at their budget, prioritize their academic areas of emphasis, and add more agricultural mechanics."

Respondents felt strongly that agricultural mechanics courses should remain an integral part of the high school curriculum. Harper, Buriak, and Hitchings (2001) in their summation of Rosencrans and Martin work, recommended that "agricultural mechanization continue to be viewed as a viable component of secondary agricultural education to reflect emerging technologies, problem-solving, critical thinking, systems approaches, as well as science and mathematics applications" (pp. 1-2).

Conclusions: Research Question 1

What education or experiences enable certain teachers to develop successful agricultural mechanics programs? Of the 19 respondents, thirteen professed not to be prepared to instruct in the agricultural mechanics curriculum at the onset of their teaching careers (R1, 3, 4, 5, 6, 8, 10, 11, 12, 14, 15, 16, 19). Of the remaining few who felt comfortable teaching, all had more class hours of agricultural mechanics than is currently required by universities for agricultural science certification. Currently Texas teacher education universities require from nine to 12 hours of agricultural mechanics or engineering for teacher certification.

Additionally, nine respondents recognized the TEA-approved workshops offered for certification in agricultural mechanics as the single biggest positive influence on their careers (R1, 4, 5, 8, 12, 14, 15, 16, 19). Three teachers cited previous industry experience as the greatest contributor to their teaching careers in agricultural mechanics (R7, 9, 11). Six others noted a combination of things including several additional hours of collegiate instruction and previous experiences (R2, 3, 6, 13, 17, 18) as the major reasons for their successes.

Conclusions: Research Question 2

What influences teachers to instruct in the portion of the agricultural mechanics curriculum they do teach? Seventeen of 19 successful teachers recognized that not all portions of the approved agricultural mechanics curriculum for high school agricultural sciences are adequately taught in depth, scope, and quality (R1, 2, 3, 4, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19).

Eleven respondents felt that a lack of preparedness of the teacher was the major reason units of instruction were omitted from the approved curriculum (R1, 3, 4, 6, 7, 10, 13, 15, 17, 18, 19). "They're probably just like me, they have areas they feel very comfortable and confident in, and they probably spend more time in those areas than in others they feel least qualified" (R3).

Most of the respondents cited one of the current leaders in collegiate agricultural mechanics instruction as a major influence on their recognized success. Nine AST teachers noted Dr. Billy Harrell of Sam Houston State University was a major influence (R1, 2, 4, 5, 6, 8, 9, 10, 12) and nine credited Dr. Lon Shell of Southwest Texas State University as an exemplary mentor (R3, 4, 5, 6, 10, 13, 14, 17, 19).

When asked to explain some lack of instruction in all areas of the curriculum, six respondents noted a shortage of time and interest on the part of the teacher. Three of the respondents alluded to the issue of time. Three members mentioned the lack of interest or effort on the part of the instructor as a reason for failing to include all areas of the curriculum.

Conclusions: Research Question 3

What steps should the agricultural education community engage in to assure quality instruction in the agricultural mechanics discipline in the future? Eighteen of 19 teachers insisted that more instruction in agricultural mechanics or agricultural engineering was necessary for the bachelor's degree and agricultural science teacher certification. When asked if the teacher education universities offered enough courses in agricultural mechanics currently for future agricultural science teachers to successfully teach agricultural mechanics, 18 stated or implied that they did not (R1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19). Fourteen of the 19 respondents stated that more workshops in the field of teaching high school agricultural mechanics were imperative (R1, 3, 5, 6, 7, 8, 9, 10, 12, 13, 15, 16, 17, 19). Additionally, all respondents felt that a mentoring process was critical in their personal development and should be promoted. "The mentoring process has got to be there" (R1). Also 12 of the respondents predicted a shortage of qualified university professors to teach and mentor agricultural science teachers (R1, 6, 7, 8, 9, 10, 12, 13, 15, 16, 17, 19).

Conclusions

After a careful review and analysis of the interview transcripts used in this work coupled with a 23 year immersion in the community of practice by the principal researcher, several themes emerged. The teacher education universities in Texas must re-examine the number of agricultural mechanics courses in the degree plan. Preservation of the three-week agricultural mechanics certification workshop is crucial. The agricultural community as a whole should develop systematic mentoring whereby recognized experienced teachers tutor early-career AST teachers. Texas universities with teacher education programs, Texas Education Agency, and the Vocational Agriculture Teachers Association of Texas (VATAT) must collaborate to provide systematic, hands-on, technical skill enhancing professional development workshops. The agricultural community as a whole must continue to encourage pre-service teachers to advance their education and enter the teacher education profession.

Recommendations

As a result of this analysis, the researchers offer the six recommendations in no particular order for public action: 1) Provisions for systematic mentoring of early-career teachers tied to a public action plan must be made. This should be a commitment from the agricultural education community as a whole. 2) A commissioned comprehensive state-wide task force should be established to review the roles, scope and organizational delivery of knowledge and skills essential for students preparing for careers in contemporary agricultural industry. Task Force recommendations should address teacher preparation, certification, graduate education, industry internships and in-service education that advance student success and meet societal needs. 3) Research should be commissioned to identify alternative strategies necessary to develop critical competencies during pre-service teacher certification programs. The findings should be used to make critical modifications to pre-service teacher certification programs. 4) Commission research to identify contemporary "emphasis areas" of knowledge and skills, whereby degree plans are structured to encourage pre-service teachers to gain expertise in one or more knowledge domains. This research should couple degree plans with learning agreements, communicate learning outcomes, and empower multiple forms of credit in several educational settings. 5) A statewide plan should designed to include strategies to reward teachers for continue professional development, life-long learning and teaching excellence. Incentives should be identified and offered to reward student career success and teacher professional development. 6) Professional development should become a shared responsibility on the part of Texas public universities that prepare AST teachers, the Texas Education Agency, the State Board for Educator Certification, Texas Independent School Districts and the agricultural industry. This partnership would serve to better prepare AST teachers for the state of Texas.

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RELATIONSHIPS BETWEEN THE PERCEIVED CHARACTERISTICS OF E-EXTENSION AND BARRIERS TO ITS ADOPTION

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Abstract

In 2006, Cooperative Extension launched an online information source known as eXtension. Perceptions of eXtension's characteristics, and potential barriers to adoption, are likely to influence an extension agent's decision to adopt eXtension. An online survey instrument was used to collect information related to the adoption of eXtension by Texas Cooperative Extension county extension agents. The primary variables for the study were: (a) relative advantage, (b) compatibility, (c) complexity, (d) trialability, (e) observability, (f) concerns about time, (g) concerns about incentives, (h) financial concerns, (i) planning issues, and (j) technology concerns. Low, negative relationships were found to exist between perceptions of relative advantage and concerns about time, as well as perceptions of compatibility and planning issues. Financial concerns had a low, negative relationship with relative advantage, compatibility, complexity, and trialability. Adequate planning can increase the likelihood that an innovation will be adopted rapidly, but financial concerns must be thoroughly addressed. Reducing or eliminating the barriers related to the perceived characteristics of eXtension would be expected to increase agents' rate of adoption.

Introduction

In 2002, a Cooperative State Research, Education, and Extension Service (CSREES) white paper warned, "The capacity of the Extension System to change is swiftly eroding through decreasing human resources and decreasing financial capital" (Crosby et al., Problem/Need section, ¶ 2). CSREES is not the only entity to have expressed its concern with the current state of Cooperative Extension; it has been observed that "cultural and technological changes are quickly outpacing the traditional Extension delivery model" (Accenture, 2003, p. 5). Budgetary concerns plague Extension programs across the country, as they have for years (McDowell, 2004). Extension's funding woes have created unmet needs in many communities and threatened the collaborative nature of the system by forcing partners into direct competition with each other to receive federal dollars (Payne, 2004). The unstable financial situation highlights the need for Extension to move beyond the status quo and embrace innovative methods of educational outreach.

An online information resource known as eXtension (pronounced e-extension, www.extension.org) was developed by the Cooperative Extension System as an innovative solution to address some of Extension's challenges. eXtension was described as "a national Internet-based information and education network that provides public access to land-grant university (LGU) expertise" (McCarthy & Hutchinson, 2004, The Opportunity section, ¶1). It is hoped that eXtension will (a) reduce the duplication of efforts between states, (b) produce profits, (c) increase visibility, and (d) increase customer satisfaction (Accenture, 2003). These benefits are unlikely to be realized without the adoption of eXtension by county-level Cooperative Extension agents and educators (Accenture, 2003). An investigation of the factors affecting agents' adoption of eXtension would be considered prudent for planning the successful implementation of eXtension.

Theoretical Framework

The theoretical framework for this study was developed from Rogers' (2003) theory of the diffusion of innovations. According to Rogers, an innovation is "an idea, practice, or object that is perceived as new by an individual" (2003, p. 12). When an individual first learns of an innovation, he/she has entered into the first stage of the innovation-decision process. Rogers defined the innovation-decision process as

> the process through which an individual … passes from first knowledge of an innovation, to the formation of an attitude toward the innovation, to a decision to adopt or reject, to implementation and use of the new idea, and to confirmation of this decision (2003, p. 20).

The speed with which individuals pass through the innovation-decision process is partially dependent upon the individuals' view of an innovation's characteristics. Rogers (2003) described five such characteristics: (a) relative advantage, (b) compatibility, (c) complexity, (d) trialability, and (e) observability. Relative advantage is "the degree to which an innovation is perceived as better than the idea it supersedes" (Rogers, 2003, p. 15). Perceptions of relative advantage are largely subjective, but are often linked to social prestige factors and convenience. Compatibility is "the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters" (Rogers, 2003, p. 15). Innovations which appear to be compatible with an individual's social system are more rapidly adopted. Complexity is "the degree to which an innovation is perceived as difficult to understand and use" (Rogers, 2003, p. 16). As would be expected, innovations that are easy to use tend to have the fastest rates of adoption. Trialability is "the degree to which an innovation may be experimented with on a limited basis" (Rogers, 2003, p. 16). Experimenting with an innovation on a trial basis reduces the uncertainty individuals often have and increases the rate of adoption. Finally, observability is "the degree to which the results of an innovation are visible to others" (Rogers, 2003, p. 16). Observable innovations instigate discussion amongst peers, thereby increasing the rate of adoption.

Researchers have often framed their research in terms of the barriers to adoption; that is, those factors which are thought to negatively impact an individual's perceptions of an innovation (Berge, Muilenburg, & Van Haneghan, 2002; Berge, 1998; Curbelo-Ruiz, 2000; Haber, 2006; Kuck, 2006; Maguire, 2005; Murphrey & Dooley, 2000; Murphy & Terry, 1998; Nelson & Thompson, 2005; Porter, 2004; Roberts & Dyer, 2005). However, few studies have focused exclusively upon the relationship between an individual's perceptions of the characteristics of an innovation and perceptions of barriers to the adoption of that innovation. One such study investigated Web-based distance education, a close cousin to eXtension. Li (2004) examined the relationships between faculty perceptions of Web-based distance education and the barriers to that innovation. Relative advantage, compatibility, complexity, and trialability were related to one or more perceived barriers. Li concluded the elimination of perceived barriers would positively, and significantly, influence faculty perceptions of Web-based distance education. Schifter (2000) concurred with Li, noting that participant adoption increases when barriers and inhibitors are eliminated. Likewise, the identification of similar relationships with regard to eXtension may provide an understanding of how to expedite its adoption.

Purpose and Objectives

The findings presented in this article were part of a larger study undertaken to understand the influence of selected factors on the adoption of eXtension by Texas Cooperative Extension county extension agents (Harder, 2007). The section of the study presented here was correlational in nature. The objective was to describe relationships between agents' perceptions of eXtension based upon Rogers' (2003) characteristics of an innovation, and their perceptions of potential barriers to the adoption of eXtension.

Procedures

The target population was Texas Cooperative Extension county extension agents employed in 2007. According to the Texas Cooperative Extension office, there were 533 county agents (K. A. Bryan, personal communication, February 12, 2007). Cochran's (1977) formula was used to determine the sample size (n = 237) for the study. County extension agents were randomly selected to participate (Gall, Gall, & Borg, 2007).

An online questionnaire was used to collect data. The original instrument was developed by Li (2004) to examine the diffusion of distance education at the China Agricultural University. Li's original instrument was modified by the researchers to fit the context of eXtension, based upon constructs adopted from Li (2004), Rogers (2003), and related studies from the literature. It was then converted to an online format.

The instrument was reviewed for content validity by a panel of experts composed of faculty members in the Department of Agricultural Education, Leadership, and Communications at Texas A&M University and the national marketing director of eXtension. A pilot study was conducted to test face validity and establish reliability.

The instrument contained four sections. The second and third sections were related to the objectives reported here. The second section asked participants to rate their agreement with 28 statements related to their perceptions of eXtension, based upon a six-point Likert-type scale (1 = *Strongly Disagree*, 2 = *Disagree*, 3 = *Somewhat Disagree*, 4 = *Somewhat Agree*, 5 = *Agree*, 6 = *Strongly Agree*). The scale was interpreted as follows: *Strongly Disagree* = 1.00 – 1.50, *Disagree* = 1.51 – 2.50, *Somewhat Disagree* = 2.51 – 3.50, *Somewhat Agree* = 3.51 – 4.50, *Agree* = 4.51 – 5.50, *Strongly Agree* = 5.51 – 6.00. Rogers' (2003) characteristics of an innovation were used to categorize the statements into constructs as follows: (a) relative advantage, (b) compatibility, (c) observability, (d) trialability, and (e) complexity. The third section asked participants to rate their agreement with 31 statements related to their perceptions of potential barriers to eXtension, using the same Likert-type scale as the second section. The statements were clustered into five constructs: (a) concerns about time, (b) concerns about incentives, (c) financial concerns, (d) planning issues, and (e) technology concerns.

The reliability of the instrument was tested by calculating Cronbach's alpha coefficient for each internal scale (Cronbach, 1951). A reliability level of .80 or higher was considered acceptable (Gall, Gall, & Borg, 2007). Reliability levels for the internal scales are presented in Table 1.

Table 1
Reliability Levels of Internal Scales

Internal Scale	α Levels
Relative Advantage	.887
Compatibility	.873
Complexity	.860
Trialability	.952
Observability	.881[a]
Concerns about time	.890
Concerns about incentives	.924
Financial concerns	.909
Planning issues	.921
Technology concerns	.883

Note: Reliability levels ≥ .80 were considered acceptable.
[a]Original α level was .758; one item was deleted.

Data were collected online according to Dillman's (2000) tailored design method. Of the original 237 E-mail addresses, 236 were valid. A final response rate of 66.90% (n = 158) was obtained. Eight participants opted out. There were 25 responses removed due to missing or incomplete data, reducing the number of usable responses to 125.

Non-response error was controlled by comparing early and late respondents on the primary variables of interest. Results may generalized to the target population when no significant differences exist between early and late respondents (Lindner, Murphy, & Briers, 2001). There were no significant differences between early and late respondents for the majority of the primary variables of interest, with the exception of observability. Findings related to observability are limited to the sample due to the significant difference between early and late respondents.

Demographic data was collected from the participants as a part of the larger study (Harder, 2007). The majority of respondents had primary responsibilities in the areas of agriculture (n = 45), family and consumer sciences (n = 39), and 4-H/youth development (n = 26). There were fewer agents in the areas of horticulture (n = 8) and natural resources (n = 3). No respondents reported community development as a primary agent role. All of the respondents had obtained a minimum of a bachelor's degree. Most (84.8%) of the agents were at least thirty years of age. Of the respondents who reported gender, 46% were female and 51% were male.

Relationships between perceptions of eXtension and potential barriers were described by calculating Pearson's product-moment correlation coefficient using Davis' (1971) convention.

Findings

The objective was to describe the relationships between perceptions of eXtension and potential barriers to the diffusion of eXtension. Agents' perceptions of eXtension were described according to (a) relative advantage, (b) compatibility, (c) observability, (d) complexity, and (e) trialability. Potential barriers to the adoption of eXtension were analyzed according to (a) concerns about time, (b) concerns about incentives, (c) financial concerns, (d) planning issues, and (e) technology concerns. The means and standard deviations for the primary variables are presented in Table 2, so that the findings which follow may be interpreted in context (Harder & Lindner, in press).

Table 2
Descriptive Statistics for the Primary Variables

Variable	*M*	*SD*
Complexity	4.48	.77
Compatibility	4.35	.87
Concerns about time	4.12	.87
Trialability	4.11	.88
Concerns about incentives	3.90	1.00
Planning issues	3.84	.93
Financial concerns	3.77	1.01
Relative advantage	3.75	.82
Technology concerns	3.66	.97
Observability	2.85	.98

Note. Scale: 1 = *Strongly Disagree*, 2 = *Disagree*, 3 = *Somewhat Disagree*, 4 = *Somewhat Agree*, 5 = *Agree*, 6 = *Strongly Agree*.

Relative Advantage

The correlations between respondents' perceptions of relative advantage and the potential barriers to the diffusion of eXtension are presented in Table 3. A significant, low negative relationship existed between perceptions of concerns about time and perceptions of relative advantage, r (125) = -.21, $p < .05$. A significant, low negative relationship existed between perceptions of financial concerns and perceptions of relative advantage, r (125) = -.20, $p < .05$. No other significant relationships existed.

Table 3
Correlations between Perceptions of Potential Barriers to eXtension and Relative Advantage

	Relative Advantage		
Potential Barrier	*r*	*p*	Magnitude
Concerns about time	-.21*	.02	Low
Concerns about incentives	-.10	.29	
Financial concerns	-.20*	.03	Low
Planning issues	-.16	.08	
Technology concerns	-.06	.53	

Note. Magnitude: .01 ≥ r ≥ .09 = Negligible, .10 ≥ r ≥ .29 = Low, .30 ≥ r ≥ .49 = Moderate, .50 ≥ r ≥ .69 = Substantial, r ≥ .70 = Very Strong.
*$p < .05$.

Compatibility

The correlations between respondents' perceptions of compatibility and the potential barriers to the diffusion of eXtension are presented in Table 4. A significant, low negative relationship existed between perceptions of financial concerns and perceptions of compatibility, r (125) = -.20, $p < .05$. A significant, low negative relationship existed between perceptions of planning issues and perceptions of compatibility, r (125) = -.23, $p < .05$. No other significant relationships existed.

Table 4
Correlations between Perceptions of Potential Barriers to eXtension and Compatibility

	Compatibility		
Potential Barrier	*r*	*p*	Magnitude
Concerns about time	-.10	.25	
Concerns about incentives	-.05	.55	
Financial concerns	-.20*	.02	Low
Planning issues	-.23*	.01	Low
Technology concerns	-.08	.36	

Note. Magnitude: $.01 \geq r \geq .09$ = Negligible, $.10 \geq r \geq .29$ = Low, $.30 \geq r \geq .49$ = Moderate, $.50 \geq r \geq .69$ = Substantial, $r \geq .70$ = Very Strong.
*$p < .05$.

Observability

The correlations between respondents' perceptions of observability and the potential barriers to the diffusion of eXtension are presented in Table 5. There were no significant relationships between potential barriers to the diffusion of eXtension and observability.

Table 5
Correlations between Perceptions of Potential Barriers to eXtension and Observability

	Observability		
Potential Barrier	*r*	*p*	Magnitude
Concerns about time	-.01	.90	
Concerns about incentives	-.15	.11	
Financial concerns	-.10	.39	
Planning issues	-.03	.75	
Technology concerns	-.14	.12	

Complexity

The correlations between respondents' perceptions of complexity and the potential barriers to the diffusion of eXtension are presented in Table 6. A significant, low negative relationship existed between perceptions of financial concerns and perceptions of complexity, $r(125) = -.25$, $p < .01$. No other significant relationships were found.

Table 6
Correlations between Perceptions of Potential Barriers to eXtension and Complexity

	Complexity		
Potential Barrier	*r*	*p*	Magnitude
Concerns about time	-.16	.08	
Concerns about incentives	.08	.40	
Financial concerns	-.25**	.01	Low
Planning issues	-.08	.38	
Technology concerns	-.15	.10	

Note. Magnitude: $.01 \geq r \geq .09$ = Negligible, $.10 \geq r \geq .29$ = Low, $.30 \geq r \geq .49$ = Moderate, $.50 \geq r \geq .69$ = Substantial, $r \geq .70$ = Very Strong.
**$p < .01$.

Trialability

The correlations between respondents' perceptions of trialability and the potential barriers to the diffusion of eXtension are presented in Table 7. A significant, low negative relationship existed between perceptions of financial concerns and perceptions of trialability, r (125) = -.21, $p < .05$. No other significant relationships were found.

Table 7
Correlations between Perceptions of Potential Barriers to eXtension and Trialability

	Trialability		
Potential Barrier	*r*	*p*	Magnitude
Concerns about time	-.15	.09	
Concerns about incentives	-.14	.12	
Financial concerns	-.21*	.02	Low
Planning issues	-.12	.20	
Technology concerns	-.06	.53	

Note. Magnitude: $.01 \geq r \geq .09$ = Negligible, $.10 \geq r \geq .29$ = Low, $.30 \geq r \geq .49$ = Moderate, $.50 \geq r \geq .69$ = Substantial, $r \geq .70$ = Very Strong.
*$p < .05$.

Conclusions

The objective was to describe the relationships between perceptions of eXtension (relative advantage, compatibility, observability, complexity, and trialability) and potential barriers (concerns about time, concerns about incentives, financial concerns, planning issues, and technology concerns) to the diffusion of eXtension. There were no significant relationships between perceptions of observability and any potential barrier. This was consistent with Li's (2004) conclusion that perceptions of observability were not related to how faculty perceived potential barriers to Web-based distance education.

Concerns about time negatively affected how agents perceived relative advantage. This was not consistent with Li (2004), who concluded the perceived relative advantage of Web-based distance education was negatively related to planning issues. However, planning issues were negatively related to how agents perceived eXtension's compatibility. Li found planning issues to be related to the perceived compatibility of Web-based distance education.

Financial concerns were most often related to perceptions of eXtension. Relative advantage, compatibility, complexity, and trialability were negatively affected by financial concerns. Only the relationship between complexity and financial concerns was supported by Li (2004).

Implications

It is important to note this study did not attempt to establish whether increasing eXtension's rate of adoption is a desirable outcome for Cooperative Extension agents. However, this assumption has been made for the purposes of framing discussion. Certainly this important question should be addressed prior to acting upon the implications and recommendations presented here.

Understanding the relationships between agents' perceptions of eXtension and potential barriers provides valuable information which may be used to effectively target resources allocated to promoting the adoption of eXtension. While decreasing or eliminating *any* of the five barriers identified in this study would be expected to positively increase perceptions of eXtension (Schifter, 2000), the results of this study indicated a particular need to address financial concerns. Financial concerns were related to perceptions of four out of five of the characteristics of eXtension. Decreasing or eliminating financial concerns would be expected to have the most significant impact on improving perceptions of eXtension and its rate of adoption.

As mentioned previously, the findings for this objective differed from Li's (2004) findings in several ways. Rogers' (2003) description of the diffusion process—an innovation diffuses through a *social system* over time—provides an explanation for the differences between the two studies. Although eXtension and Web-based distance education are similar innovations, the social systems associated with Chinese faculty members and Texas Cooperative Extension county agents are vastly different. Some discrepancies in perceptions were to be expected. Diffusion research must focus not only on the innovation itself, but the social system within which the diffusion is expected to occur.

There was consistency between the two studies with regard to the lack of a relationship between observability and any of the perceived barriers despite the differences in social systems. The nature of the online innovations studied may account for the common findings. Rogers (2003) noted that software components of innovations are difficult to observe and are associated with slower rates of adoption. Both Web-based distance education and eXtension qualify as software components and do not lend themselves towards establishing the same type of observability that might be associated with a more visible innovation, such as a hybrid car.

The results of this study supported Li's (2004) conclusion that planning issues were negatively related to perceptions of compatibility. Planning issues, in the context of this study, included opportunities to learn about the innovation, how the innovation fit the vision of the organization, and the existence of a need for the innovation. Rogers (2003) listed these factors as influential in how individuals determine an innovation's compatibility. The implication is adequate planning can significantly increase the probability that adopters will view an innovation as compatible.

Change agents should be cautioned against launching an innovation prematurely; patience will yield more fruitful rewards.

Recommendations

Recommendations for practice are based upon the assumption that increasing the adoption of eXtension by extension agents is desirable. To do so, barriers related to (a) concerns about time, (b) planning issues, and (c) financial concerns should be decreased or eliminated, in order to increase perceptions of four of the five characteristics of eXtension. Special consideration should be given to addressing financial concerns due to its influence on perceptions of multiple characteristics.

Research is recommended to understand the influence of (a) concerns about time and financial concerns on perceived relative advantage, (b) financial concerns and planning issues on perceived compatibility, (c) financial concerns on perceived complexity, and (d) financial concerns on perceived trialability. Future studies should examine how the relationships between perceptions of eXtension and the barriers to eXtension differ according to social system. This study should be replicated in states other than Texas to better understand the factors related to the diffusion of eXtension throughout the entire Cooperative Extension system.

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RESEARCH THEMES, AUTHORS, AND METHODOLOGIES IN THE *JOURNAL OF AGRICULTURAL EDUCATION*: A TEN YEAR LOOK

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Abstract

The Journal of Agricultural Education (JAE) *has been a primary outlet of agricultural education publishing and research and activity dissemination—a claim validated in this study. The purpose of this study, which was a part of a larger study, was to assess ten-years of* JAE *to determine primary and secondary research theme areas, frequent primary and secondary research themes by year, prolific authorship, and research methods and types used, using a mixed-methods design. Analyzed in this study were 323 research articles published in* JAE *from 1997 through 2006. Thirty-nine primary research theme areas and 37 secondary research theme areas were identified. The compilation list of primary and secondary research themes, and prolific themes identified by year are reported. There were 751* JAE *authors identified, with James Dyer (9.0%) being the most prolific. Quantitative research methods were the most common (80.5%). The most frequent research method types were survey methods (45.5%). Research themes appear cyclic and additional research must be completed to determine depth and research influence of the potential cycles. Researchers must diversify their methodological research types to go beyond survey research. This research should be used comparatively with priorities areas identified in the National Research Agenda to determine where future research focus should be incorporated.*

Introduction

Agricultural education contributes scholarship to agricultural and educational systems by linking technical areas of agriculture and humanistic dimensions (Barrick, 1989). It is difficult both to determine the impact of agricultural education and to see its future potential (Williams, 1991). In 1987, the North Central Association of State Agricultural Experiment Station Directors expanded its social science area with the acceptance of agricultural education as a discipline (NCA-24 Committee, 1987). With recognition of agricultural education as a discipline, researchers have sought to understand the theoretical and conceptual underpinnings in context, and numerous attempts have been made to focus the discipline. These attempts have typically focused on three main objectives: (a) analyzing the dimensions of agricultural education, (b) summarizing critiques of agricultural education research, and (c) suggesting strategies to focus the discipline (Barrick, 1989). More recently, the scope has expanded to include (d) summarizing prolific authors (Harder & Roberts, 2006; Radhakrishna & Jackson, 1995; Radhakrishna, Jackson, & Eaton, 1992); and (e) identifying statistical methods used (Bowen, Rollins, Baggett, & Miller, 1990; Dyer, Haase-Wittler, & Washburn, 2003; Mannenbach, McKenna, & Pfau, 1984). Newcomb (1993) indicated a need to transform university agricultural education programs by broadening them and defining programs of inquiry. In 1990, agricultural education researchers were encouraged to "develop an improved conceptual framework for future investigators" and "integrate existing work" (Birkenholz, Harbstreit, & Law, 1990, p. 32).

Although there have been few specific calls from the discipline to examine its essence, numerous scholars have expounded on disciplinary typology (Baker, Shinn, & Briers, 2007; Barrick, 1989; Buriak & Shinn, 1989, 1993; Crunkilton, 1988; Dyer et al., 2003; Frick, Kahler, & Miller, 1991; Hamlin, 1966; Harder & Roberts, 2006; Knight, 1984; Kotrlik, Barlett, Higgins, & Williams, 2001, 2002; Love, 1978; Mannebach, 1981; Mannebach et al., 1984; McCracken, 1983; McKinney, 1987; Miller, 2006; Miller, Stewart, & West, 2006; Moore, 1991, 2006; Moss, 1986; Radhakrishna, 1995; Radhakrishna, Eaton, Conroy, & Jackson, 1994; Radhakrishna & Jackson, 1992, 1993, 1995; Radhakrishna & Mbaga, 1995; Radhakrishna & Xu, 1997; Shinn, 1994; Silva-Guerrero & Sutphin, 1990; Warmbrod, 1986, 1987; Warmbrod & Phipps, 1966). However, the review of literature failed to identify a holistic examination of research in the discipline. It is essential to examine critical components of agricultural education research to understand the current state of research and take a more futuristic approach to knowledge pursuit, development, and examination.

"The future of agricultural research depends upon many variables, not the least important of which is acquisition and application of new knowledge generated from research" (Dyer et al., 2003, p. 61). Moore (2006) posited that it is clear agricultural educators are not "driving" the profession; they spend their time "dabbling in esoteric research that doesn't have much relevance to the real world" (p. 1). Concerns have been voiced about whether agricultural education is actively engaged in research that is needed, progressive, and rigorous. Since the 1990s, rapid growth in research and publishing activities in agricultural education has resulted in a plethora of agricultural education literature (Radhakrishna & Jackson, 1995), and new research outlets were created. "Given the institutional demands of research, teaching, extension, and service, faculty often must allow one area to suffer to meet the expectations of another" (Myers & Dyer, 2004). If research suffers then every aspect of the agricultural education discipline suffers with it.

The need for this research is grounded in research by Ball and Knobloch (2005); Baker, Shinn, and Briers (2007); Crunkilton (1988); Knight (1984); Miller, Stewart, and West (2006); Newcomb (1993); and Radhakrishna and Xu (1997). Knight wrote that a discipline's journals and magazines are good indicators of research priorities in the discipline. Radhakrishna and Xu found that research journal articles are indicators of the profession's scientific activity, philosophy, and application. Ball and Knobloch indicated that it is critical for practitioners to examine the knowledge base of the field to allow the profession to reflect upon actions and ultimately improve the discipline. Crunkilton identified the need for agricultural education to know where it can and should go with research in its pursuit to develop empirical knowledge. Newcomb called for agricultural education research to become more focused, coordinated, and conducted passionately. Miller, Stewart, and West identified the need to review literature to maintain a clear sense of the discipline's research agenda. Baker, Shinn, and Briers indicated the need to examine core knowledge objects and knowledge domains. The expressed need to focus the agricultural education discipline, examine its knowledge base, and review its literature creates a call for use of a holistic approach to examine research in agricultural education.

There have been few specific calls in agricultural education to examine the essence of its research. Yet, there is a need to understand where the discipline has been to allow the profession to better understand where to focus research efforts in the future. "There is a need to re-examine agricultural education in a future that has already happened. Has the knowledge changed along with the times?" (Baker et al., 2007, p. 1). Baker, Shinn, and Briers indicated a need to examine core knowledge objects and collective knowledge domains for agricultural education, and this need remains. In an effort to strengthen research agendas, the *National Research Agenda [NRA]: Agricultural Education and Communication, 2007-2010* was created as a guide for developing futuristic research (Osborne, n.d.). Yet, how can we be sure where we are headed with research, and if the direction is adequate and appropriate, if we are unclear as to where we have been? There is a need, as illustrated by research, to analyze the dimensions of agricultural education in a holistic manner and suggest strategies to focus the discipline and prepare it for the future.

In the past, agricultural education has used limited and infrequent approaches to examining its research. By holistically examining critical components of agricultural education research, the discipline can deepen its understanding of the current state of research and take a more futuristic approach to knowledge pursuit, development, and examination. The disciple might examine many components: research theme areas, variety in research theme areas by year, prolifically published authors, and types of research being conducted. Because a discipline's journals are indicators of research priorities (Knight, 1984), by analyzing research journals it should be possible to examine dimensions of agricultural education in the *Journal of Agricultural Education (JAE)*. Understanding research occurring in agricultural education can assist the discipline and other integrated specializations, as identified in the *NRA*, to more fully focus literary contexts and further strengthen the discipline. This study assisted in creating an agricultural education framework by determining the experience-base of research reported in *JAE*. Until we understand the depth and type of research occurring in our premier journal, we will be unable to determine what futuristic research should occur in agricultural education.

Conceptual Framework

The future of agricultural education depends on many variables and application and acquisition of new knowledge via research is extremely important (Dyer et al., 2003).Yet, the quality of research has been questioned for more than two and a half decades, and in some cases has been identified as inferior to other disciplines (Buriak & Shinn, 1993; Dyer et al., 2003; Radhakrishna & Xu, 1997; Silva-Guerrero & Sutphin, 1990; Warmbrod, 1986).

The conceptual framework of the study (Figure 1) was grounded in work by numerous scholars in agricultural education. Several researchers have completed various components of journal analysis in agricultural education: familiarity and quality of journals and importance of faculty publishing (Radhakrishna, 1995; Radhakrishna & Jackson, 1993); research theme areas (Buriak & Shinn, 1993; Dyer et al., 2003; Miller et al., 2006; Moore, 1991; Radhakrishna & Xu, 1997; Silva-Guerrero & Sutphin, 1990); prolific authors (Harder & Roberts, 2006; Radhakrishna & Jackson, 1995; Radhakrishna et al., 1992); and statistical methods used (Bowen, Rollins, Baggett, & Miller, 1990; Dyer et al., 2003; Mannenbach et al., 1984).

This study examined all research articles published in *JAE* from 1997 to 2006. The study assessed primary and secondary research theme areas, authorship, and research methods and types using a content analysis approach. This research is the first step in identifying a research experience-base framework for agricultural education, using the premier journal, as identified in a field study. Conceptually, this research examined agricultural education with respect to five identified integrated specialization areas of teacher education, extension education, agricultural communications, international agricultural education, and leadership education by analyzing scholarship in published *JAE* research articles. The experience-base, from this research, can then be used as a framework to suggest future research strategies when compared to the *NRA*.

CONCEPTUAL MODEL

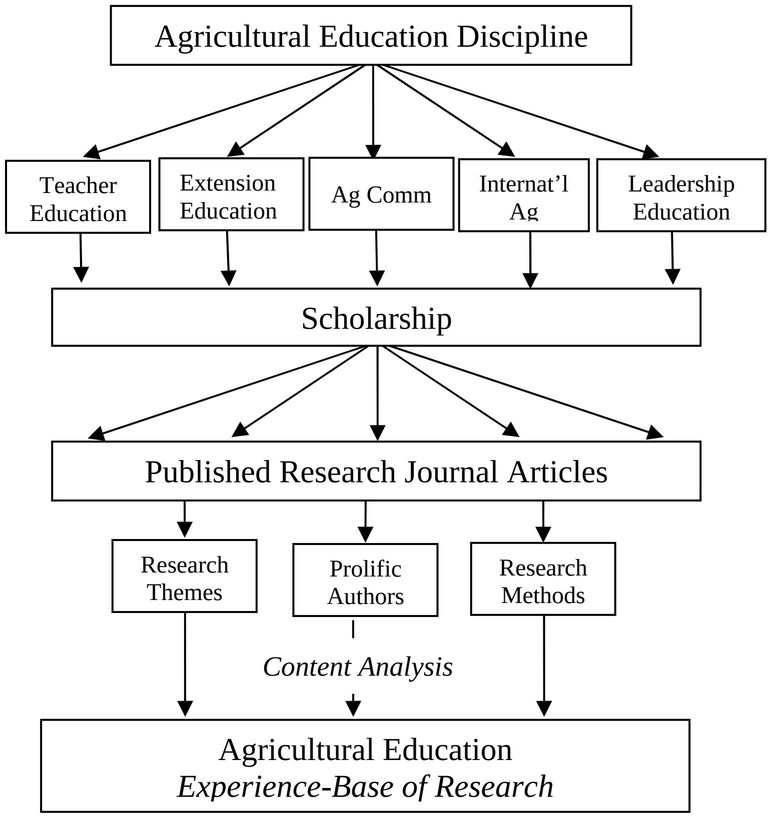

Figure 1. Conceptual base of the study.

Purpose and Objectives

The purposes of this study, which was a part of a larger study, were to review research published in the *Journal of Agricultural Education* from 1997 to 2006 and to examine the historical record of the journal to provide a base of past research, in order to create an experience-base to examine and direct future research. *JAE* is a research journal with authors who are university and college faculty; it is not a practitioner-based outlet. The specific objective was to describe and synthesize published research in the *JAE* during the ten year period by: (a) identifying primary (knowledge-base) and secondary (conceptual-base) research themes in published research articles; (b) identifying primary and secondary research theme areas among research articles published by year; (c) identifying the most prolific authors; and (d) identifying research methods and designs.

Research Methods and Procedures

This study employed a mixed-methods content analysis design. Content analysis as a research method has existed for decades, and the best content-analytic studies use mixed methods methodologies (Weber, 1990). Content analysis can be used to give researchers insight into problems or hypotheses that can then be tested by more direct methods. Content analysis is a systematic, replicable technique for compressing many words of text into fewer content categories based on explicit rules of coding (Berelson, 1952; Krippendorf, 1980; Weber, 1990).

Content validity was maintained using both previous research as a guide and a field study to focus the research. Baker, Shinn, and Briers (2007) identified 104 individuals as active agricultural education research authors. A field questionnaire was developed and sent to 96 of those authors with valid email addresses. The contacted authors were asked to identify premier journals and to validate or add to research theme categories. Research theme categories were created based on previous content analyses of journals in the specializations of teacher education, extension education, agricultural communications, international agricultural education, and leadership education. These categories were provided to the pilot study, and it was the respondents' responsibility to compress or expound on research theme areas. The pilot study identified 37 research theme areas for the five specialization areas identified in the *NRA*. Dillman's (2000) Tailored Design Method was used, and 62 of 96 possible respondents completed the questionnaire, yielding a 65% response rate.

Research journal articles from 1997 to 2006, in the identified premier journal, the *Journal of Agricultural Education*, were used as the frame for the study. The main focus of each article (knowledge-base) was coded as the primary research theme area. The most prevalent supporting theme (conceptual-base) was identified as the secondary theme of each article. The principal investigator and a peer independently reviewed the material and formed a checklist of information required during the review of each journal article. The researchers compared notes and reconciled differences on their initial checklists via negotiations. Researchers used a consolidated checklist to independently apply coding. The researchers then checked for agreement in coding; if reliability was not acceptable, then the previous steps were repeated. Once reliability had been established, the coding was applied on a large-scale basis. The final stage was a periodic quality control check (Weber, 1990). Inter-coder reliability was completed, with at least 10% overlap for the reliability test. Final reliability was calculated using a random sample of 5% of the analyzed articles. Reliability was assessed using Spearman's rho. Reliabilities met or exceeded the minimum standard of .70 (Bowen et al., 1990; Tuckman, 1999).

Findings

The *Journal of Agricultural Education* was identified in the field study as the premier research journal by 93% of respondents. All research journal articles (N = 323 articles) published in *JAE* from 1997 to 2006 were analyzed. Primary research themes identified in *JAE* are shown in Table 1. There were 39 primary research themes identified in *JAE* in the ten-year content analysis. The most frequently identified primary research theme was teacher preparation and competence (10.2%). The second most frequent primary research theme was needs assessment, identified in 9.0% of the *JAE* research articles. Primary research theme areas identified in *JAE* research articles 6.5% or fewer times are identified in the table.

Secondary research themes identified in the *JAE are* displayed in Table 2. There were 37 secondary research theme areas identified. The most frequently identified secondary research theme was teacher preparation and competence (11.8%). The second most frequent secondary research theme was food, agriculture, natural resources, health, and family, identified in 6.5% of the research articles. Secondary research theme areas identified 6.2% or fewer are in the table.
Table 1

Primary Research Themes Identified in the Journal of Agricultural Education *1997–2006*

(*N* = 323)

Research Theme	*f*	*P*
Teacher Preparation and Competence	33	10.2
Needs Assessment	29	9.0
Perceptions and Attitudes Assessment	21	6.5
Food, Agriculture, Natural Resources, Health, and Family	20	6.2
Research (methods and models)	17	5.3
Academic Programs	12	3.7
Critical Thinking	12	3.7
Distance Education	12	3.7
Evaluation	12	3.7
Instructional and Program Delivery Approaches	12	3.7
Processes, Principles, and Styles of Learning	12	3.7
Youth Leadership and Development	12	3.7
Appropriateness of Education	10	3.1
Leadership Management	10	3.1
Institutional Organization and Institutionalization	8	2.5
Curriculum and Program Development	7	2.2
Professional Development	7	2.2
Service and Experiential Learning	7	2.2
Diversity (culture, ethnicity, gender)	6	1.9
Knowledge Competencies and Development	6	1.9
Leadership Development	6	1.9
Volunteer Development and Leadership	6	1.9
Career Development and Assessment	5	1.5
Leadership Education	5	1.5
Agriculture Literacy	4	1.2
Communication Management	4	1.2
Formal and Informal Teaching Approaches	4	1.2
Skill Development and Competencies	4	1.2
Communication Technology	3	0.9
Policy Issues	3	0.9
Communications of Scholarship	2	0.6
Globalization and Internationalization	2	0.6
Information Sources and Technology	2	0.6
Organizational Development and Leadership	2	0.6
Writing	2	0.6
Diffusion of Innovations	1	0.3
Marketing and Promotion	1	0.3
Media Relations	1	0.3
Quality of Life and Life Skills	1	0.3

Table 2

Secondary Research Themes Identified in the Journal of Agricultural Education *1997–2006* (*N* = 323)

Research Theme	*f*	*P*
Teacher Preparation and Competence	38	11.8
Food, Agriculture, Natural Resources, Health, and Family	21	6.5
Curriculum and Program Development	20	6.2
Distance Education	18	5.6
Evaluation	18	5.6
Formal and Informal Teaching Approaches	17	5.3
Institutional Organization and Institutionalization	17	5.3
Youth Leadership and Development	17	5.3
Instructional and Program Delivery Approaches	16	5.0
Appropriateness of Education	15	4.6
Academic Programs	12	3.7
Processes, Principles, and Styles of Learning	12	3.7
Diversity (culture, ethnicity, gender)	9	2.8
Perceptions and Attitudes Assessment	9	2.8
Professional Development	9	2.8
Needs Assessment	8	2.5
Leadership Management	7	2.2
Research (methods and models)	6	1.9
Communications of Scholarship	5	1.5
Leadership Education	5	1.5
Volunteer Development and Leadership	5	1.5
Career Development and Assessment	4	1.2
Critical Thinking	4	1.2
Knowledge Competencies and Development	4	1.2
Leadership Development	4	1.2
Quality of Life and Life Skills	4	1.2
Skills, Knowledge, and Competencies	4	1.2
Community Development and Leadership	3	0.9
Accountability	2	0.6
Information Sources and Technology	2	0.6
Media Relations	2	0.6
Collaborations, Partnerships, and Coalitions	1	0.3
Consumer/Audience Response and Analysis	1	0.3
Globalization and Internationalization	1	0.3
Marketing and Promotion	1	0.3
Policy Issues	1	0.3
Service and Experiential Learning	1	0.3

Table 3 identifies most frequently-occurring primary research themes by year. Theme details, frequencies, and percentages can be seen in the table.

Table 3

Most Identified Primary Research Themes in the Journal of Agricultural Education *by Year* (*N* = 323)

Year	Research Theme	*n*	*f*	*P*
1997	Needs Assessment	29	6	20.7
1998	Needs Assessment	26	4	15.4
1999	Needs Assessment	30	7	23.3
2000	Food, Agriculture, Natural Resources, Health, and Family	43	5	11.6
2001	Perceptions and Attitudes Assessment	27	4	14.8
2002	Teacher Preparation and Competence	28	3	10.7
2003	Teacher Preparation and Competence	31	4	12.9
2004	Teacher Preparation and Competence	34	4	11.8
2005	Teacher Preparation and Competence	33	6	18.2
2006	Teacher Preparation and Competence	42	10	23.8

Table 4 outlines frequently used secondary research themes, identified in the *JAE*, by year. Theme details, frequencies, and percentages can be seen in the table.

Table 4

Most Identified Secondary Research Themes in the Journal of Agricultural Education *by Year* (*N* = 323)

Year	Research Theme		*n*	*f*	*P*
1997	Youth Leadership and Development		29	4	13.8
1998	Appropriateness of Education				
	Distance Education				
	Diversity (ethnicity, gender, culture)				
	Evaluation	(4-way tie)	26	3	11.5
1999	Perceptions and Attitudes Assessment		30	4	13.3
2000	Teacher Preparation and Competence		43	8	18.6
2001	Food, Agriculture, Natural Resources, Health, and Family				
	Institutional Organization and Institutionalization	(2 way tie)	27	3	11.1
2002	Teacher Preparation and Competence		28	4	14.3
2003	Teacher Preparation and Competence		31	5	16.1
2004	Institutional Organization and Institutionalization		34	4	11.8
2005	Distance Education				
	Institutional Organization and Institutionalization				
	Teacher Preparation and Competence	(3-way tie)	33	4	12.1
2006	Teacher Preparation and Competence		42	9	21.4

Prolific authors identified in *JAE* are listed in Table 5. No distinction was made between lead and supporting authorship. There were 751 authors (duplicated count) identified in the 323 analyzed *JAE* articles. James Dyer was identified as the most prolific author in the journal, authoring or co-authoring 29 of the 323 articles (9.0%). Additional prolific *JAE* authors are identified in the table.

Table 5

Prolific Authorship in the Journal of Agricultural Education *1997–2006* (*N* of Authors = 751; *N* of Articles = 323)

JAE Author	*f*	*P* of Authors	*P* of Articles
Dyer, James E.	29	3.9	9.0
Miller, Greg	19	2.5	5.9
Lindner, James R.	12	1.6	3.7
Rudd, Rick D.	12	1.6	3.7
Williams, David L.	11	1.5	3.4
Roberts, T. Grady	10	1.3	3.1
Ball, Anna L.	9	1.2	2.8
Balschweid, Mark A.	9	1.2	2.8
Edwards, M. Craig	9	1.2	2.8
Garton, Bryan L.	9	1.2	2.8
Thompson, Gregory W.	9	1.2	2.8
Briers, Gary E.	8	1.1	2.5
Knobloch, Neil A.	8	1.1	2.5
Johnson, Donald M.	8	1.1	2.5
Murphy, Tim H.	8	1.1	2.5
Osborne, Edward W.	8	1.1	2.5
Wingenbach, Gary J.	8	1.1	2.5
Conroy, Carol A.	7	0.9	2.2
Dooley, Kim E.	7	0.9	2.2
Kelsey, Kathleen D.	7	0.9	2.2
Myers, Brian E.	7	0.9	2.2
Talbert, B. Allen	7	0.9	2.2
Trexler, Cary J.	7	0.9	2.2
Connors, James J.	6	0.8	1.9
Cano, Jamie	6	0.8	1.9
Gamon, Julia A.	6	0.8	1.9
Gartin, Stacy A.	6	0.8	1.9
Shih, Ching-Chun	6	0.8	1.9
Torres, Robert M.	6	0.8	1.9

Research methods used in the *JAE* were identified. Quantitative research methods were the most common at 80.5% (260 out of 323 articles), followed by qualitative in 11.1% of the articles (36 out of 323); the least often used research methods were mixed qualitative and quantitative methods (8.4%; 27 out of 323). Research designs used in the 323 analyzed articles published in the *JAE* are outlined in Table 6. Surveys were the most frequent research design used (45.5%). Correlation research designs were used in 10.5% of the published research. Additional research designs and procedures, in *JAE* research articles, are identified in the table.

Table 6

Research Design Used in the Journal of Agricultural Education *1997–2006* (*N* = 323)

Design	*f*	*P*
Survey	147	45.5
Correlation	34	10.5
Experimental	28	8.7
Historical	25	7.7
Delphi	19	5.9
Ex Post Facto	12	3.7
Case Study	9	2.8
Content Analysis	9	2.8
Interviews	9	2.8
Evaluation	8	2.5
Other designs	23	7.1

Conclusions

The *Journal of Agricultural Education* was identified as the premier journal in agricultural education. Although *JAE* was identified as the premier journal, the discipline relies on numerous additional journals to disseminate scholarship. Research in *JAE* is adding to the scope and topography of research occurring in the discipline.

In articles published, variety in research theme areas was seen. However, teacher preparation and competence monopolized the discipline, being the most frequently identified primary and secondary research theme. Needs assessment was the most frequently identified primary research theme from 1997 to 1999. Investigations focusing on teacher preparation and competence were the most frequent research theme areas published in *JAE* journal articles from 2002 to 2006. Research themes were cyclic, moving between primary and secondary and moving out of primary and secondary for a time before cycling back in. An example of this phenomenon is the theme teacher preparation and competence. It is seen as the most frequent secondary research theme in 2000 and then cycles out before being the most frequent primary and secondary research theme in 2002. This theme remains the most frequent primary research theme throughout the analyzed years, and was noted as the most identified secondary research theme area in 2003, 2005, and 2006. These apparent research cycles may be indicators of the breadth of research occurring in the field. But are they indicators of research depth? Frequent research themes may be indicators of what agricultural educators' value in terms of research priorities.

Numerous researchers add to the scope of the discipline; no author or authors dominated *JAE*. Quantitative research employing survey methods were most prevalent in agricultural education research. Based on research methods and designs, agricultural education lacks research methodological diversity and scope and, perhaps, depth and quality—if one assumes that depth and quality are indicated by methods that move toward cause and effect relationships.

This study was an attempt to establish an experience-base in research occurring in agricultural education. It is critical to create an experience-base in order to complete a comprehensive and holistic examination of a benchmark, such as the *NRA*. Ball and Knobloch (2005) and others have indicated the explicit need to improve the agricultural education discipline, and this study was undertaken in an effort to assist in that area. We must make every effort to understand the depth and impact of agricultural education research.

Discussion and Implications

Baker, Shinn, and Briers (2007) issued a specific call to examine the knowledge domains of agricultural education. Miller, Stewart, and West (2006) identified the need to review literature to maintain a clear sense of the discipline's research agenda. This study identified variety in research theme areas in published agricultural education research. Agricultural education research may reflect a broader view as it examines elements of various knowledge domains. Furthermore, numerous researchers add to the scope and topography of the discipline; no author or authors dominated the discipline. Because researchers bring with them a variety of interests in research topics and strategies, this finding is important in research diversity.

Furthermore, this research discovered that numerous researchers add consistently to the scope and topography of agricultural education research; however, there are prolific authors who clearly led the way in published research in *JAE*. Because researchers bring with them a variety of interests in both research topics and strategies, this finding is an important component in research stability and diversity. Would the discipline benefit from prolific authors assisting graduate students and new faculty with developing research focus? Can we better utilize prolific authors by highlighting their areas of expertise and using them as specialists? Would this allow us the opportunity to move from a generalist approach in examining knowledge to becoming research area (theme) experts?

Knight (1984) and Radhakrishna and Xu (1997) indicated that published research journal articles are indicators of the profession's current state. Although this research supports Knight and Radhakrishna and Xu, it also provides a note of caution and an evident need for more variety in research methodology and design in the discipline. If research reported in *JAE*, over the past ten years is indicative of all research in the discipline, then there is a clear need to improve methodological research strategies beyond survey research. There has been criticism regarding research rigor and diversity in the discipline. The findings of this study indicate that a majority of research in agricultural education is survey research. There is a need to engage in more rigorous research methodologies to answer the "why" questions as well as the "what is." There is a need to understand if current research is adding to depth and not just the breadth of research.

In 1993, Newcomb identified a need to transform university agricultural education programs; he encouraged universities to broaden programs by offering leadership programs, extension education, agricultural communications, and international development and to add depth to teacher education programs. The 1990s was a time of rapid growth in research and publishing activities in agricultural education; this resulted in enormous growth of agricultural education literature (Radhakrishna & Jackson, 1995; Sax et al., 1999). Since that time research programs have shifted and publication outlets have increased. It is critical that agricultural education have a clear picture of past research priorities and strategies to allow the discipline to continue to improve its investigations. As faculty members in agricultural education continue to forge new alliances and diversify funding portfolios, it is important to know where we have been in order to identify where we should go in the future. This study was a step in determining an experience-base of research in agricultural education. This research attempted to outline research priorities, strategies, and designs used during the past ten years; it calls for a comparison of the identified experience-base to a futuristic framework, such as the *National Research Agenda: Agricultural Education and Communication, 2007-2010* (Osborne, n.d.).

Recommendations

The profession must continue to reflect upon those actions that ultimately improve and strengthen the discipline. It is imperative that professionals in agricultural education improve research methodologies to include more experimental research. We must understand if today's research is adding to the depth of our "well" of research and not merely to the breadth. Our research should strive for depth, richness and impact. We must continue to deepen our "well" of knowledge and not just enlarge our "pool." As a discipline, do we have the volume and quality of theoretical underpinnings and fundamental works needed to support us as we expand the broadness of our "well"? Or do we need to continue to move deeper before we expand in width? Reflections regarding efforts to improve and diversify the discipline must continue. Additional research must be completed to expand the research themes identified in this study. Broader research themes would assist agricultural education in determining how research is incorporated into the integrated specialization areas, as identified in the *NRA*, as well as other disciplines and research initiatives.

A pattern appears to exist in the primary and secondary research themes identified in this study. Further inquiries should be completed to determine the degrees of research theme cycles, meaningfulness of cycles, and how cycles affect agricultural education both as an area of scholarship and as an area of practice. Agricultural education researchers must diversify their research methodological portfolios to include more variety in research methods and designs. Additional investigations should be completed to determine the depth and rigor of survey methods used in our research. Research must continue to determine whether current research methodologies are serving the discipline in an effort to advance its scholarship. Further discovery should be done to provide methods and standards for exceptional rigorous research in agricultural education. Investigations should also focus on determining the breadth and depth of exploration and application of research in each of the identified research theme areas represented in this study.

Additional research must be completed to determine the breadth and depth of research themes identified in this study, and how/if these themes affect research occurring in agricultural education. Current agricultural education research (experience-base) must be compared to emerging research priorities for the discipline. By using a benchmark, such as the *National Research Agenda: Agricultural Education and Communication, 2007–2010*, (Osborne, n.d.), agricultural education can better determine if past research is supporting emerging research priority areas, and determine where adjustments must be made. It is also critical to determine how agricultural education research is incorporated into other disciplines and research initiatives.

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RESEARCH THEMES IN AGRICULTURAL EDUCATION: FUTURE GAP ANALYSIS OF THE NATIONAL RESEARCH AGENDA

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Abstract

Agricultural education relies on multiple research journals to disseminate findings. This study focused on a ten-year content analysis of research published in identified premier agricultural education journals. The purpose of the study was to ascertain primary and secondary research theme areas in premier journals from 1997 to 2006 and compare those themes to the National Research Agenda (NRA): Agricultural Education and Communications, 2007-2010*. This study employed a mixed-method content analysis design with gap analysis. There were 49 primary and 49 secondary research theme areas identified with food, agriculture, natural resources, health, and family (14.16%; 11.12%) being the most frequently researched theme area reported in our research. The researchers used compiled research theme data to analyze frequencies and gaps in the* NRA*. Agricultural education in domestic and international settings: extension and outreach was identified as the contextual area most researched. RPA 9 (ascertain the public's knowledge, views, and openness regarding the agri-food and natural resource system) was the most frequently researched priority area (26.2%). There were no gaps identified in the* NRA*, which indicated that there may be no emerging or futuristic research priority areas identified for the discipline. To continue to strengthen agricultural education research, findings from this study must be used to adjust research priority areas in the* NRA.

Introduction

Agricultural education contributes scholarship of agricultural and educational systems by linking technical areas of agriculture and the humanistic dimensions (Barrick, 1989). In the past, it has been difficult to appraise the impact of agricultural education, and it is equally difficult to perceive its potential (Williams, 1991). With recognition of agricultural education as a discipline, research has sought to further understand the theoretical and conceptual underpinnings of agricultural education in its context, and numerous attempts have been made to focus the discipline (Barrick, 1989).

Newcomb (1993) identified the need to transform university agricultural education programs and encouraged programs to embrace a different approach to research to include a defined program of inquiry. Although there have been few specific calls from the discipline to examine its essence, numerous scholars have expounded on disciplinary topology (Baker, Shinn, & Briers, 2007; Barrick, 1989; Buriak & Shinn, 1989, 1993; Crunkilton, 1988; Dyer, Haase-Wittler, & Washburn, 2003; Frick, Kahler, & Miller, 1991; Hamlin, 1966; Harder & Roberts, 2006; Knight, 1984; Kotrlik, Barlett, Higgins, & Williams, 2001, 2002; Love, 1978; Mannebach, 1981; Mannebach, McKenna, & Pfau, 1984; McCracken, 1983; McKinney, 1987; Miller, 2006; Miller, Stewart, & West, 2006; Moore, 1991, 2006; Moss, 1986; Radhakrishna, 1995; Radhakrishna, Eaton, Conroy, & Jackson, 1994; Radhakrishna & Jackson, 1992, 1993, 1995; Radhakrishna & Mbaga, 1995; Radhakrishna & Xu, 1997; Shinn, 1994; Silva-Guerrero & Sutphin, 1990; Warmbrod, 1986, 1987; Warmbord & Phipps, 1966; Williams, 1991). However, the review of literature failed to identify a holistic examination of research in the discipline. It is essential to examine critical components of agricultural education research and suggest strategies to focus the discipline. By understanding the components of past research it is possible to understand the current state of research and take a more futuristic approach to knowledge pursuit, development, and stratagem.

"The future of agricultural research depends upon many variables, not the least important of which is acquisition and application of new knowledge generated from research" (Dyer et al., 2003, p. 61). Moore (2006) posited that it is clear that agricultural educators are not "driving" the profession, they spend their time "dabbling in esoteric research that doesn't have much relevance to the real world" (p. 1). Concerns have been voiced about whether future agricultural education is actively engaged in research that is both needed and futuristic.

Peter Drucker (1998) suggested:

> …in human affairs political, social, economic, and business, it is pointless to try to predict the future, let alone attempt to look ahead 75 years. But it is possible and fruitful to identify major events that have already happened, irrevocably, and that therefore will have predictable effects in the next decade or two. It is possible, in other words, to identify and prepare for the future that has already happened (p. 16).

Scholarship varies in importance, need, content, superiority, and capacity; however, the research created in the discipline influences the future efforts of the field. Since the 1990s, rapid growth in research and publishing activities in the agricultural education profession has resulted in enormous growth of agricultural education literature (Radhakrishna & Jackson, 1995), and new research outlets were created. "Given the institutional demands of research, teaching, extension, and service, faculty often must allow one area to suffer to meet the expectations of another" (Myers & Dyer, 2004). If research suffers, then every aspect of the agricultural education discipline suffers with it.

Knight (1984) and Radhakrishna and Xu (1997) indicated that research journal articles are indicators of the profession's current state. Ball and Knobloch indicated that it is critical for practitioners to examine the research base of the practice to allow the profession to reflect upon those actions and ultimately improve the discipline (2005). Miller, Stewart, and West identified the need to review literature and track citations to maintain a clear sense of the discipline's research agenda (2006). Crunkilton identified the need for agricultural education to know where it can and should go with research in its pursuit to develop empirical knowledge (1988). The expressed need to focus the agricultural education discipline, examine its research base, and create a futuristic framework calls for use of a holistic examination of research in the discipline. This can be accomplished through the comparison of past research to a futuristic framework.

Theoretical and Conceptual Framework

The theoretical framework of this study lies in Boulding's (1956) general systems theory: "the skeleton of science that aims to provide a framework or structure of systems on which to hang the flesh and blood of particular disciplines and particular subject matters in an orderly and coherent corpus of knowledge" (p. 208). The theory is used to study all relationships abstracted from any body of empirical knowledge. In a sense, agricultural education corresponds to a specific segment of the empirical world, and the discipline develops theories that have applicability to its own empirical segment. Agricultural education creates certain elements of the experience of individuals and develops theories and patterns of research that provide understanding to its empirical knowledge.

Systems theory deals with epistemological processes underlying knowledge acquisition and allows algorithms to be developed for computer-based systems modeling (Gaines & Shaw, 1984). It is typically a part of positivistic research that can be used with gap analysis. "System theory can be used to analyze -- logically, precisely and completely -- the implications of a philosophical position" (Gaines, 1978, p. 13). Theoretically, this model (Figure 1) can assist agricultural education in establishing a system of past and futuristic research. The agricultural education context is based on research theories derived from the discipline. The general systems model works to develop theoretical models having applicability to two or more of the integrated specializations in agricultural education (Gaines, 1978). General systems theory indicates that the agricultural education discipline is embedded in the agricultural and education contexts which encompass the integrated specialization areas of teacher education, extension education, agricultural communications, international agricultural education, and leadership education.

The conceptual framework of the study was grounded in these integrated specialization areas that support the context of agricultural education. These specialization areas have faculty involved in scholarship (research), and this scholarship influence research occurring in journal articles both inside and outside the discipline. This study was conceptually grounded in past research indicating that research theme areas are important in determining the current state of research (Buriak & Shinn, 1993; Dyer et al., 2003; Miller et al., 2006; Moore, 1991; Radhakrishna & Xu, 1997; Silva-Guerrero & Sutphin, 1990). This past research frame becomes the experience-base of agricultural education research. The *National Research Agenda (NRA): Agricultural Education and Communication, 2007-2010* was developed, in an effort, to outline future research priorities for the discipline (Osborne, n.d.). The *NRA* was used as a benchmark for the study. The *NRA* is the first holistic document outlining research priority areas in each of the integrated specialization areas of agricultural education. The *NRA* was used to provide a benchmark for agricultural education research. Gap analysis was used to compare the experience-base (past research) to the benchmark (*NRA* priority areas) to determine the future state of agricultural education research. The use of gap analysis provided insight in to the research theme area frequencies and gaps represented in agricultural education research.

Purpose and Objectives

The purposes of this study, which was part of a larger study, were to review research published in major research journal outlets in agricultural education from 1997 to 2006 and examine the status of the journals to provide a base from which to direct future research. Three objectives guided this study:

1. Determine premier research journals in agricultural education.
2. Describe and synthesize primary and secondary research theme areas from the journals identified in objective one for the timeframe of 1997 to 2006.
3. Determine frequencies and gaps in agricultural education (Ag Ed) research by comparing past research theme areas, identified in the premier Ag Ed journals, to the *NRA*.

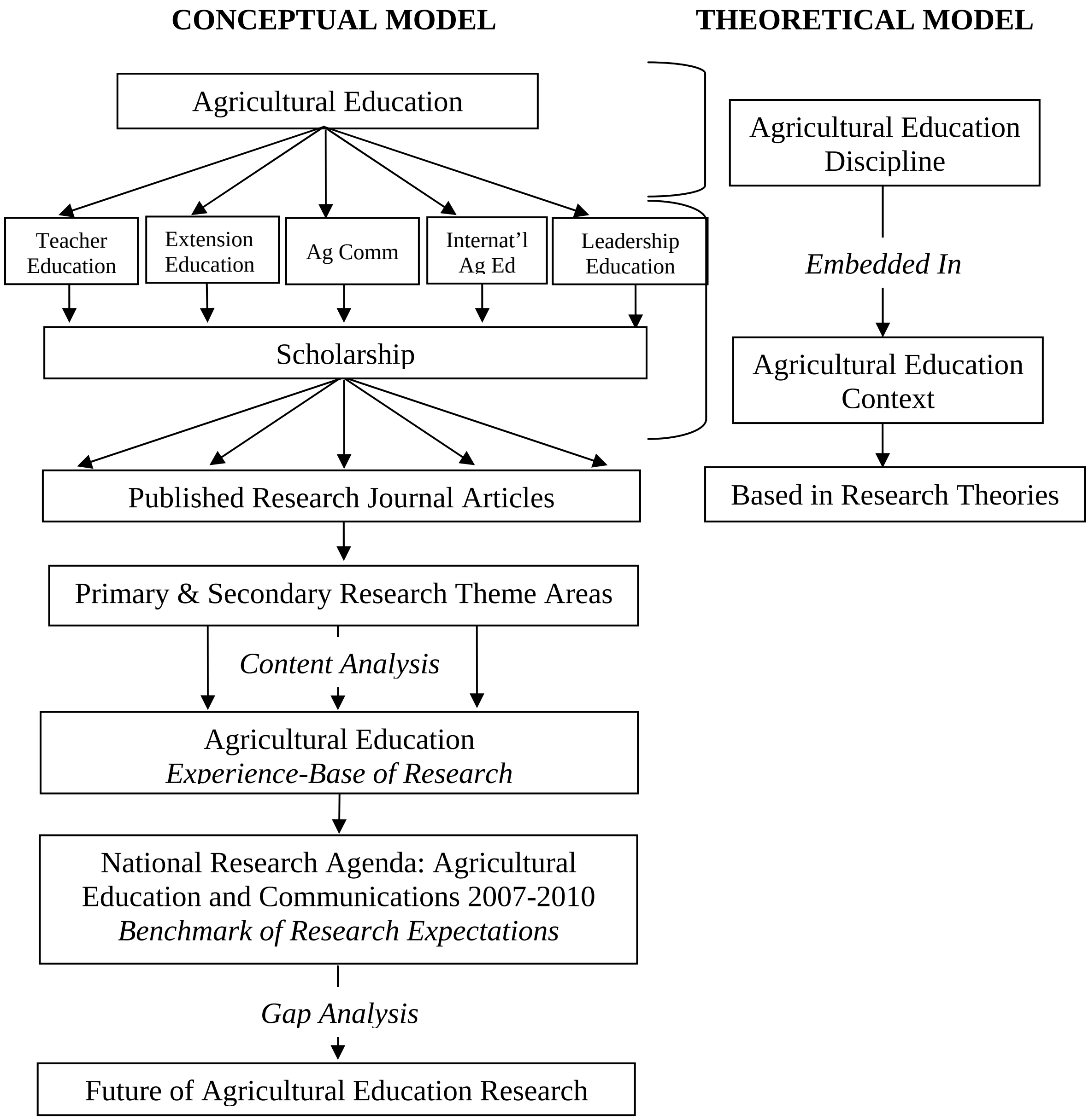

Figure 1. Theoretical and conceptual base of the study.

Research Methods and Procedures

This study employed a mixed-method content analysis design. Content analysis as a research method has existed for decades, and the best content-analytic studies use mixed-methods methodology (Weber, 1990). Content analysis can be used to give researchers insight into problems or hypotheses that can then be tested by more direct methods. Content analysis is a systematic, replicable technique for compressing many words of text into fewer content categories based on explicit rules of coding (Berelson, 1952; Krippendorf, 1980; Weber, 1990).

Content validity was maintained using both previous research as a guide, and a field study to focus the research. Baker, Shinn, and Briers (2007) identified 104 individuals as active agricultural education research authors. A field questionnaire was developed and sent to 96 of those authors with valid email addresses. The contacted authors were asked to identify premier journals and to validate or add to research theme categories. Research theme categories were created based on previous content analyses of journals in the integrated specializations of teacher education, leadership education, agricultural communications, international agricultural education, and extension education. These categories were provided to the pilot study, and it was the respondents' responsibility to compress or expound on research theme areas. The pilot study identified 37 research theme areas for the five specialization areas identified in the *NRA*. Dillman's (2000) Tailored Design Method was used, and 62 of 96 possible respondents completed the questionnaire, yielding a 65% response rate.

Research journal articles from 1997 to 2006 in the identified premier agricultural education journals were used as the frame for the study. The main focus of each article (knowledge-base) was coded as the primary research theme area. The most prevalent supporting theme (conceptual-base) was identified as the secondary theme of each article. The principal investigator and a peer independently reviewed the material and formed a checklist of information required during the review of each journal article. The researchers compared notes and reconciled differences on their initial checklists via negotiations. Researchers used a consolidated checklist to independently apply coding. The researchers then checked for agreement in coding; if reliability was not acceptable, then the previous steps were repeated. Once reliability had been established, the coding was applied on a large-scale basis. The final stage was a periodic quality control check (Weber, 1990). Inter-coder reliability was completed, with at least 10% overlap for the reliability test. Final reliability was calculated using a random sample of 5% of the analyzed articles. Reliability was assessed using Spearman's rho. Reliabilities met or exceeded the minimum standard of .70 (Bowen et al., 1990; Tuckman, 1999).

The study content analysis identified 91 research theme categories. A panel of research experts was used to independently review and then compile, compress, and collapse research theme areas. After the independent review, researchers checked for agreement on research theme areas and adjusted research themes based on negotiations. This study identified 50 research theme areas during the ten-year assessment.

Findings

Field study respondents indicated that the *Journal of Agricultural Education* (93%) was the premier journal. The *Journal of International Agricultural and Extension Education* was identified as the second premier journal (67%) in the discipline. The *Journal of Extension* was identified as the third premier journal (63%). The fourth premier journal identified was the *North American Colleges and Teachers of Agriculture Journal* (48%). *Journal of Applied Communications* (*43%*) and the *Journal of Leadership Education* (*41%*) were identified as the fifth and sixth most popular premier journals. Respondents nominated 21 journals as premier research outlets in agricultural education. Those journals identified by 40% or more of the respondents were used in this study. The researcher looked for a natural split in the frequencies of premier research journals. That natural split existed at a frequency level of 40%. The *National*

Association of Colleges and Teachers in Agriculture Journal (48%) was excluded from the study due to its broad college and teaching scope. Furthermore, the journal does not have a distinct focus on one of the five integrated specialization areas in agricultural education as outlined *NRA*.

There were 1,151 articles analyzed. All research articles from 1997 to 2006 (323 articles) were examined in the *Journal of Agricultural Education (JAE)*. Articles in the *Journal of International Agricultural and Extension Education (JIAEE)* issues I and III, from 1997 to 2006, were analyzed (144 articles); issue II was excluded because they house annual conference proceedings. All research (in brief) articles and feature articles with research methodologies in the *Journal of Extension (JOE),* from 1997 to 2006, were analyzed (548 articles). Articles in the *Journal of Applied Communications (JAC)* identified as research or professional with research methodologies, from 1997 to 2006, were analyzed (91 articles). The *Journal of Leadership Education (JOLE)* was first published in the summer of 2002; research articles with research methodologies, since its inception until 2006, were analyzed (45 articles). The above journals were identified as the premier agricultural education (Ag Ed) journals in the discipline by participants in the field study.

Primary research theme areas identified in premier Ag Ed journals are shown in Table 1. There were 49 of the 50 identified research theme areas represented in the primary research theme area of premier Ag Ed journals. Graphic design was not identified as a primary research theme area; however, it was noted as a secondary research theme. Food, agriculture, natural resources, health, and family was the most frequently identified primary research theme area (14.16%). Those primary research theme areas identified in premier Ag Ed research articles 6.26% or fewer are identified in the table.

Table 1

Primary Research Themes Identified in Premier Ag Ed Journals 1997–2006 (*N* = 1,151)

Research Themes	*JAE* *f*	*JIAEE* *f*	*JOE* *f*	*JAC* *f*	*JOLE* *f*	Total *f*	Total *P*
Food, Agriculture, Natural Resources, Health, and Family	20	12	128	3	0	163	14.16
Needs Assessment	29	13	29	0	1	72	6.26
Instructional and Program Delivery Approaches	12	3	45	1	1	62	5.39
Youth Leadership and Development	12	0	45	0	3	60	5.21
Evaluation	12	23	22	0	1	58	5.04
Information Sources and Technology	2	2	28	17	0	49	4.26
Volunteer Development and Leadership	6	1	29	1	2	39	3.39
Teacher Preparation and Competence	33	2	1	0	1	37	3.21
Research (methods and models)	17	3	13	0	1	34	2.95
Curriculum and Program Development	7	9	13	3	0	32	2.78
Leadership Development	6	2	9	0	14	31	2.69
Perceptions and Attitudes Assessment	21	7	2	0	0	30	2.60
Distance Education	12	0	12	5	0	29	2.52
Diversity (culture, ethnicity, gender)	6	8	11	0	0	25	2.17
Professional Development	7	5	9	2	1	24	2.09
Communication Management	4	1	4	13	1	23	2.00
Globalization and Internationalization	2	14	5	0	0	21	1.82
Institutional Organization and Institutionalization-	8	5	5	3	0	21	1.82
Collaborations, Partnerships, and Coalitions	0	5	14	0	0	19	1.65
Academic Programs	12	5	0	0	1	18	1.56
Leadership Education	5	0	2	0	11	18	1.56
Leadership Management	10	0	7	0	1	18	1.56
Processes, Principles, and Styles of Learning	12	0	5	1	0	18	1.56
Critical Thinking	12	2	1	2	0	17	1.48

Table 1 (continued)

Research Themes	*JAE* *F*	*JIAEE* *f*	*JOE* *f*	*JAC* *f*	*JOLE* *f*	Total *f*	Total *P*
Career Development and Assessment	5	4	6	0	1	16	1.39
Policy Issues	3	1	11	1	0	16	1.39
Organizational Development and Leadership	2	3	11	0	0	16	1.39
Communications of Scholarship	2	0	3	9	0	14	1.22
Service and Experiential Learning	7	0	4	0	3	14	1.22
Formal and Informal Teaching Approaches	4	0	8	0	1	13	1.13
Skill Development and Competencies	4	1	8	0	0	13	1.13
Accountability	0	0	9	3	0	12	1.04
Appropriateness of Education	10	0	2	0	0	12	1.04
Communication Technology	3	2	3	4	0	12	1.04
Knowledge and Competencies	6	5	0	0	0	11	0.96
Diffusion of Innovations	1	5	3	0	1	10	0.87
Biotechnology Communications	0	1	2	6	0	9	0.78
Marketing and Promotion	1	0	8	0	0	9	0.78
Media Relations	1	0	1	6	0	8	0.70
Quality of Life and Life Skills	1	0	7	0	0	8	0.70
Community Development and Leadership	0	0	7	0	0	7	0.61
Consumer/Audience Response and Analysis	0	0	4	3	0	7	0.61
Agricultural Literacy	4	0	0	1	0	5	0.43
Electronic Media	0	0	2	3	0	5	0.43
Funding (resource development and needs)	0	0	5	0	0	5	0.43
Risk and Crisis Communications	0	0	2	2	0	4	0.35
Business/Employee Management and Expansion	0	0	3	0	0	3	0.26
Framing	0	0	0	2	0	2	0.17
Writing	2	0	0	0	0	2	0.17

Secondary research themes identified in premier Ag Ed journals are displayed in Table 2. There were 49 secondary research theme areas identified. Biotechnology communications was the only research theme area not identified as a secondary research theme in premier Ag Ed journals. The most frequently identified secondary research theme was food, agriculture, natural resources, health, and family (11.12%). Those secondary research theme areas identified 8.69% or fewer are identified in the table.

Table 2

Secondary Research Themes Identified in Premier Agricultural Education Journals 1997–2006 (*N* = 1,151)

Research Themes	*JAE* *f*	*JIAEE* *f*	*JOE* *f*	*JAC* *f*	*JOLE* *f*	Total *f*	Total *P*
Food, Agriculture, Natural Resources, Health, and Family	21	16	78	13	0	128	11.12
Evaluation	18	12	67	0	3	100	8.69
Instructional and Program Delivery Approaches	16	5	53	3	1	78	6.78
Curriculum and Program Development	20	8	42	1	1	72	6.26
Youth Leadership and Development	17	2	42	0	2	63	5.47
Needs Assessment	8	6	37	4	1	56	4.87
Teacher Preparation and Competence	38	2	3	0	0	43	3.73
Institutional Organization and Institutionalization-	17	3	19	4	0	43	3.74
Distance Education	18	1	8	3	0	30	2.61
Diversity (culture, ethnicity, gender)	9	0	14	4	2	29	2.52
Information Sources and Technology	2	5	11	10	1	29	2.52
Formal and Informal Teaching Approaches	17	4	5	0	2	28	2.43
Academic Programs	12	6	0	2	4	24	2.09
Appropriateness of Education	15	4	4	1	0	24	2.09
Perceptions and Attitudes Assessment	9	11	1	3	0	24	2.09
Professional Development	9	8	5	0	0	22	1.91
Skill Development and Competencies	4	2	10	4	2	22	1.91
Globalization and Internationalization	1	15	1	3	1	21	1.82
Leadership Management	7	2	11	0	1	21	1.82
Research (methods and models)	6	4	8	1	0	19	1.65
Community Development and Leadership	3	5	8	1	1	18	1.56
Accountability	2	0	10	3	2	17	1.48
Leadership Development	4	0	8	1	4	17	1.48
Collaborations, Partnerships, and Coalitions	1	1	14	0	0	16	1.39
Processes, Principles, and Styles of Learning	12	0	3	0	1	16	1.39

Table 2 (continued)

Secondary Research Themes	*JAE* *f*	*JIAEE* *f*	*JOE* *f*	*JAC* *f*	*JOLE* *f*	Total *f*	Total *P*
Career Development and Assessment	4	4	5	1	1	15	1.30
Quality of Life and Life Skills	4	0	10	0	1	15	1.30
Leadership Education	5	1	0	0	8	14	1.22
Consumer/Audience Response and Analysis	1	0	9	3	0	13	1.13
Policy Issues	1	1	9	2	0	13	1.13
Volunteer Development and Leadership	5	0	7	0	1	13	1.13
Communications of Scholarship	5	2	2	3	0	12	1.04
Communication Management	0	0	5	6	0	11	0.96
Funding (resource development and needs)	0	1	7	2	0	10	0.87
Critical Thinking	4	3	1	0	1	9	0.78
Organizational Development and Leadership	0	0	6	0	3	9	0.78
Diffusion of Innovations	0	3	5	0	0	8	0.70
Knowledge and Competencies	4	4	0	0	0	8	0.70
Risk and Crisis Communications	0	2	4	1	0	7	0.61
Marketing and Promotion	1	0	5	0	0	6	0.52
Media Relations	2	0	0	4	0	6	0.52
Service and Experiential Learning	1	0	4	0	0	5	0.43
Writing	0	0	1	3	0	4	0.35
Business/Employee Management and Expansion	0	0	3	0	0	3	0.26
Communication Technology	0	1	0	2	0	3	0.26
Agricultural Literacy	0	0	1	1	0	2	0.17
Framing	0	0	0	1	1	2	0.17
Electronic Media	0	0	2	0	0	2	0.17
Graphic Design	0	0	0	1	0	1	0.09

Research themes identified in the premier Ag Ed journals were used to analyze the *National Research Agenda: Agricultural Education and Communication 2007-2010* (Osborne, n.d.). Data (research theme areas) from the content analysis were transformed /renamed /reclassified based on *NRA* content categorizes. Transformed data were used to identify frequencies and gaps in the agricultural education discipline. There are five contextual research category identified in the *NRA*, and 22 research priority areas. The *NRA* outlines research priority areas in the following areas: agricultural communications; agricultural leadership; agricultural education in domestic and international settings: extension and outreach; agricultural education in university and postsecondary settings; and agricultural education in schools.

Table 3 outlines research priority areas (RPA) and descriptions associated with each RPA as listed in the *NRA* and frequencies and percentages associated with the comparative gap analysis. RPA 1 through 4 relate to the context area of agricultural communications (P = 66.0). RPA 5 through 8 relate to agricultural leadership (P = 52.7). RPA 9 through 13 relate to agricultural education in domestic and international settings: extension and outreach (P = .94.8). RPA 14 through 17 relate to agricultural education in university and postsecondary settings (P = 54.2). RPA 18 through 22 relate to agricultural education in schools (P = 76.7). The following table identifies the primary and secondary research theme frequencies, derived from research theme areas identified in content analysis of premier Ag Ed journals, as the research themes relate to the *NRA*. RPA 9 (ascertain the public's knowledge, views and openness regarding the agri-food and natural resource system) was the most frequently identified research priority area (26.2%). The research context area with the highest frequencies of research currently occurring was agricultural education in domestic and international settings: extension and outreach.

There were no gaps identified in the *NRA*. Gaps are areas of research outlined in the *NRA* (also referring to the research benchmark) that have not been identified in past research, as identified in the content analysis of premier Ag Ed journals (experience-base of research). However, there were research themes that were not categorized into the *NRA*; yet, they were identified in analyzed premier Ag Ed research articles from 1997 to 2006. The research theme areas were: funding (resource development and/or needs), graphic design, policy issues, research (methods and models), and writing. All research priority areas, outlined in the *NRA*, have previously been researched to some degree as identified in the assessed premier Ag Ed journals.

Table 3

Summary of Primary and Secondary Research Themes Related to the Priority Areas of the National Research Agenda (*N* = 2,302)

RPA	Research Priority	*f*	*P*
1	Enhance decision making within the agricultural sectors of society.	182	7.9
2	Within and among societies, aid the public in effectively participating in decision making related to agriculture.	510	22.2
3	Build competitive societal knowledge and intellectual capabilities.	480	20.9
4	Develop effective agricultural work forces for knowledge-based societies.	346	15.0
5	Develop and disseminate effective leadership education programs.	367	15.9
6	Support leadership opportunities for underrepresented populations.	257	11.2
7	Ensure leader succession in sustaining agricultural enterprises, and enhance citizen engagement in rural and urban community development.	193	8.3
8	Engage citizens in community action through leadership education and development.	399	17.3
9	Ascertain the public's knowledge, views and openness regarding the agri-food and natural resource system.	604	26.2
10	Identify the needs and competencies of stakeholders and professional practitioners in nonformal agricultural extension education.	285	12.4
11	Identify appropriate learning systems to be used in nonformal education settings.	249	10.8
12	Examine appropriate nonformal educational delivery systems.	547	23.8
13	Identify and use evaluation systems to access program impact.	498	21.6
14	Recruit and prepare students for the future workforce in the agricultural and life sciences.	199	8.6
15	Improve the success of students enrolled in agricultural and life sciences academic and technical programs.	405	17.6
16	Enhance the effectiveness of agricultural and life science faculty.	341	14.8
17	Assess the effectiveness of educational programs in agricultural and life sciences.	305	13.2
18	Enhance program delivery models in agricultural education.	358	15.6
19	Provide a rigorous, relevant, standard-based curriculum in agricultural, food, and natural resources systems.	414	18.0
20	Increase access to agricultural education instruction and Programming.	494	21.5
21	Prepare and provide an abundance of fully qualified and highly motivated agricultural educators at all levels.	289	12.6
22	Determine the effects of agricultural education instruction.	208	9.0

Conclusions

Agricultural education relies on numerous journals to disseminate research in the discipline. Six journals were validated as premier in this study. They are: the *Journal of Agricultural Education,* the *Journal of International Agricultural and Extension Education,* the *Journal of Extension,* the *North American Colleges and Teachers of Agriculture Journal,* the *Journal of Applied Communications,* and the *Journal of Leadership Education*. Research articles housed in these journals are adding to the scope and topography of scholarship occurring in the discipline. However, research theme area variation across journals is an indication that research journals in agricultural education are specialized, and they carry with them unique needs, authorships, focus, and impact.

This study discovered variety in research theme areas in all identified premier agricultural education journals; research articles are adding to the scope and topography of agricultural education scholarship. It was also discovered that there is extensive variety in research theme areas in journals with fewer research articles. In *JAC* and *JOLE* the breadth of identified research theme areas appear to contribute a lack of continuity in discovery. In *JAC* there were 22 research themes identified as primary and 30 as secondary in the 91 analyzed articles. The primary research theme "framing" and the secondary theme "graphic design" were housed only JAC articles. In *JOLE* there were 17 research themes identified as primary and 23 as secondary themes in the 45 analyzed articles. There were no research theme areas confined solely to *JOLE* articles. When research themes in the respective journals are compiled, this lack of continuity in discovery appears to be contributed to the journals less frequently identified as premier by experts in our field. This study found that new research outlets (*JAC* and *JOLE*) have provided venues for additional research publications while also adding to the research variation, perhaps, excessively. This excessive variety in research themes may be due to agricultural communications' and leadership educations' attempt to find their place in agricultural education academic units and research agendas. The results from research theme areas can be seen as indicative of what the discipline has valued in terms of research. Although these themes are indicators of the breadth of research occurring in the field, are they indicators of research depth?

There were no gaps identified, at the macro-evaluation level, when comparing past research themes to the *NRA*. "Ascertain the public's knowledge, views and openness regarding the agri-food and natural resource system" was identified as the most frequent research priority area. This research priority area relates to agricultural education in domestic and international settings: extension and outreach, which maintained the largest percentage of overall research. The least frequently researched theme was "enhance decision making within the agricultural sectors of society." The theme is related to the agricultural communications construct. The construct area agricultural leadership maintained the lowest percentage of research, followed by agricultural communications. This may be due to the shear lack of research articles in *JOLE* and *JAC*; the analyzed journals that respectfully represent these two contextual areas under the large umbrella of agricultural education.

Discussion and Implications

Although a framework for future research has been created (*NRA*), the framework, on a macro-evaluation level, can not be verified as futuristic. Past research theme areas, identified in the discipline, are excluded in the framework and no new research priority areas are identified. Furthermore, it is not clear which *NRA* research priority areas are the most important and demand the most focus, or if past research is adequately fulfilling each research priority. This study identified past research supporting each of the priority areas outlined in the *NRA*, but is this research fulfilling each of the broad research priority areas needs? Each PRA represents one of five integrated specialization areas that support agricultural education. Is the research currently occurring adequate for these construct areas? If no, how do we determine where we need to expand our pursuit of knowledge? This study can not add to these questions. Also, the *NRA* outlines broad priority areas, what do we need to know and do to understand if we are fulfilling those needs?

This research joins with concerns expressed by Williams (1991) in that it has been difficult to appraise the impact of agricultural education, and it is equally difficult to see its potential. Although the *NRA* aids researchers in exploring priority areas in the discipline, it adds little to solving the apparent lack of continuity in discovery and future research needs of agricultural education. This research adds to work by Buriak and Shinn (1993) and data from this study can be used to provide a current frame for the discipline to assist researchers in a clearer picture of past research. By understanding past research and priorities outlined in the *NRA* researchers can better employ research strategies that will assist agricultural educators in becoming more progressive. This research supports the theoretical and conceptual model outlined in this study.

Faculty members must thrive in teaching, scholarship, service, and funding in order to achieve and maintain tenure. Scholarship is a critical piece to faculty success. This research supports Buriak and Shinn's (1993) position of the need for a research agenda to: (a) to maintain compatibility with the national priorities for the food and agricultural science system and the educational system, (b) to guide research investments, and (c) to communicate priorities to agencies and organizations that have national responsibilities for planning and budgeting research. However, the researchers express caution when adhering to such an agenda. This research discovered that the *NRA* is not all encompassing and although it does provide a reasonable framework for the discipline, it is not all inclusive. In part, the *NRA* was developed to assist with funding efforts in agricultural education and caution must be used to ensure that the discipline is not wielded by the highest dollar but by the needs of our diverse audiences.

Peterson (1999) posited that by 2009, a million-dollar research and development agenda focused on the teaching and learning processes in and about agricultural, food and environmental education would provide guidance to the discipline. The *NRA* was a step in preparing an all-encompassing agenda. However, there is a need to continue to revise and strengthen the agenda.

Recommendations

The profession must continue to reflect upon those actions that ultimately improve and strengthen the discipline. This study calls for additional discovery to expand the research theme areas identified. We must determine the breadth and depth of research themes identified in this study, and how/if these themes affect futuristic research in agricultural education. Research, in this study, regarding the *NRA* was completed at a macro level. More in-depth research must be conducted to determine which RPAs are the most critical and demand immediate attention.

Research priority areas in the *NRA* are broad. This allowed for multiple interpretations of RPA meaning and potential content theme match to each area. Efforts must be made to interpret the breadth of research that can occur in each research priority area and suggestions for future critical research must be made. It is not clear whether research currently occurring in agricultural education is adequately meeting the needs of each RPA identified in the *NRA*. Additional research must be conducted to determine whether current research is meeting the needs of each RPA and/or if additional futuristic research is needed. Additions, revisions, and deletions to the *NRA* must continue. Research agendas should also be developed on regional and state levels.

The discipline may benefit from identifying "expert" researchers in each of the RPAs and construct areas. These experts could serve as mentors for less experienced researchers. Efforts should be made to analyze the breadth, depth, and quality of research occurring in each of the RPAs. The identified premier agricultural education journals should be used, respectively, for further analysis regarding the quality and depth of research occurring in each integrated specialization area. It can be assumed that *JAC* is fulfilling research in the agricultural communications, and JOLE is fulfilling RPAs in agricultural leadership, etc. However, it is imperative that we use empirical knowledge to determine the degree and magnitude that premier journals are meeting RPA needs.

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SELF-REPORTED LEVEL OF MATHEMATICS INTEGRATION OF OUTSTANDING VIRGINIA AGRICULTURAL EDUCATORS

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Abstract

This study is a part of a larger investigation which focused on determining the attitudes, perceptions, level of integration, and perceived needs of outstanding agricultural education teachers. The purpose of this study was to determine the outstanding agricultural teachers' level of mathematics integration into each agricultural course taught and provided baseline data as the agricultural education instructors' increase their integration of mathematics. The participants of this study were selected by a panel of experts who frequently visit agricultural education teachers and observe them teaching. The panel reached a consensus on 26 outstanding agricultural education teachers. An electronic survey instrument was developed by the researcher. The teachers reported integrating mathematics in a range from 0 to 75% in individual agricultural courses.

Introduction/Theoretical Framework

Agricultural education has been present in public schools since their development in America. Minnesota was the first state to offer secondary agricultural education with the first school organized in 1888. By 1910, Virginia promoted agricultural education through Congressional district agricultural schools. A total of 30 states had agricultural education courses established in the public schools systems prior to the Smith Hughes Act, which was passed in 1917 (Phipps & Osborne, 1988). The Smith-Hughes Act provided funding to promote and establish agricultural education courses.

Phipps and Osborne (1988) noted that agricultural education has developed deep philosophical roots, placing a great deal of emphasis on pragmatism. “The practical application and successful transfer of knowledge, skills, and attitudes into real-world settings is the goal of instruction” (p. 19). Phipps and Osborne (1988) further acknowledged that “agricultural education has been cited as an innovative program model for education, in order to maintain an innovative program, efforts have been made to reshape agricultural education programs to ensure their continued value, relevance, vitality, and quality” (p. 14).

The need for educational reform surfaced from the National Commission on Excellence in Education’s (1983) report suggesting that American students are falling behind those in other nations. As a result of the report, titled *A Nation at Risk*, high school graduation requirements for academic subjects increased since 1983 (Barrick, 1992; Campbell, Hombo, & Mazzeo, 2000). The increased academic requirements have come at the expense of career and technical education courses (Cetron & Gayle, 1991). Studies have indicated that the increase in academic coursework has not led to an increase in academic achievement (Clune & White, 1992; Hoffer, 1997). National Assessment of Educational Progress scores for mathematics have been relatively flat for the past 30 years (Castellano, Stringfield, & Stone, 2002).

At the same time, traditional mathematics instruction has experienced a great deal of scrutiny. One of the reoccurring themes suggests that in academic programs, students are lectured to about theories and principles, but are never shown how these theories and principles can be applied to real situations (Bottoms & Sharpe, 1996). Researchers have suggested that mathematics as it is being taught in American schools lacks the real-world “connection” and “context” needed to be learned and applied effectively (Britton, Huntley, Jacobs, & Weinberg, 1999; Hoachlander, 1999; Parnell, 1995; Resnick & Hall, 1998; Von Secker & Lissitz, 1999). Mathematical educators have expressed a need to reform mathematics education; one of the themes that emerged is contextually based learning (Briner, 1999).

Career and technical education courses have also come under scrutiny. Some researchers have expressed concern that skills are taught simply by showing a student how to perform an operation without properly training the student in the theory behind the operation (Parnell, 1996). Warmbrod (1974) stated that “if vocational education assumed its proper role in American education that vocational education must be concerned with the student’s intellectual, social, and cultural development as well as their vocational development” (p. 5). Phipps and Osborne (1988) praised agricultural education; however, they pointed out that one of the image problems associated with agricultural education programs is the emphasis placed on the vocational skills.

Warmbrod (1974) indicated that vocational education should be held accountable for students' achievement in both academic and vocational skills. Phipps and Osborne (1988) stated that agricultural education should promote meaningful and practical applications of subject matter, such as mathematics. The National Research Council (1988) indicated that in order for secondary agricultural education courses to remain effective, programs must provide a strong emphasis on traditional academic skills.

The lack of application of the theories and principles taught in the academic classroom and the lack of theories and principles associated with the skills taught in the career and technical education courses have left a gap (Parr, 2004). The lack of connection between subject matter in secondary schools has been widely recognized for a number of years (Glasgow, 1997; NASSP, 1996). This gap between practice and theory must be bridged (Parr, 2004). Warmbrod (1974) indicated that theories and principles must be linked with the application and practice. According to a guide for implementing curriculum integration published by The Ohio State University (Center on Education and Training for Employment, 1998), this bridge could come in the form of contextualized learning.

Agricultural education has great potential to deliver relevant curriculum that engages students with hands-on and minds-on learning environments that are rich with real world applications of mathematics (Shinn et al., 2003). Agricultural education, by the very nature of its structure and content, can be used to teach information which may be difficult to teach in other settings (Drawbaugh & Hull, 1971). Phipps and Osborne (1988) linked academic and vocational education, specifically agricultural education stating that:

> Vocational education in agriculture (i.e., agricultural education) is an integral part of public school education and contributes to the general objectives of education. It contributes to the development in students of the ability to think and study and in the ability to solve problems efficiently, which require skill in collecting and interpreting data. (p. 9)

Agricultural education provides that authentic context in which students can apply the concepts and skills grounded in mathematic theory (Conroy, Trumbull, & Johnson, 1999). Parr (2004) found that a math-enhanced agricultural curriculum had a positive effect on student math performance, while maintaining the vocational skills associated with the curriculum. According to Bottoms and Sharp (1996), integration of both academic and vocational skills into content areas such as agricultural education holds great potential for enhancing student learning in critical academic, technical, and personal areas.

Drosjack (2003) reported that fewer than one in every three students nationally are able to do math at a proficient level. The Bayer Corporation (2003) found that 9 out of 10 U.S. citizens are concerned that today's students may not have the mathematical skills to produce the excellence required for homeland security and economic leadership in the 21st century. Students today require strong mathematical knowledge and skills in order to pursue higher education, compete in the technology driven workforce, and be informed citizens (VDOE, 2005).

Agricultural education instructors are required by the standards set forth in the Carl D. Perkins Act of 1998 to integrate academics into the agricultural education curriculum.

Miller and Gliem (1993a as cited in Hunnicutt, 1994) found that nearly half of the agricultural education teachers studied in Ohio did not coordinate their efforts to integrate mathematics into the agricultural education curriculum with mathematics teachers. Gliem and Warmbrod (1986, as cited in Shinn, 2003) encouraged agricultural education departments to attempt to integrate practical mathematics applicable to agriculture into the curriculum. Hunnicutt (1994) indicated that agricultural education instructors in Alabama self-reported that they integrated mathematics into 26-50% of the units in the agricultural education curriculum. Parr (2004) found mathematically enhanced agricultural power and technology courses in Oklahoma had a positive effect on student math performance.

Purpose of the Study

The purpose of this study was to determine the outstanding agricultural teachers' level of mathematics integration into each course currently taught. This study provided baseline data as the agricultural education instructors in Virginia increase their integration of mathematics. The study resulted in proposed actions to increase mathematics integration into agricultural education curriculums. Research objectives investigated in this study were:

1. Describe the characteristics of outstanding agricultural education instructors who were nominated by Virginia agricultural education leaders and the programs in which these instructors teach.
2. Describe the self-reported level of integration of mathematics by each instructor and across instructors for each course taught.

Methods/Procedures

The participants of this study were selected by a panel of experts who frequently visit agricultural education teachers and observe them teaching. The panel was composed of two agricultural education teacher educators, the Director of Agricultural Education in the State Department of Education, and two State agricultural education curriculum specialists. An email message was sent to the panel of experts requesting nominations of 10 outstanding agricultural education classroom teachers using the following criteria: knowledgeable of the agricultural education curriculum; willing to accept change; provide an in-depth analysis of the questions; willing to complete the study thoroughly; and able to communicate effectively through email. After compiling the responses from the panel of experts, a list of nominees was created based on those who were identified by the expert panel. The nomination list was then submitted to the panel of experts for final approval. The panel reached a consensus on 26 outstanding agricultural education teachers. An email was then sent to all prospective participants to inform them of their nomination.

An electronic survey instrument was developed by the researcher. The survey instrument was created based on the review of the literature regarding academic integration into the career and technical education and agricultural education curricula. Principles of electronic survey design from Dillman's (2000) tailored design method were consulted when constructing the instrument. A group of 10 Agricultural and Extension Education pre-service teachers completed the instrument while they were student teaching in order to field test the instrument. Upon completion of the field-tested instrument, the pre-service teachers were given the opportunity to provide additional suggestions for improvement of the instrument and report any technical problems to establish face validity. Reviews of responses indicated that only minor revisions were needed and these changes were made prior to data collection. The data collected from the field test allowed the researcher to analyze the reliability of the instrument which yielded a Cronbach's alpha coefficient of $\alpha = 0.868$ and a Spearman-Brown coefficient of $\alpha = 0.874$. However the results from the study yielded a lower reliability score for both Cronbach's alpha and Spearman-Brown (0.64 and 0.66 respectively). The change in reliability scores may be due to the fact that the student teachers in the field study all received prior instruction on academic integration.

The responses from the online survey were automatically downloaded into a Microsoft Excel worksheet. The time allotted for data collection was three weeks as recommended by Dillman (2000) and Truell, Bartlett, and Alexander (2002). The survey data were analyzed using the Statistical Package for the Social Sciences (SPSS) 13.0 Student Version for Windows. Data associated with research question were analyzed using descriptive statistics. Frequencies, percentages, means, and ranges were calculated for each outstanding agricultural education instructor's overall integration of mathematics and for each agricultural mechanics course taught. The number of instruments that were completed was 25, resulting in a 96% return rate.

Results/Findings

Research objective one was aimed at determining demographic information for the respondents. The outstanding agricultural education teachers had range of 5-34 years of teaching experience, with a mean of 17 years. However, 44% of the respondents had 5-10 years of teaching experience and 44% of the respondents had 20 or more years of experience. The mean age of the 25 outstanding agricultural education teachers was 40 ($SD = 9.08$) with a range of 29 to 59. Caucasians accounted for 96% of the respondents, while there was only one African American. Fifty-six percent of the respondents were males and 44% were females.

A bachelor's degree and master's degree were the only two levels of education indicated by the outstanding agricultural education teachers. The findings indicated that 52% had master's degrees, while 48% had only a bachelor's degree. All 25 outstanding agricultural teachers had an endorsement in agricultural education, while three had an endorsement in science and one had an endorsement in both mathematics and business. Seventeen (68%) of the respondents indicated holding a Collegiate Professional License while respondents with a Postgraduate Professional License accounted for the other eight (32%). More than three fourths of the respondents (76%) taught at the high school level and 24% taught at the middle school level. Ninety-two percent of respondents indicated membership in the Virginia Association of Agricultural Educators (VAAE), the state professional association for agricultural education teachers. The frequencies and percentages for selected teacher characteristics are listed in Table 1.

Table 1
Summary of Selected Teacher Characteristics (n=25)

		f	%
Level of Education	Bachelor's Degree	12	48
	Master's Degree	13	52
Gender	Male	14	56
	Female	11	44
Ethnicity	African American	1	4
	Caucasian	24	96
Grade Level Taught	Middle School	6	24
	High School	19	76
Member of VAAE	Yes	23	92
	No	2	8

A majority (68%) of the respondents completed 4-5 mathematics courses in high school. A majority (56%) of the respondents did not complete a mathematics course at a two-year college and/or community college, but a range or 1-4 courses at this level was reported by 34% of the agricultural education teachers. Forty-eight percent of the respondents completed 2 to 3 mathematics courses at a four-year college or university. The number of courses completed by the outstanding agricultural teachers is indicated in Table 2.

Sixty percent of the respondents taught in an urban school, while 40% of the respondents taught in a rural school. The largest number of departments (n=10, 40%) had two teachers as indicated by the respondents. Departments with only one agricultural education teacher made up 28% and three teacher departments were reported by 24%. The respondents (n=25) reported a range of 62 to 440 students enrolled in their agricultural education programs with a mean of 188 students (SD= 76.67). Only three agricultural education teachers indicated that students receive academic credit outside of agricultural education for courses completed in that department. Two teachers said that students received a science elective credit for completing an agricultural education course while one indicated students receive a forestry credit. A majority (22) indicated that students did not receive any academic credit for courses taught in their department. Forty percent of the respondents' schools utilized the A/B block scheduling system. Schools that used the 4x4 block system made up 28%, and the seven-period system was reported by 24% of the respondents. The frequencies and percentages for selected program characteristics are listed in Table 3.

Table 2
Mathematics Courses Completed by Respondents (n=25)

		f	%
Mathematics Courses Completed in High School	1	1	4
	3	2	8
	4	11	44
	5	1	4
	6	4	16
Mathematics Courses Completed in Community College	0	14	56
	1	4	16
	2	2	8
	3	2	8
	4	1	4
Mathematics Courses Completed at University	0	5	20
	1	2	8
	2	6	24
	3	6	24
	4	3	12
	6	2	8

Note: Totals do not equal 100% due to non-respondents.

Table 3
Summary of Selected Program Characteristics (n=25)

		f	%
Location of School	Urban	15	60
	Rural	10	40
Agricultural Education Teachers on Campus	1	7	28
	2	10	40
	3	6	24
	4	2	8
Type of School Schedule	7 Period	6	24
	8 Period	2	8
	A/B Block	10	40
	4x4 Block	7	28

The agricultural education teachers (n=24) reported a mean of 21.63% of course content that utilizes mathematics in their curriculum, with a standard deviation of 11.34. The respondents indicated a range of 4 to 47% of mathematics integrated per teacher. The teachers reported integrating mathematics in a range of 2 to 75% in individual agricultural education courses. The 24 teachers reported teaching 29 different courses. There were seven courses that were taught by only one teacher and six courses by only two teachers. There were seven courses that were taught by at least five teachers, with agricultural mechanics and basic plant science I being taught by the most teachers (10). The seven courses taught by at least five different teachers had a range of 8.60 to 26.43 mean percentage of mathematics integration. Information for each course taught is presented in Table 4.

There were only three courses that were taught by at least two agricultural education teachers that had a mean percentage of integration over 30%; all three courses were agribusiness courses. The teachers of the five agricultural mechanics courses reported integrating mathematics at the second highest level ranging from 18.33 to 26.43%. The floriculture, floral design, and horticulture courses yielded the lowest percentages of integration, ranging from 5 to 8.6%. However, landscaping yielded 20% of mathematics integration and greenhouse management yielded 75% integration. The agricultural mechanics and Basic Plant Science I course that was taught by the most agriculture teachers yielded 22.9% mathematics integration.

Conclusions

The results of this study also suggest that there is an interest in academic integration within the agricultural education curriculum by these outstanding agricultural education teachers. This study may be helpful for state leaders in agricultural education by providing the self-reported level of mathematics integration among these selected outstanding agricultural education teachers. The mean indicated that the typical agricultural education teacher in this study integrated mathematics into 23% percent of their lessons.

It was noted that the percentage of integration of mathematics is lower than the percentage of integration among agricultural education teachers in Alabama as reported by Hunnicutt (1994). However, Hunnicutt gave the agricultural education teachers the option to select a range 0 to 25, 26 to 50, 51 to 75, and 76 to 100 in their total curriculum; the researchers had the teachers report the level of integration for each agricultural education course they taught. It should also be noted that by breaking down each course taught allowed the researchers to identify the individual courses have been utilized to integrate mathematics. This also provides the state curriculum specialists with the breakdown of the courses that teachers are struggling to integrate mathematics in as well.

The results of this study are also helpful in acknowledging that there was a negative relationship between percentage of mathematics integration and years of teaching and age. The younger agricultural education teachers tended to integrate mathematics at a higher percentage than older agricultural education teachers. This could help teacher education program leaders recognize that their efforts to help pre-service teachers to integrate mathematics may have helped thus far. This also provides teacher education programs with the benchmark data to know that additional efforts to integrate academics into the agricultural education curriculum. This data also provides insight to curriculum specialists to identify the needs among agricultural education teachers regarding mathematics integration.

Table 4
Percentage of Mathematics Integrated per Course (n=25)

Course Number	Title	N	Minimum	Maximum	Mean	SD
8035	Greenhouse Plant Production and Management	1	75	75	75.00	0.00
8024	Agricultural Business Operations IV	2	45	50	47.50	3.54
8022	Agricultural Business Fundamentals III	3	40	50	45.00	5.00
8026	Agricultural Business Operations V	1	45	45	45.00	0.00
8073	Applied Agricultural Concepts	1	40	40	40.00	0.00
8014	Operating the Farm Business IV	4	25	50	33.75	11.09
8042	Forestry, Wildlife, and Soil Management IV	3	20	40	28.33	10.41
8010	Agricultural Production Technology III	3	15	45	26.67	16.07
8008	Agricultural Mechanics and Basic Animal Science II	7	10	50	26.43	12.33
8004	Agriscience and Technology	6	15	50	25.00	13.04
8082	Small Engine Repair	3	25	25	25.00	0.00
8016	Introduction to Power, Structural, and Technical Systems	7	20	35	23.57	5.56
8006	Agricultural Mechanics and Basic Plant Science I	10	10	50	22.90	12.33
8012	Agricultural Production Management IV	3	15	30	21.67	7.64
8036	Landscaping	2	15	25	20.00	7.07
8003	Agriscience Exploration	8	15	20	18.75	2.312
8018	Agricultural Power Systems	3	10	35	18.33	14.43
8040	Introduction to Natural Resources III	4	0	40	17.50	16.58
8084	Small Animal Care II	2	5	20	12.50	10.61
8088	Veterinary Science	2	5	20	12.50	10.61
8080	Equine Management Production	3	5	20	11.67	7.64
8002	Introduction to Agriscience	6	5	15	9.17	3.76
8034	Horticulture Science	5	3	15	8.60	4.72
8038	Floriculture	2	5	12	8.50	4.95
8065	Exploratory Agriculture	1	8	8	8.00	0.00
8000	Floral Design I	1	5	5	5.00	0.00
90916	Leadership and Communication	2	0	5	2.50	3.54
8083	Small Animal Care I	1	2	2	2.00	0.00

Recommendations for Implementation

The following recommendations are based upon the findings and conclusions of this study. Agricultural education practitioners should continue to emphasize the importance of academic integration into the agricultural education curriculum to improve student learning. Agricultural education practitioners should continue to link academic standards of learning to each agricultural education competency. Agricultural educators should take it upon themselves to reinforce the State Standards of Learning or similar standards in other states to help students connect the principles to real-life applications. Agricultural education curriculum specialists should continue to develop integrated learning activities that reinforce the academic theories and principles with agricultural mechanization applications. State agricultural and mathematics education leaders should develop workshops that utilize hands-on activities that integrate academics. The workshops should place the teachers in the student role. The workshops should be practical, allowing the teachers to take what they learned in the workshop and implement it into their lessons.

Textbook companies that develop teacher education materials need to develop more materials that emphasize the academic theories and principles that are being integrated into the agricultural mechanization content; specifically, the materials should utilize team activities, real-life applications, and revamp current laboratory activities. State educational leaders should develop a standardized curriculum that includes generic lesson plans that utilize all of the State Standards of Learning and workplace readiness skills associated with each lesson. These lessons will help in-service teachers who need help integrating academics into their lessons. State professional organizations should invite agricultural education teachers from programs that offer mathematics credit through agricultural education courses to serve as workshop presenters to share how they integrate mathematics.

Recommendations for Further Research

The following recommendations are based upon the findings and conclusions of the study. Conduct an in-depth study that investigates the lessons plans of in-service teachers to determine to what extent they are integrating mathematics, where they are emphasizing mathematics, and where they could be integrating mathematics. Investigate the achievement levels of students who receive applied mathematics instruction vs. traditional mathematics instruction in the schools that are currently offering mathematics credit for students who complete a mathematics applied to agriculture course. Conduct a study that investigates the pre-service teachers' attitudes and academic problem-solving abilities before and after completing an agricultural education course that integrates academics. Conduct a study that investigates the level of academic integration by teachers after they participate in workshops that emphasize academic integration.

Investigate the integration of other academic areas such as English, social studies, and foreign languages. Conduct a study to investigate students' attitudes toward receiving mathematics credit for completing an agricultural education course that integrate mathematics. Conduct a study that investigates mathematics teachers' attitudes toward mathematics integration into the agricultural education curriculum and their attitudes toward mathematics integration into the agricultural education curriculum and their attitudes toward collaboration with the agricultural education teachers. Replicate this study comparing agricultural education teachers who have been teaching since 1988 to those agricultural education teachers who have been teaching prior to 1988, when the name vocational agriculture was changed to agricultural education.

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STRUCTURED COMMUNICATION: EFFECTS ON STUDENT TEACHER – COOPERATING TEACHER RELATIONSHIPS

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Abstract

Perceptions held by agricultural science student teachers about their relationship with cooperating teachers during field experiences is a variable that may affect the number of student teachers entering the profession. The purpose of this study, which was part of a larger study, was to examine the effects implementing structured communication between student teachers and cooperating teachers would have on student teachers' self-perceived relationship between the student teacher and cooperating teacher during the student teaching experience. The learning environment of these field experiences must be more fully understood to explain why some student teachers enter the profession of agriculture science teaching, and others do not. This study employed a quasi-experimental design with a non-random sample (N=81) in a multiple time-series design. The average respondent in this study was a 23 year old white undergraduate female placed at a multiple placement cooperating center. Through contrast analysis, the age and academic standing of student teachers significantly affected their perception of the value cooperating teachers placed upon student teacher – cooperating teacher relationships. Structured communication influences student teachers' perception of their relationship with the cooperating teacher. To better understand perceptions of student teachers regarding the student teacher – cooperating teacher relationship, additional research should be conducted.

Introduction

The National Council for Agricultural Education (The Council, 2002) created the initiative Reinventing Agricultural Education for The Year 2020. The first goal outlined in this report was to provide “an abundance of highly motivated, well-educated teachers in all disciplines, pre-kindergarten through adult, providing agriculture, food, fiber and natural resource education” (The Council, 2002, p. 4). Agricultural education is charged to provide the most highly motivated and efficacious teachers to improve knowledge about agriculture. How can preparatory agricultural education professional programs accomplish this task? Does preservice teacher education provide skills and abilities, beliefs, and motivation to teacher education graduates of agricultural education departments? Are there avenues of research to improve those abilities and skills, beliefs, and motivation of preservice teacher education?

The discipline of agricultural education continually faces a deficiency of qualified teachers filling positions in public schools (Camp, Broyles, & Skelton, 2002). Camp et al. (2002) reported there were 798 secondary agricultural education positions available for new graduates of agricultural education in 2001. Of the 857 newly qualified agricultural education graduates, only 509 (59%) chose to enter the profession of agricultural education at the secondary level. The discipline of agricultural education graduates enough professionals to fill the positions available, and yet many of those graduates choose not to enter the field of agricultural education. What factors contribute to a graduate’s choice to enter the profession of agricultural education?

A significant element of preservice teacher preparation is the field experience portion of most teacher education programs. Field experiences are usually conducted as early field experiences and student teaching. Both have been found to contribute to a decision to enter the profession of agriculture education. Myers and Dyer (2004) stated that being involved in early experiences contribute to preservice teachers’ decision to enter the profession at the secondary level. They also stated that preservice teachers in agricultural education programs alter their beliefs as a result of field experiences. Therefore, it is concluded that field experiences can have dramatic effects upon the perceptions of those involved in these experiences.

Student teaching is an important element of the teacher education program (Borne & Moss, 1990; Deeds, Flowers, & Arrington, 1991; Edwards & Briers, 2001; Harlin, Edwards, & Briers, 2002; Norris, Larke, & Briers, 1990). Furthermore, both early field and the student teaching (field) experiences positively impact preservice teachers of agricultural education programs (Myers & Dyer, 2004). Teacher education programs must place student teachers at cooperating centers that provide the best experience available (Borne & Moss, 1990). Agricultural education must look into how the teacher education programs are structured and define avenues that will allow graduates to be motivated to enter the agricultural education profession. Camp et al. (2002) stated teacher education programs should expand their capabilities to prepare student teachers to meet the needs of secondary agricultural education programs.

Fritz and Miller (2003) concluded student teachers should “reflect on their daily concerns and receive feedback … communicate with other student teachers and supervisors” (p. 51). Structured communication between the cooperating teacher and student teacher is a vital link that needs to be addressed to understand beliefs held by student teachers. Dewey (1980) stated:

> Not only is social life identical with communication, but all communication … is educative. To be a recipient of a communication is to have an enlarged and change experience. One shares in what another has thought and felt … has his own attitude modified. Nor is the one who communicates left unaffected. (p. 8-9)

Theoretical Framework

The theoretical framework of the study is grounded in the theory of constructivism. Constructivism operates under the premise that learners create understanding through experience (Fosnot, 1996; Schuman, 1996). Doolittle and Camp (1999) proposed four epistemological tenets of constructivism based upon literature (Dewey, 1980; Garrison, 1997; Gergen, 1995; Larochelle, Bednarz, & Garrison, 1998; Maturana & Varella, 1992; Von Glaserfield, 1984); the four tenets are as follows:

> 1) knowledge is gained through dynamic cognizing by the individual, 2) individual behavior becomes more viable in particular environments because of the adaptive nature of cognition, 3) cognition is not a method to create accurate representations of reality but organizes and clarifies an individual's sense of experiences, and 4) learning is mutually rooted in cultural, social, and language-based interactions and neurological/biological construction. (p. 6)

Therefore, Doolittle and Camp (1999) concluded that constructivism recognizes the student's constant position in "the personal creation of knowledge, the importance of experience (both individual and social) in this knowledge creation process, and the realization that the knowledge created will vary in its degree of validity as an accurate representation of reality" (p. 7). These basic principles provide the foundation of the learning, knowing, and teaching process which can be differentially emphasized resulting in a menagerie of degrees of constructivism.

Social constructivism will act as the foundational principle for this study. The two basic tenets of social constructivism provide that knowledge is social in nature and knowledge is the result of social interaction rather than an individual experience. Therefore, we must conclude that through social interaction learners are able to gain knowledge through the dynamic interplay of social interactions that clarify knowledge based on experiences rooted in cultural, social, and language-based interactions and neurological/biological construction.

Student teaching is the capstone experience of many teacher preparation programs. This event impacts the experience held by student teachers through numerous experiences occurring during the field experience. One of the major factors during this experience for student teaching is the cooperating teacher. Many institutions have stringent guidelines for choosing cooperating teachers and placing student teachers at cooperating centers.

Kasperbauer and Roberts (2007a) found that the student teachers' perceptions of the student teacher and cooperating teacher relationship were not predictive of a decision to teach. This study further concluded that the student teacher and cooperating teacher relationship is important to student teachers involved in field experiences (Kasperbauer et al., 2007a). This finding implies student teachers value their perceptions of relationships with cooperating teacher. Another study conducted by Kasperbauer and Roberts (2007b) evaluated changes in student teacher perceptions of the cooperating teacher and student teacher relationship during student teaching field experiences. This study concluded that student teachers' perceptions of cooperating teachers' relationship level exhibited decreased throughout the student teaching experience (Kasperbauer, et al., 2007b). This study, although not to be generalized beyond the population studied implies that as student teachers engage in field experiences their perception of the level of relationship exhibited by cooperating teacher decreases.

David Berlo developed the Source-Message-Channel-Receiver (SMCR) model. The SMCR model consists of four main areas: source, message, channel, and receiver. However, the model also considers feedback in order to make the model more complete. In this model, source is where a communication originates (Guth & Marsh, 2006). The use of this model can readily be translated through the communication that occurs through the student teacher and cooperating teacher relationship. As the cooperating teacher is considered the supervisor of the student teacher during the field experience, the cooperating teacher will serve as the source of many communication roles such as subject matter expert, daily performance evaluator, and supervisor.

Purpose

Understanding the needs of student teachers during the student teaching phase of their professional training program is paramount to producing highly qualified and motivated professionals who will enter the profession. The purpose of this study, which was part of a larger study, was to examine the effects implementing structured communication between student teachers and cooperating teachers would have on student teachers' self-perceived relationship between the student teacher and cooperating teacher during the student teaching experience. A secondary purpose was to explore relationships between selected variables including gender, age, ethnicity, agriculture science experience, academic standing, agriculture work experience, and placement at cooperating center.

Based on consulted literature, the following hypotheses were developed to guide this study and tested *a priori* at the .05 level.

Ho_1: There is no difference in student teachers' perception of their relationship with their cooperating teacher when cooperating teachers use a communication tool.

Ho_2: There is no difference in student teacher's perception of their relationship with their cooperating teacher when cooperating teachers use a communication tool in the presence of gender, age, ethnicity, agriculture science experience, academic standing, agriculture work experience, or placement at cooperating center.

Procedures

This study employed a quasi-experimental design with a non-random sample in a multiple time-series design (#14) (Campbell & Stanley, 1963). Campbell and Stanley (1963) defined quasi-experimental designs as follows:

> There are many natural social settings in which research person can introduce something like experimental design into his scheduling of data collection procedures (e.g., the when

and to whom of measurement), even though he lacks the full control over the scheduling of experimental stimuli (the when and to whom of exposure and the ability to randomize exposures) which makes a true experiment possible. (p. 34)

The design of this study was employed as follows:

Fall 2006 student teachers (*n*= 20)	O_1	X_1	O_2	X_1	O_3
Fall 2005 student teachers (*n*= 27)	O_1		O_2		O_3
Fall 2004 student teachers (*n*= 35)	O_1		O_2		O_3

The first measurement of the student teacher's perception of the relationship with the cooperating teacher (O_1) was taken at the end of the first four weeks of the semester in which the participant was involved in a field experience (student teaching). The second measurement (O_2) was taken during the fifth week of the 11-week field experience at the mid-semester conference between student teachers and teacher education faculty (university supervisors) of a university. The third (O_3) and final perception of the relationship between the student teacher and the cooperating teacher measurement was taken at the end of the 11-week field experience. The intervention, or experimental variable (X_1), was introduced during the full field experience of the fall 2006 teacher education student teaching semester, incorporated weekly.

Threats to internal validity were addressed in the design of this study (multiple time-series design #14) (Campbell & Stanley, 1963). Tuckman (1999) stated "internal validity depends, in part, on the condition that the effect attributed to a treatment is a function of the treatment itself, rather than a function of some other unmeasured and uncontrolled differences between treated and untreated persons" (p. 9-10).

The sample for this study was student teachers enrolled in field experience at a university. This purposive sample was chosen to represent student teachers engaged in field experiences. This sample included three semesters of students during the student teaching phase of their teacher education program. The control groups consisted of student teachers enrolled in field experience at a university during the fall semesters of 2004 (*n*= 35) and 2005 (*n*= 27). The treatment group consisted of student teachers enrolled in field experience at a university during the fall semester of 2006 (*n*= 20). Therefore, the researcher makes the assumption that the results from this study can be inferred and inferential statistics are employed (Oliver & Hinkle, 1982). Judgments based on the findings from this study should be made with caution when generalizing to other groups of student teachers in agricultural education (Oliver & Hinkle, 1982).

The communication form employed in this study is an adaptation of a form used by the Department of Education at Florida State University. The communication form contains 12 sections of accomplished practices of the student teacher. Accomplished practices included: assessment, communication, continuous improvement, critical thinking, diversity, ethics, human development and learning, subject matter knowledge, learning environment, planning, role of the teacher, and technology. The cooperating teacher rated the student teacher based on their observation of prescribed practices each week. Comments and recommendations fields were available for each accomplished practice to further describe observations of the student teacher. Directions on using the communication tool and the submission process were outlined in both a short and long form provided to cooperating teachers. The communication form was used to aid in the communication process between the cooperating teacher and student teacher. The role of the communication tool was to document the implementation of the treatment in this study.

A researcher-developed instrument (Roberts, 2006; Kasperbauer & Roberts, 2007b) was utilized to collect perceptions of student teachers concerning the student teacher's relationship with the cooperating teacher. This instrument was developed to coincide with the background/demographic instrument. Cooperating teacher/student teacher relationship section consisted of 43 items rated on the student teacher's perception of this relationship. The four constructs used in this instrument were as follows: teaching/instruction, professionalism, personality, and cooperating teacher/student teacher relationship. The teaching/instruction construct consisted of nine statements. The professionalism construct contained 10 statements. The personality construct contained 10 statements. Finally, the cooperating teacher/student teacher relationship consisted of 14 statements. The scale used ascertains the level that the cooperating teacher exhibits those characteristics as perceived by the student teacher. Face and content validity were established through an expert panel in the Department of Agricultural Leadership, Education, and Communications at Texas A&M University. Cronbach's Alpha reliability coefficient for the relationship questionnaire was .78.

A researcher-developed instrument (Roberts, et al., 2006; Kasperbauer & Roberts, 2007b) was utilized to collect background and demographic data for this study. This instrument was developed to coincide with the relationship instrument. Background/demographics section consisted of seven items: gender, age (years), ethnicity, placement at cooperating center, semesters of high school agricultural education courses completed, academic standing, and agriculture work experience. Dillman (2000) stated that questions having ready-made answers such as demographic questions gain more accurate responses. Face and content validity was established through an expert panel in the Department of Agricultural Leadership, Education, and Communications at Texas A&M University.

Data were analyzed using SPSS® 15.0 for Windows™ statistical package. Demographics and background characteristics were assessed using descriptive statistics – means, frequencies, and standard deviations. In order to ascertain the influence of the independent variable, use of the communication tool, upon the dependent variable of perception of relationships, data collected on contextual variables (gender, age, ethnicity, agriculture science experience, academic standing, agriculture work experience, or placement at cooperating center) were used as covariates during data analysis. Repeated measures mixed design and repeated measures analysis of covariance were utilized to further delineate the findings of this study.

Data were analyzed for normalcy and an outlier was identified when descriptive statistics were employed. Further investigation of the data, revealed through box plot analyses identified the specific case contained in the treatment group (n=20). This case was identified and removed from further data analysis (N=81, treatment group (n=19). Judd and McClelland (1989) argue outlier removal is desirable, honest, and important.

Findings

The average respondent in this study was a 23 year old white undergraduate female placed at a multiple placement cooperating center. Data showed similar make-up of control and treatment groups in gender, age, and placement. The treatment group was composed of all white respondents but the control group reported two Hispanic and one Hawaiian or other Pacific Islander. Differences in demographics were also noted in agricultural sciences taken in secondary schools. It was reported a greater percentage of the control group respondents had never been enrolled in secondary agricultural science classes. In addition it was reported that a greater percentage had taken at least three or more semesters of secondary agricultural science classes.

Perceptions of student teachers on level of relationship exhibited by the cooperating teacher shown in Table 1 yielded data for control, treatment, and an overall measurement of groups of study. Data were collected at three points of the field experience. Mean scores for the perceptions of the student teacher on level of relationship exhibited by the cooperating teacher in the control group (*n*=62) for the three measurement points were 4.23 (SD = .63), 3.82 (SD = 1.04), and 3.89 (SD = 1.04), respectively. Mean scores for the treatment group (*n*=19) at the three measurement points were 3.88 (SD = .79), 3.91 (SD = .83), and 3.77 (SD = .94). Data showed a decrease in mean scores by the control group from first measurement to the second measurement and then an increase from the second measurement to the third. The data for the treatment group showed a decrease from second measurement to the third measurement as the control group data also indicated an increase in mean score. The treatment group showed an increase from the first measurement to the second measurement in mean score whereby the control group's mean scores indicated a decrease in the perceptions of the level of relationship.

Table 1

Means Comparison of the Level of Relationship Exhibited by Cooperating Teacher

	1st measurement		2nd measurement		3rd measurement	
	M	*SD*	*M*	*SD*	*M*	*SD*
Control Group (*n*=62)	4.23	.63	3.82	1.04	3.89	1.04
Treatment Group (*n* = 19)	3.88	.79	3.91	.83	3.77	.94
Overall Group (*N*=81)	4.14	.68	3.84	.99	3.86	1.01

Note. Scale used to measure relationships had a range from 1 through 5. 1 indicating low importance perceived and 5 indicating the highest perception held by the respondent(s).

Null hypothesis one stated there is no difference in student teachers' perception of their relationship with their cooperating teacher when cooperating teachers use a communication tool. Repeated measures analysis was used to test for differences in perceived level of importance of the relationship with cooperating teachers as seen by student teachers (see Table 2). This test produced a significance level of $p < .00$ (*Mauchly's W = .78*). In this case, the sphericity assumption was not met; therefore, Greenhouse-Geisser adjustment was used. The significance level of $p = .16$ ($F = 1.88$) suggests there were no differences in the student teachers perceptions of their cooperating teachers current level of relationship exhibited throughout the student teaching semester during the three data collection points (see Figure 1). The overall model was not significant (Between Groups, $p = .59$). The null hypothesis was held tenable and not rejected.

Table 2

Student Teacher Perceptions of Their Cooperating Teachers' Current Level of Relationship

Source	*df*	SS	MS	*F*	*p*	η^2	Power
Within Groups							
Relationship Level (RL)	1.63	1.80	1.10	2.34	.11	.03	.42
RL x Treatment Group	2	1.45	.72	1.88	.16	.03	.35
Error	119.31	55.98	.47				
Total	123						
Between Groups							
Treatment Group	1	.52	.52	.29	.59	.00	.08
Error	73	129.23	1.77				

Note. Sphericity assumption not met (*Mauchly's W* = .64, *p* = .03) [1]Greenhouse-Geisser adjustment used

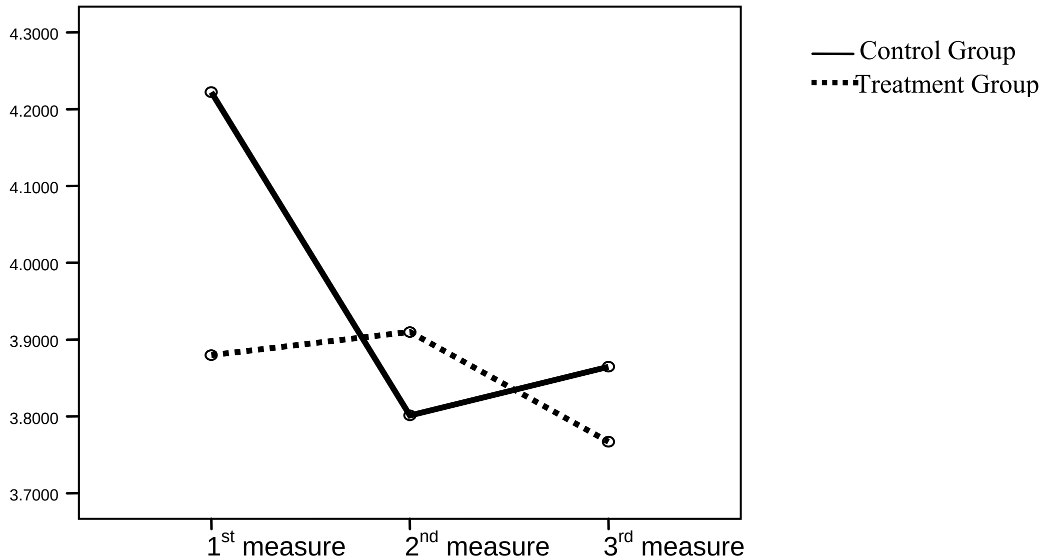

Figure 1. Mean plots of relationship level perception of student teacher for control and treatment groups.

Further data analysis revealed through within subject contrasts no significance on treatment group and perceptions of relationship of the cooperating teacher by the student teacher (see Table 3). It should be noted that overall both the treatment group and the control group displayed a reduction of their perception of the relationship through this time series design.

Table 3

Within Subject Contrasts for Relationship Level

Source		*df*	SS	MS	*F*	*p*	η^2	Power
Within Group Contrasts								
Relationship Level (RL)	Level 1 vs. 2	1	2.17	2.17	2.46	.12	.03	.34
	Level 2 vs. 3	1	.09	.09	.22	.64	.00	.08
RL x Treatment Group	Level 1 vs. 2	1	2.88	2.88	3.28	.07	.04	.43
	Level 2 vs. 3	1	.60	.60	1.47	.23	.02	.22
Error	Level 1 vs. 2	73	64.12	.88				
	Level 2 vs. 3	73	30.09	.41				

Null hypothesis two stated there is no difference in student teacher's perception of their relationship with their cooperating teacher when cooperating teachers use a communication tool in the presence of gender, age, ethnicity, agriculture science experience, academic standing, agriculture work experience, or placement at cooperating center. Repeated measures analysis was used to test for differences in perceived level of importance of the relationship with cooperating teachers as seen by student teachers (see Table 4). This test produced a significance level of $p = .01$ (*Mauchly's W = .67*). In this case, the sphericity assumption was not met; therefore, the Greenhouse-Geisser adjustment was used. The significance level of $p = .17$ ($F = 1.84$) suggests that there were no significant differences in the student teachers perceptions of their cooperating teachers current level of relationship exhibited throughout the student teaching semester during the three data collection points (see Figure 2). The overall model was not significant (Between Groups, $p = .49$). However, significance was found in the interaction between relationship level perceived by the student teachers and age ($p = .01$). This interaction shows high power (.82) with a small effect size ($\eta^2 = .09$). It should be noted that as age level of the sample increased, student teachers' perceptions of their cooperating teachers level of relationship exhibited was significantly increased. Overall, the model was not found significant and the null hypothesis was held tenable and failed to reject.

Table 4

Student Teacher Perceptions of Their Level of Relationship with Cooperating Teacher

Source	*df*	SS	MS	*F*	*p*	η^2	Power
Within Groups							
Relationship Level (RL) [1]	1.50	1.01	.67	1.45	.24	.02	.26**
Interactions							
RL x Gender[1]	1.50	.61	.41	.88	.42	.01	.18**
RL x Age[1]	1.50	4.46	2.97	6.40	.01*	.09	.82**
RL x Placement[1]	1.50	1.79	1.19	2.56	.10	.04	.43**
RL x AgSc Semesters[1]	1.50	.37	.25	.53	.54	.01	.13**
RL x Academic Standing[1]	1.50	1.28	.85	1.83	.17	.03	.32**
RL x Ethnicity[1]	1.50	.40	.27	.58	.52	.01	.13**
RL x Ag Work Experience[1]	1.50	.52	.35	.74	.44	.01	.16**
RL x Treatment Group[1]	1.50	1.28	.86	1.84	.17	.03	.33**
Error	99.05	46.03	.47				
Total	113.00						
Between Groups							
Treatment	1	.89	.89	.48	.49	.01	.10**
Error	66	122.65	1.86				

Note. Sphericity assumption not met (*Mauchly's W* = .667, *p* = .0001) [1]Greenhouse-Geisser Adjustment Used), **p* significant < .05, ** power computed using alpha = .05.

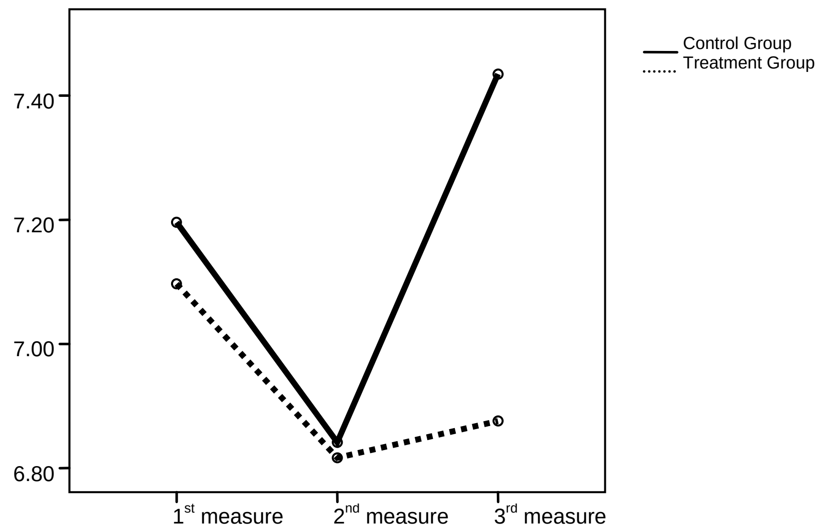

Figure 2. Mean plots of relationship level perception of student teacher for control and treatment groups with covariate adjustment.

Within subject contrasts did reveal three significant interactions. From the second to the third relationship measurement, age interacted significantly (F = 21.01, p = .00). Also from the second to the third measurement of relationship, academic standing interacted significantly (F = 8.20, p = .01).

Table 4-28
Within Subject Contrasts for Relationship Level with Covariates

Source		*df*	SS	MS	*F*	*p*	η²	Power
Within Group Contrasts								
Relationship Level(RL)	Level 1 vs. 2	1	.89	.89	.99	.32	.02	.17
	Level 2 vs. 3	1	.20	.20	.68	.41	.01	.13
RL x Gender	Level 1 vs. 2	1	.19	.19	.21	.67	.00	.07
	Level 2 vs. 3	1	.44	.44	1.48	.22	.02	.22
RL x Age	Level 1 vs. 2	1	.03	.03	.04	.85	.00	.05
	Level 2 vs. 3	1	6.20	6.20	21.01	.00*	.24	1.00
RL x Placement	Level 1 vs. 2	1	2.21	2.21	2.47	.12	.04	.34
	Level 2 vs. 3	1	.07	.07	.24	.63	.00	.08
RL x AgSc Semesters	Level 1 vs. 2	1	.22	.22	.25	.62	.00	.08
	Level 2 vs. 3	1	.15	.15	.52	.48	.01	.11
RL x Academic	Level 1 vs. 2	1	1.20	1.20	1.34	.25	.02	.21
	Level 2 vs. 3	1	2.42	2.42	8.20	.01*	.11	.81
RL x Ethnicity	Level 1 vs. 2	1	.75	.75	.83	.36	.01	.15
	Level 2 vs. 3	1	.42	.42	1.41	.24	.02	.22
RL x Ag Work Exp.	Level 1 vs. 2	1	.01	.01	.01	.94	.00	.05
	Level 2 vs. 3	1	.84	.84	2.85	.10	.04	.38
RL x Treatment	Level 1 vs. 2	1	2.46	2.46	2.74	.10	.04	.37
	Level 2 vs. 3	1	1.15	1.15	3.88	.05	.06	.49
Error	Level 1 vs. 2	66	59.09	.90				
	Level 2 vs. 3	66	19.48	.30				

Note. *p significant < .05

Conclusions, Discussion, and Implications

No significant difference was found in relation to student teacher's perception of their relationship with their cooperating teacher when a communication tool is used by cooperating teachers. Although not significant, a difference was shown in data reported by both groups. The direction of the mean plots revealed through the implementation of structured communication change was observed in the second measurement. This measurement illustrated the treatment group increasing in their perception of the relationship and the control exhibiting a substantive decrease in mean scores. Because of data exhibited in this study, although not significant the downward trend of both groups in relation to relationship between student teacher and cooperating teacher should be further investigated.

Kasperbauer and Roberts (2007b) concluded that student teachers' perceptions of cooperating teachers' relationship level exhibited decreased throughout the student teaching experience. This study concurs with Kasperbauer et al. (2007b) with results exhibiting a downward trend in perceptions of relationships by student teachers of cooperating teachers. Communication is important in relationships and if the perception of the relationship erodes over time, the impact of sharing knowledge and experience may lessen.

No significant difference was found in relation to student teacher's perception of their relationship with their cooperating teacher when a communication tool is used by cooperating teachers in the presence of contextual variables. The perception of relationship held by student teachers may be an impacting variable as student teachers reflect upon experience and skill acquisition during this stage of their professional career. Although not significant, a difference was shown in data reported by both groups. The direction of the mean plots revealed through the implementation of structured communication with adjustment for covariate showed a change in the overall direction of the means plot. This measurement showed the treatment group decreasing in their perception of the relationship and the control showing a substantive increase in mean scores. Significance was found in relationship level perceived by the student teachers and age during data analysis. This interaction of age and relationship level shows that as age of student teacher increases, the perception of the level of relationship of the cooperating teacher increases. This is a significant finding because although the mean age for this study was 23 (range of 21 to 47), older student teachers may perceive relationships between themselves and cooperating teachers more importantly than do younger student teachers.

Although there is negligible research available regarding the importance of relationships in student teaching experience, their impacts can be paramount upon the perception of the whole experience of student teaching. Edwards and Briers (2001) conducted a focus group with and a quantitative follow up study of cooperating teachers who attended a workshop. This research identified items and the student teacher and cooperating teacher relationship were among five of the ten highest rated items through quantitative analysis. Further research should be undertaken regarding relationships during field experiences in agriculture education.

Recommendations for further research include replication of this study at other institutions involved in teacher education in agricultural education. Further knowledge about the impact of communication on the perception of the relationship between the student teacher and cooperating teacher will explain the effects structured communication can have on relationships during field experiences. A further recommendation is to educate cooperating teachers about the impact that communication has towards student teachers during field experiences and its effect upon the perceptions of student teachers. Cooperating teachers should be educated about the value and correct communication occurring during student teaching and its impact.

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