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CHARACTERISTICS OF THE TURFGRASS INDUSTRY IN 2020: A DELPHI STUDY WITH IMPLICATIONS FOR AGRICULTURAL EDUCATION PROGRAMS

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Abstract

The primary purpose of this study was to determine the characteristics of the turfgrass industry in the year 2020 in order to recommend curriculum content for agricultural education programs of the future. Specific objectives were to determine: the general characteristics of the turfgrass industry in the year 2020, a demographic profile of opinion leaders in the turfgrass industry, whether the Delphi technique could be used to achieve consensus among turfgrass experts, the workforce requirements of the turfgrass industry, and the educational requirements of those employed in the turfgrass industry in the year 2020.

This was a national study using a three-round Delphi technique. The panel of experts was nominated by turfgrass professionals (teaching, research and extension) at all the land-grant institutions, the four-year and two-year colleges offering turfgrass, and the executive boards of related turfgrass associations. The 38 most frequently nominated experts were invited to participate in the study. A structured Delphi instrument consisting of nine categories was developed from the literature. This instrument was circulated to the panel of experts for comments on each category. Their responses were used in the development of a structured Delphi instrument consisting of 147 items on a Likert-type scale. The instrument was reviewed for content and face validity by an 20-member panel.

Consensus was achieved on an item if at least 60% of the respondents were in agreement and the composite score fell in the "agree" or "disagree" range. The mean and standard deviations indicated that the central tendency was a movement toward consensus. The responses were found to be very stable from round 2 to round 3, as indicated by the Pearson product-moment correlation coefficient procedure and the Wilcoxon matched-pairs signed-ranks test.

Thirty-two content items were identified as essential inclusion in agricultural education curriculum.

Introduction

Turf is one of the blessings of nature and includes both service and beauty, a concept which originated when man started to domesticate animals (Huffine & Grau, 1971). Turfs were developed by modern specialists in order to further enhance the environment (Beard, 1973). Turf is the most widely grown, most discussed, and least appreciated commodity in the United States (Hanson & Juska, 1971). In discussing this topic, such terms as "turf," "turfgrass," and "grass" have been used through the years. As far as research done with turf and turfgrass, Hanson and Juska stated that much of the initial work on the development and management of turfgrasses was conducted by agronomists who had some training and experience in growing grasses

for pasture and forage.

However, the first published report related to turfgrass research was initiated in 1880 by a noted botanist, Dr. W. J. Beal, of the Michigan Agricultural Experiment Station (Beard, 1982). Interest in the science of turfgrass culture began to manifest itself. Beard indicated that other projects were initiated at the Connecticut Agricultural Experiment Station in 1886, the Rhode Island Agricultural Experiment Station in 1905, and the Arlington Turf Garden, Arlington, Virginia in 1916. To further expand its potential, the federal government cited and allocated funding in turf through the Agricultural Appropriations Act in 1901. Although these federal allocations of funds for research in turfgrass were made, it was not until the end of World War II that most agricultural experiment stations initiated turfgrass research programs (Huffine & Grau, 1971).

Turf industries have been defined in various ways including geographic influence, scope and size, products, market and trade practices, human resources, and public and political policies (Nutter & Watson, 1971). Even though turfgrass has experienced a long existence, it was not until the latter half of the 20th century that the turfgrass industry actually began booming. Thus, public and political policies are either new or currently being developed.

Nutter (1965) noted that the turfgrass industry encompassed the production and maintenance of specialized grasses as required in the development and management of facilities for utility (erosion control), aesthetics (ornamentation), and recreation (sports). It involves turfgrass science and technology, manufacturing, and marketing of turfgrass products and services, business management, human resources, effective communications, and environmental management skills (Nutter & Watson, 1971; Wagner, 1999; Grigg, 1999; Ellis, 1999; Jaques, 1998; Dysart, 1995; Fry, Thien, Miller, Elsea, & Krause, 1998).

This suggests some important questions about the future of turfgrass and the role of agricultural education. What will the turfgrass industry be like in the future? What careers will be available in the turfgrass industry? Will today's turfgrass curriculum in agricultural education prepare students for jobs in an increasingly technological turfgrass industry? Can vocational educators look into the future and develop a curriculum to satisfy and complement this end?

O'Kelley (1969) defined curriculum as "the sum total of the student's experiences and activities under the direction of the school, including teaching materials and methodology" (p. 29). Since curriculum is the life of agricultural education, changes made in the curriculum are long term and far reaching (Iverson & Robinson, 1990). Thus, curriculum content is the basic building block of curriculum planning; without constant monitoring and revision, it becomes stagnant, outdated, and ineffective (Flanders, 1988).

How each individual views the rate, scope, and substance of change is influenced by the personal values and perceptions of the observer (Hawking, 1988). Turfgrass is in a state of change. Traditional management philosophies are being challenged by both professional organizations and the public. Some speak of the need for entirely new management paradigms (Wagner, 1999; Grigg, 1999; Ellis, 1999; Wake, 1999; Jaques, 1998, Dysart, 1995; Fry, Thien, Miller, Elsea, & Krause, 1998).

One thing that certainly can be predicted is that there will be change, even though most systems are compelled by assumptions of stability. Events of minimal

probability are usually ignored even though some unpredictable events are likely to occur. Change comes to a system from the ends of a bell-shaped curve, which are variations of the system. Planning explores possible futures and develops strategies to address those futures (Brighton, 1987).

The future will bring about change, and vocational educators must be ready to accept and react to this challenge. Curriculum development processes have to be adjusted to meet the challenges of the future. Shane (1981) suggested that vocational educators must become involved in curriculum development that considers jobs for tomorrow and the demands of the changing work place.

Curriculum content must be kept up to date in the agricultural education/turfgrass area if students are to be prepared for the jobs of the future. Experts now agree that planning should be based on a futuristic model (Brodzinski, 1979; Finch & Crunkilton, 1999; Gough, 1987;Wiles, 1999). A futuristic strategy utilizing the Delphi technique may be needed to accomplish this goal. The Delphi has been used in government, industry, medicene, regional planning, and education for a variety of situations including futures forecasting, curriculum planning, program planning, policy information and problem identification and solutions (Adler & Ziglio, 1996; Cyphert & Gant, 1970; Iverson, 1993; Lang, 1996; Linstone & Turoff, 1975; Turoff & Hiltz, 1995).

Purpose

The purpose of this study was to determine characteristics of the turfgrass industry in the year 2020. By doing so, program planners will be able to make recommendations based on futuristic research. The results of this study will be useful as a basis for program planning and curriculum development in agricultural education.

This study was needed because the literature search revealed no futures research with specific implications for determining turfgrass curriculum content in agricultural education programs. In addition, further justifications for the study include:

1. Turfgrass instruction in agricultural education programs is a viable means of preparing students for careers in turfgrass and turfgrass related jobs.
2. Regularly updated curriculum content needs to be available to agricultural education teachers to prepare students for turfgrass jobs in the year 2020.
3. The turfgrass industry generates significant dollars annually and accounts for the employment of a considerable number of workers each year throughout the United States. Agricultural education (turfgrass) programs can have a positive impact on the economy of the United States by providing skilled and competent graduates with the ability to become rational and critical thinkers in problem-solving activities as workers.
4. The study is timely. It is crucial that futuristic projections of this format be made since the only certain constant is change.

Objectives

The primary objective of this study was to make recommendations for curriculum content for turfgrass course work in agricultural education programs. This determination was accomplished by employing futures research to determine the

characteristics of the turfgrass industry in the year 2020.

The following specific objectives were developed to direct this study:

1. To identify the general characteristics of the turfgrass industry in the year 2020.
2. To determine whether the Delphi technique was a viable means of eliciting a consensus among those nominated to a panel of turfgrass industry experts concerning the description of the turfgrass industry in the year 2020.
3. To determine the work force requirements of the turfgrass industry and the educational requirements of those employed in the turfgrass industry in the year 2020.
4. To make recommendations for program thrusts and curriculum development in turfgrass-related courses in agricultural education, in order to prepare students for jobs in the turfgrass industry in the year 2020.
5. To develop a demographic profile of those nominated to the panel of experts based upon: (a) education, (b) age, (c) sex, (d) race, and (e) turfgrass industry work experience.

Procedures

This was a national futures study utilizing the Delphi technique. Collection of data consisted of five phases: selection of a panel of experts, instrument development, and three rounds of the Delphi instrument.

To select members of the Delphi panel of experts, nomination letters were mailed to the turfgrass-related representatives of land grant institutions (teaching, research and extension), college and technical school personnel (teaching and demonstration), and executive or administrative personnel of related professional associations. These representatives were asked to nominate five persons who they felt would be best qualified to forecast the future directions of the turfgrass industry. The 38 members of the chosen panel of experts (Table 1) were selected from a list of 428 total nominations which consisted of 194 different people. A total of 110 nomination forms were returned with five or fewer nominations.

An intensive review of the literature revealed no instrument suitable to collect data for the objectives of the study. The investigator developed the format for the instrument, based on the specific requirements of the study which involved the identification of subjective categories from the literature review. Such categories included personnel education and staff development, technology, availability of turfgrass cultivars, turfgrass management services, legal issues, chemical issues, environmental issues, best management practices, and other issues and/or circumstances. These categories were circulated as the first round of the instrument for individual responses from each member of the Delphi panel of experts. A “guide question” and a “sample statement” were composed and included in round one of the Delphi technique, focusing on the subject area of each category. The Delphi panel of experts was instructed to read the “guide question” and “sample statement,” then develop statements that describe how the category will appear or function with respect to the turfgrass industry in the year 2020. For the nine categories, 512 statements were collected from the first round of the Delphi technique.

These responses were developed into a draft of the Delphi instrument consisting

of 164 items in the nine categories. This draft was reviewed by a panel of 20 persons with expertise in the turfgrass industry, in futures research, and/or in education. This review panel assisted in the refinement of the document into a 147-item instrument to be circulated in round two of the

Table 1. Experts Invited to Serve on the Delphi Panel

Name	Affiliation	City, State
Dr. James B. Beard	Texas A&M University	College Station, TX
Dr. Lee Burpee	University of Georgia	Griffin, GA
Dr. Bob Carrow	University of Georgia	Griffin, GA
Dr. Nick Christians	Iowa State University	Ames, IA
Dr. Stephen Cockerham	University of California	Riverside, CA
Ms. Cindy Code	*Lawn & Landscape*	Cleveland, OH
Dr. Karl Danneberger	Ohio State University	Columbus, OH
Dr. Joe DiPaola	Novartis Crop Protection	Greensboro, NC
Dr. Joe Duich	Penn State University	State College, PA
Dr. Milt Engelke	Texas A&M University	Dallas, TX
Mr. Douglas Fender	Turfgrass Producers International	Rolling Meadows, IL
Dr.Reed Funk	Rutgers University	New Brunswick, NJ
Dr. Victor Gibeault	University of California	Riverside, CA
Mr. Gary Grigg, CGCS	Royal Poinciana Golf Club	Naples, FL
Dr. Wayne Hanna	USDA - Agricultural Research Service	Tifton, GA
Mr. Ted Horton, CGCS	Pebble Beach Company	Pebble Beach, CA
Dr. Richard Hurley	Rutgers University	East Stroudsburg, PA
Mr. Ray Jensen	Turfgrass Consultant	Tifton, GA
Dr. Keith Karnok	University of Georgia	Athens, GA
Mr. Mike Kenna	USGA Green Section	Stillwater, OK
Dr. Gil Landry	University of Georgia	Griffin, GA
Mr. Bill Liles	Prokoz, Inc.	High Point, NC
Dr. William Meyer	Rutgers University	New Brunswick, NJ
Mr. James Moore	USGA Green Section	Waco, TX
Mr. Randy Nichols, CGCS	Cherokee Town & Country Club	Dunwoody, GA
Dr. Charles Peacock	North Carolina State University	Raleigh, NC
Dr. A. J. Powell	University of Kentucky	Lexington, KY
Dr. Paul Rieke	Michigan State University	East Lansing, MI
Dr. Robert Shearman	University of Nebraska	Lincoln, NE
Mr. Trevor Smith	Predator Ridge Golf Resort	Vernon, BC
Mr. Jim Snow	USGA Green Section	Far Hills, NJ
Dr. A. J. Turgeon	Penn State University	University Park, PA
Dr. Don Waddington	Penn State University	University Park, PA
Dr. Coleman Ward	Auburn University	Auburn, AL
Dr. Tom Watschke	Penn State University	University Park, PA
Dr. Jim Watson	Toro Company	Littleton, CO
Dr. Richard White	Texas A&M University	College Station, TX
Mr. Stanley Zontek	USGA Green Section	West Chester, PA

Delphi technique to the panel of experts. The instrument used in the study was set up with a Likert-type five-point scale as follows: SD for Strongly Disagree, D for Disagree, U for Undecided, A for Agree, and SA for Strongly Agree.

The data from the first round instrument were carefully transcribed and summarized into the draft for the second-round instrument, which was reviewed for content and face validity. The data collected from the second-round instrument were transferred to computer files. The investigator manually completed the transfer of data and triple checked the instruments and computer answer sheets for accuracy. As a final numerical check, student workers assisted the investigator in comparing the computer sheets to the each respondent's answer. The data were submitted for SAS analysis to the Director of the Office of Information Technology and Statistical Services at the University of Georgia College of Agricultural and Environmental Science Coastal Plain Experiment Station, Tifton, GA (SAS Institute, 2000).

Analysis of the data for the study consisted of primarily descriptive statistics using a practical, non-parametric approach (Conover, 1971). Means and standard deviations were calculated, and the Pearson product-moment correlation coefficient and the Wilcoxon matched-pairs signed-ranks test were computed. Also, the composite score, as used by Dillon and Wright (1980), was also calculated for each item. As an additional test, the medians and interquartile ranges were calculated to further determine convergence of opinion (Conover, 1971).

Findings

Thirty-four (90%) of the 38 nominated experts completed and returned the first round of the instrument. The responses were compiled and organized into the Delphi instrument which was evaluated by a 20-member review team. The second instrument was circulated to the thirty-four experts with thirty (79%) completing and returning the instrument. The most common responses on each item from the second round were compiled and provided to 30 members of the panel of experts, along with the round three instrument. A 66% overall response rate (25 of 38) was attained in round three after two follow-ups of non-respondents.

Two national groups were involved in the process of completing this study. The first group was the nominators who were asked to provide the names of persons for a national panel of experts in the turfgrass industry. The second group was the national panel of experts nominated by the first group. This pool of human resources provided a diverse panel of experts from private and public sectors across the United States.

When asked to indicate the category that best described their current affiliation with the turfgrass industry, 13 (52%) of the 25 members of the panel indicated that they were university educators (teaching, research, or extension), 4 (16%) were professional association directors, 3 (12%) were in turfgrass business and industry, 2 (8%) were turfgrass consultants, 2 (8%) were golf course superintendents, and 1 (4%) was a federal researcher. All twenty-five experts were male and 24 (96%) Caucasian and one (4%) mixed race. They were well-educated with 3 having bachelor's degrees, 5 having master's degrees, and 17 having doctoral degrees. The group had a total of 806 years experience, a mean of 32.2 years in turfgrass. Respondents ranged from 44 to 83 years of age, a mean of 57.6 years. The nomination process was without bias to women or minorities. One woman

was invited to participate from the original thirty-eight invitations but declined. The presence of women in this male-dominated field has been expanding in recent years. A description of the experts is not necessary for the interpretation of the Delphi, but demographic data relative to the panel of experts were important for verification of the expert status of panel members. This information may also be important in the selection of groups for further study.

The use of the Delphi technique, as used for this research study, requires that the participants respond to two rounds of an instrument. An underlying principle was that in the third round the responses tend to converge toward the measure of central tendency, with decreasing variability in scores. A related principle to be measured when using the Delphi technique was stability. Responses are considered stable when the answers do not change substantially from round to round. Delphi studies by Flanders (1988), Varnadore (1989) and McAllister (1992) showed similarity in stability.

Composite scores were calculated to rank order the items in the instrument (Dillon & Wright, 1980). The 147 items on the instrument were marked by the respondents on a five-point Likert-type scale. Only round three of the results were considered for the discussion of composite scores since, by the nature of the Delphi technique, the results of the last round (round three) are the most accurate and therefore of the most value.

Consensus was indicated on an item if both of the following conditions were met: (1) at least 60% (15 of 25) of the respondents were in agreement and (2) the composite score was greater than 87.5 (70% of 125) or less than 62.5 (50% of 125). In other words, the composite scores had to be in either the agreement or disagreement range. The two required conditions indicating consensus were met on 114 of the 147 items (78%) with 113 items scoring in the agreement range and one item scoring in the disagreement range. This one item concerned pesticide and fertilizer applications being available only on a contractual basis and performed by individuals licensed by the federal government (#51). Thus, thirty-three items (23%) failed to meet the required criteria for consensus. However, three of those items, #57, #110, and #125 were closely approaching consensus but did not meet the criteria with the composite score only. Turfgrass management companies will offer the golf course superintendent additional opportunities to grow in professionalism (#57, composite score of 87). Turfgrass managers will be required to have fertilizer and pesticide application programs approved before they can be implemented (#110, composite score of 84). And, low-input, sustainable turfgrass management will be the key (#125, composite score of 87). Two items had 15 or more respondents that marked choice number 3 (Undecided) on the survey instrument. These items were #18: Laser mowing will become an integral part of improved technology, and #146: Laser and other cutting methods will remain too expensive and produce unsatisfactory cutting units.

A composite score was calculated on round three data for each item and was used to rank the items in order of agreement. The highest-ranked and lowest ranked items are identified in Table 2. The standard deviations indicated that the group answers were moving toward consensus. As measured by standard deviations, 59% of the items moved toward the mean. Stability of the responses from round two to round three was measured using the Pearson product-moment correlation coefficients and the

Wilcoxon matched-pairs signed-ranks test. Responses were found to be very stable (not significantly changed) in 145 (99%) of the items as measured by the Pearson product-moment correlations and in 147 (100%) of the items as measured with the Wilcoxon matched-pairs signed-ranks test. The medians and interquartile ranges for all items on round two and three and the change in interquartile ranges from round two to round three were also reported.

Table 2. Items of Highest and Lowest Rank by Composite Score in Round 3

Highest Ranked Items

#	Item	Score	Rank
12.	Computers will play a major role in the educational, decision-making, and recordkeeping processes of the turf manager's job	121	1.0
14.	More sophisticated equipment will be available for the maintenance of turfgrass sites	118	2.5
7.	More training will be available "on line" which should give turf managers better access to information on turfgrass management	118	2.5
102.	Environmental issues of great concern will be the use of scarce water resources, and the prevention of water pollution	114	5.5
48.	Services will increase, but the individual on-site superintendent will continue to be the core of the industry	114	5.5
28.	New cultivars with improved performance potential will continue to become more available	114	5.5
6.	Turfgrass managers must have at least a 2- or 4-year degree in an area of plant or soil sciences to be eligible for superintendent certification	114	5.5
134.	In addition to technical skills, turf managers will need to know people management, risk management, environmental stewardship, communication skills, business administration, and foster public relations and image management to their employer and to members of the community	113	9.0
96.	Expanded use of treated water and less potable water will be the focus of turf managers.	113	9.0
10.	More emphasis will be placed on meeting the requirements of the many environmental regulations	113	9.0

Lowest Ranked Items

#	Item	Score	Rank
51.	Chemical (pesticide and fertilizer) application will only be available on a contractual basis and performed by individuals licensed by the federal government	62	147.0
50.	Regulations may require contractual services for aeration of turfgrass sites	65	146.0
137.	Golf courses and other turfgrass areas will have on-sitelaboratories as a means of conducting various research programs, cooperating with state and federal agencies	67	145.0
81.	All turfrass personnel, regardless of level, will be required to have a license to operate various pieces of maintenance equipment as an expression of competency	68	144.0
20.	Subsurface irrigation techniques will become more commonplace	69	142.5
41.	The longevity of cultivars will be only 3 or 4 years because of continuous improvements, genetic changes in population, and plant protection patents	69	142.5
58.	Contractual management services will be standard by the year 2020 which will lower management costs and lessen liability expense	72	140.5
62.	Public institutions, grounds, and parks will primarily be managed by private firms on a contractual basis	72	140.5

Conclusions

Based on the review of the literature and findings of this study, several conclusions were reached. These were:

1. The turfgrass industry will grow and change rapidly into the year 2020, with increasing emphasis on protecting the environment through best management practices.
2. Opinion leaders in the turfgrass industry can best determine curriculum content for turfgrass programs of the future.
3. The Delphi technique was effective in determining consensus among turfgrass experts regarding future characteristics of the industry.
4. There will be increased employment opportunities and a corresponding need for training programs in turfgrass.
5. There is a need to continually update the turfgrass curriculum in agricultural education programs.

Recommendations

As a result of this research study, it is recommended that:

1. The Delphi technique should be employed as a common method to project curriculum content for agricultural education course work.
2. The turfgrass curriculum in agricultural education should be continuously updated using leaders in the turfgrass profession as resources in the planning and development of curricula. The curriculum should be updated every five years so that students will be prepared for all but the most recent advances in technology. This would benefit both the turfgrass industry and the vocational education curriculum specialists.
3. Teachers of agricultural education should be continuously updated with the assistance of turfgrass industry resource people. Prospective teachers should be required to take course work in turfgrass. The content of this course work should have been kept current utilizing futuristic methods. Workshops and seminars should be conducted on a regular schedule and include representatives from turfgrass enterprises, public and private.
4. Post-secondary vocational programs should offer more educational services for the turfgrass industry. Most of the continuing education programs currently being offered are directed towards restricted use pesticide licensing. Adult training and continuing education for industry employees is a need that vocational education at the post-secondary level can further provide.
5. As opportunities increase in the turfgrass industry, turfgrass course work in agricultural education should be expanded and emphasized. Recruitment of students into turfgrass programs should be based on expanding career opportunities. Groups that are traditionally lacking in representation in turfgrass, such as minorities and women, should be actively recruited into turfgrass programs. Employment opportunities for students with turfgrass beyond the secondary level should be included in the curriculum. The turfgrass industry should be viewed with a continuing positive

and professional image, and principles of professionalism, etiquette, and ethics should be included in the curriculum.

6. Curricula for turfgrass course work in agricultural education should be expanded to include the application of the basic cultural practices of mowing, fertilization, and irrigation. The students should be prepared for lifelong learning through continuing education, whether private or public. The turfgrass industry has become more complex requiring more advanced and refined job skills. Communications, social, and problem-solving skills should be included in the curriculum. Students should be exposed to environmental concerns, worker safety, economics, and governmental regulations that impact production, maintenance, and management of turfgrass. Furthermore, future generations of turfgrass employees will further need to assimilate knowledge of behavioral science and social-cultural systems into biological and technical conceptions of turfgrass.
7. The 32 curriculum content items identified by this study should be included in the turfgrass curriculum in agricultural education (Table 3).

Table 3. Curriculum Content Items

Computer competency and applications	World wide web training and competency
Sophisticated turfgrass maintenance equipment	Environmental concerns
Water conservation and use	Environmental stewardship
Contractual services in turfgrass maintenance	New cultivar understanding
Certification needs	Effective communication skills
Human resource management and ethics	Risk management
Business management skills	Environmental regulations
Integrated pest management programs	Continuing education
Lifelong learning	Best management practice programs
Chemical fate	Wildlife and plant preservation
Natural area protection	Record keeping
Nutrient management programs	Public relations
Pesticide application	Consulting services
Remote sensing technologies	Genetic engineering
Ecology services	Management companies
Pest scouting	Professional and trade organizations

Implications

As a result of the findings and conclusions presented in this study, the following implications are presented:

1. The turfgrass industry will likely continue to provide opportunities for employment of effectively trained employees. And, agricultural education programs will likely continue to offer the turfgrass option. Furthermore, agricultural education teachers will likely need more assistance in adapting to and

managing change. And, curriculum specialists will likely be employed in each agricultural education district office to provide assistance in preparation and implementation of the curriculum.

2. Leaders in the turfgrass industry are recognized as opinion leaders and are considered capable of forecasting the future of the industry. It is probable that these opinion leaders in the turfgrass industry can best determine the content of turfgrass course work in agricultural education to prepare students for future turfgrass jobs.
3. The Delphi technique is effective in achieving consensus and will be more likely utilized in determining curriculum content.
4. There will likely be increased opportunities in the turfgrass industry for effectively trained employees with high school, vocational school and technical college education, as well as graduates of baccalaureate, masters, and doctoral programs. Furthermore, vocational and technical programs will likely need to emphasize and teach communications and human relations skills, as well as critical thinking and problem-solving skills. In addition, turfgrass enterprises will likely further promote training and continuing education for their employees as lifelong learning is realized.
5. The specific curricula subject areas outlined in the recommendations are based on the opinions of the most frequently nominated turfgrass experts in the United States. Thus, it is probable that they be consulted and their services utilized in updating turfgrass curriculum in agricultural education programs.

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LOSS, RETENTION AND RECRUITMENT OF JUNIOR MARKET LIVESTOCK SALE BUYERS IN THE STATE OF COLORADO: FACTORS THAT CONTIRBUTE TO RETENTION AND LOSS

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Abstract

Individuals with buying experience from Junior Market Livestock Sale (JMLS) Programs were identified. An analysis of the preliminary data collected from the counties yielded the identification of three distinct groups of buyers; lost, retained and recruited. Interviews of 1,440 of those individuals were conducted in late 1999 throughout the state of Colorado to determine factors effecting the retention and recruitment of buyers. Distinct categories of reasons to continue or discontinue support of the JMLS program were identified. Major retention factors include belief in the positive impact that the program has on the youth and the rewarding of members for a year of hard work in their projects. Main factors in the loss of buyer support include their feeling of a lack of appreciation and that too many other people were involved in our JMLS program, taking away some of the responsibility that should rest with the youth. Factors to consider when troubleshooting these problems are encouraging supporters to retain faith in our programs by presenting them with examples of the positive impacts that our programs have and encouraging positive behaviors in our youth, volunteers and agents/advisors through appreciation programs and innovative ways of saying thank you to our supporters.

Introduction

The county fair junior market livestock sale is the hallmark of any 4-H Youth development or FFA members' year of hard work, dedication and sacrifice. Every youth who enters that ring, does so with the knowledge that they are a winner, because they have achieved the right to sell their animal, a goal not all members achieve. Through the publicity, both negative and positive garnered by the animal agriculture industry in recent years, the junior market sale is one of the standing traditions in the agriculture organizations for youth, 4-H and FFA. It stands as the pinnacle of achievement and success for those young people enrolled in market animal projects. Reaching the sale is a sign to everyone that the animal that these young people have worked hard to raise is of superior quality.

The junior market livestock sale is one of the few chances that Extension and FFA advisors have to showcase what they do within the 4-H and FFA livestock programs all year long to an audience of people who may have no conception of what those programs entail. The success of this day rests on those individuals and businesses that come to support the sale, and the youth, by purchasing an animal. Without junior market livestock sale buyers, the sale as we know it, could not exist. Dreams and hard work, that is what showing livestock means for nearly all involved youth. Once they are inside that arena, they are winners whether or not they bring home trophies and ribbons (Johnson, 1995). That is the picture that every agent and leader in every extension county or FFA chapter will paint as they discuss their junior livestock programs and sales. The stories that you will be told will paint young people out in the show ring,

showing their animals that they have worked hard to raise, and then selling those animals at the JMLS auction at the end of the fair. The money that they make will be going back into breeding programs for their herds, or into college funds to aid in attaining a member's future educational goals. Members will be learning life skills, responsibility, communication, determination and perseverance. These skills will only make the future that they are preparing for, a smoother transition. The youth involved in livestock programs will be well rounded, well prepared for the future, and ready to attack on coming challenges. For anyone who is familiar with the junior market system, this is a well-known picture.

The overriding goal of the 4-H program is youth development and accomplishment (University of Idaho, 1999). There are many opportunities within the 4-H and FFA organizations to fulfill these two goals through leadership, citizenship and projects. These high ideals are emphasized through these two youth organizations' livestock programs, where a youth member is charged with the health and well being of an animal or animals. The livestock programs are also given the responsibility to aid in the building of positive life skills for the youth enrolled in the projects and activities. The definition of life skill development includes the development of life skills necessary to perform leadership functions in real life (Seevers & Dormody, 1995). This is a testimony to the commitment of the programs, and their leaders and advisors, to preparing their members for life after 4-H and FFA.

A Junior Market Livestock Sale (JMLS) Program is any market animal program or project that is a part of the 4-H or The National FFA Organization (FFA) youth programs. These programs involve members of the youth organizations raising any one of several recognized animal species for a set period of time with the purpose of selling that animal at the end of the project year at the JMLS auction. Also included in these programs are the breeding animal projects, livestock judging, stockman's bowl competition, livestock and dairy presentations, animal clinics, cookery competitions, cumulative records and other activities. These programs also attempt to teach their members positive life skills, including self-esteem, character, integrity and confidence while overcoming adversity and challenges within the various projects.

The question is often asked, "Do these programs fulfill their set goals?" Participation in many different leadership activities, at a variety of levels, promotes personal development of several different kinds (Seevers & Dormody, 1995). One former member noted that projects taught him the value of hard work and commitment (Ferguson, 1995). In the last several years, however, there have been abundant amounts of publicity on questionable ethical practices within the youth livestock arenas. Several youth programs around the country have had negative news articles printed in nationally recognized publications surrounding questionable acts by members and leaders in their programs. This negative publicity is generally surrounding the JMLS auction at the end of the show and the practices that take place beforehand when members are preparing their livestock projects to show.

Fairs encourage exorbitantly high prices for champion animals. Such high prices garner more publicity. The conception is that buyers are driven by advertising, prestige, tax advantages or just fun (Fulk, 1997). Ethical violations that in some cases are only matters of questionable behaviors, running a hog in order to drop weight for example, are only the precursors to what has been called down right cheating. From drugging animals with steroids like

clembuterol, to swapping animals the night before a sale in order to continue to show and make money from a champion animal, members in the junior livestock projects have come under fire. Some would say that the attitude has changed from youth wanting to learn about their projects to the attitude of "anything to be the Grand Champion", in order to sell their animal first and make the big dollars at the sale. And big dollars it is, with some steers getting as much as three times their market value at the bigger livestock sales and shows nearing prices of $90,000 or better at some points (Johnson, 1995). Some would wonder if the money is really worth the time and trouble that it takes to cheat, or if the education is still the major thrust of these programs. Throughout all this publicity and all of the negative attention, where are our buyers?

In a study of 4-H agents in Louisiana, Burnett, Johnson, and Hebert (2000) found that junior livestock show participants spent, on average, over 100 hours a year working on their project. They further found that the educational value to junior livestock show participants was high. Kieth and Vaughn (1998) noted that 4-H competitive activities, such as the junior livestock show helps youth develop personal skills such as responsibility, work ethic, cooperation, sportsmanship, and dependability. Kieth and Vaughn note that competitive youth activities also result in negative outcomes such as excessive parental involvement, unethical practices, development of bad characteristics such as poor sportsmanship and too much emphasis on winning. They further noted that additional research is needed to understand how these behaviors affect participation by youth, parents, and others in competitive youth activities. This research was conducted to address the aforementioned problem.

Purpose and Objectives

The purpose of this study was to describe and explore factors that contributed to retention and lose of junior market livestock sale buyers in Colorado. The specific objectives of the study were to:

1. Describe counties by overall buyer retention, loss and recruitment for the years 1990 through 1999.
2. Describe factors contributing to the loss of buyers.
3. Describe factors contributing to the retention of buyers.
4. Describe factors contributing to the recruitment of buyers.

Methods

Population and Sample

The target population for this study consisted of past and present junior market livestock sale buyers in Colorado counties where there was a 4-H Extension program and/or Future Farmers of American program that culminated in a junior market livestock sale. Of the 63 counties in Colorado 57 met this criterion. Past and present junior market livestock sale buyers were selected for participation in the study using a two-stage random sampling procedure (Fraenkel & Wallen, 1999). The first stage of sampling was to select 12 counties randomly from the target population of 57 counties. Extension offices in each of the participating counties were contacted to obtain lists of all junior market livestock sale buyers for a ten-year period. From this list buyers were sorted into three sub groups; retained buyers, recruited buyers and lost buyers. The second stage was to randomly select 40 participants each from the three sub groups, in each of the 12 counties. Anonymity with respect to participants' county was provided to ensure open and honest responses. The

retained buyers were those who had consistently supported sales every year for the ten-year period. Recruited buyers were those who had started buying at some point during the ten-year period and continued their support for at least five years through the end of the ten-year period. Lost buyers were those who had supported the sale for at least four years and had discontinued their support at some point within the ten-year period. A total sample of 1,440 people was selected for participation in the study.

Research design and data analysis

The research design was a descriptive and exploratory method. From a review of the literature a survey instrument was developed to collect data related to the objectives of the study through telephone interviews. Dillman's (1978) procedures for telephone surveys were followed. The instrument consisted of two general forms of structured opened ended questions to allow for individualized responses and insure participants had the opportunity to give undirected responses. The general forms of the questions used were what factors encouraged participation in the junior market livestock sale as a buyer, and what factors may contribute to discontinued support of the program? Face and content validity of the instrument was established by a panel of experts of the former Department of Agricultural Education at Colorado State University. The instrument was pilot tested with a group of people not included in the target population. A total of 1,417 people selected for participation in the study completed the telephone interview for an overall cooperation rate of 98%. The high cooperation rate can be attributed to participants' familiarity and understanding of the University and the researcher (Miller & Smith, 1983). Responses to questions were recorded on paper by the researchers. Responses were then categorized based on the nature of the response and relying upon the researchers' judgment. Responses were read and analyzed by two trained researchers. Results generated by the two researchers were compared to determine discrepancies between researchers. When discrepancies existed the two researchers, working together, reanalyzed the data and agreed on the correct code.

Findings

This section presents findings by objectives.

Objective One

The first objective of this study was to describe counties by buyer retention, loss and recruitment for the years 1990 through 1999. As shown in Table 1, 64% of the sample were characterized as lost buyers (f=15,842). Twenty-five percent of buyers were categorized as recruited buyers (f=6,300). Retained buyers (f=2,736) made up 11% of the total population.

Table 1. Overall buyer retention, loss and recruitment for the years 1990 through 1999

County by code	Lost		Recruited		Retained	
	f	%	*f*	%	*f*	%
10J	1,776	87.0	144	6.0	150	7.0
3C	1,038	76.3	156	11.0	174	12.7
4D	3,042	74.0	816	20.0	240	6.0
2B	954	73.5	294	22.5	54	4.0
5E	1,002	71.2	294	20.8	114	8.0
9I	678	66.6	234	22.9	108	10.5
11K	1,422	65.8	582	26.8	162	7.4
12L	2,550	65.5	1,170	29.5	234	5.0
7G	726	65.0	282	25.0	114	10.0
6F	1,470	64.4	582	25.4	234	10.2
1A	954	42.2	648	28.8	648	28.8
8H	240	16.5	1,098	49.5	504	34.0
Total	15,852	64.0	6,300	25.0	2,736	11.0

Objective Two

The second objective of this study was to describe and explore factors contributing to the loss of buyers for the years 1990-1999. As shown in Table 2, the two most frequent responses to why there has been a discontinuation of support by buyers who have been lost is "got tired of not receiving a thank you" (26%) and "personal business not doing well enough to participate as a buyer in the sale" (24%). Also, the two least frequent responses to why there has been a discontinuation of support by buyers who have been lost is "leaders not doing their jobs" (10%) and "programs were not well done" (10%).

Table 2. Lost Buyer Responses. Responses to the question of the catalysts to buyer discontinuation of support for junior market livestock sales

Rank	Responses	*f*	%
1	Got tired of not receiving a "thank you"	124	26.0
2	Personal businesses didn't do well enough to participate in the sale	115	24.0
3	Children left the program	73	15.0
4	Parents were too involved	72	15.0
5	Leaders did not do their jobs	49	10.0
6	Programs were not well done	47	10.0
	Total	480	100.0

Objective Three

The third objective of this study was to describe and explore factors contributing to the retention of buyers for the years 1990-1999. As shown in Table 3, the two most frequent responses for retained buyers to the catalyst of buyer retention questions are "4-H is a great program for youth" (27%) and "pay back for hard work" (13%). Also, the responses "have always supported the sale" (5%) and "only supporting farm/ranch youth

or ways of life" (5%) are the two least frequent responses.

Table 3. Retained Buyer Responses. Responses to the question of the catalysts to buyer retention of support for junior market livestock sales

Rank	Responses	*f*	%
1	4-H is great program for youth	129	27.0
2	Pay back youth for a year of hard work	60	13.0
3	Give youth money for future education	42	9.0
4	Community support	41	9.0
5	Encourages youth to work hard	40	9.0
6	Support the 4-H program [generally]	36	8.0
7	Former 4-H member	24	5.0
8	Provides youth with opportunities	23	5.0
9	Has youth in the program	22	5.0
10	Have always supported the sale	21	5.0
11	Support farm/ranch youth or way of life	19	5.0
	Total	457	100.0

Objective Four

The fourth objective of this study was to describe and explore factors leading to the recruitment of buyers for the year 1990-1999. As shown in Table 4, among recruited buyers the two most frequent responses to the questions of buyer recruitment was "youth support our businesses so we support the youth" (26%) and "[The program is] Good for the youth" (15%). Also, are the two least frequent responses by recruited buyers are "[Program is] Good for the community" (5%) and "supports only agricultural programs" (4%).

Table 4. Recruited Buyer Responses. Responses to the question of the catalysts to buyer recruitment for support of junior market livestock sales

Rank	Responses	f	%
1	Youth support buyers businesses so they support the youth	125	26.0
2	[The program is] Good for the youth	74	15.0
3	Former 4-H member	51	10.0
4	Corporate decision	45	10.0
5	Employees involved in some way in the program	28	6.0
6	Has youth in the program	25	5.0
7	Program builds positive attitude	24	5.0
8	[4-H is] Good all around program	24	5.0
9	[Buyer] has always supported the program	24	5.0
10	[Program is] Good for the community	22	5.0
11	Spouse [other family member] grew up in 4-H	20	4.0
12	Supporter of only agricultural programs	18	4.0
	Total	480	100.0

Conclusions and Recommendations

Lack of appreciation shown by youth participants was the number one reason for lost buyers discontinuing participation in the livestock sale. Recruited and retained buyers did not mention appreciation shown as a reason for continued support. Culp and Schwartz (1999) found that 4-H volunteers were not motivated by individual recognition with respect to initiation, continuation, or discontinuation or support for 4-H programs. The results presented here partially support that of Culp and Schwartz (1999). Culp and Schwartz also found that affiliation was the primary reason of 4-H volunteers to begin support, while recognition and personal satisfaction were the primary catalysts to continuing 4-H volunteer support. Culp and Schwartz also found that physical impairment and feeling unneeded were the main thrusts for the discontinuation of support by 4-H volunteers. Perhaps the feeling of a lack of appreciation experienced by lost buyers is an indicator of Culp and Schwartz' volunteers' feelings of not being needed, thus supporting Culp and Schwartz (1999). More research on this association is needed to verify the hypothesized relationship.

From the total of 24,888 buyers 15,852 (64%) have been lost within a ten-year period. To continue to lose buyers at this rate could cause the junior market livestock sale system, as we know it, to be indelibly changed. A buyer not feeling appreciated is something that people in agricultural education and extension education can play a positive role in improving. Assessing whether or not our thank you programs are working is an easy enough task and something that, in light of the findings of this researcher, is essential. If our appreciation programs and efforts are working, then we continue the programs and work each year to improve them. If we find that our programs need to be improved right away, it is a simple matter of discovering what we as agricultural educators can do to help our parents, volunteers and especially our youth make our buyers feel as important as they are. Implementing a program in extension counties that would facilitate increased appreciation efforts including innovative ideas in individual appreciation and increased volunteer/agent efforts in appreciating junior market sale buyers, could cause a significant increase in our buyer pools. This increase could in turn, lend to an increase in the success of our junior market sales. More people in our sale barns can only mean that our youth need not worry if someone will be there to bid on their projects.

The second most frequently reason cited by lost buyers for discontinuation of participation in the junior market livestock show was that their personal businesses were not solvent enough to allow them to participate. Retained buyers made no mention of business as a retention catalyst, but worth noting are that recruited buyers did mention an unwritten or informal reciprocal type agreement ("youth support us and our businesses and so we support them in their sales") as a buyer trait (26%). While in Extension, we can do nothing, directly, with regard to area business solvency; there are steps that we can take to facilitate positive partnerships between our community and our youth. Encouraging youth and parents to thank their buyers, as mentioned above, should be a priority. Parents and youth should be encouraged to contact prior buyers (those who have been out of the sale of a number of years) to extend their thanks for participations, as well as invitations to the current sale. These things all lend to a welcoming environment for those buyers who may not be able to purchase for a number of years due to business constraints, but leaves the door

open to future participation thus encouraging them to come back and support our youth. It also allows buyers a continued connection to our youth programs, and keeping a relationship between the program and its supporters. A welcoming and familiar environment is much easier to come back to than one that is cold and unfamiliar. Again, this only lends itself to more buyer participation and increased sale success.

Youth grow up and are too old to participate in the 4-H and FFA programs; that is a fact of life we cannot change. However, when it is the third most frequent response, we must attempt to address how we can rectify buyers discontinuing participation because of it. Recruited and retained buyers both mentioned that having children in the program has been a catalyst for support (6th and 9th most frequent responses respectively). However, also worth noting is that 2nd and most frequent responses respectively in those two groups and that is that the Junior Market sale program is a positive one for youth to be in. In Extension, we should take an opportunity to capitalize on this response and work towards the goal of retaining these parents who are buying animals because their children are in the program, by demonstrating what the program will do for the next generation of children in the program. If we continue to put our best feet forward, so to speak, it could encourage those parents to continue to support a great program, thereby retaining more buyers and continuing the success of the sales.

It would be no surprise to anyone that parents with children in 4-H and FFA zealously support their children's pursuits. Few parents would like to see their children fail in or out of the show and sale ring. However, when the involvement of parents gets in the way of the success that they are trying to work so hard for, the involvement must be addressed. This finding is consistent with Kieth and Vaughn (1998) who found excessive parental involvement in competitive youth activities detracted from the overall experience. It is a difficult thing to look at a parent and tell them that they are too involved in their child's projects. When we struggle so often in a society where people are stretched to the limit, it seems to be a quandary to look at parents and tell them to be less involved with their children's livestock projects. In Extension, often times there are policies regarding parent involvement, but when it comes time to enforce them, the task is difficult. To remedy this situation we need to have strict policies regarding parent involvement at county fair shows and sales because now it does not just effect the children in the show ring and what they are learning in their projects, it is effecting the success of our sales, the reward at the end of a long year of hard work by the youth in the program. While we would not be discouraging parental involvement in their children's projects, we should be directing where that support is appropriate and where it is not. This will allow for the children to continue learning all they can with their projects and then showcase that knowledge at the fair, while still making parents an important part of the process. This also shows to our supporters that we follow through with our motto in 4-H that we "learn by doing" which will only serve to encourage supporter participation.

A program like 4-H, thrives only through the hard work of the extension agents and FFA advisors and the successful participation of parents and other adult volunteers. Without our volunteers no extension program, and especially no junior livestock sale, would be successful. The question that continually arises within extension today is what is the job of the leader? Obviously the role of the leader is very different today than it was when

extension and 4-H as we know it began years ago. Extension continues to put out volunteer management literature, and we have various different levels of volunteer leaders training, but what is that doing to our JMLS programs? How does that training and what those individuals take away from that affect what we do in the junior market livestock programs? Where do we draw the line between tried and true support and having leaders doing the job that should be the work of the youth in the programs? More importantly where do our buyers draw that line? Whether or not we want to admit it, public perception has a large amount to do with our jobs in Extension and the recruitment of new people to our programs. Obviously, we see that here is another area where the perception of the public is making a difference in our programs. When we lose buyers because they perceive that our leaders are either doing too much or not enough, we need to address that by making some sort of change to address that public perception. As with the parent involvement we, in Extension, need to have some concrete guidelines that will set forth what the role of a livestock leader is. Beyond that, we then need to have solid policies that will be enforced prior to and during the county fairs in order to ensure that the face that we put forth to the public, most importantly to our buyers, is one that shows that the youth in our programs are still the most important component and that when we say that they are "learning by doing" they truly are.

Putting on a junior livestock sale takes a tremendous amount of work by the agents and volunteers in any county. Hours of work before the sale in making programs, arranging the sale order, setting up the building, and cooking the barbeque, is just the ending of what takes months to set up. The response that the programs weren't well done ranked sixth on the list of responses of the lost buyers. It bears mentioning that both the retained and recruited buyers listed the opposite as catalysts for the continuation of support; "programs were great for the youth" were first and second respectively. However, again, we see that public perception is going to play a major role in the success of our programs. Extension needs to discover what it is that turns someone from a strong supporter to a lost buyer in terms of our programming. Again, we need to be able to put our best faces forward when facilitating the programs that we produce. No agent needs to be told that an organized, well facilitated program that runs with as few mishaps as possible will be better perceived by the public than one that is wrought with mistakes and hang-ups. However, having set plans on which volunteers and agents rely, will help to alleviate some of the miscommunication that causes the programs to appear to be mishandled. Keeping everyone on the same page will put out a united front instead of one that displays confusion and mistakes. Knowing that the public and our buyers are watching how we facilitate our programs, should help us to be more aware of the face that we show people during those days of fair shows and sales.

Finally, looking at the categories of both retained and recruited buyers, we see that, respectively, the first and second most frequent responses were that the "program is a great one for youth" (27% & 15%). As 4-H Extension Agents and FFA Advisors, we should continue to promote our programs and ensure that the public knows who we are and the positive impact that we are having on the youth in our communities. It is not simple public relations, it is allowing the individuals in our communities to see what the future holds, not just for those in the agriculture industry, but also for all people in the community that are invested in our youth. As advisors, we need to be getting

out in our communities with the members of our programs letting them speak to civic organizations, clubs and schools. This is the best ad campaign we could have. As enthusiastic as we are about our respective programs, nothing works better than testimonials of the youth that are reaping the benefits of what we do. If our communities see that the youth in our programs are gaining positive skills, are becoming responsible, competent young people, what better way to continue the buyers in our community to continue their support? These youth would be living examples that the time and money that our buyers spend at our sales and at our shows, is not money misspent and time that could have been used elsewhere. To show them the positive impact our agriculture programs have on youth would be proof to our buyers that what they do as supporters of our program is indispensable, that without them the positive impacts that we make in our classrooms and in our club meetings would not be the same.

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ACHIEVEMENT, AFFILIATION AND POWER NEEDS OF GEORGIA=S MIDDLE GRADE AGRICULTURAL EDUCATION STUDENTS

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Abstract

The purpose of this study was to examine the motivational needs of middle grade (grade 7-8) students who enroll in Agricultural Education classes in Georgia. McClelland's motivational needs theory served as the framework for the study. The data determined that agricultural students had a higher need for achievement than for affiliating or power and that no differences existed between FFA members and non FFA members. The study also determined that female agricultural education students had a higher need for affiliation and power than male students. No differences were found in the need for achievement, affiliation or power when students were grouped by grade or geographic location. African-American students had a higher need for achievement and power than students in all other ethnic categories.

Introduction

The FFA program has been an integral component of agricultural education aimed at motivating students to learn a variety of different skills at all levels of learning (Phipps & Osborne, 1988). Studies by Dormody and Seevers (1994) suggested that students should be encouraged to join FFA and develop a supervised agricultural experience program (SAEP), regardless of self-esteem, age, ethnicity, place of residence or years in FFA.

When FFA was established, it was designed to involve students in high school Agricultural Education programs. At the 1988 National FFA Convention, a constitutional amendment passed officially allowing middle grade student membership into the FFA organization (Rossetti, Padill & McCaslin, 1992). This change also brought about a different focus for FFA programs for these middle grade students. Programs for middle grade FFA members offer students the opportunity to start developing self-discipline, organizational and leadership skills, competitive spirit and regard for teamwork (National FFA Organization, 1998, p. 43). All three components of the high school Agricultural Education Program are included in the middle grade program however; they have been altered to focus on the exploration of the agricultural industry. Middle Grade Agricultural Education and FFA offer students the opportunity to explore and stimulate interest in the careers and issues in agriculture while providing students with an opportunity to be a part of

something larger than themselves (National FFA Organization, 1998). According to Flanders (1998) middle grade teachers and administrators emphasize that when compared to high school students, middle grade students need more hands-on activities and more teamwork than individual tasks. Middle grade FFA activities include competitive team events and team projects to provide opportunities to learn leadership and personally develop.

Even though Agricultural Education has tailored the high school program to the developmental stage of middle grade students, only ten percent of Georgia students are involved in the FFA component of the program. While a number of studies (Connors, Moore & Elliot, 1990; Dormody & Seevers, 1994; Hoover & Scanlon, 1991; Luft & Glere, 1991; Marshall, Herring & Briers, 1992; Talbert & Larke, 1993) have been found on the subject of motivation from educators' perspectives few (Turner, 1996) have addressed motivational needs as perceived by students and none have focused on the perceived motivational needs of middle grade Agricultural Education students.

Theoretical Framework

This study utilized the motivation theory developed by McClelland (1962). McClelland developed a meaning for motivation and a model of motivation. McClelland stated that intrinsic motivators are critical to meeting a person's needs, because they describe a pattern of how an individual may behave. McClelland's theory of motivation depicts three types of motivational needs: The need for achievement, the need for affiliation and the need for power. People have either one of these needs or a combination of these three needs which motivate them toward a certain pattern of behavior (McClelland, 1962). Based on McClelland's theory, individuals with a high need for achievement like situations in which they take personal responsibility for finding solutions to problems. They set moderate achievement goals and take calculated risks. People with a high need for achievement strive to make things better. They are more willing to compete with a personal standard of excellence as a guideline to evaluate performance.

Students with a high need for achievement do not like work that is too easy or too hard (McClelland, 1987). If tasks are too easy, there is no Areal@ improvement. If tasks are too hard, then by not completing the task, no improvement was accomplished either.

Individuals with a high need for affiliation tend to think often about the quality of their relationships (McClelland, 1987). These individuals cherish the positive experiences while worrying about any shortcomings in a relationship. Persons with a high need for affiliation will seek the companionship of others and take steps to be liked by them, as well as wanting to project a favorable image. These individuals will tend to be the peacemakers, smoothing out disagreements and often choosing to work and make decisions collectively in a group. Individuals with a high need for power are control and influence oriented (McClelland, 1987). These individuals spend more time thinking about how to obtain and exercise power and authority. Persons with a high need for power need to win arguments, persuade others, to prevail, and to obtain positions where they can exert influence (McClelland & Steele, 1973). McClelland

(1987) suggested that there are two aspects of power. The first is a negative one that is concerned with having one's way by controlling and dominating others. The second is social or institutional, one that emphasized the skills of persuasion and inspiration to help people achieve, attain happiness, and learn. These individuals help people form and attain goals while not dominating them.

Behavior may be predicted if all motivator needs can be identified. By exploring these needs, educators can determine what motivates their students to enroll and participate in agricultural classes and the FFA. An important part of participating in an activity for any student is that the student is responsible for choosing the activity in which he/she would like to participate such as those provided through FFA (Carter & Neason, 1984).

A variety of factors may motivate young people to affiliate with a group such as agricultural education and the FFA. Turner (1996) studied the motivational needs of high school students enrolled in agricultural education programs in Georgia. Turner found that high school students were motivated by the need for achievement, and that FFA members had a greater need for achievement, affiliation and power than non-FFA members. Turner also found that females had a higher need for affiliation and power than males, and that African-American students had a higher need for achievement and power, while Caucasians had a higher need for affiliation. He also found that freshmen had a lower need for power than students in upper grades and that students living on a farm and in a rural setting had a higher need for power than students living in an urban setting. To better understand these reasons, agricultural educators need to know the motivational need structure of their students. The information from this study should aid educators in recruiting students and in developing programs that will help retain students.

Purpose of the Study

The overall purpose of the study was to examine motivational needs of middle grade (grade 7 - 8) students who enroll in agriculture classes. The research questions for this study were:

1. What are the motivational needs of middle grade students enrolled in agriculture programs in Georgia?
2. Are there differences in the need for achievement, need for affiliation, and/or the need for power among middle grade students enrolled in agriculture programs in Georgia based on membership/non-membership in the FFA?
3. Are there differences in the need for achievement, need for affiliation, and the need for power of middle grade students enrolled in agriculture programs in Georgia when grouped by: gender, grade level, geographic location, and ethnicity?

Methodology

The population for this study was all seventh and eighth grade agricultural education students in Georgia for the 1998-1999 school year. Middle grade FFA membership above the local level is available only to seventh and eighth grade students; therefore, sixth grade students were not included in the study. The population size,

14,115, in 38 schools was determined utilizing enrollment figures provided by the local agricultural education instructor to the Department of Education. These figures were available in the Agricultural Education office at the Georgia Department of Education in Atlanta, Georgia. The presence of the FFA component was critical to the findings of this study. The FFA organization is one of the three components of the Agricultural Education Program, however not every local middle school system offers a complete program with all three components. Therefore, the Georgia FFA Membership rosters from the Georgia FFA Association office were utilized to determine the number of Georgia Middle Grade Agricultural Education Programs with an active Middle Grade FFA Chapter for the 1998-1999 school year; the number of chapters was 19 with 7420 students.

Due to the size of the population, a census was deemed impractical. Therefore, random sampling with the use of inferential statistics was utilized. Cluster random sampling was used because pure random sampling was impractical due to logistics, time and money constraints. Borg and Gall (1987) define cluster random sampling as the use of naturally occurring groups of individuals within the population rather than individuals. The local agricultural program was the most naturally occurring group within the population, therefore, the Middle Grade Agricultural Education Program was utilized as the cluster.

Utilizing a sample size table, the target sample size was determined in proportion to the population which the sample would represent. The target sample size of 370 seventh and eighth grade students was surpassed by randomly selecting eight middle grade agricultural education programs as the cluster sample. The distribution of Middle Grade Agricultural Education programs with FFA chapters in Georgia is not equal. There are three FFA Association Regions in Georgia. More than half of the middle grade programs are located in Georgia FFA Association's South Region and only two programs with chapters are located in the Georgia FFA Association's Central Region. However, the random sampling of eight programs from the nineteen yielded representation comparable to the distribution of programs throughout the state. The sample includes two schools from the North Region, one school from the Central Region and five schools from the South Region. This sampling yielded 445 seventh and eighth grade agricultural education students to participate in the study.

Instrument

To collect data for the study an instrument developed by Turner (1996) was utilized. Only slight modifications to some demographic items were made. The instrument was divided into two parts. The first part was designed to determine the motivational needs of Middle Grade Agricultural Education students in Georgia. The response items followed McClelland's (1962) motivational theory with five of the fifteen items correlating to each of the three areas in the motivational theory; the need for achievement, the need for affiliation and the need for power. A five point scale (1 = strongly disagree; 5 = strongly agree) was used with each response item. The second part of the instrument contained five multiple-choice items to gather demographic information from the participants.

The validity of the instrument was established through its use in Turner's (1996)

study. In the construction of the instrument, Turner reviewed and edited the instrument with University of Georgia faculty; pilot tested the instrument with thirty students and utilized the instrument in the research study involving 1,952 students (Turner 1996). For this study the researcher reviewed and edited the instrument with University of Georgia faculty and Georgia Middle Grade agricultural instructors. The reliability of the instrument was established by Turner utilizing the responses from the pilot study. Cronbach's alpha was used to measure the internal consistency reliability. The alpha for the five items that measured the need for achievement was .89 and the alpha for the five items that measured the need for affiliation was .76. The alpha for the five items that measured the need for power was.81 (Turner 1996, p32). For this study the alpha for the items measuring achievement, affiliation and power was .60, .66 and .64 respectively. While these levels were lower than expected, Nunally (1975) recognized .60 or above to be an acceptable alpha level.

Data Collection

The data collection process began by first mailing a participation request letter to the agricultural instructor of the eight randomly selected programs. The letter was addressed to the teacher identified as the FFA advisor on the chapter FFA Membership roster. The letter explained the purpose of the study, explained the procedure of the study and asked the instructor for participation from their program. The instructor signified their intentions of participating in the study by completing an enclosed participation response form. The participation response form asked the instructor to write the school name and name of the instructor, check the box if they were willing to participate, write the total number of seventh and eighth grade students currently in agricultural education classes and sign their name. The participation request letter also included the principal approval request letter as an enclosure. This authorization form explained the purpose of the study, explained the procedure for the study and asked for the administrator to yield permission for the survey research to be conducted within the school system. Included in the mailing was a stamped, return envelope for the completed response form and approval letter.

The researcher contacted non-respondents with a phone call. If the instructor agreed to participate in the study, the researcher asked the instructor to forward the required participation response form and principal approval letter so that survey materials could be mailed to the program. All eight middle grade programs agreed to participate in the study.

The researcher mailed survey packets to each program as soon as the authorization forms were received. Each survey packet contained a cover letter, parental consent form, instruction sheet and the script for the teacher and a copy of the instrument for each student. Each instructor received a stamped envelope for the return of completed surveys and consent forms.

Follow up phone calls were made two weeks later to retrieve packets not yet received. All eight programs returned the completed surveys and consent forms for a return rate of one hundred percent. These eight clusters yielded a total of 445 survey responses.

All surveys were examined by the researcher for completeness. Data were then coded for efficient and accurate statistical

analyses. The researcher entered the data into a database using the Statistical Analysis System (SAS, 1995).

Data Analysis

Research question one was primarily analyzed using means and standard deviations. An Analysis of Variance (ANOVA) Repeated Measures Design and the Duncan Multiple Range Test were also utilized to determine statistically significant differences in the need for achievement, the need for affiliation, and the need for power among the middle grade agricultural students.

Research objective two was analyzed utilizing a series of t-tests to determine statistically significant differences in the need for achievement, the need for affiliation, and the need for power between FFA and non-FFA member agricultural students.

Research objective three was analyzed by computing a series of Analysis of Variance (ANOVA) and Duncan Multiple Range Tests to determine statistically significant differences in the need for achievement, the need for affiliation, and the need for power among agricultural students when grouped by gender, geographic location, ethnicity, and grade level. Acceptance level was set at alpha level .05 for the study.

Findings

Objective 1: Motivational Need of Students

Research objective one sought to determine the motivational needs of students enrolled in middle grade agricultural education programs in Georgia. Part one of the instrument contained fifteen items that examined the need for achievement, the need for affiliation and the need for power. These fifteen items were analyzed utilizing an Analysis of Variance (ANOVA). The results of the ANOVA revealed statistically significant differences among the variables, therefore, the Duncan Multiple Range Test was utilized to compare group mean scores. These data are presented in Table1.

Table 1 shows the motivational needs of all middle grade agricultural education students in the study. The need for achievement displayed the highest mean ($\underline{M}$ = 3.97), followed by the need for affiliation ($\underline{M}$ = 3.63), and the need for power ($\underline{M}$ = 3.33).

Table 1. Means, Standard Deviations and Analysis of Variance Repeated Measures Design for Agricultural Education Students and the Need for Achievement, Affiliation and Power (N = 445)

Source	M	SD	df	F	p>F	Duncan*
Agricultural Education Students			2	102.21	.0001	1>2>3
Motivational Needs			1332			
Achievement (1)	3.97	.653				
Affiliation (2)	3.63	.615				
Power (3)	3.33	.750				
Control Total			1334			

*Note. 1 = Need for Achievement, 2 = Need for Affiliation and 3 = Need for Power

Objective 2: Difference in Motivational Needs Between FFA and Non-FFA Members

Research question two sought to describe the differences in the need for achievement, the need for affiliation and the need for power among students enrolled in middle grade agricultural education programs in Georgia based on membership/non-membership in the FFA. The fifteen instrument items that examined the need for achievement, the need for affiliation and the need for power along with the demographic variable of FFA membership/non-membership were analyzed with a series of t-tests (Table 2). Results indicate no significant differences in need for achievement, need for affiliation, and need for power based on FFA membership and non-membership.

Table 2. T-test for Need for Achievement, Need for Affiliation and Need for Power of Agricultural Education Students Based on FFA Membership/Non-membership (N = 445)

FFA Membership	n	M	SD	t-value	p
Achievement					
Yes	101	3.94	.692	-0.611	.5419
No	344	3.98	.642		
Affiliation					
Yes	101	3.60	.622	-0.424	.6721
No	344	3.63	.613		
Power					
Yes	101	3.44	.738	1.771	.0784
No	344	3.29	.751		

Objective 3: Differences in Motivational Needs by Gender, Grade Level, Geographic Location, and Ethnicity.

Research question three sought to determine differences in the need for achievement, need for affiliation, and need for power for middle grade agricultural education students in Georgia when grouped by gender, grade level, geographic location and ethnicity. A series of t-tests was used to determine the differences based on gender, grade level and geographic location.

The first set of t-tests utilized gender as the independent variable. Findings are presented in Table 3. The results indicated that there were no statistically significant differences in the need for achievement ($p = .6445$) based on gender. Results did indicate statistically significant differences in the need for affiliation ($p = .0006$) and the need for power ($p = .0223$) based on gender. Female students displayed a higher need for affiliation ($M = 3.74$) and need for power ($M = 3.42$) than male students enrolled in middle grade agricultural education programs.

Table 3. T-test for Need for Achievement, Need for Affiliation and Need for Power of Agricultural Education Students Based on Gender (N = 445)

Gender	n	M	SD	t-value	p
		Achievement			
Male	251	3.99	.646	.462	.6445
Female	194	3.96	.664		
		Affiliation			
Male	251	3.54	.649	-3.468	.0006
Female	194	3.74	.548		
		Power			
Male	251	3.26	.758	-2.293	.0223
Female	194	3.42	.730		

The second set of t-tests utilized grade level as the independent variable. Findings are presented in Table 4. The results indicated that there were no statistically significant differences in the need for achievement ($p = .1859$), the need for affiliation ($p = .3424$) or the need for power ($p = .5419$) based on grade level.

Table 4. T-test for Need for Achievement, Need for Affiliation and Need for Power of Agricultural Education Students Based on Grade Level (N = 445)

Grade Level	n	M	SD	t-value	p
		Achievement			
Seventh	199	4.02	.613	1.325	.1859
Eighth	246	3.94	.683		
		Affiliation			
Seventh	199	3.60	.635	-0.951	.3424
Eighth	246	3.65	.598		
		Power			
Seventh	199	3.30	.765	-0.611	.5419
Eighth	246	3.35	.738		

The third set of analyses utilized geographic location as the independent variable. The responses to the demographic question were grouped into two categories: farm and non-farm. These categories were utilized to perform t-tests on the dependent variable of geographic location. Findings are presented in Table 5. The results indicated that there were no statistically significant differences in the need for achievement ($p = .9713$), the need for affiliation ($p = .9577$) or, the need for power ($p = .2748$) based on geographic location.

Table 5. T-test for Need for Achievement, Need for Affiliation and Need for Power of Agricultural Education Students Based on Geographic Location (N = 445)

Geographic Location	n	M	SD	t-value	
		Achievement			
Farm	61	3.97	.581	-0.036	.9713
Non-Farm	384	3.97	.665		
		Affiliation			
Farm	61	3.62	.639	-0.056	.9577
Non-Farm	384	3.63	.611		
		Power			
Farm	61	3.62	.733	1.099	.2748
Non-Farm	384	3.31	.752		

The fourth independent variable, ethnicity, was analyzed by utilizing the Duncan Multiple Range Test. Findings are presented in Table 6. The results indicated that there were no statistically significant differences in the need for affiliation (p = .6287) based on ethnicity. The results indicate statistically significant differences in the need for achievement (.0001) and need for power (.0002). African-American students had a higher need for achievement (M = 4.23) than the Caucasian (M = 3.88), Asian (M = 3.73), Hispanic (M = 3.89), and Native American (M = 3.28) classified students. African-American students also had a significantly higher in the need for power (M=3.58) than the Caucasian (M = 3.22) classified students.

Table 6. Duncan Multiple Range Test on Mean Category Scores by Ethnicity* (N = 445)

Category	Mean Score by Ethnicity I Caucasian n = 306	II Other** n = 15	III African-American n = 124	df	F	p
Achievement	3.88	3.65	4.23[a]	2	15.55	.0001
Affiliation	3.60	3.80	3.67	2	1.16	.3153
Power	3.22	3.30	3.59[b]	2	10.78	.0001

*Differences between and among means are insignificant unless noted with a super script.
**Asian, Hispanic, Native American [a]The mean scores for Category III were significantly higher for the need for Achievement than Categories I, II, and III.
[b]The mean scores for Category III were significantly higher for the need for Power than Category I.

Conclusions

The conclusions for this study are based on the findings related to each of the research objectives.

1. As a whole, middle grade agricultural students had a higher need for achievement than need for affiliation. These students' need for affiliation was also significantly higher than their need for power. However, all of the mean responses were less than 4 (agree) which support that students were not strongly motivated by achievement, affiliation or power, as expressed by McCelland.
2. There was no significant difference between middle grade agricultural students who join the FFA and those who don't join the FFA in terms of their need for achievement, need for affiliation or need for power. Thus FFA memberships may not be as important in meeting motivational needs as previously thought

(Turner, 1996).

3. Female students had a higher need for affiliation and a higher need for power than male students. Consistent with Turner's (1996) study, females are more concerned with relationships and influence than are males. However, there was not a significant difference in the need for achievement between male and female students.
4. Results indicated no significant differences in the need for achievement, the need for affiliation or the need for power of middle grade students when grouped by grade level. In contrast, Turner (1996) found that students in higher grades had a higher need for power than lower grade students.
5. No differences in the need for achievement, the need for affiliation and the need for power between middle grade students living on a farm and students not living on a farm. Turner (1996) however, found students from rural settings to have a higher need for power than their urban counterparts.
6. There were no significant differences in the need for affiliation when students were grouped by ethnicity. African-American students had a higher need for achievement and power than Caucasian other Ethnic group students. While the indings from this study regarding African-American students are consistent with research by Turner (1996), he also found that Caucasians had a higher need for affiliation than other Ethnic groups.

The results from each of the three objectives yielded few statistically significant differences among student groupings. Differences among high school students (Turner, 1996) were more evident than the differences among middle grade students in this study. These results provide insight for possible teaching strategies for middle grade students. This lack of differences may indicate that during this developmental stage of adolescence, students' motivational needs are not yet clearly defined. To aid students in developing their motivational needs, exploratory teaching methods may be implemented. The developmental stage of adolescence is a period of self-discovery. Teaching methods should be developed to meet the current motivational needs of students, however, methods may also be utilized to aid students in self-discovery for continual personal development. Activities designed to allow students to experiment with personal development characteristics may assist them in developing the motivational needs which become more evident as the student matures.

Recommendations

Based on the findings and conclusions of this study, the following

recommendations are
offered:

1. Directors of Agricultural Education on the state and national level as well as local agricultural educators should review middle grade agricultural education programs to ensure they emphasize activities that appeal to middle grade students' need for achievement and need for affiliation. The need for power should not be overlooked since it is a higher need for female students. When compared to the high school program, the middle school program may require a greater emphasis on achievement and affiliation.
2. Few statistically significant differences were found throughout the sample, therefore, exploratory teaching methods should be utilized to assist students with personal characteristic development.
3. No significant differences were found between the motivational needs of FFA members and non-members, therefore, advisors may explore what motivates the members in an effort to find motivators of non-members.
4. Female middle grade students display a greater need for affiliation and need for power than their male counterparts. Encouraging and providing female students with group activities and leadership roles which allow them to influence outcomes and others may help to meet these needs. Instructors, however, should be aware that female students are motivated to participate in different ways than males.
5. Agricultural education programs are becoming more diverse. Agricultural educators must provide educational experiences to meet the achievement and power needs of African-American students. Providing African-American students leadership opportunities and educational experiences that empower and inspire them can help to meet these needs. Providing these opportunities and experiences can also facilitate their performance in a way that may motivate them to become more achievement oriented.
6. This study and the research by Turner (1996) were conducted in one state. These studies could be replicated in other states or regions to determine differences in motivational needs by geographic location or program. Further research could be conducted to determine how motivational needs change as students mature or how they might differ from students in other vocational programs.

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INTERNET AND PAPER BASED DATA COLLECTION METHODS IN AGRICULTURAL EDUCATION RESEARCH

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Abstract

A total of 389 AAAE members participated in this experimental study. Participants were randomly assigned to one of two groups: Web-based and traditional paper based survey groups. Web-based and traditional paper based survey modes were found to be equally valid and reliable for collecting social science research data. A difference between the two groups resulted in the aggregate response rate. The traditional survey group exceeded the Web-based group 157 to 98 in total response rate. However, when considering the number of valid returned responses within the first week of data collection, the Web-based survey group exceeded the traditional paper based group 72 to 7. The authors propose using the W/PSDC Model (Web/Paper Survey Data Collection), a mixed-mode survey, to attain large amounts of data and high response rates in an economically shortened time frame. This study provides strong evidence for using Web-based surveys in future social science research studies.

Introduction

The use of different survey modes is usually justified by a desire to cut costs through use of the least expensive mode first. The second or third mode is then used to collect responses from people who are reluctant or will not respond to the prior mode(s). (Dillman, 2000, p. 219)

Since the mid 1990s, the Internet has grown into a multi-billion dollar business that is present in almost all American homes. As the role of the Internet has increased in daily American life, it also has increased its role in today's educational system. Over 90% of schools now have some type of access to the Internet, someplace in their building (Becker, 1999). The impact of the Internet on higher education is even greater (Gromov, 1995). Since most higher education institutions were connected to the Internet from its birth, it is only natural that educators and researchers will find new uses for the Internet, such as using it as a research tool.

As researchers look for ways to increase the amount of information that can be gathered, it is without exception that they are already looking to the World Wide Web. When researching databases for examples of Web-based surveys, it was possible to find in excess of over 100 different journal articles or dissertations that have used the Web as a survey tool. However, when searching for studies of Web-based surveys' reliability or validity, the number drops to less than ten. This dilemma is magnified further in the agriculture and the human

sciences, where Web-based surveys number about 20 and no research was found in agricultural education regarding the validity of any Internet protocols as a means of conducting social science research surveys.

Theoretical Framework

Traditionally, it was believed that researchers should use the Web only to conduct surveys if a set of five criteria were met. Levine (1998) noted those criteria as: 1) When the target audience is online users, 2) When the target audience has a profile similar to online users, 3) When there are "hard-to-reach" target audiences, 4) When a large number of respondents are needed quickly, you have a limited budget, and exploratory findings are adequate in the short term, and 5) When the researcher wants to supplement telephone or in-person surveys. (Online)

The thinking behind this methodology was that Web-based surveys were used as a means of sampling instead of scientific research. Also, in earlier years of the Internet, the population was mostly male and middle- to upper-class persons. Thus, researchers did not believe they could obtain a representative population. Today, Web-based surveying has become a major information source for all researchers. A simple Internet query of "Web-based surveys" produced over 18,500 matches, most of which were from private companies offering to do surveys via email or Web-based formats for other companies.

Current literature suggests that the advantages far outweigh the disadvantages of online surveying (DSS Research, 2000). The major advantage for conducting Web-based surveys is found in the savings of money. When information is transmitted electronically, researchers do not have to pay for postage, paper, staples, envelopes, or other materials needed. The second major advantage is time. Electronic surveys offer almost instantaneous results. This is in stark contrast to waiting weeks, if not months, for mailed surveys (CASRO, 1996).

The major problems facing Web-based survey methods are that it is not a "mainstream technology" and some online surveys have been the targets of hackers. This situation occurs in open market research where companies invite all interested persons to participate, but could happen to anyone using a Web-based survey. While you may select whom you desire to participate in the survey, you still may not be able to guarantee the desired person is the one completing the survey. However, this problem is encountered with mail surveys too. There is no guarantee that the proper person completes the survey unless the researcher is present to witness it (DSS Research, 2000). Survey length is another factor to consider. The personalities of today's Internet population make it difficult to lure respondents into completing long surveys.

Courson (1999) and Leung (1998) conducted notable uses of Web-based surveys. Courson surveyed 179 county extension professionals to assess their in-service needs for retraining to become more technologically adept. The individuals were selected and identified from the faculty and staff directory of the Mississippi State University Extension Service.

Courson's research employed a Web-based descriptive survey. Participants in the study were asked to access the instrument electronically using a Web browser. Respondents rated 42 skill statements for importance and competence, completed the demographic data, entered an authentication code, and submitted the survey electronically. Upon submission of the survey, data were collected in an

electronic database at Mississippi State University (Courson, 1999). From the initial mailing, Courson obtained a 75% response rate. Two weeks later, a second mailing increased responses to 93%. Data collection was completed in one month.

Leung's (1998) exploratory study was Web-based using a research instrument posted on a popular Web site that provided natural resource information. Unlike the Courson (1999) study, the respondents in Leung's survey were self-selected. Leung's sample was non-random, thereby restricting the external validity or generalizations of the survey. The study remained active to all who wanted to participate for a period of four months. Leung's survey gathered the Web-based habits of people interested in natural resources.

The host Web site for Leung's survey received 2,255 hits, but only 279 responses were considered valid. The disparity was due to hits counting anyone who looked at the page, while valid responses were only those who completed the survey instrument. The Web-based survey was constructed using a Likert-type scale, similar to that of Courson's. Leung's results showed respondents were comfortable using and completing Web-based surveys. Leung concluded that using a Web-based survey for research may save much time and cost, but it also consumed time without accomplishing the desired goal of collecting valid and reliable data.

Web-based surveying has come from small beginnings to wide commercial acceptance, even though the academic acceptance of this surveying methodology is still somewhat suspect. As researchers become more familiar with Web-based surveying and the idea of using it to do research, the numbers for both scientific and non-scientific surveys will increase.

Purpose and Objectives

The purpose of this study was to determine the validity of the World Wide Web as a research tool for surveying and collecting data. As the Web becomes more accessible to diverse audiences, does Web-based surveying provide a valid research methodology for conducting social science research? Research hypotheses tested in this study were if differences existed between Web-based and traditional paper based survey groups, when compared by:

1. Response rates.
2. Response times.
3. Instrument reliability.
4. Criterion related validity.
5. Perceived usefulness of Web-based surveying.

Procedures

A control group post-test only design was applied in this study (Campbell & Stanley, 1963). The study used Web-based and traditional paper based survey methods. This true experimental design allowed random assignments of individuals to treatments ensuring treatment groups were equivalent (Borg & Gall, 1989).

The population for this census study consisted of members of the American Association for Agricultural Education (AAAE). The AAAE member database was attained in February 2001 after all dues had been processed. Using valid email addresses, a total of 424 respondents were selected from the database. Once selected, respondents were divided randomly into two groups.

From the initial population of 424 AAAE members, 35 members (21 in the Web-based group and 14 in the traditional group) were found to not be AAAE members, reducing the population to 389. Data collection began in early April and was

completed in 35 days. The first reminder was sent 14 days after collection began; a second reminder was sent in the third week of collection. Upon conclusion of data collection, respondents totaled 98 (51.3%) for the Web-based group and 159 (80.3%) for the paper based group, for a total of 257 (66.07%).

The research instrument used was similar to Chou's (1997), which was modified by Wingenbach (2000). The instrument contained four sections measuring: 1) computer anxiety, 2) attitudes toward computers, 3) perceptions of using Web-based surveys, and 4) demographics. The first section contained a 12-item, four-point, Likert type scale measuring responses to computer anxiety. Responses could range from Strongly Disagree (1) to Strongly Agree (4). Chou reported a Cronbach's alpha coefficient of .83 and Wingenbach achieved alpha coefficients of .86 and .89 in two rounds of testing. Cronbach's alpha was .89 for this study.

Section two contained the same Likert type scale, but consisted of 26 items that measured attitudes toward computers. Chou's study had an alpha of .94 in section two; Wingenbach's alphas were .92 in the first test and .90 in the second test. The alpha was .90 for this study. The third section was developed by the researcher and was used to measure respondents' perceptions of Web-based surveying. This section contained 12 items based on the same Likert type scale used in the first two sections. Perceptions of Web-based surveying items were derived from the CASRO Web site (2000). This section also was modeled after the Attitudes toward Electronic Exams subscale developed by Wingenbach (2000). Wingenbach (2000) achieved Cronbach's coefficients of .78 and .82 in pilot tests, and a final alpha of .84 for the subscale. In this study, a Cronbach's alpha of .85 was achieved.

Respondents in the experimental group were contacted via email and regular mail at the beginning of the study. A short cover letter similar to that of the paper based group was mailed to respondents to ensure that respondents knew the survey was an academic endeavor and not spam email. The email contained a link (www.ais.msstate.edu/Research/) that directed respondents to a Web site on the Agricultural Information Science and Education (AISE) server.

Once on the AISE server page, respondents were prompted for a password (code number). After submitting the code number, respondents could access the survey. The appearance of the Web-based survey was exactly the same as the paper based survey. Once the survey had been completed, respondents submitted it, saving the data to a database. Follow-up emails were sent on the 14th and 23rd days of collection.

Those selected for the traditional paper based group were sent an initial mailing that consisted of a cover letter, survey instrument, and a self-addressed stamped return envelope. Non-respondents were sent follow-up postcards 14 days after the initial mailing; an additional cover letter, survey instrument, and self-addressed stamped return envelope was sent to all non-respondents 23 days after the initial mailing.

To measure for non-response error, researchers compared early to late respondents (responses received before and after the third mailing). ANOVA was conducted on the responses and showed that for each subscale there were no differences between the two groups. Descriptive statistics were derived for each section and the instrument as a whole. Demographic data were analyzed using percentages and frequencies. Alpha levels were set at .10 *a priori* due to the exploratory nature of this study.

Findings

Among the respondents were 190 (73.9%) males and 40 (15.6%) females. It was noted that 10.5% of the respondents (n = 27) chose not to respond to the gender question. Data showed 81.6% of the respondents in the Web-based group and 69.19% in the paper-based survey group were male (Table 1). Ages ranged from under 29 to over 60 years of age. The majority (n = 90) of respondents classified themselves in the 40-49 age group.

Respondents were described on the basis of teaching appointment (Table 1). Full professors made up the largest group with 37.7% of the total (n = 97). The "Other" category accounted for 40 respondents (15.6%). Persons in the category of "Other" could be visiting professors, staff, graduate students, and instructors. Years of teaching experience at the post-secondary level revealed a dichotomy between those with 16+ years teaching experience (44.4%) and those having taught from one to three years (16.0%).

Respondents' level of experience with Internet protocols is illustrated in Table 1. When referring to Internet technologies, questions implied use of the World Wide Web, email, search engines, ftp, and telnet. Internet technology experience ranged from 4 to 15 years. Respondents' number of years using computer technologies is shown in Table 1. Computer technologies experience referred to a general working knowledge of computers, using the programs Word, PowerPoint, Excel, and Solitaire as descriptors. The largest percentage (35%) of respondents had 16+ years of experience in computer technologies.

Table 1. Demographic Frequencies of AAAE Respondents (N = 389)

	Total		Web		Paper	
Gender	f	%	f	%	f	%
Male	190	73.9	80	81.6	110	69.2
Female	40	15.6	18	18.4	22	13.8
No Response	27	10.5	0	0.0	27	17.0
Age						
29 and under	10	3.9	6	6.1	4	2.5
30-39	46	17.9	21	21.4	25	15.7
40-49	90	35.0	26	26.5	64	40.3
50-59	79	30.7	35	35.8	44	27.7
60 and over	31	12.1	10	10.2	21	13.2
No Response	1	0.4	0	0.0	1	0.6
Position						
Assistant	59	23.0	21	21.4	38	23.9
Associate	57	22.2	24	24.5	33	20.8
Full	97	37.6	35	35.8	62	39.0
Emeritus	3	1.2	1	1.0	2	1.2
Other	40	15.6	17	17.3	23	14.5
No Response	1	0.4	0	0.0	1	0.6
Years Taught at the Post-Secondary Level						
1-3	41	16.0	19	19.4	22	13.8
4-6	28	10.9	8	8.2	20	12.6
7-9	20	7.8	11	11.2	9	5.7
10-12	28	10.9	9	9.2	19	12.0
13-15	23	8.9	6	6.1	17	10.7
16+	114	44.3	44	44.9	70	43.9
No Response	3	1.2	1	1.0	2	1.3
Internet Technology Experience (years)						
1-3	8	3.1	5	5.1	3	1.2
4-6	67	26.1	20	20.4	47	18.4
7-9	77	29.9	31	31.8	46	18.0
10-12	57	22.2	22	22.4	35	13.7
13-15	28	10.9	13	13.2	15	5.9
16+	19	7.4	6	6.1	13	5.1
No Response	1	0.4	1	1.0	0	0.0
Computer Technology Experience (years)						
1-3	5	1.9	1	1.0	4	2.5
4-6	17	6.6	5	5.1	12	7.5
7-9	28	10.9	11	11.2	17	10.7
10-12	58	22.6	27	27.6	31	19.5
13-15	59	23.0	21	21.4	38	23.9
16+	90	35.0	33	33.7	57	35.9

The first hypothesis was no differences existed in the response rates between Web-based and traditional paper based survey groups. Results showed the Web-based survey group had a population of 191 subjects with a usable response rate of 98 (51.30%). The traditional paper based survey group had a population of 198 with a response rate of 159 (80.30%) (Table 2).

Table 2. *Response Rate of Web-based and Traditional Paper based Survey Groups*

Groups	Number of Respondents	Number in Population	Percentage
Web-based	98	191	51.30
Paper based	159	198	80.30
Total	257	389	66.07

Due to the nature of this census study, a visual comparison showed that the traditional group did have a higher level of response. Thus, the null hypothesis was rejected.

The second hypothesis was no differences existed in the reliability coefficient of the instrument between Web-based and traditional paper based survey groups. Cronbach's alpha was calculated for each section to gain a global perspective for each of the concepts under study. The computer anxiety section had a Cronbach's alpha of .87 for the Web-based group and .91 for the paper-based group. The two groups combined Cronbach's alpha on the computer anxiety section was .89 (Table 3). Reliability coefficients for the section measuring attitudes towards computers were .90 for the Web-based group, paper-based group, and for both groups combined (Table 3). The section measuring respondents' perceptions of Web-based surveying yielded a Cronbach's alpha of .78 for the Web-based group versus .88 for the paper-based group. A coefficient of .85 was achieved when the groups were combined (Table 3).

Table 3. Reliability Coefficients

	Groups		
Sections	Web	Paper	Combined
Computer Anxiety	.87	.91	.89
Computer Attitudes	.90	.90	.90
Web Perceptions	.78	.88	.85

Small differences in selected items' means did occur between the Web-based and paper-based groups. However, researchers found no differences between groups when viewing each subsection as a whole. The researchers failed to reject the null hypothesis that no difference existed in the reliability coefficients for Web-based and traditional paper-based groups.

The third hypothesis was no differences existed in the response times, as measured by data collected within the first seven days, for Web-based and traditional paper-based groups. Response time was deemed an important factor in conducting

cost- and time-effective research. As noted in Table 4, the Web-based survey group far exceeded the paper-based survey group in the frequency of responses, 72 to 7. It is noted in the second week of collection that the paper-based group produced 92 responses to 12 for the Web-based group. To determine if a difference existed between groups, a Chi-Square Test of Independence was conducted. The calculated value for the Pearson Chi-Square was 137.77, indicating that for the first week of data collection a significant difference existed between the Web-based and paper-based groups. The null hypothesis that no difference existed in response times, as measured by data collected within the first seven days, for Web-based and traditional paper based survey groups was rejected.

Table 4. Responses of AAAE Members by Week

	Responses	
Week	Web	Paper
April 3 – 9	72	7
April 10 – 16	12	92
April 17 – 30	11	37
May 1 – 14	3	23
Total	98	159

χ^2=137.77

The fourth hypothesis was no differences existed in the criterion related validity of the instrument for Web-based and traditional paper-based survey groups. To gain a better understanding of the individual items that contributed to the summated scale scores for each section, the following descriptive statistics were calculated. ANOVA was administered to the summated data for each section of the instrument (Table 5). None of the sub-sets were found to have a significance level equal to or less than the acceptable measure of .10. The researchers failed to reject the hypothesis that no differences existed in the criterion related validity of the instrument for Web-based and traditional paper based groups.

Table 5. Criterion Related Validity of the Instrument

	Total		Web		Paper	
Sections	M	SD	M	SD	M	SD
Computer Anxiety	49.61	6.72	49.47	7.32	49.69	6.34
Computer Attitudes	58.22	8.42	58.55	8.57	58.02	8.35
Web Perceptions	34.33	6.28	35.14	5.62	33.82	6.61

The fifth hypothesis was no differences existed in the perceived usefulness of Web-based surveying for Web-based and traditional paper-based survey groups. Combined groups' means for the 12 items in this section ranged from 2.37 to 3.19 (Table 6). ANOVA was calculated for each statement in the section and significant differences were found in two statements, "Web based surveys can be as reliable as paper surveys," (Web, M=3.32; Paper, M=3.11) and "I am confident in

reporting data obtained in Web-based surveys (Web, M=3.26; Paper, M=3.02)." However, no practical differences materialized between the two groups because both sets of means indicated respondents "agreed" with the statements. It should be noted that higher means indicate respondents' have a more positive perception of using Web-based surveying. With no significant differences between groups, researchers failed to reject the null hypothesis that no differences existed in the perceived usefulness of Web-based surveying for Web-based and traditional paper based groups.

Table 6. Descriptive Statistics for Respondents' Perceptions of Web-based Surveying Instruments

	Total		Web		Paper	
Statements	M	SD	M	SD	M	SD
Web based surveys can be as reliable as paper surveys.	3.19	.69	3.32	.61	3.11	.72
Web-based surveys provide a valid means for conducting research.	3.16	.66	3.25	.58	3.11	.70
Using the web for conducting surveys can be a secure method of collecting data.	3.15	.64	3.24	.52	3.10	.71
I am confident in reporting data obtained in web-based surveys.	3.11	.67	3.26	.53	3.02	.73
Web based instruments are applicable for many types of research.	3.09	.54	3.13	.53	3.07	.55
Access to Web-based survey information cannot be controlled.	3.09	.62	3.13	.59	3.06	.63
Web based instruments are only useful for quantitative research.	3.06	.59	3.10	.59	3.04	.59
Web based surveying allows the researcher to gather a representative sample of Web users' perceptions.	2.90	.74	2.96	.69	2.87	.77
Web based surveying allows the researcher to collect a random sampling of Web users' perceptions.	2.83	.78	2.86	.76	2.81	.80
Web knowledge is common enough for using Web-based surveys.	2.83	.65	2.84	.67	2.83	.64
Web based instruments are only useful in researching Web users.	2.47	.80	2.52	.81	2.44	.79
I am confident in constructing Web-based survey instruments.	2.37	.85	2.35	.89	2.38	.83

Scale: 1.0-1.5 = Strongly Disagree, 1.51-2.5 = Disagree, 2.51-3.5 = Agree, 3.51-4.0 = Strongly Agree.

Some respondents took the initiative to respond in writing about the instrument, survey, and/or the methodology used in this study. The most common statement was that there needed to be a neutral category on the four-point Likert-type scale. Respondents

did not like being forced into a category, and some avoided choosing a category by not responding to some statements. Other comments included "*Some of the items (computer anxiety) may have been an issue years ago, but may not matter now. Computer support personnel may have removed a lot of the anxiety about the technical side of the computer use*." Two respondents were deemed to be anomalies. One respondent chose not to respond to the survey stating that he/she "*had no anxieties or time to complete another survey*." The other respondent stated that he/she "*would not even use a computer if it were not for email*."

Conclusions and Recommendations

The Internet was once thought to be a passing trend, but now it is commonplace among most American homes. Younger generations are embracing not only the Internet, but also the world of technology at increasingly younger ages. As society and the commercial sector of America embrace these technologies, the time has come for the academic sector to do the same. While many educators embrace these technologies, no researcher had investigated if Web-based surveys provide a valid means for collecting data. This research was conducted and designed to address the validity of using Web-based surveys. This study does not attempt to change the manner in which research is conducted, but simply adds another tool for researchers to employ.

Respondents in this study were mostly male (73.9%) and were full professors (37.7%). The respondents had a wealth of experience in teaching at the postsecondary level with 44.4% having taught 16 or more years. This skill base contrasts respondents' Internet technology skills, where 59.2% of respondents had nine or less years of experience. However, respondents reported high levels of computer technology skills with 80.6% having ten or more years of experience. While there was a significant difference in response rates between groups, the researchers felt this difference was unique to the population under study and can be explained when considering the demographics. Age affected response rates; 77.8% of the population was over the age of 40, and 42.8% of the population over the age of 50.

In all other hypotheses tested, no statistical differences were found. These findings indicate that Web-based surveying methodology has the same reliability and criterion related validity as traditional paper based survey methods. The findings support the idea that Web-based surveying is a valid and reliable method of conducting social science research.

It should be noted that this study had two measures of response rates. The first measure was for response rate of the entire collection period; the second was for data collected within the first seven days of the study. In the first measure, the paper-based survey group far exceeded the Web-based group, 157 to 98. However, in the second measure, the Web-based survey group far exceeded the paper-based group, 72 to 7. This result is consistent with the current literature that states if researchers want to collect a large amount of data in a short time frame, one should use a Web-based survey mode. However, if researchers want to attain high response levels, a traditional survey mode should be used. While literature on survey methodology describes the benefits and barriers of each data collection process, it does not propose a combination of both modes within the same study for agricultural education research. Based on results of this study, the researchers recommend a new model for the social science research data collection process.

The proposed W/PSDC (Web/Paper Survey Data Collection) Model suggests that researchers employ a mixed-mode survey to attain large amounts of data and high response rates in an economically shortened time frame. Consistent with the findings in this study, researchers should create their research instrument in a Web-based format initially and follow-up non-respondents using a traditional paper based survey. Researchers should email all respondents about the study and collect responses via the Web for three days. At the end of the three-day period, researchers should mail paper versions of the research instrument to those who had not responded, but include the option to complete the instrument using the Web. Additional follow-up reminders should be mailed seven days after the initial paper based survey mailing.

The results of this study agree with those found by Courson (1999) and Leung (1998) and support the mixed-mode survey proposed by Dillman (2000). Web-based respondents are confident and comfortable completing online surveys. This study shows that Web-based survey instruments provide a valid and reliable means of collecting data. It demonstrates that Web-based data collection provides quick response rates (within the first seven days) and is an economical means of conducting social science research. The cost of the Web-based survey mode in this study cost less than $50 for software. However, the paper-based survey mode was in excess of $550 dollars in postage, paper, and other supplies. In a time of budget crisis, Web-based surveys could be a cost cutting alternative. This scenario becomes important when researchers multiply the costs of one study by the number of annual department, college, or university studies.

The question remains, "Can researchers accept using the Web-based survey mode?" In the case of the academic world, repeated tests comparing Web-based and traditional survey modes will provide a more definitive answer. The economic world has embraced Internet technologies and steadily expands Web surveying possibilities. Researchers must consider if their target population has Internet access before employing the W/PSDC Model. In this study, all respondents had valid email addresses, so the researchers deduced that the respondents had Internet access. However, researchers at the forefront of the technological race must remember that not everyone has the access or ability to use the Internet for responding to surveys.

Additional recommendations resulting from this study include further research in the effectiveness of Web-based survey modes in a variety of academic settings. Possible research studies might include investigating the differences in response rates using incentives for Web-based survey modes. Also, an investigation of the differences in response rates using other mixed-modes such as pre-letters, email, follow-ups, and other means to increase response rates should be completed. A replication of this study with a different population would allow researchers to re-test the hypotheses for consistency. One possibility is a study with incoming freshmen's perceptions of the college of agriculture, while using the W/PSDC Model. Research is needed to determine if the proposed W/PSDC Model would bring about the same response levels as seen in this study.

In viewing this study from a cumulative perspective, Web-based and traditional paper based survey modes were found to be equally valid and reliable for

collecting social science research data. This study provides strong evidence for using Web-based surveys in future social science research studies.

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IMPORTANT ISSUES FACING AGRICULTURE IN OKLAHOMA: AN ANALYSIS OF AGRICULTURAL LEADERS' PERSPECTIVES

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Abstract

The purpose of this qualitative analysis was to gain a conceptual understanding of participants' outlook surrounding important issues facing the Oklahoma agricultural industry. Seventeen themes emerged from the data that focused on a greater need for agricultural literacy, especially among elected leaders and the voting population. Participants detailed a series of connecting variables that would ultimately result in the loss of small farming operations within the United States. Agricultural illiteracy remains a dominant concern among those engaged in farming, in spite of agricultural educators' efforts toward teaching every citizen in and about agriculture. Other educators may wish to present these findings to students in agricultural courses to test the conceptual linkages and explore similar relationships within communities faced with analogous challenges.

Introduction

Production agriculture has faced declining public support among many Americans, in part due to a century of separation from the land. Agriculturalists moved from farms to cities in the early 1900s as the industrial revolution swept the nation. The great depression of the 1930s drew still more farmers into urban areas in search of economic opportunity. Declining income from farming during the 1970s and 1980s claimed the livelihood of many more of those who had remained in production agriculture. Those who continue to farm today face ever-increasing pressures to produce more with less, to accept fluctuating prices for their products, and sell in a buyers market.

In response to the need for a larger impact on agricultural policy issues within the state, the Department of Agricultural Education, Communications, and 4-H Youth Development at Oklahoma State University established the Oklahoma Agricultural Leadership Program (OALP) in 1990. The purpose of the program was to assist potential leaders develop a deeper understanding of the various systems of economics and government and to help participants increase and utilize their knowledge and skills to solve problems and to explore opportunities for Oklahoma agricultural products (OALP Advisory Council, 2000).

Purpose of the Analysis

The purpose of this analysis was to gain a conceptual understanding of OALP participants' perspectives surrounding important issues facing the Oklahoma agricultural industry upon entry into the program. Knowing how this population perceived agricultural issues served to strengthen the training they received over the following two years, as well as enlightened policy makers as to pressing issues facing farmers and agribusiness persons in a rapidly shifting economy.

Methods

The data gathered for this analysis came from the written applications where candidates were asked to state their perspective of the most important issues concerning the agricultural industry in 200 words or less. Responses were typed verbatim from the application and loaded

into a software program called ATLIS.ti (available from www.atlisti.de) for analysis.

The grounded theory approach was used for analysis and interpretation of the data. Grounded theory is an inductive approach to data analysis that results in conclusions that are deeply rooted in the data (Strauss & Corbin, 1998). When using grounded theory methods for analysis, theory genus is taken from the data collected for a specific study; hence no literature review was reported in this study as to not establish a priori cause and effect relationships among the variables. The researchers began this analysis with the intent of better understanding participants' awareness and exposure to issues that influenced their lifestyle and community. When constructing grounded theory, the emphasis was placed on building rather than testing theory through deductive hypothesis testing. The researchers considered alternative meanings of phenomena in a systematic and creative process. No attempts were made to generalize the findings of this analysis to other populations (Merriam, 1998).

Findings were negotiated among the research team to increase creditability. One researcher served on the selection committee for the OALP class 10 and interviewed several participants. During the interviews the researcher checked interpretations of the data with the participants. Another researcher currently serves as the director of the OALP and had ongoing interaction with participants. Early drafts of the manuscript were shared with participants to confirm emerging hypothesis.

Researcher bias control is the attempt to "limit the influences of unjustified views" (Scriven, 1991, p. 69) and was monitored by comparison of emerging hypothesis within the research team. The perspectives of the individual researchers were examined through peer review (Merriam, 1998) when discussing emerging hypothesis. The fact that one of the researchers was also the director of the OALP served to introduce bias and to control bias by providing a tension that keep the other researchers from wandering too far from the purpose of the study and by causing self-reflection within the team.

Population

The objective of OALP was "to further develop future leaders for the Oklahoma Agricultural industry" (Selection criteria for OALP, April 6, 2000). Official criteria for the program stated that candidates must have "demonstrated leadership potential" and who were between 25 and 45 years of age. Thirty-nine candidates applied for the program and 30 were chosen based on merit and leadership potential documented through an extensive application process and three letters of recommendation (Table 1).

Table 1. Names and Occupations of Participants

Occupation	n	Name
Agricultural production (reported that they earned 100% of their income from farming)	10	Avery, Buck, Chapin, Hawks, Heart, Mathews, Muller, Sweet, Waters, Wilson
Agricultural sales representative	3	Finds, Homer, Larke
USDA specialist	2	Hughes, Overton
Agricultural education instructor	2	Born, Ramsey
Executive director for livestock council	2	Linders, Weather
Farm manager	2	Jorgensen, Trout
Accountant for farm	1	Keith
Farm credit services	1	Shoes
Oklahoma Department of Forestry	1	Stream
Meat scientist	1	Gabriel
Nutrition, physiology corporation owner	1	Raymond
Nursery producer/owner	1	Berkley
Public relations specialist	1	Johns
Senior Appraiser	1	Piaget
Tax services	1	Shawshank
Total	30	

All 30 candidates who were selected for the program agreed to allow the researchers access to their written comments for the analysis. Participants' names were substituted with pseudonyms to protect their identity. The participants' average age was 35.8 years and ranged from 26 to 45 years. Twenty-three participants were male and 7 were female. In order to apply for the OALP participants had to be engaged in agricultural business or production activities. Candidates reported that they worked in a variety of agriculturally based occupations including production agriculture, agricultural sales representatives, USDA specialists, and teaching about agriculture. Participants lived in rural communities throughout Oklahoma, with an average population of 14,860 and a range of 980 to 45,230 people (1998 estimated data, available www.odoc.state.ok.us. The mean and range were based on 18 towns and cities, as data were not available for 12 towns or cities).

Results and Conclusion

Participants expressed concern over 17 issues facing the agricultural industry. Table 2 displays the categories along with the number (n) and names of individuals whose responses were coded for each category from the data set. Each issue is discussed along with supporting text from the data set. A grounded theory is then presented to summarize the findings, which draws relationships among the 17 variables as reported by the participants.

Advocacy was not the intent of this analysis; however, in presenting the views of the participants an activist tone for greater efforts in agricultural literacy shines through – perhaps the result of a need for self-preservation as agriculturalist.

Table 2. Important Issues, Number, and Name and of Individuals Making Claim

Issue	n	Name of individual making claim
Need for agricultural literacy	11	Blakley, Buck, Finds, Heart, Hughes, Keith, Larke, Linders, Mathews, Ramsey, Wilson
Lack of financial soundness of farming	11	Finds, Hawks, Johns, Larke, Linders, Overton, Piaget, Shoes, Sweet, Trout, Wilson
Lack of sound farm policy	9	Born, Chapin, Hawks, Homer, Johns, Muller, Stream, Trout, Wilson
Loss of family values	8	Gabriel, Hawks, Linders, Overton, Raymond, Ramsey, Shoes, Waters
Centralization of production agriculture	7	Chapin, Gabriel, Heart, Homer, Overton, Piaget, Ramsey
Loss of family farms	6	Buck, Finds, Heart, Ramsey, Trout, Wilson
Lack of rural economic development	3	Avery, Chapin, Gabriel
The graying of farmers	4	Born, Piaget, Sweet, Wilson
Need for education of farmers in production techniques	3	Buck, Jorgensen, Trout
Conflicts with environmentalist groups	4	Blakley, Keith, Muller, Waters
Need for moral leadership	4	Blakley, Buck, Heart, Raymond
Concern over urban sprawl	3	Blakley, Mathews, Sweet
Concern over environmental issues	3	Larke, Raymond, Ramsey
Need for sound tax laws	3	Chapin, Piaget, Sweet
Miscellaneous	2	Weather, Muller

Need for Agricultural Literacy

The majority of participants' comments regarding important agricultural issues centered on agricultural literacy, which was conceptualized as educating and informing the nonagricultural population about agricultural practices. Participants stated that agricultural practices were environmentally neutral, that products were safe and nutritious, and that farmers contributed to balancing world trade with food and fiber exports. They were firm in their stance that American agriculture was beneficial to national security; however, admitted that there was a need for those involved in agriculture to spend more time educating and informing the public about the value of agriculture to the nation.

Blakley stated "it is our duty as leaders in agriculture to educate and inform the public of our practices, about how safe and vital they are in the production of agricultural products, which in turn provides this country with an ample supply of food and fiber". Finds reiterated, "We need to come together as one entity, pool our resources to educate the consumer as to what goods and services agriculture is providing to the consumer. Agriculture is helping the environment with sound, practical farming and ranching management practices".

Agricultural literacy was linked to sound agricultural policy. Heart stated that legislatures "have the power to change consumers' ideas about agricultural products. We must educate our legislatures about the problems we, the farmers, face. Legislatures need to understand so they can help us correct the glitches in the political system". A lack of agricultural literacy was cited as a reason that "agriculture will continue to struggle as an industry" (Hughes). Mathews stated that consumers "want safe food and a clean environment and demand legislation" that is most often in opposition to farm profitability. "Consumers will be less sympathetic to the plight of the American farmer and more susceptible to the message of the farmer's detractors" in the absence of agricultural literacy efforts (Ramsey).

Participants explained that a lack of agricultural literacy lead to a lack of sound farm policy, which in turn allowed for urban sprawl

and the increase of land values and taxation burdens for farmers. “Hobby farms are driving up farm prices and bringing more complaints about smell, dust, sprays, etc.” (Mathews).

According to several participants, agriculturalists need to become better advocates of their occupations or be left behind as both the public and farmers are mostly uninvolved in matters that affect their livelihood and their country. “The fewer people that know and understand the agriculture industry, the more opposition there is in the form of activist groups who protest how farmers grow crops and raise livestock” (Wilson).

Lack of Financial Soundness of Farming

The inability of farming activities to earn a reasonable rate of return on investment (ROI) was a vital concern to 11 participants. “It is probably over simplified to say that the prices we receive for our commodities are too low and expenses are too high” (Shoes).

Linders expressed a characteristic optimism in finding “new ways for agriculture to be profitable” through seeking “new partnerships between producers and Agribusiness”. However, Overton offered a practical reality in that the current mode of operation is not sustainable. “Many farmers are facing the decision of either to become large enough to compete, leaving agriculture completely, or do as I have done and work away from the farm full-time and farm part-time”. Piaget confirmed this trend. “When I began working for Farm Credit, the majority of our customers were full-time farmers and ranchers. Today, most, particularly those in the 25-45-age bracket, are part-time farmers and must have off-farm employment to support the financial demands of farming and ranching. Unless you have a passion for a rural lifestyle, why would you invest in agricultural operations with common returns of 1% to 5%, when historically, you could invest in other business ventures earning significantly more?”

Many participants were concerned about being “able to make end's meet in the down years” (Finds) when equity accumulated over time has been exhausted with the long downturn of farm commodity prices. “Producers are receiving prices for their products they received in the 1950s, while struggling to keep up with 2000 production expenses. Those who are holding on are eating into years of equity with guarded optimism. Others are simply getting out” (Johns). Farmers have spent both their parents and their children’s inheritance, leading to the issue of the graying of the farming community. As children of farming families come to understand that little economic opportunity exists on the farm, they exit for employment in urban areas. “There is very little incentive for young people to enter into production agriculture considering the expense of land and capital outlay necessary in regard to the guaranteed returns on their investment. In the near future, most small producers will be gone because of age” (Sweet).

Lack of Sound Farm Policy

Nine individuals raised the issue of farm policy, or governmental regulation, or both. Participants complained about too much government regulation, yet suggested more farm policy to end the current cheap food policy that has kept commodity prices at near depression-era rates. Born asked the question, “How important is it for our country to continue to have a cheap food policy while the average farmer cannot make enough on the farm to care for his family without having an off-farm job?” This dichotomy was express by Chapin when discussing a need for more policy, and more freedom to farm. “We need our government to open up markets around the world so we can sell our commodities without trade tariffs and barriers. We need free trade but also fair trade”.

Inadequate farm policy has lead to the lack of financial soundness of farming in some participants’ minds. Participants drew the relationship between legislators’ inability to create adequate farm policy due to agricultural illiteracy, and the decline of rural communities. “The emergency packages offered by Congress the last couple of years have been a Band-Aid for some to cover the gaping wounds left behind from failed trade and farm policies that do not effectively address fluctuations in prices. Something must be done to establish what has been referred to as a safety net to support American producers when prices are low. I see this as a national food security issue as well as a

debilitating factor for our rural communities and farming and ranching families" (Johns).

Muller pointed out that poor agricultural policy might give special interest environmental groups a power advantage over farmers to determine the fate of our nation's food supply. "The EPA is illegally trying to regulate non-point source water pollution. They blame agriculture for all non-source water pollution. Their success in regulating it will drastically alter farming forever". Stream echoed Muller in lamenting that "the programs administered by the USDA Natural Resource Conservation Service have become cumbersome and out of touch with the purpose and goals with full-time agricultural producers. These agricultural directives have been forced into the USDA programs by nonagricultural producers and other agencies in government that feel they know what is best for the land and the producers living off that land".

One participant expressed deep concern for legislators' ineffectual nature in general: "I'm concerned about agricultural export markets being used as pawns by politicians to help them achieve their political objectives with other countries" (Wilson).

Loss of Family Values

The loss of family values, although not directly an agricultural matter, was a pressing issue for eight participants. Concern was voiced over youth drug use and smoking, premarital sex, violence in schools, the lack of values in the home, and a lack of moral leadership on local, state, and national levels. "Leaders need to be an example of positive qualities that our youth can look up to" (Overton). Loss of family values was seen as one result of the loss of the family farm and rural way of life; if the farm is lost, values are also lost (Ramsey).

Working mothers were cited as contributing to the decline of the social fabric as well by Gabriel and Waters. Shoes stressed that the current trend of the decline of the social fabric is a result of a lack of "moral leadership in the home". "If more parents take on the responsibility and become more involved with our children, I would expect that the major problems in our great society would work themselves out with time" (Waters).

Centralization of Production Agriculture

The seven individuals who commented on centralization focused on a noticeable shift in production practices from family-owned and operated farms to corporate owned farms. Although the status of corporation is a business legal classification, not an indicator of business size, participants who discussed this issue equated the term corporation with mega-conglomerates such as Tyson and Cargill. Gabriel discussed the relationship between increasing centralization and loss of the family farm.

Centralization referred to the grouping of production related activities into relatively homogeneous operations, for example, the consolidation of poultry and swine operations within a few regions of the nation. Chapin stated that farmers in the state should diversify production to remain competitive in the marketplace.

A lack of sound farm policy was also woven into the construct and consequences of centralization. Without sound farm policy, large operations are allowed to dominate specific sectors of the production economy, thus driving out smaller, less competitive operations (Heart and Homer). Participants called for better enforcement of specific laws to control the detriments of agricultural centralization.

Loss of family farms

Loss of the family farm was cited by six individuals and was in an inverse contingent relationship with centralization of farming operations, mono-cropping, rural economic development, and receiving profitable prices for farm commodities. Buck linked the loss of family farms with the decline of rural communities. "It brings school closings, loss of businesses, less industry, and a financial crisis for all involved in agriculture".

Wilson discussed the relationship between low ROI, graying of farmers, and the loss of the family farm along with noting that farming is a lifestyle, versus a job. "Due to increasing costs of farm inputs and low returns on time and dollars invested, it is very difficult for younger people to get started and stay in farming. There is increased pressure to treat

farming only as a business and not a way of life. Yet, with no guarantee of profit farmers must invest long hours, high amounts of capital, and skills. This calls for farm families to be committed to a lifestyle that is no longer appealing to much of society. Most must come to grips with having less leisure time and less disposable capital than non-farmers for many of their farming years".

Lack of Rural Economic Development

A lack of rural economic development was sandwiched in-between the loss of the family farm and a brain drain of rural communities when youth leave for the economic diversity offered in urban areas (Gabriel). Avery reported a downward spiral effect when jobs leave communities. A lack of economic development decreases the tax base, which in turn leads to decreased development opportunities. "There are fewer landowners to pay taxes, fewer children in the schools, and fewer people to support our towns, churches, businesses, and organizations. This also leads to fewer opportunities for our young people to be exposed to situations that will enhance their lives".

The Graying of Farmers

The concept of graying of farmers was equated to the aging population of farmers as few young people are entering the profession due to the lack to financial soundness of farming. "I am 32 years old, and probably one of the youngest, if not the youngest cow/calf producer in [my] County that is ranching as a full time occupation. There is very little incentive for young people to enter into production agriculture considering the expense of land and capital outlay necessary in regard to the guaranteed return on their investment" (Sweet).

All four individuals centered on an overall concern of the age of farmers in general and a lack of young people to replace them. Born asked, "Who will step up to feed our nation?" Piaget, Sweet, and Wilson pointed out that the large capital investment required for starting an agricultural operation was a barrier to new farmers entering the business.

Need For Education of Farmers In Production Techniques

Three participants reported that if farmers were more knowledgeable about production and marketing techniques, then they would increase their profit margin. New marketing structures, such as value added products, were seen as a way to increase farm profitability. Jorgensen suggested that adding value to crops was an important aspect of modern farming. Buck stressed that farmers "must research every phase of an operation" and "make smart decisions" to stay in business.

Conflicts With Environmentalist Groups

Four participants noted that environmental groups were contributing to the demise of American agriculture by influencing consumer preferences in the marketplace. Keith suggested that a lack of agricultural literacy among consumers has allowed environmental groups to put fourth and agenda that may lead many voters to condemn modern agricultural practices.

Need For Moral Leadership

Four participants discussed the need for moral leadership that was supportive of American agriculture as the general population becomes more agriculturally illiterate over time. If leaders are moral and agriculturally literate, they will set sound agricultural policy that will support family farms, and in turn support family values.

"Our legislatures are the people in our community, state, and nation who have the power to change the popularity of corporate farms and the consumers' ideas about agricultural products. We must educate our legislatures about the problems we, the farmers, face. Legislatures need to understand so they can help us correct the glitches in the political system" (Heart).

Concern Over Urban Sprawl

According to three participants, urban sprawl was a result of poor farm policy that allowed for urban encroachment on fertile

agricultural lands Blakley). Urban sprawl was viewed as a factor leading to conflicts with non-farming populations who complain about smell, dust, and sprays (Mathews) and increases the tax base for farmers (Sweet).

Concern Over Environmental Issues

Three participants discussed clean water and a safe and healthy food supply as urgent issues as the rural-urban interface continues to put pressure on farming practices such as use of animal manure as fertilizer (Larke). Raymond pointed out that farmers "have spent a lot of time on production efficiency but not on areas of consumer concern such as quality of products. We need to do a better job of paying attention to what our customers (consumers) are saying about our products and adapt our production practices to meet what they are asking for".

Need For Sound Tax Laws

Three participants wrote about the need for sound tax laws in protecting agricultural interests. Chapin demanded that the legislators find alternative ways to fund education as real estate taxes were driving farmers off the land. Piaget suggested "estate tax legislation, beginning farmer incentives, diversification, and profitability all need to be enhanced to keep the next generation in agricultural related production and industries". The connection between tax legalization and urban sprawl was clearly acknowledged by Sweet, who pointed out that as taxation burdens farmers, "Wealthier populations buy the small farms and ranches and become hobby producers for tax deductions, making it impossible for the dedicated or small or beginning producer to compete with their available cash flow. Year-end losses are welcome situations to [hobby farmers]; whereas, losses to the small operator can be devastating when yield is low".

Miscellaneous

Weather discussed the burden of international competition upon U.S. agriculture, stating that farmers face "excruciating competition" in the marketplace. Muller mentioned water rights in the context of a traditional battle over demand for water as surrounding communities grow such a Dallas, TX.

Proposed Solutions To Problems

Three participants discussed solutions to agriculturally related problems. Chapin called for higher paying jobs for rural youth through the value-added products market. Shoes suggested that farmers must come up with new ways to increase the income from their commodities via niche markets, value-added products, marketing associations, or cost-cutting methods such as limited or no-till farming. Weather called for farmers to become knowledgeable about opportunities in the market place, both domestically and internationally.

Summary

Findings of this analysis indicated that agricultural literacy is a legitimate starting point for reversing the current downward trend of small to mid-sized agricultural production facilities in America. This finding is consistent with the National Research Council's (1988) recommendation that agriculturally literate citizens will be able to "participate in establishing the policies that will support a competitive agricultural industry in this country and abroad" (p. 2). The 17 themes presented can be strung together as a series of if-then statements that result in the ultimate outcome of a loss of food and fiber production within our national boarders.

The starting point is a lack of agricultural literacy among the general population, which in turn leads to a lack of sound agricultural policy. A lack of sound agricultural policy leads to an imbalance of power between agriculturalists and environmental groups, urban sprawl, taxation problems, centralization of commodity production, and the need for adequate leadership in industry and government.

Centralization of commodity production leads to the loss of family farms through a decline in the financial soundness of small-scale farming. Centralized operations have a competitive advantage in the market place and are able to drive down prices for farm

commodities, thus forcing out competition. Loss of family farms and centralization lead to mono cropping, as family farms tend to be more bio-diversified than centralized operations.

The loss of the family farm leads to a lack of rural economic development, as centralized operations tend to hire immigrant and migrant farm labors at minimum wage. As families and communities disintegrate from a lack of economic opportunity, the social structure collapses leading to what participants referred to as a loss of family values. The graying of farmers results from youth leaving rural communities in search of employment in urban and suburban areas as the cost of entering farming as a vocation exceeds a reasonable rate of return on investment.

As farmers age and eventually perish, suburban hobby farmers buy the farms and convert them into gentlemen farms. Once farms are converted to non-farm real estate, property taxes increase serving to permanently remove the land from agricultural production, leaving foreign corporations in control of the American food and fiber supply.

Discussion and Implications

While this analysis of important agricultural issues facing Oklahoma agricultural leaders has served to deepen our understanding of the variables affecting the sustainability of Oklahoma agriculture, much work remains to be done to truly assign causal relationships. Future research should strive to confirm the grounded theory presented with a more diverse population and a more inclusive review of the literature. The relationships that were drawn were based on participants' perceptions, as this was the purpose of this analysis; however, it would allow findings to be more generalizable if other researchers found similar relationships surrounding the 17 themes discussed.

The implications of this analysis can be immediately applied to the OALP in helping participants to unravel the intricate balance between agricultural literacy and the foregone conclusion that foreign corporations will control the American food supply. These logical leaps and factoids have not been proven through a macroeconomic analysis as would be suggested prior to accepting them as facts; however, they are important in understanding participants current understanding of the state of affairs in agriculture. Other educators may wish to present these findings to students in agricultural courses to test the conceptual linkages and explore similar relationships within communities faced with comparable challenges.

Conclusions and Recommendations

Twelve years after the Committee on Agricultural Education in Secondary Schools (1988) put forth recommendations for increasing agricultural literacy among all public school children there is still a perception in Oklahoma that the majority of Americans are increasingly illiterate about agriculture. Much work remains to be done to turn the tide of a population that continues to distance itself from the food and fiber system.

Igo (1998) conducted a review of the agricultural literacy literature and pointed out that most of the agricultural literacy research documented what individuals did not know about agriculture, rather than focusing on what people should know in order to be considered agriculturally literate. Much of the past research surrounding agricultural literacy has focused on obtaining disconnected facts that people possess regarding agriculture, i.e. how many pounds of beef do Americans eat per year? (Cox, 1994). Future research on agricultural literacy should focus on the nature of people's connection to agriculture from a global conceptual perceptive and how it influences their consumer and political behavior.

Terry, Herring, and Larke (1992) studied 4th grade teachers in Texas and concluded that teachers in elementary schools were teaching children about agriculture; however, they were teaching "inaccurate perceptions" and had "limited knowledge of agriculture" (p. 58). According to the authors, the agriculturally illiterate were teaching children about agriculture. The authors recommended, "efforts should be made to improve teachers' perceptions and increase their technical knowledge of agriculture" (p. 58). Who will take responsibility for that task when the only group of teachers currently required to take technical agricultural courses are agricultural education teachers?

Somewhere along the way, agricultural educators have neglected to educate all Americans in and about agriculture, as was the charge when the Smith-Hughes Act of 1917 was passed (Moore, 1987). Consequently, the practice of agriculture has lost a significant support base for its continued existence within our national boarders. As Moore pointed out, "prior to 1917 agriculture was being taught in every state of the Union" (p. 10); however, in more general terms and with great variation among programs. It could be argued that the Smith-Hughes Act has served to distance the public from agriculture by removing the subject from the general curriculum and giving it specialty status, rather than a *need to know* item for every American. Clearly, asking senior citizens to supplement farming activities with their social security checks is not a sustainable course of action for American agriculture (R. Westerman, personal communication, October 26, 2000 stated that the average age of the Oklahoma farmer was 63 years). It is time for agricultural educators to accept the challenge put forth by the Oklahomans who participated in this analysis to move into leadership roles that will shape sound farm policy that spreads its tentacles into all areas of teacher education, not only that which occurs within the domain of the colleges of agriculture.

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TEXAS AGRI-SCIENCE TEACHERS' ATTITUDE TOWARD AND STAGE OF ADOPTION OF THE INTERNET

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Abstract

The purpose of this study was to assess Texas Agri-Science teachers' attitudes toward and stages of adoption of the Internet. The study also determined what relationships, if any, existed between demographic and program variables with teachers' attitudes and stage of adoption. Rogers' (1995) Diffusion of Innovations theory was used to guide the study.

Texas Agri-Science teachers had favorable attitudes toward all forms of information technology with the highest attitude toward the Internet. They also perceived themselves in advanced stages of adoption of information technologies. Texas Agri-Science teachers also supported on-line activities such as FFA contest registration and award applications. High correlations were discovered between computer anxiety, computer importance, computer use outside the classroom and home access with attitudes and adoption.

The adoption of the Internet has reached critical mass among Texas Agri-Science teachers. Results of the study have implications for the education, implementation of on-line activities and communication with Texas Agri-Science teachers for stakeholders in the field.

Introduction

The spread of technology over the past decade has changed our world forever. The Internet specifically has transformed the workplace, education, and the home through on-line activities, research capabilities, and communication through electronic mail and chat-room type technologies. Phrases like "www", "hotmail" and "dot com" and exchanging electronic mail addresses are now common place as web sites give us the most current, extensive source of information available.

New technologies hold a great promise for improvements in the field of agricultural education. Appropriate use of the Internet within the classroom, has been shown to increase student performance and provides the teacher with a powerful tool for information gathering, communication, and presentation (Sion, 1998; Lewis, 1998; Baker & Blue, 1999).

Research of Texas Agri-Science teachers' adoption of the Internet has been unreported in the literature over the past decade. A few studies have been conducted on the use of the micro or personal computers in Texas Agri-Science classrooms (Brown, Townsend & Carnes, 1985: Cepica et al., 1984). A nationwide survey of agriculture teachers reported that

72.08% used computers in their programs, but only 26% of all the teachers had a computer with a modem (Birkenholz & Stewart, 1991).

The rapidly diffused use of electronic mail (an Internet application) can be observed through a brief investigation of the 2000-2001 *Directory of Agricultural Science Teachers* (TEA, 2000). Roughly 51% of all Texas Agri-Science teachers reported their email addresses in the directory, compared to 29% (TEA, 1999) the previous year and 5% (TEA, 1998) during the 1998-99 school year. This trend indicates that Texas Agri-Science teachers are quickly adopting and using electronic mail technology at increasing rates.

Harris (1997) suggested that teacher adoption of information technology could be better understood in the context of the Diffusion of Innovations Theory. Everett Rogers (1995) Diffusion of Innovations Theory has been used for many years to explain the adoption of innovations such as information technology and is utilized to guide this study. The innovation-decision process is an information seeking and information processing activity in which an individual obtains information in order to decrease uncertainty about the innovation. Potential adopters must learn about the innovation (Knowledge Stage) through the different communication channels; second, they must be persuaded of the value of the innovation (Persuasion Stage); they then must decide to adopt it (Decision Stage); the innovation must then be implemented (Implementation Stage); and finally, the decision must be reaffirmed or rejected (Confirmation Stage).

Numerous forces and factors have contributed to the rapid adoption of the computer and Internet by Texas educators. One of the most contributing factors is the increased access to information and communication technology such as electronic mail, discussion groups, newsgroups, and the Internet. Research shows that increased access dismantles some of the differences between the novice and expert users that become barriers to the use of information technology (Mitra, Steffensmeirer & Lenzmeier, 1999). According to a U.S. Census Bureau (1998) 43% of all secondary teachers in the U.S. reported using the Internet at school and 60% reported using the Internet at home.

Researchers (Nantz & Wilkins, 1995; Herling, 1995) have positively correlated the connection between technology use and attitude toward technology. The U.S. Department of Commerce (2000) found level of education and Internet usage highly correlated and that Internet usage rose with age until people reached their senior (55+) years. A study of public school teachers found the negative relationship to be true of age and the use of the Internet at home (U.S. Department of Education, 1999).

The Department of Commerce study (2000) also found gender differences in access to the Internet and electronic mail use. This "gender gap" is supported by research that sites media stereotyping for a difference in technology use (Knupfer, 1998; Shashanni, 1994). However, the most recent studies report no differences in Internet use based upon gender (U.S. Department of Education, 2000).

Purpose/Objectives

The new technological age has made it important for Agri-Science teachers to possess high levels of competency with information technology in the classroom. Evidence that Agri-Science teachers in Texas have adopted the Internet, has been unreported in the

literature. Information regarding the teachers' attitudes toward and adoption of the Internet should be helpful in creating improvements to secondary agricultural education programs, teacher education programs, as well as in designing future in-service topics to meet the needs of the teachers. Enhanced communication between Texas Agri-Science teachers with stakeholders such as university faculty, extension personnel, industry specialists, community contacts as well as other Agri-Science teachers through the use of electronic mail and the Internet could lead to overall program improvement.

The following objectives were developed in order to accomplish the purpose of this study:

1. To determine the attitudes of Texas Agri-Science Teacher's toward the Internet.
2. Determine which stage of adoption of the Internet that Texas Agri-Science teachers perceive themselves.
3. Determine Texas Agri-Science teachers' support of on-line activities including:(a) FFA contest registration, (b) FFA Award Applications, (c) FFA rosters, (d) stock show registration and (e) research questionnaires.
4. Explore the influence of demographic characteristics, computer anxiety, computer importance, and Internet Stage of adoption upon Texas Agri-Science teachers' attitude toward the Internet.
5. Explore the influence of demographic characteristics, computer anxiety, computer importance, and attitude toward the Internet upon Texas Agri-Science teachers' stage of adoption of the Internet.

Methods/Procedures

The researcher utilized a non-experimental quantitative research design for this descriptive correlational study (Ary, Jacobs & Razavieh, 1996). The target population included secondary Agri-Science teachers in Texas for the 2000-2001 school year (N=1,524). The accessable population included the Texas Agri-Science teachers identified by the Texas Teachers of Agricultural Science & Technology Directory published by the Texas Education Agency (TEA, 2000) for the 2000-2001 school year. A simple random sample (n=310) was selected (Krejcie & Morgan,1970) from the accessable population according to population size.

A researcher-modified version of the Teachers Attitude Toward Information Technology Questionnaire (Christensen & Knezek, 1996; TCET, 1999) was used to determine Texas Agri-Science teachers' attitudes toward information technology (CPP, CCU, email, WWW). Attitudes toward information technology were measured using Semantic Differential scales. Originally developed by Osgood, Suci, and Tannenbaum (1967), subjects are presented with bipolar or two opposite adjective descriptors for that object. Several adjective pairs are combined to yield an overall score describing subjects' feelings toward the object.

The researcher-modified version includes seventeen 5-point Likert-type questions taken from the original version that measured computer importance, computer enjoyment, and computer anxiety. A Principle Components Analysis yielded two components termed "computer anxiety" and "computer importance". Demographic and program data were collected for each subject related to: (a) age, (b) teaching experience, (c) hourly

computer use inside of the classroom, (d) hourly computer use outside of the classroom, (e) computers in the Agri-science classroom, (f) computers in the personal office, and (g) Internet home access.

The on-line version included a section with descriptions of Russell's (1995) Stages of Adoption of Technology and a place for subjects to indicate their self perceived stage of adoption. Russell (1995) proposed that adult learners pass through six stages of technology adoption. He suggested that learners could begin at any stage and progress at their own rates. With Roger's (1995) model in mind, Russell presented stages of technology adoption with email as a base. Russell's research found the stages of (1) awareness, (2) learning the process, (3) understanding the application of the process, (4) familiarity and confidence, (5) adaptation to other contexts and (6) creative applications to new contexts. The on-line version was adapted for use as a direct-mail questionnaire and descriptions for each stage were modified by the researcher to address the use of the Internet.

Face and content validity was achieved by field-testing the instrument among a sample of Texas Agri-Science teachers not included in the random sample (n=23). Further editing and revision of the researcher-modified instrument was required. Using Cronbach's alpha, high reliability scores were calculated on the attitude measurement scales.

The data collection procedure followed the Dillman (1978) model for mailed questionnaire administration.

Useable questionnaires were returned by 218 of the respondents for a return rate of 70.32%. Early and late respondents were compared as recommended by Miller and Smith (1983) to control for non-response error. Differences were detected between early and late respondents restricting the generalizability of the findings to the accepting sample.

Using SPSS, multiple regression analysis was used to determine the amount of variance characteristics had on stage of Internet adoption and attitude toward the Internet. Correlations were also determined and are described using the Davis Convention (1971).

Results/Findings

Objective One

Results of the semantic sub-scales revealed that Texas Agri-Science teachers had a favorable attitude toward the Internet (M=5.87). Scores ranged from 1 to 7 with 7 being the most favorable score possible. Respondents reported the highest scores on the Unimportant/Important (M=6.11) scale and the lowest on the Unexciting/Exciting scale (m=5.68). Data provided by the respondents and summarized in Table 1 showed that all subscales indicated largely positive attitudes toward the Internet.

Table 1. Comparison of Texas Agri-Science Teachers' Attitude Scores Toward the Internet

Scale	Mean
Unimportant/Important	6.11
Boring/Interesting	5.96
Irrelevant/Relevant	5.94
Unexciting/Exciting	5.68
Means Nothing/Means a Lot	5.83
Unappealing/Appealing	5.72
Mundane/Fascinating	5.71
Worthless/Valuable	5.99
Uninvolving/Involving	5.78
Not Needed/Needed	6.00

Note: Score range of 1 to 7 with 7 being the most favorable score possible, n=213

Objective Two

Respondents were given explanations of Russell's Stages of Technology Adoption within the researcher modified instrument and asked to respond with their own stage of adoption of computers, email and the Internet. The six stages are arranged with Stage 1: Awareness being the stage of least adoption to Stage 6: Creative Application being the highest stage of adoption.

Respondents reported having a high level of adoption of the Internet (M=4.28). A majority of Texas Agri-Science teachers perceived themselves in the upper stages of adoption. The highest percentage of respondents reported themselves in Stage 5: Adaptation, where the Internet has been adopted and is being adapted to other contexts being used in many applications and as an instructional aid. Each stage along with reported frequencies and percentages are presented in Table 2.

Table 2. Summary of Internet Stages of Adoption

Internet Stage of Adoption	Frequency	Percent	Cumulative Percent
Stage 1: Awareness	8	3.67	3.67
Stage 2: Learning	16	7.34	11.01
Stage 3: Understanding/Application	36	16.51	27.52
Stage 4: Familiarity/Confidence	50	22.94	50.46
Stage 5: Adaptation	62	28.44	78.90
Stage 6: Creative Application	46	21.10	100.00

Objective Three

Respondents were asked a simple dichotomous question on the instrument to determine their support of on-line activities such as on-line registration of stock show entries, on-line FFA contest registration, on-line FFA award applications, on-line FFA rosters and research questionnaires via electronic mail or Internet.

Data summarized in Table 3 indicate that a majority of respondents supported all on-line activities. FFA contest registration received the most support (85.58%) and on-line research questionnaires reported the least support (72.99%).

Table 3. Summary of Agri-Science Teachers' Support of On-line Activities

On-line Activity	Percent Support
On-line FFA Contest Registration *	85.58
On-line FFA Award Applications *	81.40
On-line FFA Roster **	82.71
On-line Stock Show Registration *	78.14
On-line Research Questionnaires ***	72.99

Note: *n=215, **n=214, ***n=211

Objective Four

As reported in Table 4, substantial positive correlations were found between attitude toward the Internet with home access, computer importance, and stage of adoption. A substantial negative correlation was found between attitude toward the Internet with computer anxiety. Moderate positive correlations were discovered between attitude toward the Internet and computers in the classroom and computers in the personal office.

Table 4. Summary of Correlation Between Attitude Toward the Internet and Selected Variables

Selected Demographics	Internet
Age (r)	-.19
Teaching Experience (r)	-.22
Hourly computer use outside of class (r)	.24
Hourly computer use inside of class (r)	.20
Computers in classroom (rpb)	.46
Computers in personal office (rpb)	.39
Internet Home Access (rpb)	.50
Computer Anxiety (r)	-.55
Computer Importance (r)	.57
Internet Stage of Adoption (r)	.51

Note: * r=Pearson product moment correlation coefficient and rpb=Point Biserial coefficient.

In determining the amount of variance that demographic characteristics, computer anxiety, computer importance, and Internet stage of adoption explain in the overall attitude toward the Internet, a multiple regression was performed (Table 5). The model explained 42% of the total variation. Computer importance and Internet stage of adoption were the most powerful predictors of Texas Agri-Science teachers' attitude toward the Internet. Table 5 presents the multiple regression of selected characteristics on attitude toward the Internet.

Table 5. Regression on Attitude toward the Internet

Variable	Mean	S.D.	b
Age	41.21	10.37	-.05
Teaching Experience	16.07	10.32	-.05
Computer Use in Class (hours)	4.26	4.38	-.05
Computer Use Outside of Class (hours)	5.92	6.04	-.05
Computers in Classroom [a]	.77	.42	.01
Computers in Personal Office [a]	.82	.39	.07
Internet Home Access [a]	.62	.49	.03
Computer Anxiety	2.37	.81	-.18
Computer Importance	3.80	.58	.38
Internet Stage of Adoption [b]	4.26	1.40	.21
(Constant)			

Note: n=194, R^2=.42, Standard Error .8341
[a]0=No, 1=Yes
[b]Scale 1-5 with 5 most advanced stage of adoption

Objective Five

Figures contained in Table 6 show a substantial negative correlation between computer anxiety and stage of Internet adoption. A substantial positive correlation was also reported between stage of adoption and attitude toward the Internet. Moderate negative correlations were discovered between stage of Internet adoption with age and teaching experience. Positive moderate correlations were found with computer use inside the class, computer use outside of the class, and computer importance.

Table 7 presents a multiple regression on the amount of variance that the degree of Internet Stage of Adoption can be explained by selected demographics, computer anxiety, computer importance and attitude toward the Internet. The model explained 56% of the total variation in Internet stage of adoption. Respondents reported computer anxiety and attitude toward the Internet as the most meaningful predictors of Internet stage of adoption.

Table 6. Correlation of Stages of Adoption and Selected Variables

Selected Variable	Internet Stage of Adoption
Age (r)	-.32
Teaching Experience (r)	-.31
Computer use outside of class (r)	.37
Computer use inside of class (r)	.31
Computers in classroom (rpb)	.23
Computers in personal office (rpb)	.23
Internet Home Access (rpb)	.23
Computer Anxiety (r)	-.69
Computer Importance (r)	.41
Attitude Toward the Internet	.51

Note: r=Pearson product moment correlation coefficient & rpb=Point biserial coefficient.

Table 7. Regression on Internet Stage of Adoption

Variable	Mean	S.D.	b
Age	41.21	10.37	-.05
Teaching Experience	16.07	10.32	-.11
Computer Use in Class (hours)	4.26	4.38	.04
Computer Use Outside of Class (hours)	5.92	6.04	.00
Computers in Classroom [a]	.77	.42	.10
Computers in Personal Office [a]	.82	.39	.08
Internet Home Access [a]	.62	.49	.09
Computer Anxiety	2.37	.81	-.54
Computer Importance	3.80	.58	-.04
Attitude toward the Internet [b]	4.26	1.40	.16
(Constant)			

Note: N=194, R^2=.56, Standard Error .9500
[a]0=No, 1=Yes
[b]Scale 1-7 with 7 the most positive attitude

Conclusions/Recommendations

Due to non-response error, it should once again be pointed out that these findings must be interpreted with caution, and subsequently the following conclusions and recommendations are limited to the accepting sample only. Based upon the findings of this study, several conclusions can be made:

1. Texas Agri-Science teachers have a favorable or positive attitude toward the Internet.
2. Texas Agri-Science teachers are aware of and beginning to fully adopt the Internet.
3. On-line activities such as on-line FFA contest registration, FFA rosters, FFA award applications, stock-show registration and research questionnaires are highly supported by Texas Agri-Science teachers.
4. Computer importance and Internet stage of adoption are significant predictors of Texas Agri-Science teachers' attitude toward the Internet.
5. Computer anxiety and attitude toward the Internet are significant predictors of Texas Agri-Science teachers' stage of adoption of the Internet.

Based upon the findings of the study, several recommendations can be made:

1. Encourage the FFA and other organizations to implement on-line activities for Texas Agri-Science teachers.
2. Encourage teacher education institutions to emphasize the integration of technology into instructional formats that utilize the Internet.
3. Promote the utilization of email and the Internet among stakeholders in Texas Agri-Science teachers for professional correspondence and dissemination of information such as research questionnaires.
4. Advocate replication of this study among different populations within the education discipline.
5. Encourage study of emerging technologies (Instant Messenger, DSL, etc) and software used by Agri-Science teachers (PowerPoint, Word, etc).

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TEACHERS' PERCEPTIONS OF FACTORS AFFECTING THE INFORMATION TECHNOLOGY WORKFORCE IN MISSISSIPPI

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Abstract

The purpose of this study was to ascertain agriculture and non-agriculture teachers' perceptions of the factors affecting Mississippi's Information Technology Workforce (ITW). A three-round, modified Delphi procedure was used to collect the perceptions of 24 agricultural science and business/biology teachers regarding factors affecting the information technology workforce. Twenty-one teachers completed all three rounds of this study. After an initial set of 45 factors was generated, participants strongly agreed that 11 of the factors are very important factors affecting Mississippi's information technology workforce. Most of the factors dealt with either training or equipment issues. The factors identified by teachers are congruent with findings from the Mississippi Department of Education (2000) and the Mississippi Economic Council (2000). Recommendations include placing more emphasis on information technology concepts into preservice and inservice programs, obtaining and maintaining information technologies comparable to that used in industry, and forging relationships with business and industry to provide on-the-job training opportunities for individuals pursuing information technology careers.

Introduction

Information Technology (IT) is a concept describing all aspects of managing and processing information. Most IT careers now and in the future are based on computer technologies, the Internet, and networks that tie it all together. Information tools, such as personal computers and the Internet, are increasingly critical to economic success and personal advancement. However, a widening technological gap in America currently exists. This significant digital divide separating American information 'haves' and 'have nots' will further segregate America's IT workforce.

The persons with the least likely access to technology, and by default, lesser opportunities for economic well being, are low-income blacks or Hispanics in rural communities. In Mississippi, this is an alarming fact since one in four Mississippians lives at or below the poverty level and is rural-based, and nearly one in three children lives at or below the poverty level (US Census Bureau, 1998). Yet, Mississippi has the research, industry base, and public/private institutions to support information technology clusters (Mississippi Economic Council, 2000). Jackson, Mississippi, the state capital, has been recognized as a telecommunications hub for not only the state, but also the world (Doty, 2000). Because these building blocks are present, Mississippi can enhance the productivity of traditional industries and move towards a competitive advantage within the region (Mississippi Economic Council, 2000). Such gains would be more attractive at the national level and could entice information technology businesses to locate in Mississippi, especially in rural areas.

If Mississippi is to develop a competitive advantage in relation to IT, public school systems must educate and train students about information technologies. The Governor's Task Force for Classroom Technology (Office of the Governor, 2001) established as its goal to have an Internet-accessible computer in every public classroom by the end of 2002. By achieving this goal, the educational experiences of Mississippi students will be enhanced and the digital divide in Mississippi will be bridged.

Note: This paper is based upon work supported by the National Science Foundation Information Technology Workforce Project *Changing Perceptions: Agriculture, Education, and Information Technology in Mississippi*.

Conceptual Framework

Mississippi faces a number of challenges to become savvy in information technologies. Public school systems are not producing IT-ready students for the workforce. Students also cannot receive IT training at community colleges because the proper resources are not available. Currently, inefficiencies exist in the labor market, resulting in an unsatisfactory demand and students not being linked to potential information technology job opportunities. Even if individuals were to become employed in IT jobs in Mississippi, the salaries they would receive would be considerably lower than IT jobs in other regions (Mississippi Economic Council, 2000).

Being a rural state, few IT businesses exist within Mississippi's rural communities. As educational institutions train students for IT careers, few, if any, opportunities exist to have adequate on-the- job training. Thus, proper training programs cannot be developed to prepare individuals for IT careers. Likewise, inadequate salaries and a poorer quality of life make it difficult to attract quality instructors to these rural areas to train prospective and current workers for information technology careers (Mississippi Economic Council, 2000).

Certain needs must be addressed if educational institutions are to prepare a literate information technology workforce. The most critical needs are in the areas of software/hardware acquisition, training, and facility upgrades (Mississippi Department of Education, 2000; Kotrlik, Redmann, Harrison, & Handley, 2000). Training is a big concern when it comes to preparing individuals for information technology careers. Without properly trained individuals, the technological infrastructure is of little value (Mississippi Department of Education, 2000). Mississippi must commit to providing relevant and up-to-date training at all levels if the IT workforce is to succeed.

Teacher training and continuing education need to be provided to teachers for them to know how to operate and integrate appropriate information technologies into the curriculum (Kosakowski, 1998). The U.S. Congress's Office of Technology Assessment reported that only 64% of teachers had received any type of training in distance learning technologies (Mississippi Department of Education, 2000). Furthermore, 75% of teachers who were interviewed indicated the greatest service need was for initial and advanced training in information technologies.

How adequate are Mississippi's classrooms and teachers in preparing future workers for information technology careers? While over 80% of Mississippi's public school classrooms have a TV/VCR, less than 10% of public school classrooms are wired for data. Also, less than 10% of the classrooms have access to a multimedia distribution center and 15% only had ways for parents to communicate electronically with the school (Mississippi Department of Education, 2000). Teachers felt completely comfortable using TVs and VCRs in the classroom but were less comfortable using CD-ROMs, satellite learning, telecommunications, and integrated learning systems as a means of classroom instruction.

The Office of Technology Policy (OTP, 1999) found other factors affecting the supply and quality of IT workers. These included a poor image of the IT profession, lack of career information and encouragement for students, a need for increased competency in math and science, challenges in the IT teaching infrastructure, and a failure to attract underrepresented groups to the IT profession. The OTP report encouraged educators to provide K-12 students, especially middle school

students, with information on science and technology careers, their rewards, and what education and training are necessary to pursue them (Meares & Sargent, 1999). At the heart of this encouragement should be a basic understanding of IT and its connection to using computers in the workplace. Mississippi's Agricultural and Environmental Science and Technology (AEST) programs—a computer skills and IT based curricula—are fostering students' IT career path decisions as it relates to using information and computer technologies for today's food and fiber production. At the core of this issue is determining the IT perspectives from many groups charged with the education of Mississippi's youth.

Future IT users must be computer literate. IT users must be able to interpret information that technology makes available, understand IT concepts, and be lifelong learners of IT, which is much more than earning a degree in computer science. Researchers must understand that the United States and the world will always have more IT users than workers; it is time to determine the factors associated with IT use, to better understand how to influence the factors affecting the IT Workforce.

If the United States is to remain competitive in the world marketplace, the foundation of information technology knowledge and skills is a necessity of the U.S. is to have a well-trained workforce (Kotrlik, et. al., 2000). For Mississippi to focus on information technology careers and move towards a competitive advantage, potential factors affecting the future IT workforce need to be identified and addressed. What are the factors associated with the decision to enter an IT career path? Who influences this decision? What do agriculture and non-agriculture teachers think are the factors affecting Mississippi's Information Technology Workforce?

Purpose and Objectives

The purpose of this study was to ascertain agriculture and non-agriculture teachers' perceptions of the factors affecting Mississippi's Information Technology Workforce (ITW). The objectives guiding this study were:

1. Identify factors affecting Mississippi's ITW.
2. Rate the importance of each factor in addressing Mississippi's ITW.
3. Rate the level of agreement for each factor in addressing Mississippi's ITW.

Procedures

The population for the study consisted of 24 secondary Agricultural Science and Business/Biology teachers attending the initial research workshop for the National Science Foundation project "Changing Perceptions: Agriculture, Education and Information Technology in Mississippi." The population included 13 Agricultural science teachers and 11 Business/Biology teachers, with a gender ratio of 15 males and 9 females who represented all geographical areas in the state. Teaching experience ranged from 1 to over 25 years.

A modified Delphi procedure was selected for this study because it is a tool that is useful in generating a consensus about a current problem, while anticipating future problems and related needs (King, 2000). The Delphi procedure develops consensus in a series of rounds. The initial stage solicits open-ended comments from the panel of experts, which are returned anonymously then reformatted by the researchers into opinion statements placed on an instrument and returned to the panel for round two. Round two responses are synthesized and refined into the instrument to be used in additional rounds to reach consensus (Lang, 1998). The technique can be used to reach consensus, formally or informally, with large and small groups and avoids the conflicts that may develop in face-to-face confrontations (Cline, 2000)

The first Delphi round was conducted as a pre-workshop item before any topics related to Information Technology were discussed, thus preventing researchers' biases in the population's responses. The participants were asked to list the three most important factors facing Mississippians in relation to the Information Technology Workforce. Researchers reviewed the responses, excluded duplicate responses, and generated 45 statements for rating purposes in the second round. The second round of the modified Delphi was

conducted as a post-workshop activity, along with the workshop evaluation. Participants rated the 45 statements as (1) Not Important, (2) Somewhat Important, (3) Important or (4) Very Important in addressing Mississippi's Information Technology Workforce Issues.

In conducting the third Delphi round, a total of 18 statements were considered for the final instrument since they were rated as very important ($\underline{M}$ = 3.50-4.0) in round two. In reviewing these statements, some statements were combined because participants rated statements with very similar content equally important. Therefore, the third round of the Delphi consisted of 16 factors from round two to which the respondents indicated their level of agreement from (1) Strongly Disagree, (2) Disagree, (3) Agree and (4) Strongly Agree. The participants were sent an email message with the Internet location of the round three Delphi instrument and asked to respond online within 24 hours. (Three participants did not have email address, but did have Internet access and were faxed the information and were asked to respond online.) Respondents were asked to email the researcher that they had completed the instrument so non-respondents could be followed-up with an additional email messages. The final Delphi round had 21 respondents for an 87.5% response rate (two teachers transferred between programs and one teacher retired between the second and third rounds of the Delphi).

Findings

As a pre-workshop activity, the 24 Mississippi Agricultural Science and Business/Biology teachers identified what they perceived to be the top three factors affecting Mississippi's Information Technology Workforce. It was important for teachers to identify and record their perceptions of these factors prior to learning additional definitions of information technology careers and the researcher team's perceived beliefs of information technology. As a group, the teachers identified over 60 factors, which resulted in a finalized list of 45 factors once duplicate items were deleted. The research team recorded teachers' perceived factors verbatim and prepared the list of factors for individual ratings of the importance each factor held in addressing Mississippi's ITW.

Near the completion of the initial Mississippi ITW research workshop, each teacher was allowed as much time as needed to rate the level of importance (1=Not Important, 2=Somewhat Important, 3=Important or 4=Very Important) for each of the 45 factors identified from the first Delphi round. Item means of Agricultural Science and Business/Biology teachers' perceived level of importance for each of the factors affecting Mississippi's information technology workforce are presented in Table 1, ranked in order of importance.

Teachers participating in the first and second rounds of this Delphi study identified and rated 18 of the items affecting Mississippi's Information Technology Workforce with a mean score of 3.5 or higher. Of these 18 items, educating the future workforce to be resourceful in the use of technology received the highest rating ($\underline{M}$ = 3.92) while two items, communication with industry about their ITW needs and training opportunities for all students in all schools ($\underline{M}$ = 3.50), were the lowest rated items of these 18 statements. Ten of the 18 items were training related while 4 items were related to equipment. The remaining four items that were rated with a mean score of 3.50 or higher were concerned student perceptions of technology; the state's ability to attract technology businesses; cooperation among students, parents, and schools; and communication with industry about their needs.

Table 1. Agricultural science and business/biology teachers' perceived level of importance of the factors affecting Mississippi's Information Technology Workforce

Information Technology Workforce Factors	Total N=24 M	Agri. N=13 M	Bus./Bio N=11 M
Educating future workforce to be resourceful in the use of technology.	3.92	3.92	3.91
Keeping information and equipment updated.	3.83	3.85	3.82
Availability/access to computers in schools—for student use—one (computer) per classroom is not enough.	3.79	3.77	3.82
Access to computers, Internet in schools for student use.	3.75	3.69	3.82
Teacher training in technology.	3.70	3.92	3.45
Ability to adopt/adapt technology with academic courses.	3.67	3.62	3.73
Educating current workforce so people can adapt to changes occurring in their jobs.	3.67	3.77	3.55
Keeping teaching strategies and information compatible with industry.	3.67	3.85	3.45
How students view technology—what it is—how it will help them?	3.67	3.54	3.82
Students' ability to comprehend what they have read.	3.63	3.77	3.45
Availability of effective computer classes in schools.	3.63	3.46	3.82
Time needed for gaining information technology knowledge.	3.63	3.85	3.36
Lack of technology training so people can be productive in the workforce.	3.57	3.62	3.50
Attracting technology business to locate in Mississippi.	3.55	3.75	3.30
Technology (how to use technology) in the workplace.	3.54	3.46	3.64
Involvement with students, parents and schools-working together.	3.52	3.67	3.36
Communication with industry about their needs (ITW).	3.50	3.38	3.64

Scale: 1 = Not Important, 2 = Somewhat Important, 3 = Important, 4 = Very Important

(table continues)

Table 1. (continued)

Information Technology Workforce Factors	Total N=24 M	Agri. N=13 M	Bus./Bio. N=11 M
Training opportunities for all students in all schools.	3.50	3.62	3.36
Lack of computers or new technologies.	3.46	3.62	3.27
All industries, including agriculture, require people to interact with high tech, and many Mississippians do not receive any training that allows them to compete in the local workforce.	3.42	3.38	3.45
Computer literacy.	3.42	3.54	3.27
Funding in some parts of the state have delayed getting computers in classes for students.	3.42	3.38	3.45
Involvement with parents.	3.42	3.54	3.27
Money to upgrade existing technology labs.	3.42	3.38	3.45
Training students for new jobs.	3.42	3.46	3.36
We (students) are not able to apply what they have learned.	3.38	3.46	3.27
Interest in new subject matter (ITW).	3.35	3.38	3.30
Preparing people for new ideas.	3.33	3.23	3.45
Various computer programs.	3.33	3.38	3.27
Work habits.	3.33	3.62	3.00
Learning more about what students are being taught.	3.29	3.38	3.18
Responsibility for workforce technology training.	3.25	3.31	3.18
Changing attitudes of older Mississippians toward new technologies.	3.17	3.23	3.09
Computers used in the home.	3.13	3.15	3.09
Many technology areas require specific training and knowledge.	3.13	3.23	3.00

Scale: 1 = Not Important, 2 = Somewhat Important, 3 = Important, 4 = Very Important

(table continues)

Table 1. (continued)

Information Technology Workforce Factors	Total N=24 M	Agri. N=13 M	Bus./Bio N=11 M
Need for more instructors.	3.08	3.08	3.09
Motivation to learn/absorb subject matter in ITW.	3.00	3.15	2.82
Overcoming negative attitudes-"I can't," "They just mess up all the time," etc.	3.00	3.15	2.82
Curriculum not developed to teach technology-based courses.	2.96	3.00	2.91
Most people count on television as their only source of information.	2.88	2.92	2.82
Fear of change.	2.83	2.77	2.91
Computer use by Mississippi adults is behind their children.	2.82	2.82	2.82
All schools are not participating (in ITW).	2.79	2.46	3.18
Myth: technology is a complicated area that requires expansive knowledge and study.	2.54	2.31	2.82

Scale: 1 = Not Important, 2 = Somewhat Important, 3 = Important, 4 = Very Important.

For Round 3, the research team included those factors receiving a rating of 3.50 or higher from round two. Although 18 items had mean scores of 3.50 or higher, two pairs of items were combined because of their likeness. This yielded a round three instrument with 16 items. All 24 teachers were asked to rate their level of agreement for each of the 16 items through an online interactive survey form. Item means for Agricultural Science and Business/Biology teachers' level of agreement for each of the factors affecting Mississippi's information technology workforce are reported in Table 2.

In the third and final round of this modified Delphi study, 21 Agricultural Science and Business/Biology teachers strongly agreed with 11 of the 16 factors affecting Mississippi's Information Technology Workforce. Training opportunities for all students, educating the current and future workforce about technological changes and computer access issues were rated as the factors most affecting Mississippi's current and future information technology workforce. Teachers participating in this round of the Delphi were not as strong in their agreement with the factors of availability of effective computer classes in schools or the lack of technology training so people can be productive in the workforce.

Table 2. Agricultural science and business/biology teachers' agreement levels on factors affecting Mississippi's information technology workforce

Information Technology Workforce Factors	Total N=21 M	Agri. N=10 M	Bus./Bio. N=11 M
Training opportunities for all students in all schools.	3.90	3.90	3.91
Educating current workforce so people can adapt to changes occurring in their jobs.	3.76	3.70	3.82
Educating future workforce to be resourceful in the use of technology.	3.71	3.80	3.64
Access to computers/Internet in schools for student use.	3.71	3.80	3.64
Keeping teaching strategies and information compatible with industry.	3.71	3.80	3.64
Teacher training in technology.	3.67	3.60	3.73
How students view technology—what it is—how it will help them?	3.67	3.50	3.82
Involvement with students, parents and schools-working together.	3.67	3.60	3.73
Attracting technology businesses to locate in Mississippi.	3.62	3.40	3.82
Keeping information and equipment updated.	3.52	3.50	3.55
Ability to adopt/adapt technology with academic courses.	3.52	3.50	3.55
Students' ability to comprehend what they have read.	3.48	3.20	3.73
Time needed for gaining information technology knowledge.	3.48	3.50	3.45
Communication with industry about their needs (ITW).	3.43	3.40	3.45
Lack of technology training so people can be productive in the workforce.	3.38	3.40	3.36
Availability of effective computer classes in schools.	2.95	3.22	2.73

Scale: 1.0 - 1.50 = Strongly Disagree, 1.51 - 2.50 = Disagree, 2.51 - 3.50 = Agree, 3.51 - 4.0 = Strongly Agree.

Conclusions and recommendations

Agricultural science and business/biology teachers participating in this study believe that there are important factors affecting the ITW workforce in Mississippi. The majority of these factors are training related. Both teacher and student training appeared to be important factors affecting Mississippi's Information Technology Workforce. Teachers responding to this study also believe that important factors relating to having access to current equipment/technology contribute to Mississippi's Information Technology Workforce. These conclusions support statements made by the Mississippi Department of Education (2000) and Kotrlik, et. al (2000) regarding the need for on-going training for individuals seeking careers in the IT workforce. Congruent with a 2000 report by 21st Century Workforce Commission that the lack of IT businesses provides little opportunity for on-the-job training, it can also be concluded from the findings in the present study that the state's inability to attract businesses with IT careers has had negative effects on individuals IT training.

It is recommended that Mississippi educational public and private institutions place more importance on information technology in preservice and inservice teacher preparation programs. It is also suggested that Mississippi educators, from Kindergarten through the university level, look for more opportunities to infuse information technology subject matter and use into their instruction. Plans need to be made by educational institutions for obtaining and maintaining information technology comparable to that used in industry. This technology needs to be made available in sufficient quantities to insure availability to all students. Educational institutions need to forge relationships with IT businesses to establish on-the-job training opportunities for their students and graduates.

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A CASE STUDY OF STAKEHOLDER NEEDS FOR EXTENSION EDUCATION

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Abstract

The 1998 Farm Bill mandated collecting stakeholder input for land-grant universities. This study collected stakeholder input into forestry programming priorities at a major land-grant university using qualitative case study methods. It was found that communication barriers existed between the faculty and their stakeholders. Stakeholders were not getting the information they needed to solve their daily problems. Cooperative Extension Service agents generally lacked appropriate content knowledge in forestry to serve stakeholders. It was recommended that the forestry department simplify documents that were intended for stakeholders as they were written using technical terms. Efforts to communicate with stakeholders should be expanded via the Internet, email, newsletters, demonstration plots, field days, and workshops.

Introduction

The Cooperative Extension Service (CES) has recently undergone a period of expansion within this state. Over the last two years, the state legislature has increased annual base level funding by $1.6 million to place two CES agents in each of the state's counties. The expansion efforts have focused on traditional program areas such as production agriculture, family and consumer sciences, and 4-H youth development.

The failure to recognize areas of need outside traditional program areas has been a core issue in the widening gulf between the land-grant university and its constituency (Dale, 2000). Recently the American public has demanded higher accountability from land-grant universities as evidenced by the 1998 Farm Bill, which mandated that public institutions collect stakeholder input when developing research, education, and extension programs (AREERA, 1998).

According to the 1998 Farm Bill, land-grant universities, experiment stations, and CES must take steps to identify stakeholders for each of the various research and academic areas to assess their needs for information and programs. This study was conducted to gather stakeholder input to fulfill the 1998 Farm Bill mandate for the Forestry Department at a major land-grant university. The researchers gathered data to assist the department in understanding its constituents' needs for information and programs and to increase communication between the research faculty and stakeholders. The Forestry Department was chosen because timber resources and wood products were the third largest agricultural commodity in the state and the most important agricultural product in the tri-county region of the state where the data were collected.

Sample selection for participation in this study was based on legitimate stakeholders who had sufficient program knowledge to contribute to the process in meaningful ways, and whose self-defined stake in forestry programs and research was high (Greene, 1988). Stakeholders were divided into three categories: beneficiaries, agents, and underrepresented citizens. Beneficiaries were those people who benefited from university programs, agents were those people involved in research and planning or delivery of programs, and the underrepresented citizens were those who were inadequately served by the university (Guba & Lincoln, 1989).

Purpose and Objectives

The purpose of the case study was to identify and gather input from Forestry Department stakeholders for setting research and

educational programming priorities. The specific objectives of the study were to:

1. Identify stakeholders of the Forestry Department.
2. Describe stakeholders' forestry related problems and challenges.
3. Describe stakeholders' educational needs.
4. Identify sources of information used by stakeholders.
5. Determine stakeholders' level of interaction with the Cooperative Extension Service.
6. Collect stakeholder recommendations on how the land-grant university could better serve them.

Methods and Procedures

The study utilized qualitative case study techniques (Merriam, 1998; Stake, 2000; Yin, 1984) to collect, analyze, and interpret the data. One of the most important uses of the case study is to "*explain* the casual links in real-life interventions that are too complex for the survey or experimental strategies" (Yin, 1984, p. 25, emphasis in original). When using the case study approach, researchers collect extensive data on individuals and programs under investigation. The data included observations, face-to-face interviews with 65 stakeholders, and document analysis. The researchers also spent an extended period on-site and interacted with the stakeholders at various meetings and within their places of business.

Data were collected from January to June 2000 from 65 citizens engaged in forestry-related activities, artifacts, and participant observation (Patton, 1990). The interviews were audio taped and transcribed for verbatim accuracy. All interviews adhered to a flexible interview schedule that was developed in conjunction with the purpose and objectives of the study. The researchers engaged participants in probing questions, which evolved during the interview process to explore their claims.

Stakeholder identification was accomplished utilizing the snowball technique; that is, stakeholders were asked to identify additional peers when interviewed by the researchers (Babbie, 1989). The initial list of stakeholders was identified by the Forestry Department faculty and by the researchers when attending a forest utilization conference in April 2000. Data were collected until no new themes emerged from the interviews based on negative case analysis (Guba & Lincoln, 1989). The data were analyzed and reported using procedures recommended by Creswell (1998):

1. Organization of data. Facts about the case were arranged in a logical order.
2. Categorization of data. Categories were identified and the data were clustered into meaningful groups (coded).
3. Interpretation of codes. Specific statements that fell into like clusters (codes) were examined for specific meanings in relationship to the purpose and objectives of the study.
4. Identification of patterns. The data and their interpretations were scrutinized for underlying themes and patterns that characterized the case and allowed the researchers to draw conclusions.
5. Synthesis. An overall portrait of the case was constructed where conclusions and recommendations were drawn based on the data presented. Because of their focus on a particular situation, case studies may not be generalized beyond the specific research parameters of the study (Yin, 1984).

Findings

Sixty-five stakeholders were identified for the study. They were interviewed and classified as an agent, beneficiary, or underrepresented citizen (Table 1). Agents were those persons who worked for the university. Beneficiaries were those persons who received benefit from the land-grant university, and underrepresented citizens where those who did not receive any benefit from the land-grant university, either by choice or by chance that the university was unable to assist them. Stakeholders were classified by self-reported connection to the university.

Table 1. Stakeholder Connection to the Forest Industry and Classification

Connection to the Forest Industry	Stakeholder Classification	n
Non-industrial private forest landowner (NIPF)	Beneficiary, Underrepresented	15
State forester	Beneficiary	15
Forest industry (small)	Beneficiary, Underrepresented	7
Natural Resource Conservation Service	Beneficiary	5
Private consultant	Beneficiary	5
United States Forest Service	Beneficiary	4
Forest industry (large)	Beneficiary	4
University employee	Agent, Beneficiary	3
Private land manager	Beneficiary	3
Private organization	Beneficiary	2
Urban forester	Beneficiary	1
Journalist	Beneficiary	1
Total		65

This study sought to collect stakeholder input regarding problems they encountered in their forestry-related occupations, their need for research-based information, how they obtained information, to what extent they interacted with the CES, and their recommendations for improving services offered by the Forestry Department. Stakeholders stated their perceptions on several aspects of their relationship to the land-grant university during these interviews.

Problems

Stakeholders identified seven categories of problems encountered within their forestry-related occupations. Their problems centered on timber management, business and marketing of timber products, receiving adequate information, environmental and wildlife issues, government and legal issues, wood products and processing, and non-industrial private forest landowner (NIPF) issues.

Timber management. Forty-one stakeholders (63%) stated that they needed more information on best management practices, control of pests and invasive species, fertilization, GIS/GPS mapping, and use of fire to control invasive species.

Business and marketing of timber products. Thirty stakeholders (46%) requested information on computer simulated economic models that would demonstrate the outcome for various management practices and a means for expanding markets for wood products. Several stakeholders suggested that simulation models could meet the need for better management decisions. Economic models could also assist landowners in understanding options for land use, for example, the trade offs of beef versus timber production.

Educational opportunities and dissemination of information. Twenty-six stakeholders (40%) identified the lack in this area. Information such as stand yield tables and specific management practices for the state was not available or difficult to obtain.

Environmental regulations, conservation issues, and wildlife management. Twenty-two stakeholders (34%) reported that hunting leases, wildlife conservation, vehicle use on forestland, upland erosion, riparian impacts on water quality, drought, or land-use conflicts were problem areas and that they needed more education and information on how to deal with these issues.

Government and legal issues. Nineteen stakeholders (29%) reported that government regulations, policies, and laws concerning timber production were arbitrary or capriciously applied. However, the stakeholders also reported that many of the problems they faced could be

avoided if they better understood the regulations so they could implement strategies for compliance.

Wood products and processing. Thirteen stakeholders (20%) encountered problems with managing hardwoods, creating value-added products, and capturing more value for wood products and by-products.

Non-industrial private forest landowners. Eleven stakeholders (17%) cited problems concerning the maltreatment of NIPFs by the forest industry and the abuse of landowner rights. A few small landowners reported that timber harvesters ignored contracts and left harvested lands in disrepair.

Information Needs

As stakeholders discussed the problems and challenges they faced in producing wood and wood products, they were asked about their information needs by the researchers. Forty-two stakeholders (65%) reported that they needed more information and continuing education on forestry-related topics similar to their problem areas (timber management, business and marketing, current research, and wildlife; specifically declining quail populations and fire ant control).

Timber management education was of primary importance to this group and included several subcategories. Stakeholders wanted more information on the use of fire in forest management and appropriate silvicultural practices for various sizes of operations. Stakeholders also cited a need for more information on management for recreation, risk management (trespass and theft issues), and safety issues.

Stakeholders cited a need for business and economic education including marketing wood and wood products. They suggested that faculty develop an economic model that could predict returns from various types of forest management scenarios. Small landowners requested assistance with developing legal documents to protect themselves from abuse by loggers and developers.

Several stakeholders expressed interest in knowing more about the Forestry Department and results of research conducted by the faculty. They requested more communication from university faculty regarding research results that were written for the forestry practitioner. Several participants reported that the Forestry Fact Sheets currently available from the university were under-utilized because they were too technical.

Sources of Information

The most frequently used source of forestry-related information was other people in informal settings such as coffee shop gatherings with other forestry professionals. Table 2 describes the number of stakeholders who reported sources of information and which stakeholder category the respondent belonged to.

Stakeholders identified 22 sources of forestry-related information. Sources of information involving contact with other people constituted 70% of the responses. Other sources of information were forestry-related magazines, journals, and newsletters. Government land managers, specifically USFS employees, primarily used fact sheets; however, NIPF or people in small forest-based businesses did not use university produced fact sheets.

Of the 52 stakeholders who responded to questions on use of CES, 19 (36%) indicated that they used the CES very little, did not use their services at all, or confused them with other agencies like the Department of Forestry. Thirty-three stakeholders (63%) stated that the CES in their area did not focus on the forest industry and expressed the desire for the local CES agent to receive continuing education in various forestry-related topics.

Table 2. Sources of Information Used by Stakeholders

Source of information	n	Number of respondent and connection to the forest industry
Other people	20	NIPF 7, State forester 4, Forest industry 3, Private organizations 2, NRCS 1, University employee 1, USFS 1, Private consultants 1.
Magazines	18	State forester 5, NIPF 5, Forest industry 4, Private consultant 3, NRCS 1.
Journals	16	State forester 7, NIPF 4, Private consultant 3, USFS 1, University employee 1, Private organization 1.
Cooperative Extension	14	State forester 5, NIPF 4, Forest industry 4, Private consultant 1.
Newsletters	12	NIPF 5, State forester 4, USFS 1, state forest association 1, private consultant 1, forest industry.
Forestry professionals	11	NIPF 5, Forest industry 4, Private land manager 1, Private consultant 1.
Conferences	11	NIPF 3, Forest industry 3, State foresters 2, Urban forester 1, USFS 1, University employee 1
Associations	8	NIPF 2, State foresters 2, Private consultants 2, Private land manager 2.
Printed media	8	State forester 3, Private forester 1, Forest industry 1, NIPF 1, Urban forester 1, Journalist 1.
Government documents	7	State forester 3, Private land manager 2, NRCS 1, USFS 1.
Consultants	6	NIPF 2, Forest industry 1, Private land manager 1, State forester 1, NRCS 1.
Internet	6	State forester 2, NIPF 2, Private consultant 2, Forest industry 1.
Self	5	NIPF 2, Forest industry 2, Private consultant 1.
Fact sheets	4	State forester 3, NIPF 1.
University Researcher	3	NIPF 1, Private consultant 1, Forest industry 1.
University Courses	2	Forest industry 1, USFS 1.
Cooperatives	1	State forester 1
General	1	State forester 1
Industry representatives	1	Private consultant 1.
Newspapers	1	Forest industry 1.
Other colleges	1	State forester 1.
TV/Radio	1	Private organization 1.

NIPF=Nonindustrial private forest landowner.
USFS= United States Forest Service

Stakeholder Recommendations

The researchers collected recommendations on how the Forestry Department could better serve the needs of its stakeholders. The 79 recommendations fell into four broad categories including 42 recommendations for disseminating research results and other information more effectively, 23 recommendations for reaching target audiences, 10 recommendations for improving CES services, and 4 recommendations calling for greater cooperation between the university and other organizations that serve the forestry industry.

Fifty-three percent of the recommendations were suggestions on how the Forestry Department could promote and disseminate information to its stakeholders. The stakeholders specifically commented on creating publications for lay-audiences as well as using e-mail, listserves, and the Internet to broadcast information. It was recommended that the faculty create media-rich interactive materials such as a CD-ROM that could be used independently of the Internet for those who chose not to learn online. Stakeholders also asked for content specific workshops, demonstration plots, and field days on forestry.

Stakeholders recommended that the CES target school children, small landowners (NIPF), forestry professionals, and the legislature for its research and education programs. Respondents stressed that all citizens needed to know more about natural resource management and the economic importance of forestry as the third largest commodity in the state. It was also pointed out that the CES needed to educate the public, especially children, about natural resource management to counter environmental propaganda that has permeated school textbooks without being certified as research-based knowledge.

Stakeholders recommended several changes in practice for the university, including an increase in staffing and salary for personnel with expertise in forestry management. This state pays its CES agents $10,000/year less than the national average wage for similar positions. Several recommendations called for the CES to focus more on face-to-face interactions with constituents and to increase awareness of rural issues among urban people.

Conclusions and Recommendations

This study sought to collect stakeholder input into university research and programming priorities as mandated by the 1998 Farm Bill (AREERA, 1998). Even though the CES is undergoing a period of expansion, findings indicated that the majority of forestry stakeholders were underserved and were not enjoying the bounty of knowledge generated at the university. It is recommended that CES agents be adequately prepared with forestry content knowledge and skills before placement in the tri-county forest region of the state. This will facilitate the exchange of research-based information and stakeholder input between research faculty and stakeholders. If the CES cannot immediately place a qualified agent in the forested region of the state, then the current agent should receive in-service training to upgrade his skills to better serve forestry stakeholders.

The majority of stakeholders had not received adequate information from the land-grant university for the state. It was found that barriers existed between research faculty and citizens in both oral and written communications. The lay audience reported that written information was too technical and not usable for improving timber production. It is recommended that the university invest in appropriate communication avenues to reach their intended audience. It was also discovered that stakeholders were not using the CES Fact Sheets because they were too technical. Fact Sheets are documents that are intended for lay audiences. It is recommended that agricultural communications professionals conduct a content analysis on the fact sheets and rewrite them so that they are more comprehensible for the intended audience.

University faculty were located 250 miles from the forest region; thus, stakeholders did not have ready access to them. The university employs one extension specialist in forestry. It is recommended that the Forestry Department make institutional changes to address the extension personnel shortage to better serve stakeholders.

CES clients strongly favored face-to-face interaction with agents (van den Ban & Hawkins, 1996). International extension services, counterparts of CES, devote the greatest proportion of staff time to developing personal relationships with clients. Face-to-face consultations allow CES agents to integrate research-based findings with solving clients' problems. Stakeholders of this study were interested in being served through face-to-face channels as well. The following quote typifies respondents' desires for more contact with CES agents: "an extension forestry specialist is needed in [our part of the state], we are 250 miles from campus, telephones and e-mails are great but just not enough". Given the level of interest in traditional extension approaches, the CES should expand its forestry programming to include workshops, demonstration plots, and field days to communicate research findings and information to non-academic audiences.

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ASSESSMENT OF AN ASYNCHRONOUS LEADERSHIP LEARNING ACTIVITY FROM THE PERSPECTIVE OF STUDENTS

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Abstract

The purpose of this study was to determine characteristics of an asynchronously delivered activity that could guide future development efforts to create learning activities that meet the needs of students. Technology continues to provide tools for developing new ideas, pushing the boundaries of techniques, and allowing one to create new and inventive methods of helping students learn. With change as a constant, it is imperative that we remember that underneath the technology, fundamental concepts, such as instructional design and understanding the learner, have not changed. Development of quality instructional materials requires purposeful time, effort, and expense. Thus, as individuals use technology to create instructional materials it is important that they address the question of whether or not development efforts are creating materials needed by the population being served. Demand for particular courses, specifically "Professional Leadership Development," repeatedly surpasses the capacity within the Department of Agricultural Education at Texas A&M University to teach these courses.

The researchers believe that alternative methods of delivering leadership education to meet demand is accompanied by the responsibility to assess student interest in these methods and consideration of preferred instructional design strategies. In a prior study conducted by the researchers, students enrolled in "Professional Leadership Development" indicated a preference for audio and graphics in the presentation of materials (Boyd & Murphrey, 2001). In response to these findings, an activity was designed and developed to address one unit, "Ethics and Leadership Styles," within the course. Based on student reaction to the activity, the researchers have identified elements to guide future development and creation efforts.

Introduction and Theoretical Framework

Leadership skills are an important aspect of student development and thus institutions of higher education strive to meet this need by developing courses to assist students in acquiring these skills. Green (1992) found that while some learn leadership in unplanned ways, it is not always possible for all students to have the opportunity to learn. Demand for particular courses, specifically "Professional Leadership Development," repeatedly surpasses the capacity within some departments to teach these courses.

Technology is creating alternative methods for delivering leadership education to meet demand by generating opportunities for educators to design computer-based activities.

"While the challenges are significant, harnessing multimedia is increasingly seen as essential for training departments of the 21st century" (Barron, 1999). The exploration of how technology can be used to teach specific subjects for specific learners is a constant process. As computers and the Internet become increasingly available, the promise of educational benefit by using computers to

teach also accelerates (Hokanson & Hooper, 2000). Thus, it is important to seek understanding of the mechanisms that will allow the promise of educational benefit to be realized. As cost-effective technologies facilitate the development of educational activities (Tian, 2001), instructors look for effective ways to utilize these technologies.

Technology can be used in different ways to address different educational goals (Niederhauser & Stoddart, 2001). Designing effective learning activities requires careful consideration of the learner and the subject matter. "Instructional designers need a dynamic view of how documents and tools are modified, reinterpreted, and used to create and understand systems in the world" (Bloom & Loftin, 1998, p. 10). Excellent instructional design provides an environment that feels natural and comfortable to its users, excites and challenges its users, is functional and fulfills its purpose (Troupin, 2000). "One of the most powerful uses of multimedia is to immerse the user in a learning environment" (Boyle, 1997, p. 35). Choices in instructional methods are needed to maintain motivation and attention and to address different learning styles (Miller, 1997). Alessi & Trollip (1991) provide five major types of computer-based instruction programs: tutorials, drills, simulations, instructional games, and tests.

Simulations have been found to be an effective teaching tool. Simulations often enhance motivation, encourage transfer of learning, and are efficient in regard to the length of time required by the student (Alessi & Trollip, 1991). Situational simulations deal with attitudes and behaviors in various situations and allow the student to learn by actually performing activities in a context similar to real life. A study of engineering students using a computer simulation in conjunction with classroom instruction indicated that a substantial gain in the retention of the subject matter was obtained compared to students using only conventional teaching methods (Firth, 1972). Simulations provide educators direct opportunities to include Gagne's nine levels of learning into instruction (Gagne, 1985) and allow the learner to explore a topic and receive feedback without public humiliation. "Computer simulation affords teachers and instructional designers a powerful tool for sustaining knowledge retention and transfer" (Bill, 1997, p. 5) by encouraging exploration and case-based learning while relating the abstract to the concrete. In fact, teaching effectiveness can be improved through the use of technology (Seal & Przasnyski, 2001).

However, Born and Miller noted that faculty are concerned about the quality of web-based degrees (1999). The units of instruction utilized for courses to satisfy these degrees require close monitoring to ensure quality. Studying instructional methods used to facilitate learning in distance education is a plausible line of inquiry (Lockee, Burton, & Cross, 1999). While it is believed that a simulation is a positive addition to the instructional design used in teaching ethics and leadership styles, Boyle indicates the need to "fully evaluate their strengths and limitations" (p. 43).

Design is a process that takes place before, during, and after the development of educational materials. "The design process proceeds in a cycle of analysis, design, build, and test" (Horton, 2000). One element of testing relates to understanding student perspective. Discovering student reaction to the simulation approach used will provide insight for the researchers and other educators to assist in future development and evaluation initiatives for the class described and for courses in related fields.

Purpose and Research Questions

The purpose of this study was to determine characteristics of an educational activity delivered asynchronously that could guide future development efforts to create learning activities that meet the needs of students. The study sought to describe student reaction to the activity. A separate study, reported elsewhere, evaluated whether or not students learned from the activity and revealed that the activity did enhance learning.

Research questions developed to guide the study focused on three primary areas: reaction to the approach used for the activity (i.e., Did you find any part of the simulation offensive? Did you enjoy the simulation?), presentation issues such as color and fonts (i.e., Are the colors easy for you to read on the screen?), and issues related to use (i.e., Did you incur any difficulty viewing the simulation?).

Methodology

Research Design

A mixed method approach was utilized in the study to provide triangulation and clarification of results. The study consisted of two parts: qualitative analysis and quantitative analysis. Qualitative analysis was utilized to provide a valid glimpse into the reality (Warwick, 1973) of how the students reacted to the activity while quantitative analysis was used to measure student response deductively. The qualitative analysis preceded the quantitative analysis to avoid influencing the researchers.

A data collection instrument containing three sections was developed by the researchers. The qualitative section consisted of seven open-ended essay questions providing an opportunity for the students to express their thoughts. The quantitative section consisted of seven multiple-choice questions. A third section included four questions to allow identification of the respondents. The instrument was assessed for readability and face validity by faculty and graduate students in the Department of Agricultural Education. The instrument was placed on the Internet and students entered their responses directly online. A randomly assigned number was generated by the computer and assigned to each respondent to ensure confidentiality. Personal identification questions were used only to verify that the students received appropriate credit for completing the activity. CD-ROMs containing the activity were distributed to all 120 students enrolled in the course during their assigned labs. How to use the CD-ROM was explained and an instruction sheet detailing the tasks to be completed to receive credit and asking whether or not he/she would be willing to be interviewed was distributed. An informed consent form was also distributed. Eighty-three students self-selected to complete the activity and instrument. Of those students, more than ninety percent of the students commented in the qualitative section of the instrument. An interview protocol was developed and interviews were conducted with students who had provided vague responses. Eleven students were contacted for interview: six students were interviewed and five students failed to respond to persistent correspondence. Member checking was done throughout each interview to clarify information. Triangulation was used to verify the data. The students interviewed were representative of the on and off campus and like and dislike groups in proportion to the overall group. In addition, comments were compared based on responses to specific questions to further clarify themes in the data.

The results from the qualitative questions were compiled and grouped by question. Computer-generated codes were used to identify comments related to each student. The constant-comparative method was employed to evaluate the data (Lincoln & Guba, 1985). Initially, each idea was listed separately without categorization. Colored markers were used to identify themes and to provide visual indication of emerging categories. Once initial categories were established, the second stage of the constant comparative method consisted of a peer debriefing that was conducted in April 2001 with the Distance Education Workgroup within the Department of Agricultural Education. This workgroup included researchers familiar with technology and instructional design and allowed emerging themes to be further interpreted. As the data analysis progressed, the researchers were able to define specific categories based on overlying themes in the data. Each incident was integrated into their properties and then the construction was delimited and written.

The results from the quantitative questions were compiled and analyzed using the Statistical Package for the Social Sciences (SPSS) computer program. Descriptive statistics consisting of counts and percentages were used to describe responses from the sample.

Development of Activity

The learning activity entitled "AGED 340: Project Interaction" was designed based on findings from a previous study that indicated a preference for audio and graphics (Boyd & Murphrey, 2001). Creativity was used to generate a unique approach to the topic covering one unit within the course focused on "Ethics and Leadership Styles." The activity was designed during Fall 1999 and developed the following year. Design of the activity followed recommendations provided in *Computer-based Instruction: Methods and Development* (Alessi & Trollip, 1991). The asynchronous learning activity was designed as a simulation and created with the computer program, Macromedia Flash. The simulation includes the following components: objectives, directions, an opening, the body (presentations and student actions), and conclusions. The activity is comprised of narrated audio clips, sound effects, text, and graphics. Throughout the activity, the learner is presented with an animated clip and then asked to respond to the scenario by answering a question based on what they learned. The learner is then presented with another animated clip that resulted because of his/her response. This process continues for multiple levels. See Figure 1 for screen capture example of the activity. At the conclusion of the activity, the learner is presented with a unique summary based on earlier choices. There are eighteen possible routes within the program. See Figure 2 for a flowchart diagram illustrating a portion of the program. At the end of each route, following the unique summary, students are provided an opportunity to go through the simulation again or to proceed to a self-test quiz. The self-test quiz combines both content and questions to create an interactive learning experience. The purpose of the learning activity was to encourage retention of the primary principles covered in the units. The asynchronous approach was selected to allow students to learn at their own pace; however, the activities could be used in a traditional classroom setting.

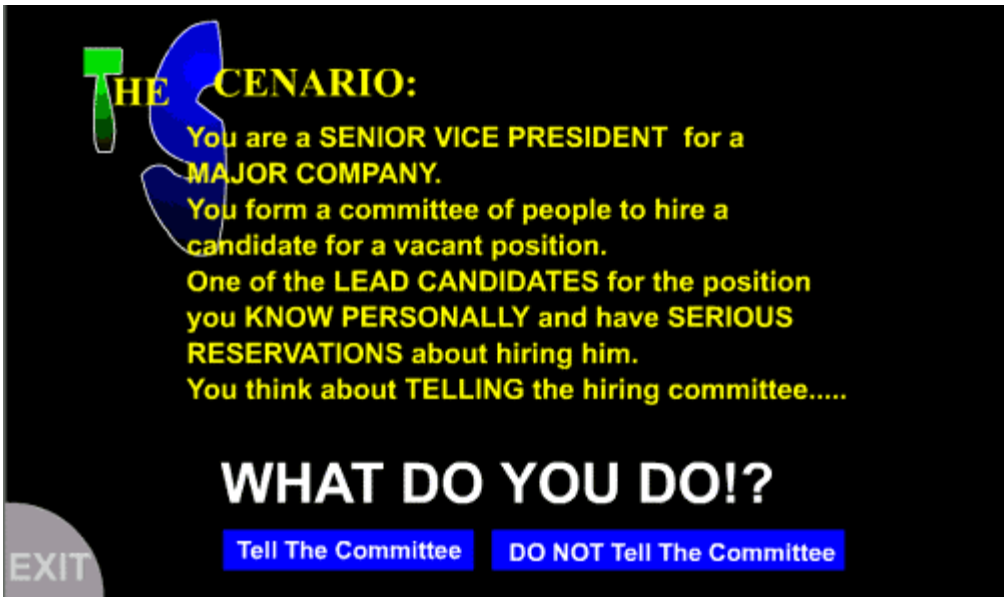

Figure 1. Screen capture of activity entitled "AGED 340: Project Interaction" used in "Professional Leadership Development" course during Spring 2001, Texas A&M University.

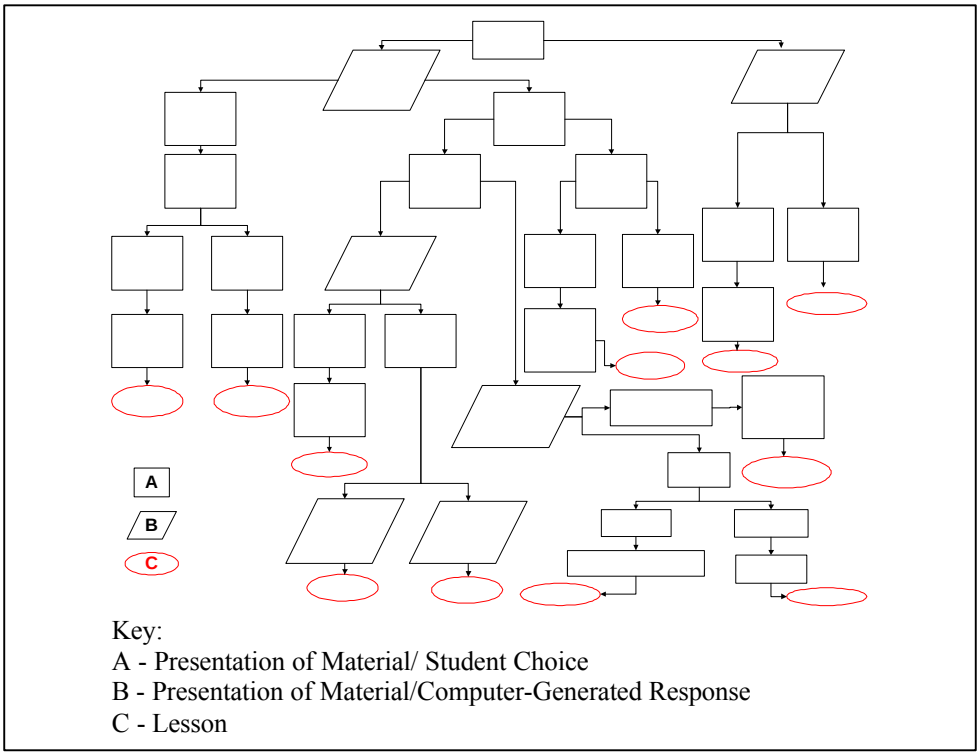

Figure 2. Portion of the flowchart for "AGED 340: Project Interaction" used in "Professional Leadership Development" course during Spring 2001, Texas A&M University.

Findings

Qualitative Findings

Evaluation and synthesis of the responses revealed two discerning and contrasting reactions to the activity. The predominant reaction to the learning activity was positive. Students indicated that "*it helped me understand* " (481), was "*informative*" (574) and that "*it made me laugh and I learned*" (507). Several students noted that they liked the way the activity displayed *ramifications of your choices* (471, 485, 521, 533, 547, 550, 552, 587) noting that it was a *good practice tool* (471, 536, 589). At the other end of the spectrum, some students indicated that the comical approach was *annoying* (505, 537, 554) and that "*it took too long*" (460, 487, 508, 527, 532, 543, 558, 562). Two activities within the program were noted as having *unclear instructions* (499, 500, 523, 546, 552, 557, 560). Eighteen students indicated that there was nothing they disliked about the simulation. Of those students that indicated they did not enjoy the activity, both on and off campus viewing was represented. Within the context of instructional design and development, three categories influencing student reaction to the activity surfaced out of the comments: *Interface, Approach, and Technology-related Issues*.

Interface is the means by which the student interacts with the computer. This involves images, text, and buttons that appear on the computer screen. Several students indicated that the program was *easy to use* (476, 479, 521, 530, 544, 545), *understand* (476, 488, 523) and *follow* (498, 510, 558). However, comments related to interface predominantly focused on the display of text and graphics.

Based on the comments, students preference varied; most students indicated *preference for the bright colors* used in the activity and felt the colors helped them focus on important aspects of the content (475, 488, 499, 515, 519, 529, 541, 564). On the other hand, a few students indicated that the bright colors were hard to read (502, 530, 547). One student stated that the colors "Hurt my eyes" (530) while another stated, "Colors chosen yielded …fast focus on the most important concepts" (574). While there were very few comments regarding specific colors, one student indicated that *greens and purples were hard to read* (543), one student noted that *blue was the easiest color to read* (565), and one student stated, "The *green and red were great* for telling whether or not I had gotten the answer right or wrong" (546).

Only a limited number of students responded regarding the fonts used in the activity and all comments were *positive regarding font size and display*. Students stated that "the different sizes kept the eyes moving, catching all of the [information]" (564, 496) and that the size of the fonts were good (529, 539, 548). One student commented that the font showed the *prioritization* of important words (574).

Approach relates to the creative design of the activity. Reaction to the approach of the activity was varied. Some of the students indicated that the activity was *too long* (488, 507, 532, 535, 587), that it should be to be "more to the point" (475), and that it was "a bit over done" (567) while another student indicated that it "wasn't time consuming" (546). Only one student indicated that portions of the activity could be offensive to others (478). Negative comments related to the approach consisted of: *annoying audio* (476, 505, 513, 523, 537, 554, 558, 582), *poor jokes* (481, 558), *too many bonus questions* (496, 502, 521, 566), and the *animation* (558).

Many of the students indicated that they liked the *humor* (472, 485, 494, 501, 507, 513, 525, 529, 535, 538, 539) and found the activity *helpful* in encouraging

understanding (478, 481, 483, 504, 528, 489). Students expressed that they liked the *ramifications of choices* (471, 485, 521, 533, 547, 550, 552, 587) and seeing the theories learned in class applied (541). One student commented, "I found it to be a great compliment to lecture and it added another style of learning that you cannot get from lecture and reading" (587). Another commented regarding style, "I liked that it talked to me like a person instead of just giving me directions" (502).

The *audio* (i.e., sound effects and voices) was well received by many students (478, 526, 540, 543, 549). Students indicated that the activity "clarified certain topics" (504) through the *examples* presented (480, 498, 508, 541) and they liked the "game show feel" (539, 556). Words to describe the activity included, "fun" (534, 548), "humorous" (539, 568), "entertaining" (538, 553), "interesting" (544, 552, 568), and "neat way to learn" (559, 565).

Technology-related Issues include aspects regarding the actual running of the computer program. Some of the students who indicated that they did not enjoy the activity revealed issues related to the failure of technology. Students indicated the *inability to hear audio* (496, 529, 545) and *slow load time* (479, 519, 541, 544, 562, 568). Several students indicated that the activity "*moved too slow*" (472, 510, 525, 528, 533, 544, 559, 562, 564). Follow-up interviews revealed that this was related to *computer technical issues* and that the statement "moved too slow" referred to the amount of time it took the computer to reveal the next screen. Students who indicated that they had computer speed problems primarily viewed the CD-ROM using their home computer. On-campus students did not indicate problems.

Quantitative Findings

As revealed in Table 1, 98.8% of the students indicated that the approach used in the activity helped them to understand the topic. A lower percentage (86.7%) of the students indicated that they enjoyed the activity. In regard to whether or not the colors and fonts used in the activity were easy to read on the screen, the majority (87.7% and 97.6%, respectively) of the students indicated that they were easy to read. More than half of the students viewed the activity off campus and the majority (85.2%) of the students did not incur difficulty viewing the activity.

Conclusions

While the findings cannot be generalized to the broad population, this study provides timely information for educators considering the development of computer-based activities. Reflection on the findings from both the qualitative and quantitative phases of the study leads one to conclude that there are specific elements of design that should be considered for the audience being studied.

Designers must resist special effects yet use creative and innovative approaches (Reiber, 2000). In general, the students that indicated that they did not enjoy the simulation – did not comment on why. However, those same individuals when asked, "What did you like" – responded with positive statements – this leads one to conclude that while he/she "personally" did not desire to learn using the approach studied – he/she acknowledged the benefit to others. In fact, one student who indicated that he/she did not enjoy the simulation stating to "keep it simple", stated, "It was an effective learning tool" (532) and another student (513) that indicated that the audio was "lame" also indicated that he/she liked the humor.

Table 1. Student Response to a Simulation Activity, Texas A&M University, Spring 2001

Question	*Response*	*n*	*%*
Did the approach used help you to understand the topic? (N = 83)	Yes	52	62.7
	Somewhat	30	36.1
	No	1	1.2
Were the colors used easy for you to read on the screen? (N = 81)	Yes	71	87.7
	Somewhat	7	8.6
	No	3	3.7
Were the fonts used easy for you to read on the screen? (N = 83)	Yes	81	97.6
	Somewhat	1	1.2
	No	1	1.2
Where did you view the simulation? (N = 83)	On Campus	24	28.9
	Off Campus	59	71.1
Did you incur any difficulty viewing the simulation? (N = 81)	Yes	12	14.8
	No	69	85.2
Did you enjoy the simulation? (N = 83)	Yes	72	86.7
	No	11	13.3

Given the finding that the majority of the students (85.2 %) did not incur difficulty viewing the activity, one can conclude that the design of the activity was effective and easy to follow. However, based on comments regarding two activities within the program, it can be concluded that the instructions related to those activities are unclear.

The interface was well received by most students. Color can be used to gain attention, direct focus, or motivate (Reiber, 2000). The finding that color and fonts were well received is not surprising given the fact that the researchers followed instructional design principles in the design and development of the activity. However, one can conclude that students perceived bright colors as a good attribute and that the interface met the needs of the students.

The majority (86.7%) of the students indicated that they enjoyed the simulation. In fact, students noted that they "enjoyed the humor" (529), "liked the sound effects" (526), and found the activity "informative" (574). However, some students noted that "the voices got on my nerves" (505), it was "time-consuming" (527), and it was "too cutsey" (560). These diverse comments lead one to conclude that not all students desired the approach used and thus there is a need to provide students with two distinctly different versions of the same activity. The development resources required to develop the highly animated version of the activity evaluated were much more than would be the development of a streamlined text-based simulation presented in a non-humorous manner. Thus, one can conclude that because of varying style preferences, it would be beneficial to offer different approaches.

Given the fact that several students indicated that the program seemed to move

slowly, one can conclude that when used with a less-than-desirable computer (computers with specifications other than those recommended by the researchers) the activity does not function as well. This finding leads one to conclude that educators should take into consideration the varying degree of computer access. The finding that students who utilized home computers experienced technology failure more frequently than those students accessing the program on-campus leads one to conclude that computers used at home may not be up to the standards required by new educational programs. It can be concluded that researchers should ask the question, "What kind of computer do you have at home?" instead of "Do you have a computer at home?" and when expecting students to access materials online, "What is your connection speed to the Internet?"

Implications and Recommendations

Implications exist for both the activity under evaluation and for others seeking to develop quality instructional materials. In relation to the activity itself, the approach used was found to be effective and useful by many of the students. Thus, the implication exists that similarly designed activities could be created for the population focused on different topics. In relation to the activity itself, the following recommendations are provided:

- Introductions to each question should be edited to provide a more direct path within the activity.
- An option to turn the sound off should be added.
- A distinctive warning should be added to the program explaining the importance of using a computer with certain specifications to avoid delayed load time.
- An activity with the exact content should be designed and developed without animations and audio in a straightforward and serious nature. Text should be revised to reflect this approach.

Implications for others relate to the fact that the approach studied could be used in other settings taking into consideration the elements identified. "Regardless of their effectiveness, graphics (and other visuals) are an integral part of most teaching strategies" (Rieber, 2000, p. 33). The three categories that surfaced (interface, approach, and technology-related issues) signal those areas to which students are most attuned. This study focused on perceptions and "smile sheet" evaluation. Understanding what the students like and dislike will enable educators to design instruction that can achieve one noted benefit of computer-based instruction, which is to engage the student. The fundamental fact that poor teaching is a result of poor planning holds true for activities created with technology. We must continue to revisit design elements to ensure that the instruction created meets the needs of the learners being served. Engagement directly impacts retention and completion of activities. It is important to note that while we often assume that creativity will engage students, based on the findings in this study, this is not always the fact.

As stated by Roger Shank, technology has created the possibility of one-on-one for every learner, the ability to stimulate, and the chance to try stuff out and fail in private (Galagan, 2000). "Clearly, how computers are used is the key to their effective use and exploitation of their vast capabilities" (Hokanson & Hooper, 2000, p.

550). While instructional design and graphic design books provide guidelines for the development of computer-based materials, this study has identified the following key elements that should be considered for individuals interested in utilizing the approach evaluated:

- Interface design issues should address font and color issues and follow guidelines available.
- Multiple design approaches should be made available to satisfy different learning preferences.
- Activities should be designed with an understanding of the computer specifications required to ensure that they match that of student access.

Based on findings reported, it is recommended that additional research be conducted to determine whether or not learning styles influence like or dislike of the activity under evaluation. In addition, based on the different responses received in regard to the questions that used the words "like" and "enjoy," the possibility exists that these words conjure up two different concepts and should be researched further. This study sought to describe the reaction of students to a simulation delivered asynchronously and identify elements of design to guide future development efforts in creating computer-based activities that meet the needs of the learners in order to allow the best utilization of resources in the development of these activities.

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A COMPARISON OF TRADITIONAL AND COMPUTER-BASED AGRISCIENCE INSTRUCTION FOR SECONDARY COURSES IN MISSISSIPPI

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Abstract

The purpose of this research was to compare the knowledge and comprehension level of students enrolled in traditional and computer-based agriscience courses for the state of Mississippi. The sample size was 152 students. The research followed a causal-comparative design. Data were based on an achievement test designed by the researcher. The instrument was divided into four units of instruction. The overall test had a reliability alpha of 0.8879. Independent t-tests were run on the overall test and each unit. Overall, a significant difference favoring the traditional teaching method was found. A significant difference was found for three of the four units favoring the traditional instruction. Recommendations for further research were included.

Theoretical Framework

The agricultural education program provides a well-rounded, practical approach to learning through three components: Classroom education in agricultural topics; hands-on supervised agricultural career experiences; and FFA, which provides leadership opportunities (Lee, 2000). These components are recognized as vital and interrelated components of a successful agricultural education program (Phipps, & Osborne, 1988).

Traditionally, agricultural education curricula was designed to be both practical and applicable for students who were returning to the farm, concentrating on the "how" of agricultural production rather than the "why". However, curriculum design efforts throughout the 1990s in agricultural education have moved toward integrating science-based material. These efforts are providing "agriscience" instruction, which is designed to meet the needs of a larger, more diverse, and broader clientele (Osborne & Dryer, 1998). The organized body of knowledge referred to as the science of agriculture is deeply rooted in the sciences that contribute to agriculture (Osborne, 1994). The terminology "agriscience and technology" describes the areas of agricultural education that integrates science-based instruction into the discipline. "Agriscience" better reflects an emphasis on science in the curriculum. New approaches are being designed to better incorporate these changes (Lee, 2000).

Since the American Association for the Advancement of Science (AAAS) advocated teaching science as a process, educators have been interested in improving the science process skills of students (Burchfield, 1995). Science process skills are used to investigate and study the world (Funk, 1985). These science-processing skills have been classified as two major categories; basic science processing skills and integrated science process skills. Basic processing skills include: observing, inferring, measuring, communicating,

classifying and predicting. Integrated science process skills include: controlling variables, defining operations, formulating hypothesis, interpreting data, experimenting and formulating models (Padilla, 1986).

All students must comprehend basic science concepts. Integrating science into agriculture would not only strengthen agricultural curricula, but also more effectively teach science (National Research Council, 1988).

Integrating science-based curriculum is the focus for agricultural education in the state of Mississippi. Two main approaches are available for Agriscience education in the state. One approach that this study discussed is the traditional approach of teacher led instruction. The second approach studied is computer based module instruction. The instructional content of the two introductory agrisciences course was similar, however, the two approaches have not been tested and compared to determine if one affords greater student achievement than the other. Research to show if one method yields a higher level of knowledge and understanding is necessary to determine future direction for teaching Agriscience in the state.

Purpose

The purpose of this study was to compare the knowledge and comprehension levels of students enrolled in the "Introduction to Agriscience" conventional teaching method and the "Concepts of Agriscience Technology" computer module based course. Mastery of these two levels is essential for learners to move to higher levels of cognition in the science of agriculture. (Bloom, Englehart, Fuest, Hill and Kratwhol, (1956) Determining if a significant difference in student achievement exists between the two teaching methodologies.

Null Hypothesis

The following five null hypothesis were tested in this study:

H_o-1: Based on the entire instrument tested, no statistically significant difference will exist between the knowledge level of students in the "Introduction to Agriscience" conventional teaching method and the "Concepts of Agriscience Technology" computer module based course.

H_o-2: For the individual section of "Introduction to Principles of Animal Science", there will be no significant difference in test score means between the students knowledge and comprehension of each curriculum.

H_o-3: For the individual section of "Introduction to Principles of Soil Science", there will be no significant difference in test score means between the students knowledge and comprehension of each curriculum.

H_o-4: For the individual section of "Introduction to Principles of Plant Science", there will be no significant difference in test score means between the students knowledge and comprehension of each curriculum.

H_o-5: For the individual section of "Principles of Mechanical Technology in Agriscience",

there will be no significant difference in test score means between the students knowledge and comprehension of each curriculum.

Procedures

Borg and Gall (1989) defined research design as "a process of creating an empirical test to support or refute a knowledge claim" (p. 324). The research design for this study is ex post facto or causal-comparative design. According to Ary, Jacobs and Razaviech (1990) causal-comparative attempts to determine the causes for differences that already exist in groups of individuals. Furthermore, the major advantage of the casual-comparative research design is that it allows researchers to examine cause and effect relationships under conditions where experimental manipulation is difficult or impossible. Another advantage is that many such relationships can then be studied in a single research study. However, a disadvantage to this design is that determining casual patterns with any degree of certainty is difficult (Borg, & Gall, 1989). Ary, Jacobs and Razaviech (1990) suggest that a method that provides partial control in a casual-comparative study is to match the subjects in the control and experimental groups on as many variables as possible. The researcher sought to determine if the presence of computer based modules had an effect on student performance on a knowledge base instrument. The variables in this study could not be manipulated, therefore a causal-comparative design can be used (Ary, Jacobs & Razaviech, 1990).

In casual-comparative, research the independent variable has already taken place and possible effects on an observed dependent variable are studied (Ary, Jacobs & Razaviech, 1990). The dependent variable was the students' mean scores on the knowledge-based achievement test. This posttest was representative of course material covered by both teaching methods used in this study. The independent variable was teaching method.

Since the sample was not randomly selected, threats to internal validity must be considered. Both history and maturation were controlled by the fact that both treatments were subject to similar historical events and time. By not giving a pretest, the threat of interaction between testing and treatment was controlled. Matched pairs of schools determined the selection of subjects. Schools were also matched based on their location in the state, size of the school, and teacher experience.

The two teaching methods researched in this study are curriculum-guided methods of instruction for the state of Mississippi. The concepts, methodology and findings of this study can apply to other settings. However, others wanting to replicate this study may need to redesign the instrumentation based on possible curriculum changes.

The total population consisted of high school students in grades 9-12 enrolled in either the AEST Concepts of Agriscience course or Introduction to Agriscience course in the state of Mississippi for the 2000-2001 school year. Students currently enrolled in these programs were chosen to reduce the risk of history and other extraneous variables. The target population for this research was the seven schools that began the AEST program in 1999 and matched schools that used the traditional curriculum. This was the second year these AEST programs were in operation. The instructors in these programs were more knowledgeable about the module programs and were more comfortable with the technology and systems than other schools who started using

the AEST curriculum this year. Using the programs that have already completed one full school year was an attempt to make the research more valid. Schools using the Introduction to Agriscience curriculum were matched by the following characteristics, location in the state, size of the school, and teacher experience. The researcher, with the State Supervisor of Agricultural Education and a professor of agricultural education determined these matches. Fourteen schools were asked to participate in this study. Ten schools agreed to participate while nine schools completed the research study. However, due to the matched design, eight schools contributed data that was used in this study.

Only students with both student assent and parental consent forms signed and returned were allowed to participate and take the instrument posttest. The sample for this study was 152 students enrolled in either course. Seventy-three students were enrolled in the Concepts of Agriscience course and 79 were enrolled in Introduction to Agriscience.

Instrumentation

This research is based on an achievement test designed by the researcher. Questions used for the research instrument were based on the shared objectives and content of both curriculums. The Mississippi State University IRB approved this study and instrument before the instrument was administered.

This instrument was a 60-question multiple choice test divided into the four units previously discussed. Each unit provided equal distribution to information covered in the described units. The researcher chose to use 60-multiple choice questions so the test could be completed in a normal class period. The main reference used for the development of the instrument was the textbook referenced by both curriculums. Other sources included curriculum referenced material.

It was predetermined to use 60 questions for the final instrument. To determine the questions used for the instrument, an 80-question instrument was developed and administered to a pilot test group. This group of agriscience students was not a part of the research study. Questions were divided into the four subgroups. Tests were scanned and graded by NCS exam SYSTEM II program provided by Test Services at Mississippi State University. The item analysis report determined by exam SYSTEM II was used to analyze the questions administered. To determine the five questions per section to delete, the upper quartile, lower quartile, discrimination index and difficulty factor were used. The upper quartile showed the number of students in the top 25 percentile of the test and their selected alternatives for each question. Likewise, the lower quartile showed the lowest quarter of the test group and their selected alternatives. The discrimination index measured the ability of an item response to discriminate between those individuals who attained a high score and those who attained a low score on the test. The difficulty factor measured how difficult the question was to answer correctly.

Questions were analyzed by section. First, questions with the lowest difficulty factor were noted. Next, the discrimination index value for these questions were compared. The questions with higher discrimination values for the correct answers implied less discrimination. Differences in upper and lower quartile scores were compared. The questions with the lowest upper quartile score and highest lower quartile scores were highlighted. This meant that fewer students that scored high overall, scored well on that question. Considering

these measurements, the five lowest questions were deleted

The content validity for this instrument was established by a panel of experts in agricultural education for the state of Mississippi. This panel consisted of faculty from the Department of Agricultural Information Science, and representatives from the State Department of Education. A current Mississippi Vocational Director and current Mississippi Agriscience instructor not participating in this study also provided insight on the validity of the instrument. The panel reviewed for face validity, clarity and correctness (Mississippi Curriculum Framework for Introduction to Agriscience).

Suggestions made by the panel were considered and modifications to the instrument were made prior to the pilot test.

To determine the reliability of the instrument used for this study, alpha scores were tested on all participants as one group. Alpha is the appropriate method to use for computing reliability for the Kuder-Richardson formulas (Borg & Gall, 1989). SPSS was used to determine the overall and individual alpha scores. First the overall alpha or K-R20 score was determined to be .8787. Individual unit alphas were also determined as seen in Table 1.

Table 1. Individual Unit Alpha Scores

Unit Title	Number of Items	Alpha
Introduction to Principles of Animal Science	15	0.7833
Introduction to Principles of Soil Science	15	0.7923
Introduction to Principles of Plant Science	15	0.5453
Principles of Mechanical Technology in Agriscience	15	0.6766

Each unit consisted of 15 questions. Although this estimate of internal consistency provides a conservative reliability, the individual alpha levels were not as high as desired. Also computed was the individual item alpha, if that question was deleted. Usually, the more items on a test, the higher the reliability. This is due in part to the fact, the more items in a test, the better estimate of a person's true score can be made. However, this is not always true. As seen in Table 2, the removal of one question per section increased the alpha of that section. Table 2 identifies which question was deleted from the test for each unit as well as the new alpha level for each section.

The deletion of four questions increased the overall alpha as well. The new alpha for the test as a 56-question instrument was 0.8879. This is considered a moderately-high reliability score (Ary, Jacobs and Razavieh, 1990). The sections introduction to principles of animal science, introduction to principles of soil science and principles of mechanical technology in agriscience were considered moderate. The reliability of the introduction to principles of plant science is not as high as desired. This must be considered when analyzing the findings of this section.

Table 2. Alpha Level with One Item Deleted

Unit Title	Question Deleted	New Alpha
Introduction to Principles of Animal Science	11	0.7893
Introduction to Principles of Soil Science	19	0.7981
Introduction to Principles of Plant Science	34	0.5714
Principles of Mechanical Technology in Agriscience	57	0.7049

Results

The hypotheses were based on the instrument data collected for the experimental computer assisted instruction group and the comparison traditional instruction group. Overall mean, standard deviations and percentages were calculated as seen in Table 3. This shows that overall, the students enrolled in the Introduction to Agriscience traditional teaching method course had a higher mean than the students enrolled in the Concepts of Agriscience computer-assisted module course. The percent of questions answered correctly for the traditional method students was 8.83% higher than the test percentage of computer-assisted module students.

Table 3. Mean Differences for Overall Test Scores

	N	Overall Test		Percent Correct
		Mean	SD	
Computer	73	25.88	9.09	46.21
Traditional	79	30.82	10.41	55.04

Means and standard deviations were calculated for each of the four unit sections (Table 4). For the purpose of reporting the findings, "Unit 1" is Introduction to the Principles of Animal Science, "Unit 2" is Introduction to the Principles of Soil Science, "Unit 3" is Introduction to the Principles of Plant Science, and "Unit 4" is Principles of Mechanical Technology in Agriscience.

Table 4. Mean Differences in Variables Across Units

Method	N	Plant Science		Animal Science		Soil Science		Mechanical	
			SD	M	SD	M	SD	M	SD
Computer	73	7.48	3.45	5.42	2.57	5.93	2.61	7.04	2.77
Traditional	79	9.05	3.21	7.44	3.99	6.01	2.72	8.32	3.31

Note. A score of 14 was the maximum score for each unit.

Independent sample t tests were run to determine if a significant difference existed between the scores of students in the experimental computer-assisted instruction course and the comparison traditional instruction course. The *a priori* alpha level of 0.05 was set. Therefore, tests having an alpha of 0.05 or below would reject the null

hypothesis. However considering the family-wise error, the overall alpha for the study was 0.226. The family wise error rate is considered when multiple tests are run on the same data set. Family-wise error is a type 1 error, reducing the power of the study. For this study the family-wise error was calculated as:

$$FW_{error} = 1- (1-alpha)^{\#\ of\ tests}$$
$$= 1- (1- .05)^{5}$$
$$= 1- (.95)^{5}$$
$$= 1- .774$$
$$=0.226$$

First, an independent sample t test was run on the overall scores of the two groups compared. Next, *t*-tests were run on each of the four units of the test (Table 5). Based on Levene's Test for Equality of Variances, equal variance was assumed.

Table 5. Summary of t test Significance of Teaching Methods

Unit	T-score	df	alpha
Overall Test	-3.109	150	.002
Animal Science	-2.907	150	.004
Soil Science	-3.67	150	.001
Plant Science	-.19	150	.851
Mechanical Technology	-2.57	150	.011

Testing of H_0-1

The first null hypothesis stated that no statistically significant difference exists between the knowledge level of students in the "Introduction to Agriscience" conventional teaching method and the "Concepts of Agriscience Technology" computer module based course based on the entire instrument. This was tested by analyzing the means of both test groups overall scores. Fifty-six questions were used for this instrument. The traditional teaching method "Introduction to Agriscience" course mean, at the .05 level of significance, was higher than the computer-based "Concepts of Agriscience" mean. Therefore, the null hypothesis was rejected. To determine where the significant difference lies, the remaining hypotheses were tested.

Testing of H_o-2

The second null hypothesis stated that no significant difference would be found for the means of the Introduction to Principles of Animal Science section for the two curriculums compared. The Concepts of Agriscience computer assisted instruction mean for this section was 7.48. The Introduction to Agriscience traditional instruction mean was 9.05. A significance of .004 was found with an independent *t*-test. Therefore, the null hypothesis was rejected.

Testing of H_o-3

The third null hypothesis stated that no significant difference would be found for the means of the Introduction to Principles of Soil Science section for the two curriculums compared. The Concepts of Agriscience computer assisted instruction mean for this section was 5.42. The Introduction to Agriscience traditional instruction mean was 7.44. A significance of .001 was found with an independent *t*-test. Therefore, the null hypothesis was rejected.

Testing of H_o-4

The fourth null hypothesis stated that no significant difference would be found for the means of the Introduction to Principles of Plant Science section for the two curriculums compared. The means compared were similar. The Concepts of Agriscience computer assisted instruction mean for this section was 5.93 and the Introduction to Agriscience traditional instruction mean was 6.01. A significance of .851 was found with an independent *t*-test. Therefore, the null hypothesis was not rejected.

Testing of H_o-5

The fifth null hypothesis stated that no significant difference would be found for the means of the Principles of Mechanical Technology in Agriscience. section for the two curriculums compared. The Concepts of Agriscience computer assisted instruction mean for this section was 7.04. The Introduction to Agriscience traditional instruction mean was 8.32. A significance of .011 was found with an independent *t*-test. Therefore, the null hypothesis was rejected.

Conclusions

The following conclusions about the Concepts of Agriscience computer-assisted instruction course and the Introduction to Agriscience traditional instruction course were drawn from the findings of this study. Since no other studies could be found that compared computer-based instruction and traditional instruction for an introductory to agriscience course, this study provides uniqueness when compared to related literature.

Overall, students enrolled in the Introduction to Agriscience course had a higher knowledge and comprehension level as determined by the research instrument than students enrolled in the Concepts of Agriscience computer based module course. This study revealed a difference in overall mean test scores favoring the traditional instruction method over the computer based modules instruction method. This research compared student's knowledge and comprehension. Higher levels of cognition were not considered.

A 56-question instrument was divided into four units that were similar in content of the two methods. The reliability of three units were considered high-moderate. These unit mean scores found a significant difference in students mean scores between the Introduction to Agriscience traditional course and Concepts of Agriscience computer module based course on all units except Plant Science. These significant differences favored the traditional instruction method.

Based on the findings of this research, it is concluded that the knowledge and comprehension level of students enrolled in Introduction to Agriscience traditional method curriculum was higher than students enrolled in the Concepts of Agriscience computer-based module curriculum.

Implications

Computers can provide students enjoyable tools in which to learn and understand information thus improving academic performance (Kay, 1991). Schwartz suggested that computers could provide a new alternative method of instruction and improved learning methods, which can increase students' potential for being competitive in today's society (1991). However, this study found traditional teaching to be more effective than the teaching modules in terms of student knowledge and comprehension. Although the findings were limited to students enrolled in the Concepts of Agriscience

course or Introduction to Agriscience course for the state of Mississippi, this research could have implications for states using computer-based module instruction. Concerns may also result from funding sources that provide resources for module-guided curricula, if computer assisted instruction is ineffective. Part of the agricultural education mission is to prepare individuals for careers. If computer-assisted module instruction is not preparing individuals in its current state, improvements need to be determined so that the best educational setting is provided.

Other research studies compared achievement, but also assessed student's attitudes, motivation and learning styles. Christmann and Badgett (1997) found that on average, students receiving traditional instruction supplemented with computer-assisted instruction attained higher academic achievement than those only receiving traditional instruction did. Although Roberts (1999) studied web-based instruction as a primary and supplementary delivery of instruction, learning styles and students attitudes were also considered. Roberts (1999) found students academic performance to be equally successful regardless of teaching method or learning style. Perhaps computer-based modules don't offer the variety that encourages higher student performance.

Miller and Honeyman (1996) found that both field-dependent and field-independent learners performed better when a variety of teaching methods was incorporated in the curriculum. Miller (1997) described the field-dependent learner as one who prefers defined goals and organization and desires positive reinforcement from the teacher and has well-developed social skills. Miller (1997) described the field-independent learner as one who prefers to develop his or her own structure for learning activities and cares little for positive reinforcement from the teacher. The student likes competition, is socially independent and has poorly developed social skills (Miller, 1997). If computer-assisted instruction is best suited for field-independent learners, the learning styles of students should be determined to provide the best learning environment for the students.

While student-teacher interaction was not part of this study, research had been found to suggest computer based modules provide sufficient interaction between both parties. Palmer (1999) studied students' perceptions of high quality science teaching and found attributes of "good teachers". Variety, hands-on activities, fun and interesting activities and clear explanations were some of the attributes found. Also, important were additional comments including allowing individual and group activities, the use of interesting approaches to raise subject interest, and the importance of having student interaction.

Student attitudes and anxieties toward computers could be related to differences found. Based on a study of traditional instruction and World Wide Web instruction, Sexton (2000) found that participants who had computer anxieties found higher levels of cognition tasks over the web to be challenging.

Recommendations

Based on the finding and conclusions of this study, the following recommendations were made for future study.

More research studies of this nature involving computer-based instruction and traditional instruction in the area of agricultural education and agriscience are recommended. Specifically for the state of

Mississippi, more studies with a higher percentage of the population are recommended. Seven AEST programs began in 1999. These schools with matched schools were asked to participate in this research. Today over 20 programs use this curriculum. Possible incentives might be offered to either teacher or student to increase participation. More research regarding secondary agriculture students would improve the generalization of these findings.

Students were not asked to supply demographic data. Research including differences in age, gender, race, academic performance and grade levels are recommended for future studies. If provided this information, it could be determined if any of these variables had an effect on achievement of the test as well as experimental mortality. Participants could provide information regarding when they received the instruction of the units tested. Differences in time and retention should be studied for further research.

Research to include difference in student motivation, attitudes and learning styles are suggested. Findings from this type of research could determine if student's reaction to the different teaching methods is significant. This would include alternate forms of instrumentation to determine differences. The Group Embedded Figures Test is commonly used to determine if individuals are field dependent or field independent. Differences, which exist in the learning styles of the individual, could affect achievement based on the teaching method.

Research has shown that computer-assisted instruction has been effective in some areas of study. The degree to which computer-assisted instruction is used should be studied. Perhaps curriculum should be evaluated to determine if computer-assisted instruction could be used more as a supplementary method of instruction used in conjunction with traditional teaching methods. Further study in this area is recommended.

Although mastery at the lower levels of cognition was not shown, research to include all levels of cognition is recommended. Increased reliability of instrumentation could effect data results.

Computer module instruction is only one form of computer-based instruction. More research of this nature should be done in other areas of agriculture where applicable. As society continues to change, so will the instruction and education methods used in educational settings. Computer-based instruction is relatively new in the area of agriscience. More research is needed to explain the effectiveness of computer based instruction as compared to traditional methods of instruction before serious financial commitments are made.

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