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THE FUTURE ROLE OF INSTRUCTIONAL TECHNOLOGY IN AGRICULTURAL EDUCATION IN NORTH CAROLINA AND VIRGINIA

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Abstract

The purpose of this study was to assess teachers' perceptions regarding the future of instructional technology in secondary school agricultural education programs in North Carolina and Virginia. A stratified random sample was selected from the populations of agricultural education teachers in North Carolina and Virginia. Likert-type scales were used to measure the future role instructional technology will play in agricultural education programs, the potential benefits of instructional technology, and the potential barriers to the use of instructional technology. In general, teachers in both states were "undecided" about the future role of instructional technology in agricultural education programs. Accessing lesson plans via the Internet was the primary way teachers perceived themselves using instructional technology in the future. Teachers in both states perceived an array of benefits from future use of instructional technology in their programs, including teacher access to information resources as the primary benefit. To a large extent, teachers were undecided about barriers to future use of instructional technology in their programs. Teachers in both states identified the cost of equipment and the cost of software as the greatest barriers.

Introduction

Today's technology-driven economy has impacted all aspects of society, including the workplace (CORD, 1999). This and other developments have placed education under great scrutiny, with calls for educational reform from multiple directions (Anglin, 1995). Instructional technology, including computers, has the potential to help improve the educative process (Milken Exchange on Education Technology, 1999).

The agricultural education community has been challenged to develop a vision of its preferred future for teaching and learning in agriculture (National FFA Organization, 1999). To keep pace with the agricultural industry, agricultural education in secondary schools needs new ways to deliver instruction (National Research Council, 1988). Instructional technology should play an integral role in teaching and learning (Simonson & Thompson, 1997).

States are required to have plans for integrating instructional technology into K-12 schools to be eligible to apply for certain types of federal funds. State funds are also commonly available to help with such initiatives. In addition, some states benefit from grants from businesses or philanthropies in their effort to integrate instructional technology into the education enterprise. Policymakers generally agree that schools need more instructional technology, but have not agreed on the best way to utilize it in the classroom (Zehr, 1998).

The infusion of instructional technology into the secondary schools has been a priority in North Carolina and Virginia. In a plan to expand the use of instructional technology in schools in North Carolina, educators focused on technology-supported classrooms. Special attention was given to infusing instructional technology into computer-based programs in vocational education, including agricultural education. The goal was for students to use technology in learning to solve problems, improve productivity, and gain the skills necessary to become contributing members of their communities and lifelong learners (North Carolina Department of Public Instruction, 1999).

The educational technology plan for Virginia emerged out of awareness that technology is not simply equipment, but a systematic treatment of information and instructional content in a specialized way to achieve a specific purpose. The plan recognized that teachers must be trained, support services must be provided, pilot studies must be conducted, equipment must be updated and maintained, guidelines must be developed, and an ongoing program of evaluation must be established (Virginia Department of Public Education, 1996).

Theoretical Framework

The profession of agricultural education has a clear philosophy with several distinguishing tenets. Emphasis is placed on solving problems in real-world settings, learning by doing, individualized learning, career guidance, leadership and citizenship development, and community-oriented programs (Phipps & Osborne, 1988). These values guide the planning of courses and programs, the selecting of methods and materials, and ultimately, teaching and learning in agricultural education. Agricultural educators are challenged to develop programs that emphasize agricultural careers, showing the connection between educational preparation and agricultural leadership, business, and scientific occupations (National Research Council, 1988).

Several theories, including behaviorism, systems theory, cognitive theory, and constructivism have provided direction for instructional technology research and practice. Behaviorism focuses on producing observable and quantifiable behavioral outcomes in the learner, while cognitive theory emphasizes the internal process that occurs during learning (Simonson & Thompson, 1997). Systems theory helps educators design and implement instruction with its emphasis on natural order and rationality of the world (Simonson & Thompson, 1997). Constructivism, with its emphasis on gaining meaning through experience, provides a student-oriented theoretical foundation in which instructional technology can play an integral role (Simonson & Thompson, 1997).

Instructional technology has aided the shift from a teacher-centered to a learner-centered paradigm in schools (Simonson & Thompson, 1997). The philosophical tenets of agricultural education support this movement, providing an opportunity to use instructional technology to enhance student achievement. Instructional technology, including computers, can bring students into research laboratories, processing plants, and fields where agricultural and food science is developed and applied. It can also show students practical problems such as soil erosion or a field destroyed by insects. Students can then be challenged to solve problems and think about career paths that may interest them (National Research Council, 1988).

Instructional technology started with a media perspective during the 1940s to support the training of military personnel. In the 1950s universities created courses in audiovisual production and instructional media were commonly used in schools and other training sites by the 1980s. Propelled by the communications revolution, the 1980s saw the emergence of laser printers, VCRs, videodiscs, hypermedia, and computers. During this time personal computers began to appear in schools, homes, and offices (Pett & Grabinger, 1995). Today, schools and even departments within schools, e.g., agricultural education departments, have fully equipped computer laboratories. Instructional technology now includes videos, computers, and other media that can be employed to implement educational plans.

Zehr (1998) identified several issues faced by states seeking to increase the use of instructional technology in K-12 schools:

- Inequities between low and high-technology schools.
- Data on the current use of instructional technology in schools.

- Funding available for instructional technology equipment.
- Infrastructure in schools to support instructional technology.
- Student standards regarding instructional technology skills.
- Teacher preparation standards regarding proficiency in instructional technology.
- In-service training for teachers.

How instructional technology is used may be the most important question of all (Milken Exchange on Education Technology, 1999). The public is asking for evidence that their investment in instructional technology is worthwhile. One problem in determining the effectiveness of instructional technology is that there is little consensus about its purpose. Some see it as a tool to prepare students for the workplace while others see it as a way to improve standardized test scores. Finally, others see instructional technology as a way to foster education reforms, e.g., making classrooms more learner-centered and changing the way teachers teach. Educators need to clarify their goals for using instructional technology in the classroom before effectiveness can be assessed (Trotter, 1998).

Murphy and Terry (1998), in a nationwide study, identified ways instructional technology could improve instruction in agricultural education in the future:

- Provide teaching aids to serve students with diverse learning styles.
- Provide teachers with greater access to information resources.
- Enable students to take courses from several institutions.
- Provide a wider range of visual materials for instruction.
- Enhance students' access to instruction.
- Make experts of all kinds more available to students and teachers.
- Make textbooks available on CD-ROM.
- Facilitate communications among teachers.
- Provide students with relevant and timely experiences.
- Provide more individualized instruction.
- Enhance teacher collaboration on curriculum and research.
- Increase opportunities for business and education partnerships.
- Facilitate feedback to learners.
- Provide direct communications with content experts.
- Make multimedia available in teaching/learning abstract concepts.
- Reduce travel time for students and teachers.
- Allow students to choose courses based on quality regardless of location.
- Provide virtual experiences for use in teaching and learning.
- Facilitate updating of course materials.

While instructional technology offers many possibilities for future improvement in agricultural education, a number of obstacles could inhibit its implementation. Barriers identified by Nordheim and Connors (1997) were: (a) computer hardware and software are too expensive and (b) limited teacher experience in using computers as an instructional tool. Additional barriers identified by Murphy and Terry (1998) included: (a) lack of administrative support, (b) lack of support services for equipment maintenance, (c) resistance to change by educators, (d) lack of reward system for technology implementation, (e) lack of teacher preparation time, and (f) lack of access to state-of-the-art equipment.

Miller and Miller (1998) and Miller (1997) identified several obstacles that inhibited use of the Interactive Communications Network (ICN) in Iowa by Iowa secondary agricultural education teachers. Barriers included: (a) coordination of schedules between schools, (b) teaching of laboratory sessions, (c) supervising agricultural experience programs, (d) lack of training, (e) administrative support, (f) negative attitude of teachers, (g) lack of student interest, (h) preparation time required, and (i) cost.

Purpose and Objectives

The purpose of this study was to assess teachers' perception regarding the future role of instructional technology in secondary school agricultural education programs in North Carolina and Virginia.

The objectives were to:

1. Determine the future role instructional technology will play in agricultural education programs.
2. Identify the potential benefits of using instructional technology.
3. Identify the potential barriers to the use of instructional technology.

Methodology

The population for this descriptive study consisted of secondary school agricultural education teachers in North Carolina (*N* = 370) (North Carolina State University, 1998) and Virginia (*n* = 313) (Virginia Vocational Agriculture Teacher's Association, 1998). A stratified random sample consisting of 210 teachers from North Carolina and 170 from Virginia was drawn (Krejcie & Morgan, 1970). Likert-type scales were used to measure teachers' perceived role of instructional technology in the next five years, benefits from using instructional technology, and barriers to using instructional technology. A panel of experts determined content and face validity, a pilot test was conducted, and suggestions were incorporated into the final instrument.

The instrument was mailed to participants with two follow-up mailings sent to nonrespondents. One hundred ninety-five usable surveys were received (NC = 85, VA = 110), for a return rate of 51%. Ten percent of the nonrespondents were telephoned and asked selected questions from the survey. T-tests revealed no significant differences between respondents and nonrespondents. Cronbach alpha coefficients ranging from .66 to .79 were determined for the three measures. Descriptive statistics were used to analyze the data. The 5-point scale was interpreted as follows: 1 – 1.79 = Strongly Disagree, 1.80 – 2.59 = Disagree, 2.60 – 3.40 = Undecided, 3.41 – 4.20 = Agree, 4.21 – 5.00 = Strongly Agree.

Findings

Characteristics of Respondents

Table 1 provides demographic information about the respondents. Similarity was observed between teachers in North Carolina and Virginia regarding gender, age, level of education, years of teaching experience, and hours of instructional technology training. Likewise, access to computers at home and school and enrollment in agricultural education programs and the FFA were similar. A majority of the teachers in both states taught horticulture, agricultural mechanics, agricultural science, and animal science classes in grades 9-12. PCs (IBM compatible) were the most common type of computer in the schools and homes of agricultural education teachers in both states.

Table 1
Characteristics of Respondents

Characteristic	North Carolina	Virginia
Gender		
Male	72%	75%
Female	28%	25%
Age (mean)	40	40
Master's or higher degree	53%	53%
Years of teaching agricultural education (mean)	13	15
Hours of instructional technology training (mean)	25	25
Teacher access to a computer at home	85%	83%
Teacher access to the Internet at home	63%	79%
Enrollment in ag. ed. program (mean)	101	97
FFA membership (mean)	77	71

Future Role of Instructional Technology

Table 2 presents the means and standard deviations for the future roles of instructional technology in agricultural education as perceived by teachers in North Carolina and Virginia. In general, the teachers in both states were "undecided" (means ranging from 2.60 to 3.40) about the future role of instructional technology in agricultural education programs. "Teacher access to lesson plans via the Internet" had the highest rating for both states, and the only item with an "agree" score for each state. Other roles with the highest means for both states were "videoconferencing to integrate resources persons into the classroom," "CD-ROMs to replace many textbooks," "the majority of student assignments and presentations will be conducted using multimedia," and "the majority of instructor presentations will be conducted using multimedia." Teachers in North Carolina disagreed, while Virginia teachers were "undecided" on "virtual simulation will reduce the need for live instructional experiences."

Table 2
Future Roles of Instructional Technology

Futures Role	[1]North Carolina (*n* = 85)		[1]Virginia (*n* = 110)		[2]Total (*n* = 195)	
	M	*SD*	*M*	*SD*	*M*	*SD*
Teacher access to lesson plans via the Internet.	3.80	.91	3.75	.88	3.77	.89
Videoconferencing to integrate resource persons into classroom.	3.35	.97	3.51	1.03	3.44	1.01
The majority of instructor presentations will be conducted using multimedia.	3.15	1.11	3.35	1.14	3.27	1.13
The majority of student assignments and presentations will be conducted using multimedia.	3.08	1.07	3.30	1.08	3.21	1.08
CD-ROM to replace many textbooks.	3.15	1.14	3.23	1.19	3.19	1.16
Teach classes at a distance via videoconferencing.	3.15	1.02	3.20	1.07	3.18	1.05
Videoconferencing to reduce the number of instructional field trips taken.	2.85	1.14	2.89	1.20	2.87	1.17
FFA career development activities conducted via videoconferencing.	2.75	1.11	2.94	1.10	2.86	1.11
The Internet to replace school libraries in conducting research.	2.84	1.21	3.02	1.12	2.94	1.16
Virtual simulations will replace the need for live instructional experiences.	2.45	1.26	2.74	1.28	2.61	1.28

[1]Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Undecided, 4 = Agree, 5 = Strongly Agree
[2]Future roles listed in order based on highest means for "Total".

Benefits Expected From Instructional Technology

Fifteen statements were used to assess teachers' perception of potential benefits from using instructional technology in teaching and learning. Table 3 shows the means and standard deviations for the benefits of instructional technology as perceived by agricultural education teachers. All of the means except two for Virginia ("videoconferencing will increase student interest" and "videoconferencing will increase student comprehension") were 3.41 or above ("agree" or "strongly agree") on a 5-point scale, indicating that teachers in both states perceived instructional technology as benefiting their programs in the future. In general, the means for North Carolina were slightly higher than the means for Virginia. Most of the standard deviations for Virginia were higher than those for North Carolina, indicating a wider variation in responses among Virginia teachers. Teachers in both states saw "teachers will have greater availability of information resources" as the greatest benefit from instructional technology. Other benefits in the top five for North Carolina were "use of greater array of visual instructional materials," "student access to instruction will be enhanced," "make agribusiness and other specialists more available to students," and "availability of up-to-date information will increase student learning." These benefits, plus "teachers will have greater access to informational resources," also were among the top benefits perceived by Virginia teachers.

Table 3
Benefits Expected From Instructional Technology

Benefits	North Carolina (*n* = 85)		Virginia (*n* = 110)		Total (*n* = 195)	
	M	*SD*	*M*	*SD*	*M*	*SD*
Teachers will have greater availability to information resources.	4.42	.66	4.01	1.01	4.19	.90
Use greater array of visual instructional materials.	4.04	.81	3.71	.97	3.85	.92
Students' access to instruction will be enhanced.	4.01	.97	3.67	1.08	3.82	1.05
Make agribusinesses and other specialists more available to students.	3.94	.84	3.65	1.06	3.77	.98
Availability of up-to-date information will increase student learning.	3.93	1.01	3.64	1.11	3.76	1.08
Teachers will have greater access to information resources.	3.41	1.55	3.85	1.22	3.66	1.39
Interest of students will be increased.	3.88	.97	3.45	1.09	3.64	1.06
Feedback to students will be quicker and more comprehensive.	3.74	1.00	3.52	1.08	3.62	1.05
Textbooks will be available on CD-ROM.	3.67	1.07	3.48	1.10	3.56	1.09
Virtual reality and other simulations will increase student comprehension.	3.71	.97	3.45	1.11	3.56	1.06
Videoconferencing with other students at other schools will aid the learning process.	3.67	1.03	3.44	1.19	3.54	1.13
Instruction will become more individualized.	3.60	1.05	3.46	1.11	3.52	1.09
Videoconferencing with agribusiness will increase.	3.54	.98	3.49	1.03	3.51	1.01
Videoconferencing will increase with student comprehension.	3.54	.99	3.34	1.10	3.43	1.06
Videoconferencing will increase student interest.	3.64	1.06	3.25	1.07	3.42	1.08

[1]Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Undecided, 4 = Agree, 5 = Strongly Agree.
[2]Benefits listed in order based on highest means for "Total."

Barriers to Future Use of Instructional Technology

Fourteen potential barriers to the future use of instructional technology in agricultural education programs were studied. Table 4 presents the means and standard deviations for the barriers for North Carolina and Virginia respondents. Means were in the "undecided" range for half or more of the barriers, suggesting that teachers were not sure whether or not the barriers studied would inhibit the future use of instructional technology in agricultural education programs. Teachers in both states rated "cost of instructional technology software" and "cost of instructional technology equipment" as the greatest barriers (means in the "agree" range) to the future use of instructional technology in agricultural education programs. Other barriers in the top five for North Carolina were "lack of technical support to maintain equipment," "lack of teacher time to master the emerging instructional technology for classroom use," and "lack of facilities designed to accommodate new technology." "Lack of teacher training in instructional technology" was among the list of the top five barriers identified by Virginia teachers.

Table 4
Barriers to Future Use of Instructional Technology

Barrier	[1]North Carolina (*n* = 85)		[1]Virginia (*n* = 110)		[2]Total (*n* = 195)	
	M	*SD*	*M*	*SD*	*M*	*SD*
Cost of instructional technology software.	4.06	.98	4.00	.94	4.03	.95
Cost of instructional technology equipment.	3.98	1.00	3.88	1.08	3.92	1.04
Lack of facilities designed to accommodate new technologies.	3.68	1.13	3.69	1.14	3.69	1.13
Lack of teachers to master the emerging instructional technology.	3.71	1.14	3.63	1.14	3.66	1.14
Lack of technical support to maintain equipment.	3.74	1.06	3.43	1.27	3.56	1.19
Lack of teacher training in instructional technology.	3.45	1.23	3.60	1.02	3.53	1.11
Lack of telephone or data connection in the classroom.	3.28	1.31	3.59	1.23	3.46	1.27
Resistance to change by educators.	3.35	1.12	3.43	1.15	3.33	1.13
Lack of administrative support for instructional technology acquisition.	3.32	1.80	3.11	1.36	3.20	1.57
Lack of awareness by administrators and legislators.	3.32	1.16	3.23	1.21	3.27	1.18
Cost of instructional technology outweighs benefits.	2.98	1.12	3.19	1.22	3.10	1.22
Lack of support from peers in securing instructional technology.	3.01	1.11	3.04	1.18	3.03	1.15
Lack of student knowledge to utilize technology.	2.78	1.16	2.99	1.16	2.90	1.16
Lack of student interest.	2.71	1.16	2.92	1.19	2.83	1.18

Conclusions, Implications, and Recommendations

Agricultural education teachers in North Carolina and Virginia did not have a clear vision for the future role of instructional technology in their programs. The vision held by state policymakers in North Carolina (North Carolina Department of Public Instruction, 1999) and Virginia (Virginia

Department of Education, 1996) to use instructional technology to enhance student learning was not shared by the agricultural education teachers in those states. Perhaps additional time is needed for strategies such as teacher training, support services, and pilot programs related to instructional technology as described in state plans to have observable impact in local schools. Teachers in both states saw the primary future use of instructional technology as accessing lesson plans via the Internet, a role that may be considered more teacher-centered than student-centered. Zehr (1998) and Trotter (1998) emphasized the need for policymakers and stakeholders to agree on the goals for using instructional technology in schools.

Teachers in both states perceived several future benefits from using instructional technology in agricultural education programs. Again, the greatest benefit for both states focused on the teacher, "teachers will have greater availability of information resources." Other highly rated benefits were more learner-centered, however, including availability of visual materials, student access to instruction, student access to agribusiness and other specialist, and availability of current information for students. This list of benefits closely parallels the ways instructional technology could improve instruction in agricultural education identified by Murphy and Terry (1998).

Teachers in both states identified the cost of software and the cost of equipment as the two greatest barriers to the future use of instructional technology in agricultural education programs. Nordheim and Connors (1997) also found that the cost of equipment and software inhibited implementation of instructional technology. Facilities not designed to accommodate new technology and lack of teacher time to master new technology were also found to be likely barriers. Lack of teacher training in instructional technology was among the top five barriers identified by Virginia teachers. However, teachers in both states were "undecided" about many of the potential barriers studied.

The vision for use of instructional technology in agricultural education should be closely tied to the philosophical tenets of the profession. For example, goals to use instructional technology to enhance learning by doing, individualized learning, career guidance, leadership development, and other processes commonly valued in agricultural education could help integrate instructional technology in agricultural education programs.

Strategies to integrate instructional technology into agricultural education programs should be guided by educational theory. Theory should be linked to benefits teachers see in using technology, helping them move teaching and learning from theory to practice.

State plans for utilizing instructional technology in agricultural education should be congruent with national initiatives, e.g., the challenge to develop programs that emphasize agricultural careers, showing the connection between educational preparation and agricultural leadership, business, and scientific occupations (National Research Council, 1988).

Strategies for integrating instructional technology into the agricultural education curriculum should include ways to use instructional technology in all three components of agricultural education: the classroom, supervised agricultural experience programs, and the FFA. Learner-centered activities utilizing instructional technology should be developed and pilot tested in all three components.

Plans to expand the use of instructional technology in agricultural education programs should address barriers teachers perceive to such future initiatives. Barriers such as lack of teacher training in instructional technology (found in Virginia) and cost of software and equipment could be addressed on a statewide basis, while barriers such as lack of facilities to accommodate new technology and lack of technical support to maintain equipment could be addressed on the local level. Such state-local partnerships should also include other stakeholders, including agribusiness.

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