THE USE OF INSTRUCTIONAL TECHNOLOGIES IN AGRICULTURAL EDUCATION

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Recent technological developments have contributed significantly to the instructional equipment available for use by high school agriculture teachers. Microcomputers, printers, VCRs, camcorders, satellite receivers, and computer modems have become available for use in high school programs. Coinciding with the increased availability of instructional equipment, the extent to which instructional technologies are being used is of concern to agricultural educators.

McCarney (1987) advocated shifting education from a labor-intensive emphasis to a capital-intensive emphasis. He indicated that this shift could best be accomplished by utilizing technologies such as computers and video cassette recorders for instructional purposes. Others have suggested that the use of instructional technologies should support and empower the learner. Wedman (cited in Mihalevich, 1989) suggested that the appropriate use of instructional technologies is one of the most important considerations educators will face in the 1990s. Rosenfeld (1986) noted that keeping up with technology is like chasing a moving target and identified problems in adjusting programs and obtaining needed equipment. He further noted that in 1984, legislation was enacted that:

> . . . explicitly addressed and responded to the impacts of technological change. Technology was no longer treated as an unseen force acting on labor market demand but as a force with known dimensions that should be factored into vocational education instructional policies (p. 13).

While many aspects of instructional technology may be directly applicable in agricultural education classrooms, Camp (1983) suggested that the primary thrust will likely be centered around microcomputers. Research conducted in North Dakota identified successful microcomputer activities which had been used for agricultural instruction (Zidon & Luft, 1986). They concluded that most agriculture teachers had microcomputers available for use, perceived them to be effective for instruction, but used them predominantly for purposes other than instruction. A recent study in Missouri examined tutorial, drill-and-practice, and simulation teaching strategies utilizing microcomputers in a classroom setting (Birkenholz, Stewart, McCaskey, Ogle, & Linhardt, 1988). They concluded that student achievement and attitudes were not found to be significantly affected when microcomputers were used to enhance traditional instructional methods.

Several researchers have attempted to assess the availability of instructional technology in education. The Office of Educational Research and Improvement (1986) reported that 99% of all public high schools in the United States had purchased microcomputers.* A study by the Nadonal FFA Agricultural Computing Service (1985) reported that only 55% of the secondary agricultural education programs had microcomputers in the departmental inventory. Another study collected data relative to the type and level of microcomputer use in agriculture programs throughout the United States (Miller & Kotrlik, 1986). They reported that 39% of the agriculture teachers had microcomputers and used them primarily for instructional management.

Foster and Miller (1985),Henderson (1985),and Malpiedi, Papritan, and Lichtensteiger (1985) completed studies which surveyed agricultural educators concerning the use of microcomputers. Each of these studies reported that further research was needed to assess the effect of using microcomputers in secondary agriculture programs.

Emphasis has been placed on the need to prepare technologically literate students. Barbour (1984) reported that there was increased emphasis on the integration of computers in the curriculum, especially in the ninth through the twelfth grades. He further noted that several states had mandated that students develop computer literacy skills as part of the secondary school curriculum. In 1982, computer literacy was the primary objective of microcomputer use in secondary classrooms. However, a recent report identified enrichment as the principal objective guiding the use of microcomputers in educational settings, followed by computer literacy and remediation (Office of Educational Research and Improvement, 1986). Lockheed and Mandinach (1986) also reported that the trend in secondary schools had shifted from computer programming courses toward an emphasis on applications-based courses.

Edward R Murrow (cited in Cline and Anderson, 1984) noted that television "can teach, it can illuminate; yes, it can even inspire. But it can do so only to the extent that humans are determined to use it to those ends. Otherwise, it is merely lights and wires in a box" (p. 39). Although this statement was made in reference to the development of television, the message applies to all educational media. Educational planners must focus on how newly-developed technologies have, will, and should be used in classrooms of the future.

Those who have responsibility for planning programs and developing instructional materials for agricultural education in classrooms have limited data available regarding the current and projected use of instructional technologies. Conflicting findings have been reported on the availability and use of microcomputers in teaching secondary agriculture. Furthermore, little data were available regarding the projected use of instructional technologies. Researchers have reported that from 39% to 55% of secondary agriculture programs and almost all high schools either owned or had access to microcomputers. However, information regarding the **use** of that and other technologies was limited. There also appeared to be wide discrepancies in the literature concerning the summer in which microcomputers were being used in agricultural education programs. Therefore, the central problem for this study was the lack of reliable information needed to make reasoned judgments regarding the use of instructional technologies in agricultural education programs.

Although subject to revision, current plans would provide an indication of how teachers anticipate usine instructional technologies in the vears to come. The National FFA Board of Directors concluded that an assessment of the intentions of teachers was needed to facilitate the infusion of instructional technologies in the classrooms of tomorrow (National FFA Board of Directors, 1988). Therefore, the purpose of this study was to document the current status and to project the future use of instructional technologies in high school agriculture programs. Information provided by this study was to be used in developing curriculum and program materials designed to accommodate instructional technologies used in secondary agriculture programs in the future.

Objectives

This study was conducted to assess the extent to which instructional technology has been or is projected to be adopted and utilized in secondary agricultural education programs int he United States. More specifically, this project was designed to fulfill the following objectives:

1. To identify the types and quantity of instructional technology available in high school agricultural education programs.
2. To ascertain if future plans differ from current use of instructional technology in high school agricultural education programs.
3. To identify barriers which inhibit greater **use** of instructional technology in high school agricultural education programs.

Procedures

This national study of the **use** of instructional technologies in agriculture programs (Birkenholz & Stewart, 1989) was funded by the National FFA Organization. The population for the study consisted of all secondary agricultural education programs (N = 9080) listed in the Agricultural Teachers a Directory (Hamp, 1988). A procedure involving a representative group from each state was used to identify agriculture programs to provide information needed to fulfill the objectives. Teachers from 479 secondary agriculture programs were contacted to provide responses to a mailed survey instrument. The number of programs surveyed exceeded the minimum sample size needed. (Krejcie & Morgan, 1970) to represent a population of 10,000. Each member of the sample was selected by identifying every twentieth school in the alphabetical listing of programs by state in the Agricultural Teachers mDirectory. and cover letters were sent to lead instructors in each selected program. Those who did not respond within two weeks were sent a reminder postcard to encourage their response. Five weeks after the postcards were sent, a second letter and instrument were sent to instructors who had not responded. Finally, a follow-up phone call was used to collect data from a 10% random sample of non-respondents.

The instrument requested information in the following areas: (a) types and quantity of equipment; (b) **level** of **current** use; (c) level of use planned for the future; (d) future needs for equipment, software, materials, training, and on-line computer services; and (e) barriers to using existing

technologies. A pilot test was conducted using members of the population which were not selected as part of the sample. Instrument validity was assessed by a panel of faculty members in Agricultural Education and Instructional Technology at the University of Missouri-Columbia. Instrument reliability was estimated by calculating a Cronbach's alpha reliability coefficient of .98 on the data collected as part of the study for the current and anticipated use of technology sections of the instrument.

The data collected were analyzed using descriptive statistics. x-tests were performed using data from the respondents and non-respondents on selected dependent variables to ascertain if the respondents were representative of the population. ANOVA tests were used to identify differences in the current and anticipated level of use of instructional technology for administration and planning, group instruction, and individual instruction.

Findings

Usable data collection instruments were received from 254 secondary agriculture teachers for a response rate of 53%. As a result of comparing the data collected from 254 respondents and 19 non-respondents, no significant differences were found between the groups on the inventory of equipment or the use of traditional equipment (e.g. overhead projectors, slide projectors, etc.). However, significant differences were found among the respondent groups on the current use of microcomputers and related peripherals. Respondents reported using microcomputers for instructional purposes to a greater extent than non-respondents at the current time. Therefore, findings related to the use of microcomputers should be limited to the respondents. Other findings and conclusions may be generalized to the population.

The first objective was to identify and document the types and quantity of instructional technology available in high school agriculture programs. Table 1 represents the percent of agriculture departments and schools reporting selected items of instructional equipment as well as the mean number of machines in the inventory of those programs with equipment. Over 50% of the agriculture departments reported an equipment inventory which included an overhead projector (80%), a microcomputer (73%) and printer (66%), a slide projector (67%), a filmstrip projector (61%), and an audio-cassette player (56%). Forty-seven percent of the agriculture departments had a 16mm film projector and 35% had a VCR player/recorder. Fewer than 26% of the agriculture departments reported having other types of instructional equipment in the departmental inventory.

The second objective, to assess differences in the current and anticipated use of instructional technology in high school programs of agriculture, was addressed using ANOVA. As noted in Table 2, teachers anticipated increasing the use of more recently developed technologies, but reported no change in the use of traditional equipment for group instructional purposes. However, the changes of practical significance were limited to microcomputers and VCRs. The use of these technologies was expected to increase to approximately the current usage level of the overhead projector and slide projector for group instructional purposes.

The respondents also anticipated using the newer instructional technologies to a greater extent for individual instruction. On a practical basis, they anticipated using the microcomputer and the VCR recorder most often for individual instruction. Major changes were not anticipated in the use of other pieces of equipment.

Respondents also anticipated increasing the use of each instructional technology for administrative and planning purposes. Most notably, microcomputers, VCRs, and VCR cameras will be used to the greatest extent in the future.

Objective three was to identify barriers which inhibit greater use of instructional technology in high school agriculture programs. When asked to identify barriers to the use of instructional technology (Table 3), a lack of funds was a frequently cited factor which limited the use of instructional equipment. Most notably, a lack of funds was a barrier which inhibited the adoption and use of the newer instructional technologies. When examining barriers to the use of microcomputers, 29% of the respondents indicated a lack of expertise in using the computer, 27% a lack of expertise in using the modem, and 30% a lack of materials and software needed to support the equipment as limiting factors. Approximately 20% of the respondents reported no interest in using the amplified telephone and the opaque projector. Having out-of-date materials was also reported as a problem with the filmstrip projector, slide projector, and audio-cassette player.

Table 1
Inventory of Instructional Equipment in Agriculture Departments and Schools (N = 254).

Equipment	Agriculture Departments			Schools		
	n	%	X inventory	n	%	X inventory
Microcomputer	18.5	72.8	2.47	216	**85.0**	32.0
Microcomputer modem	66	26.0	1.6	95	**37.4**	4.5
Microcomputer printer	168	66.1	1.7	209	82.3	15.4
Overhead computer projection unit	16	6.3	1.1	59	23.2	2.8
Amplified telephone	21	8.3	1.1	55	21.7	6.2
VCR player/recorder	90	35.4	1.4	208	81.9	5.6
VCR camera	50	19.7	1.5	208	81.9	2.5
Satellite receiver dish	7	2.8	1.1	39	15.4	1.1
Interactive video	10	3.9	1.1	52	20.5	2.2
Carousel slide projector	170	66.9	1.2	202	79.6	7.8
Overhead projector	204	**80.3**	1.4	202	79.6	16.8
Audio-cassette player	141	**55.5**	1.6	18.5	72.8	11.0
16mm film projector	120	47.2	1.2	204	80.3	7.7
Film strip projector	154	60.6	1.5	195	76.8	9.4
Opaque projector	45	17.7	1.3	189	74.4	2.8
Large screen TV	26	10.2	1.2	61	24.0	3.2

*Means are for the department/schools reporting equipment in inventory.

Table 2
Means and Comparisons of Current and Anticipated Use of Instructional Technlology in Agriculture Departments

Item	Grouo Instruction			Individual Instruction			Administration		
	X Current/Anticipated Use		Ha	X Current/Anticipated Use		F&	X Current/Anticipated Use		FJg
Microcomputer	2.72	3.44	56.0/.01	2.91	3.62	50.9/.01	3.26	3.83	33.0/.01
Microcomputer modem	158	2.36	65.8/.01	1.65	2.40	50.6/.01	1.64	254	72.0/.01
Microcomputer printer	2.84	3.40	29.1/.01	2.82	3.41	34.6/.01	3.31	3.82	24.3/.01
Overhead Computer Projection Unit	1.55	2.33	49.6/.01	xxxxxxxx		xxxx/xxx	XxXx	XxXx	xxxx/xxx
Amplified telephone	1.14	1.45	32.3/.01	xxxx	xxxx	xxxx/xxx	1.38	1.80	25.7/.01
VCR player/ recorder	3.16	3.67	38.7/.01	2.68	3.21	27.8/.01	3.27	3.68	24.5/.01
VCR camera	2.32	3.11	56.1/.01	2.14	2.78	32.9/.01	2.26	3.09	70.1/.01
Satellite receiver dish	1.18	1.75	52.4/.01	1.22	1.64	27.3/.01	1.16	1.76	53.9/.01

Note: Responses were coded: 1 = never, 5 = always
*ANOVA was used to ascertain differences between levels of current and anticipated use.

Table 2 (continued)
Means and Comparisons of Current and Anticipated Use of Instructional Technology in Agriculture Departments

Item	Group Instruction			Individual Instruction			Administration		
	X	Current/Anticipated Use	*F/p	X	Current/Anticipated Use	FJ/m	X	Current/Anticipated Use	*F/p
Overhead projector	3.37	3.43	0.4/.52	2.39	2.46	0.4/.52	xxxx	X x X x	xxxx/xxx
player cassette	2.85	2.88	0.1/.73	252	2.62	1.1/.31	1.17	1.60	32.8/.01
Filmstrip projector	2.93	2.94	0.1/.88	2.54	2.56	0.1/.87	xxxxxxxx		xxxx/xxx
16mm film projector	280	2.83	0.1/.70	xxxxxxxx		xxxx/xxx	xxxx	X x X x	xxxx/xxx
Opaque projector	1.65	1.68	0.24/.63	xxxxxxxx		xxxx/xxx	xxxxxxxx		xxxx/xxx
Interactive video	1.18	1.57	29.9/.01	1.19	1.54	25.8/.01	1.17	1.60	32.8/.01
Carousel slide	3.28	3.36	0.9/.34	2.71	2.87	3.2/.08	xxxxxxxx		xxxx/xxx

Note: Responses were coded: 1 = never, 5 = always
*ANOVA was used to ascertain differences between levels of current and anticipated use.

Table 3
Percent of Agriculture Teacher Responses to Barriers in Utilizing Instructional Technologies

Equipment	Lack of $ %	Lack of expertise %	Lack of materials %	No interest %	Materials outdated %
Microcomputer	51	29	30	4	3
Microcomputer modem	59	27	5	10	2
Microcomputer printer	42	15	10	4	4
Overhead computer projection screen	63	12	4	11	1
Amplified telephone	46	15	2	26	0
VCR player/recorder	37	1	8	0	2
VCR camera	50	5	2	4	1
Satellite receiver dish (downlink)	67	11	3	14	1
Interactive video	51	17	2	16	1
Carousel slide projector	18	0	7	2	12
Audio cassette player	15	1	7	6	11
Filmstrip projector	17	1	5	4	14
Opaque projector	1.5	2	2	19	8
16mm film projector	17	0	8	2	1

Conclusions

Secondary agriculture departments do not have a complete inventory of the newer types of instructional equipment (e.g. VCR player, VCR camera, satellite receiver dish, etc.). It was reported that slide projectors, filmstrip projectors, overhead projectors, audio-cassette players, and microcomputers and printers were items typically included in the agriculture department inventory.

Departmental control of certain types of instructional equipment does not appear to be a major factor governing its use for group instruction. For example, teachers, reported using VCR player/recorders to a greater extent than other types of equipment although only about a third of the agriculture programs reported having VCRs in the departmental inventory.

Respondents in this study use microcomputers to a greater extent for planning and administration than for instructional purposes in secondary agriculture programs. They plan to increase the use of microcomputers and VCRs for group instructional purposes in secondary agriculture programs.

The use of satellite receivers in schools is limited and will not likely play a major role in group instruction in agricultural education over the next few years. Relatively few agriculture departments or schools have access to satellite downlink facilities. Although the responding teachers revealed plans to increase the use of that technology, actual use will be limited.

The greatest barriers to the use of instructional technologies in agriculture programs are a lack of funds, expertise, and limited availability of support materials.

Implications

Based on the findings of this study related to the projected use of instructional technology, the following implications should be considered in developing curriculum materials and teacher preparation programs.

The videotape player appears to be the audio-visual equipment which teachers plan to use most for group instruction in the future. Therefore, future, curriculum development efforts should incorporate supplementary videotape programs for use in secondary agriculture programs. However, research should be conducted to assess the effectiveness of instructional strategies which incorporate the use of videotapes for group and/or individual instruction. Instructional strategies which contribute to greater levels of student achievement should be incorporated into secondary agricultural education programs.

Microcomputers and printers appear to hold the greatest promise for use in program administration and for individualized instruction. Interest in using microcomputers for group instruction is relatively high compared to other instructional technologies, but secondary to the VCR

With relatively little interest in microcomputer modems, it is apparent that teachers have yet to embrace information transfer via microcomputer telecommunications. However, taking steps to overcome funding and expertise limitations may encourage greater use of this and other technologies as they become available. Teacher educators should also assist present and future teachers to develop the skills and abilities needed to utilize microcomputers and related peripherals in secondary agriculture programs.

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