Texas Agricultural Science Teachers' Attitudes toward Information Technology

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ABSTRACT

The researchers sought to find the Agricultural Science teachers' attitude toward five innovations (Computer-Aided Design, Record Books, E-Mail Career Development Event Registration, and World Wide Web) of information technology. The population for this study consisted of all 333 secondary Agricultural science teachers from Texas *FFA Areas V and VI. The potential subjects were identified from the Texas Teachers of Agricultural Science & Technology Directory published by the* Texas *Education Agency. Demographic and program variables for each respondent were classified as independent. Teachers' attitude scores for each innovation were classified as the dependent variable. Correlation analysis was used to identify significant relationships, if existing, between independent and dependent variables. Demographic variables analyzed included years of teaching experience, highest level of education, age, gender, grade level taught, membership in the Vocational Agricultural Teachers Association of* Texas *(VATAS), types of technology training received, and source of technology training. Program variables included location of campus (rural or metro) and number of Agricultural science teachers of campus.*

The study indicated favorable attitudes toward information technology were identified since mean subscale scores for each innovation were positive. The Agricultural Science teachers in this study who participated in technology training had more positive attitudes toward information technology. The study reported new information regarding Texas Agricultural Science teachers' attitude toward, and adoption of five specific innovations of information technology (Computer-Aided Design, Computerized Online Record Books, Electronic Mail, Online Career Development Event Registration and World Wide Web). The study also found that the Agricultural Science teachers had favorable attitudes toward online CDE registration, but it had the lowest attitude score.

Introduction

Many changes have taken place in Agricultural Education over the past decade, particularly in the area of information technology. This change is even more important for Agricultural Science and other Career and Technical Education (CTE) teachers since CTE students are twice as likely to use computers as academic students (Heaviside, 1992). Studies regarding computer anxiety levels among Agricultural science teachers by Fletcher and Deeds (1994) and Kotrlik and Smith (1989) found that Agricultural science teachers' computer anxiety ranged from mild to severe with regard to the aspects of computer anxiety measured by Oetting's Computer Anxiety Scale (Compass).

Agricultural science teachers' roles in the classroom are expanding to include the integration of technology. Five specific innovations were identified as information technology used by Agricultural science teachers. It is important to assess individuals' attitudes regarding the usage of these five innovations. Agricultural science teachers attitudes toward five specific innovations of information technology (Computer-Aided Design, Computerized Record Books, E-Mail, Online Career Development Events (CDE) Registration, & World Wide Web (WWW) need to be assessed. The purpose of this study was to assess Agricultural Science teachers' attitudes toward information technology and determine what relationship, if any, exist between demographic and program variables and teachers' attitudes.

Conceptual Framework

The theoretical perspective that guided the study was the Diffusion of Innovations Theory developed by Rogers (1995). Rogers' diffusion theory has been used for many years to describe innovation diffusion and the adoption or rejection of innovations. Rogers described the five stages of the innovation-decision process as knowledge, persuasion, decision, implementation, and re-invention.

- The innovation-decision process begins with the *knowledge stage* in which the potential adopter is exposed to the innovation and begins to understand how it functions.
- The *persuasion stage* includes the individual liking the innovation, discussion about the innovation with others, acceptance of the message about the innovation, formation of a positive image of the message and innovation, and support for innovative behavior from the social system.
- After knowledge is gained and an attitude is formed toward the innovation, the potential adopters enter the *decision stage* in which they are ready to make the decision to adopt or reject the innovation. Innovations that are perceived by individuals as having greater relative advantage, compatibility, trialability, observability, and less complexity will be adopted more rapidly than other innovations.
- The *implementation stage* includes the acquisition of additional information about the innovation, as well as regular and continued use of the innovation. An important phase of the implementation stage, when the innovation is applied to uses other than its original intended purpose, is re-invention.
- The *confirmation stage* consists of recognition of the benefits of using the innovation, integration of the innovation's use into routine, and promotion of the innovation to others.

Rogers (1995) categorized adopters based on their innovativeness and reported that over time the distribution of adopters will approach normality. Adopter categories include: innovators (2.5%), early adopters (13.5%), early majority (34%), late majority (34%) and laggards (16%). Adopter category ideal types characterized the innovators as venturesome, early adopters as having respect within the social system, early majority as deliberate, late majority as skeptical, and laggards as traditional.

Evidence that Agricultural science teachers in Texas have adopted computers and specific innovations of information technology has been reported by Fraze, Fraze, Baker & Kieth

(2002) suggesting that the adoption of computers, electronic mail, and the Internet have all moved beyond awareness and learning stages therefore the Agricultural science teachers of Texas using information technology have reached critical mass. Fraze et al. (2002) also found favorable attitudes among Agricultural science teachers towards most forms of information technology. But indicated the study of new and other innovations of information technology still existed. A similar study of Texas Family and Consumer Science (FCS) teachers (Williams, 2000) indicated that FCS teachers had favorable attitudes toward information technology.

Purpose

The purpose of this study was to access Texas Agricultural science teachers' attitudes toward and stages of adoption of information technology. This study also determined what relationships, if any, existed between demographic and program variables with teachers' attitudes. This study sought out to answer the following research questions:

1. What are the demographics of Texas Agriscience teachers that participated in this study?
2. What are the attitudes of agricultural science teachers toward the use of information technology including: Computer Aided Design, Computerized Record Books, Electronic Mail, Online Career Development Event Registration, and World Wide Web?
3. Is there a relationship between the agricultural science teachers' attitudes toward specific innovations of information technology and: years of experience, level of education, age, number of agricultural science teachers in the department, type of technology training, and source of training.

Methods

The population for this study consisted of all 333 secondary agricultural science teachers from Texas FFA Areas V and VI. The participants were identified from the Texas Teachers of Agricultural Science & Technology Directory published by the Texas Education Agency.

A researcher-modified version of the Teachers Attitude Toward Information Technology Questionnaire (TAT v. 2.0) (Christiansen & Knezek, 1996; TCET, 1999) was used to determine subjects' attitudes toward information technology. The original and subsequent versions were developed at the Texas Center for Educational Technology at the University of North Texas by Christiansen and Knezek. The researchers utilized the student teachers that semester to field test the instrument.

The Data collection procedure followed the Salant and Dillman (1994) model for mailed questionnaire administration. An introductory letter, the questionnaire and a follow-up post-card were mailed in one week intervals. A data collection period of eight weeks was used to allow time for 118 usable instruments returned, resulting in a return rate of 34.5%. The research instrument did not contain any identifiers therefore the researchers were unable to indentify the non-respondents; therefore the researchers were unable to compare non-respondents to respondents. The researchers did compare early respondents to late respondents and found no significant differences between the two groups.

Findings

Descriptive statistics were used to summarize and analyze the data using PSAW (Version 18.0). Demographic and program variables for each respondent were classified as independent. Teachers' attitude scores for each innovation were classified as the dependent variable. Correlation analysis was used to identify significant relationships, if existing, between independent and dependent variables.

Demographic and program information related to the respondents was collected from the background information that accompanied the questionnaires. Demographic variables analyzed included years of teaching experience, highest level of education, age, gender, grade level taught, membership in the Vocational Agricultural Teachers Association of Texas (VATAS), types of technology training received, and source of technology training. Program variables included location of campus (rural or metro) and number of Agricultural science teachers of campus.

Teaching Experience

- Teachers with six to ten years of experience consisted of 21.1%. Two to five years of teaching experience consisted of 20.3% of the total respondents.

Level of Education

- The majority of respondents indicated a bachelor's degree and education beyond the bachelor's degree as the two highest choices indicated at 33.1% and 32.3% respectively. The respondents with a Master's degree consisted of 23.7% and work beyond a Master's degree consisted 10.2%. One person indicated having a doctorate degree.

Age

- The largest group of respondents (16.1%) when categorized by age was 51-55. The 31-35 groups accounted for 15.3%, while 26-30 and 36-40 both accounted for 14.4% 41-45 and 46-50 both totaled 12.7%.

Grade Levels Taught

- Majority of the respondents (72.9%) taught at the 9-12 grade levels, and 20.3% taught grades 7-12.

Location of Campus

- Of the respondents, 29.7% taught at metropolitan (towns or cities with 10,000+ populations) campuses and 70.3% taught at rural campuses.

Number of Agricultural Science Teachers on Campus

- Campuses with two Agricultural Science teachers reportedly made up the majority of the group (50.8%). Campuses with one teacher made up 32.2% and campuses with 3 teachers reported 13.6%.

Membership in State Professional Association

- Ninety-five percent (95.8%) of respondents indicated membership in the Vocational Agricultural Teachers Association of Texas (VATAS), the state professional association for Agricultural Science teachers.

Eighty-one percent (81.4) of respondents indicated having received training in basic computer literacy. Internet application training has been received by 78.8%, technology integration has been received by 61.9%. Sixty-one percent of the respondents indicated that they have received computerized record book training. The frequencies and percentages of responses are indicated in Table 1.

Table 1
Types of Technology Training Reported by Respondents

Source	Frequency	%
No Technology Training	7	5.9
Basic Computer Literacy	96	81.4
Internet Applications	93	78.8
Technology Integration	73	61.9
Computer Aided Design	20	16.9
Computerized Record Books	72	61.0
Other	13	11.0

The source of technology training reported by the most respondents (80.5%) was provided by the local campus or district. Respondents who were self-taught accounted for 78%. Training from professional improvement conferences for Agricultural Science teachers was reported by 58.5%. The frequency of each type of technology training is indicated in Table 2.

Table 2:
Source of Technology Training

Source	Frequency	%
Local Campus	95	80.5
Self-taught	92	78.0
Regional Educational Service Center	29	24.6
College or University course	43	36.4
Professional Improvement Conference	69	58.5
Workshop/short course	50	42.4
Other	2	1.7

The researcher-modified version of the Teachers Attitude Toward Information Technology Questionnaire (TAT) version 2.0 was the instrument used to collect data. Data relevant to this question included attitude scores of the subscale that was calculated by totaling

the subscales. The maximum range of subscales scores was -30 to +30, with -30 indicating the least favorable attitude and +30 representing the most favorable attitude. The maximum range for the overall attitude score was -150 to +150.

Favorable attitudes toward information technology were identified since mean subscale scores for each innovation were positive. The innovation with the highest mean subscale score was World Wide Web. The innovation with the lowest subscale score was Online Career Development Registration. Table 3 provides descriptive data including the number of respondents, mean subscale scores as well as standard deviation.

Table 3
Mean Innovation Subscale Scores and Overall Attitude Score

Innovation	N	M	SD
Attitude Toward Computer Aided Design	118	14.08	11.588
Attitude Toward Computerized SAE Record Books	118	16.55	11.338
Attitude Toward Electronic Mail	118	18.38	11.852
Attitude Toward Online CDE Registration	118	13.94	11.225
Attitude Toward World Wide Web	118	23.46	8.897

The Spearman Rho correlation coefficients were used to determine what relationships, if any, existed between subscale scores for Computer Aided Design and years of teaching experience, level of education, age, gender, grade level taught, campus location, number of Agricultural Science teachers in the department, membership in the state professional association for Agricultural Science teachers (VATAS), FFA Area located, type of technology training, and source of technology training. Significant relationships between Agricultural Science teachers' attitudes toward Computer aided design and these demographic and program variables are identified in Tables 4.

Table 4
Significant Relationships Between Demographic and Program Variables and Agricultural Science Teachers' Attitudes toward Computer-Aided Design

Demographic or Program Variable	Agricultural Science Teachers' Attitudes Toward Computer Aided Design	Correlation Coefficient (Rho)
Gender	Computer-Aided Design	-.258**
Grade level taught	Computer-Aided Design	.198*
Member of VATAS	Computer-Aided Design	.255**

* shown at .05
* *shown at .01

The Spearman Rho correlation coefficients were used to determine what relationships, if any, existed between subscale scores for Computerized SAE Record books and years of teaching experience, level of education, age, gender, grade level taught, campus location, number of Agricultural Science teachers in the department, membership in the state professional association for Agricultural Science teachers (VATAS), FFA Area located, type of technology training, and source of technology training. Significant relationships between Agricultural Science teachers'

attitudes toward Computerized Supervised Agricultural Experience (SAE) Record Books and these demographic and program variables are identified in Tables 5.

Table 5
Significant Relationships Between Demographic and Program Variables and Agricultural Science Teachers' Attitudes toward Computerized Supervised Agricultural Experience (SAE) Record Books

Demographic or Program Variable	Agricultural Science Teachers' Attitudes Toward Computerized SAE Record Books	Correlation Coefficient (Rho)
Gender	Computerized SAE Record Books	-.369**
Computerized Record Books	Computerized SAE Record Books	-.232*

* shown at .05
* *shown at .01

The Spearman Rho correlation coefficients were used to determine what relationships, if any, existed between subscale scores for Online Career Development Event (CDE) Registration and years of teaching experience, level of education, age, gender, grade level taught, campus location, number of Agricultural Science teachers in the department, membership in the state professional association for Agricultural Science teachers (VATAS), FFA Area located, type of technology training, and source of technology training. Significant relationships between Agricultural Science teachers' attitudes toward Online Career Development Event (CDE) Registration and these demographic and program variables are identified in Tables 6.

Table 6
Significant Relationships Between Demographic and Program Variables and Agricultural Science Teachers' Attitudes toward Online Career Development Event (CDE) Registration

Demographic or Program Variable	Agricultural Science Teachers' Attitudes Toward Online CDE Registration	Correlation Coefficient (Rho)
Years teaching	Online CDE Registration	-.195*
Gender	Online CDE Registration	-.300**
Technology Integration	Online CDE Registration	-.206*

* shown at .05
* *shown at .01

The Spearman Rho correlation coefficients were used to determine what relationships, if any, existed between subscale scores for Electronic Mail and years of teaching experience, level of education, age, gender, grade level taught, campus location, number of Agricultural Science teachers in the department, membership in the state professional association for Agricultural Science teachers (VATAS), FFA Area located, type of technology training, and source of technology training. Significant relationships between Agricultural Science teachers' attitudes toward Electronic Mail and these demographic and program variables are identified in Tables 7.

Table 7
Significant Relationships Between Demographic and Program Variables and Agricultural Science Teachers' Attitudes toward Electronic Mail

Demographic or Program Variable	Agricultural Science Teachers' Attitudes Toward Electronic Mail	Correlation Coefficient (Rho)
Years teaching	Electronic Mail	-.259**
Age	Electronic Mail	-.195*
Gender	Electronic Mail	-.268**
Member of VATAS	Electronic Mail	.236*
Technology Integration	Electronic Mail	-.271**

* shown at .05
* *shown at .01

The Spearman Rho correlation coefficients were used to determine what relationships, if any, existed between subscale scores for the World Wide Web and years of teaching experience, level of education, age, gender, grade level taught, campus location, number of Agricultural Science teachers in the department, membership in the state professional association for Agricultural Science teachers (VATAS), FFA Area located, type of technology training, and source of technology training. Significant relationships between Agricultural Science teachers' attitudes toward the World Wide Web and these demographic and program variables are identified in Tables 8.

Table 8
Significant Relationships Between Demographic and Program Variables and Agricultural Science Teachers' Attitudes toward World Wide Web.

Demographic or Program Variable	Agricultural Science Teachers' Attitudes Toward	Correlation Coefficient (Rho)
Years teaching	World Wide Web	-.207*
Age	World Wide Web	-.188*
Gender	World Wide Web	-.286**

* shown at .05
* *shown at .01

Conclusions

Agricultural Science teachers' attitude toward five innovations (CAD, Record Books, E-Mail, CDE Registration, WWW) of information technology indicated favorable attitudes toward information technology were identified since mean subscale scores for each innovation were positive. This reinforces the findings of Fraze, et al. (2002). The innovation with the highest mean subscale score was World Wide Web. The innovation with the lowest subscale score was Online Career Development Registration. The relationships between Agricultural Science teachers' attitudes and demographic and program variables were measured using correlation coefficients ($p<.05$) to determine what relationships existed. No significant relationship was found between respondents' attitudes and level of education. No significant relationship was

found between respondents' attitudes and number of Agricultural Science teachers on campus. No significant relationship was found between respondents' attitudes and source of training.

However, significant negative relationships were identified between attitudes toward Online CDE registration and years of teaching experience. Significant negative relationships were identified between attitudes toward electronic mail and years of teaching experience. Significant negative relationships were identified between attitudes toward the World Wide Web and years of teaching experience. Significant negative relationships were identified between attitudes toward electronic mail and age of respondent. Significant negative relationships were identified between attitudes toward the World Wide Web and age of respondent. These findings suggest that the veteran teachers have entered the twilight of their teaching careers and are at a point in which they are going to reject an innovation as much as possible until they are able to retire.

Significant positive relationships were identified between attitudes toward Online CDE registration and technology integration training. Significant positive relationships were identified between attitudes toward electronic mail and technology integration training. The Agricultural Science teachers in this study who participated in technology training had more positive attitudes toward information technology. This can be viewed in two different lights; first teachers who had favorable attitudes towards a particular topic are more likely to seek out additional training in those areas. The second explanation can be the result of participating in the actual training, thus introducing the novice learners to the innovation through guided practice. The familiarity that the participants had received was enough for the participants to identify the importance of those innovations.

Marrison and Frick (1988) recommended computers for classrooms as a supplement. Harris (1992) suggested the use of Computer-Aided Design to assist students to better prepare designs. The Texas Agricultural Science teachers had a favorable attitude toward the use of computer-aided design, but did not perceived them to be in the more advanced stages of adoption. Evidence from this study regarding significant relationships between attitudes towards other innovations of information technology suggest the need for more training for Computer-Aided Design relevant to Agricultural Science. The researchers suggest that several training opportunities may exist in the area of agricultural mechanics. Post-secondary agricultural education instructors who specialize in agricultural mechanics should develop opportunities for agricultural science teachers to develop additional skills in CAD. Post-secondary institutions that do not have a faculty member that has CAD experience are encouraged to work with industry representatives who can serve as content experts.

The researchers involved in this study indicated that Texas Agricultural Science teachers had favorable attitudes toward electronic mail, which reinforced the findings of Fraze, et al. (2002). In addition, Williams found another Career and Technical Education group had similar findings; the Texas Family and Consumer science teachers had favorable attitudes toward electronic mail and the World Wide Web. The researchers also found that the Agricultural Science teachers had favorable attitudes toward online CDE registration, but it had the lowest attitudinal score. Online CDE registration in Texas is required for schools to participate in FFA career development events. Rogers (1995) suggested that when an innovation-decision is made

by a system, such as universities hosting FFA events, rather than the individual, forced adoption results. When a system makes the decision to adopt the technology the individuals may resist force to the implementation or develop less favorable attitudes toward the innovation. The researchers suggest that while some of the innovations were met with some resistance, all of them had been accepted.

This study found that Texas Agricultural Science teachers had positive attitudes toward Computerized SAE Record Books and Computer-Aided Design. Fraze, et al. (2002) found that Texas Agricultural Science teachers have a positive attitude toward specific innovations of information technology such as computers for classroom use, electronic mail and World Wide Web. Fraze et al. (2002) also found that the Agricultural Science teachers supported online activities such as FFA contest registration, FFA membership roster completion, FFA award applications, stock-show registration, and research questionnaires. This study found that Texas Agricultural Science teachers have positive attitudes to similar innovations in information technology and have moved into the advanced stages of adoption.

Recommendations

The study reported new information regarding Texas Agricultural Science teachers' attitude toward, and adoption of five specific innovations of information technology (Computer-Aided Design, Computerized Online Record Books, Electronic Mail, Online Career Development Event Registration and World Wide Web). Results of this study may be of use to Agricultural Science teachers, teacher educators, technology trainers, technology coordinators, and administrators. Recommendations from this study are:

1. Increase opportunities for technology training for Agricultural Science teachers.
2. Encourage teacher education institutions to emphasize the integration of information technology into instructional formats with increased emphasis on Computer-Aided Design and Computerized Record Books.
3. Replicate this study with Agricultural Science and other Career and Technical Education teachers in other states.
4. Encourage the exploration of barriers and incentives to adoption.
5. Encourage study of other innovations of information technology used by Agricultural Science teachers.

Implications

The study reported new information regarding Texas Agricultural Science teachers' attitude toward, and adoption of five specific innovations of information technology (Computer-Aided Design, Computerized Online Record Books, Electronic Mail, Online Career Development Event Registration and World Wide Web). The study found that majority of the participants had positive attitudes towards the use of all five innovations. The findings from this study indicate that those innovations that are mandated from the top-down are met with more resistance than those innovations that are adopted from the bottom-up. There was a negative relationship between age and several of the innovations, while some would suggest phasing out

those individuals, we recommend offering some professional development opportunities for technologically challenged instructors.

The results of this study may assist professional development providers to improve their information technology training programs, specifically in computer-aided design. Topics such as computer aided design can be viewed as cross curricular in the fact that CAD can be taught in both industrial technology and agricultural science, therefore professional development can be opened up to instructors in both content areas. University teacher educators in Agricultural Science need to ensure that all teachers receive instruction in the use of the latest innovations in information technology. Teacher educators in Agricultural Science at the university level should also incorporate teaching with those new innovations in information technology into the methods classes taken during teacher preparation, as well as other classes taught.

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