

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, Steffensmeier & 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 accessible 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 accessible 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, R²=.42, Standard Error .8341

^a0=No, 1=Yes

^bScale 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, R²=.56, Standard Error .9500

^a0=No, 1=Yes

^bScale 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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