

Family and Consumer Sciences Teachers' Adoption of Technology for Use in Secondary Classrooms

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This study determined whether Louisiana family and consumer sciences teachers integrate technology in instruction. Over half use college courses as a technology training source while most are self-taught or utilize workshops/conferences and colleagues. Teachers have adopted technology for use in instruction at a moderate level and experience moderate barriers and some anxiety as they attempt to incorporate technology. Age, technology anxiety, availability, and integration barriers are individually related to technology adoption. Regression analysis was used to assess the variance explained by the variables that are individually related to technology adoption. Technology anxiety explains a large proportion of the variance in technology adoption. Age, barriers to technology integration, and technology availability do not explain significant variance beyond the variance explained by technology anxiety.

Advances in technology have afforded students a new way of experiencing learning. To tap into the benefits that technology provides, teachers need to utilize technology to enhance instruction by applying course content to realistic career and life challenges. This is especially important in career and technical education programs, such as family and consumer sciences education (FACS). In fact, the importance of the use of technology in instruction was stated in Standard 6 of the 2004 *National Standards for Teachers of Family and Consumer Sciences*:

6. Instructional Strategies and Resources. Facilitate students' critical thinking and problem solving in family and consumer sciences through varied instructional strategies and technologies and through responsible management of resources in schools, communities, and the workplace (National Association of Teacher Educators for Family and Consumer Sciences, 2004, paragraph 4).

Even before approval of the 2004 FACS standards, Keane (2002) reported that "Some states had decided to take the national standards for FCS one step further and specifically tailor them to their needs in the areas of technology" (p. 42). Keane further supported the need to integrate technology in FACS when she stated, "As technology use continues to rise, it is essential that FCS professionals grasp the latest concepts for use in their classrooms" (p. 43). Arnett and Freeburg (2008) studied the early field experiences of FACS pre-service teachers and found that the skill area that the pre-service teachers felt they needed to develop was the knowledge and use of technology in the classroom.

Reichelt and Pickard (2008) discussed how technology such as the Internet could be used in FACS classrooms. In discussing Internet learning activities for FACS, they stated, "Perhaps the simplest and most straight forward way of integrating technology into family and consumer sciences classrooms is the potential of the Internet as a source of information. . . . This is one place where the evaluation of information and critical thinking skills can be taught" (p. 52).

Technology Adoption Research

Studies have shown historically that FACS teachers have embraced or adopted technology at various levels of usage. Keane (2002) reported that FACS classrooms in the 1980s were equipped with the latest appliances, including those with computer programming, with some classrooms having computers. Even though computers were not available on a large scale in the 1980s, FACS teachers educated their students about their significance and used a wide variety of software. By the early 1990s, FACS teachers were regular users of computers (Keane).

Keane's conclusions were supported by Daulton's (1997) survey of vocational home economics teachers that reported that the computer adoption progress began slowly in 1982-1983 with a 5% adoption rate and had increased to 83% by 1992-1993. Technology usage varied from 1 to 6 hours per week with the greatest category of use (34%) being 2-3 hours per week. Daulton indicated that the rate of technology usage followed Everett Rogers' (1983) classic adoption-diffusion of innovations paradigm. It should be noted that Daulton's study addressed computer usage only and did not address the broader concept of technology use in instruction, which includes multiple types of instructional technologies. By the late 1990s, Harrison, Redmann, and Kotrlik's (2000) FACS study revealed that teachers place a high value on information technology for use in the classroom including computers in general and other instructional technologies such as the Internet and laser disc players. Although FACS teachers valued information technology, they perceived that information technology was moderately useful in program and instructional management. A low positive relationship existed between how teachers value information technology and the availability of computer technology at home and school (Harrison, Redmann, & Kotrlik).

Williams (2000) reported that Texas FACS teachers' were in the advanced stages of adoption for each of the five innovations studied (email, Internet, multimedia, computers for professional productivity, and computers for classroom use). Conversely, in a study reported the same year, Croxall and Cummings (2000) found that New Mexico FACS teachers did not regularly incorporate computers into their curricula.

Studies related to technology adoption in career and technical education clearly indicate that career and technical education teachers should adopt technology for use in instruction (Chapman, 2006; Redmann & Kotrlik, 2004; Thomas, Adams, Meghani, & Smith, 2002; Womble, Adams, & Stitt-Gohdes, 2000). Redmann and Kotrlik also found that agriscience, business, and marketing teachers were actively exploring the potential uses of technology in teaching and learning and were adopting technology for regular use in instruction, but were not actively experimenting with technology.

In a national study conducted in nine states that involved 1,666 schools, Abbot and Fouts (2001) found that over half of the teachers did not routinely use technology in teaching and learning. Cuban, Kirkpatrick, and Peck (2001) found in a study of high school teachers, administrators, and students that access to technology by itself "... seldom led to widespread teacher and student use" (p. 813). The lack of technology use in teaching and learning may be related to the adoption of innovations. How quickly individuals adopt change is related to whether they value the new approach when compared to their existing approach (Rogers, 2003). Fullan (2001) indicated that teachers need time to merge their improved knowledge into their instructional practice as a basis for the acceptance of innovations.

Variables Related to Technology Adoption

Technology Integration Barriers. Barriers are defined as any factor that discourages or prevents teachers from using technology (The British Educational Communications and

Technology Agency [BECTA], 2003). Teacher-level barriers include lack of self-confidence in using technology, lack of necessary knowledge, and lack of time while a restriction on access to resources such as technical and institutional support, equipment, and state of the art software is a major administrative barrier (BECTA). Lack of administrative and institutional support, lack of training and experience, and limitations resulting from personality or attitudinal factors often result in teachers falling short when attempting to incorporate technology (Brinkerhoff, 2006). Other studies also reported that technology unavailability was also reported as an important factor inhibiting the use of technology by teachers (BECTA, 2003; Mumtaz, 2000; Redmann & Kotrlik, 2004). Park & Ertmer (2008) expanded on the barriers identified above by stating “. . . a lack of a clear, shared vision was the primary barrier. Additional barriers included lack of knowledge and skills, unclear expectations and insufficient feedback” (p. 631). Specifically in FACS, Croxall and Cummings (2000) and Williams (2000) found that a lack of software, hardware, and time were major barriers to teachers’ use of technology in the classroom.

Technology Anxiety. Equipping teachers with technology and then failing to provide adequate training or failing to consider curricular issues has led to technology anxiety (Budin, 1999). In a 3 year study of Mississippi FACS teachers using a pre/post-test design, Lokken, Cheek, and Hastings (2003) reported that no computer anxiety existed after training, even though teachers’ anxiety was inversely related to the frequency of computer use prior to the initiation of the study. Redmann and Kotrlik (2004) also reported that technology adoption increased as technology anxiety decreased for career and technical education teachers.

Technology Training and Availability. A key predictor of technology use found by Vannatta and Fordham (2004) is the amount of technology training. Training is typically focused on basic skills instead of targeting the integration of technology in instruction (BECTA 2003). Mumtaz (2000) and BECTA (2003) reported that a lack of technology availability was a key factor in preventing teachers from using technology in their instruction. Croxall and Cummings (2000) established that hours of training and availability of technology are significantly related to FACS teachers’ classroom usage of technology; use of technology in teaching increased as hours of training increased. Williams (2000) found that Texas FACS teachers had received basic computer literacy training that included technology integration and Internet applications. Over half of the teachers were self-taught, but a larger proportion had used school system technology training. Croxall and Cummings (2000) concluded that hours of training and availability of technology was significantly related to FACS teachers’ classroom usage of technology.

Age and Teaching Experience. In Lokken, Cheek, and Hastings’ (2003) three year study of FACS teachers, the researchers concluded that older teachers had less confidence in technology and in their ability to use technology. Waugh (2004) concluded that technology adoption decreased as age increased; however, previous studies of FACS teachers found that no relationship existed between age or teaching experience and the incorporation of technology into the classroom (Croxall & Cummings, 2000; Williams, 2000), which was also supported by Redmann and Kotrlik (2004) in their study of career and technical education teachers. A lack of experience with incorporating technology in instruction was a factor that resulted in teachers avoiding the use of technology (Mumtaz, 2000) and an NCES study reported that more experienced teachers were less likely to utilize technology than less experienced teachers (Smerdon et al., 2000).

Need for the Study

Strong professional, political and organizational support for technology-based instruction (Bower, 1998; *No Child Left Behind Act*, 2001) points to the need to continue investigating the incorporation of technology in instruction. Johnson (2007) cited scholarly work that was needed in the next decade in her review of previous FACS research and scholarly work. Included in the recommendations were several research questions related to technology integration in instruction, namely “What technology is being used in classrooms? How are teachers being prepared to use technology as a teaching method and management tool? How has this changed the classroom environment and the effectiveness of instruction?” (p. 35). The need for this study, as supported by the research cited, targets FACS teachers’ incorporation of technology in instruction. The study’s results should contribute to efforts to ensure that technology is used to attain maximum impact.

Purpose and Research Questions

The purpose of this research was to determine secondary FACS teachers’ adoption of technology for use in instruction. Five questions guided the study:

1. What are the FACS teachers’ demographic and personal characteristics?
2. To what extent have teachers adopted technology in their instruction?
3. Do barriers exist that prevent teachers from using technology in their teaching?
4. Do teachers experience technology anxiety when seeking to use technology in instruction?
5. Do teachers’ demographic and personal variables explain any variance in teachers’ technology adoption? Potential explanatory variables used in the forward regression analysis included teachers’ age, years teaching experience, technology anxiety, perceived barriers to technology integration, training sources, and technology available. Gender was originally considered as a potential explanatory variable, but was not included because the random sample only included one male teacher.

Method

The target and accessible population included all secondary FACS teachers in Louisiana. The required sample size was calculated using Cochran’s (Snedecor & Cochran, 1989) formula. Data collection was conducted according to the procedures recommended by Dillman (2000). After three data collection efforts (two mailings and a phone follow-up of a random sample of non-respondents), 91 out of 182 teachers returned their surveys for a 50% response rate.

Inferential *t*-tests compared the scale means of the technology adoption, barriers to technology integration, and technology anxiety scales for those responses received during the phone follow-up to those received by mail as recommended by Gall, Gall, and Borg (2002). This analysis was used to establish whether the responses were representative of the population and to control for non-response error. The three scales described in the instrumentation section were utilized for this analysis because they represented the study’s key variables. Since no significant difference existed by response mode (Table 1), it was concluded that the data were representative of the population and the mail and phone responses were combined for use in this study.

Table 1

Comparison of FACS Teachers' Mail versus Phone Follow-up Responses

Scale	Mail Responses	Phone Responses	Levene's Test for Equality of Variances				
	<i>m</i> (<i>n</i> / <i>sd</i>)	<i>m</i> (<i>n</i> / <i>sd</i>)	<i>F</i>	<i>P</i>	<i>t</i>	<i>Df</i>	<i>p</i>
Technology Adoption ^{ab}	3.47 (72/.84)	3.36 (18/.89)	.14	.71	.53	88	.60
Barriers to Technology Integration ^c	2.67 (69/.67)	2.74 (22/.67)	.16	.69	-.38	85	.71
Technology Anxiety ^d	2.34 (72/1.03)	2.15 (19/.90)	.19	.67	-.71	89	.48

^aEqual variances assumed for *t*-tests since Levene's Test for Equality of Variances did not detect any statistically significant variance. ^b*Technology Adoption Scale*: 1 = Not Like Me, 2 = Very Little Like Me, 3 = Some Like Me, 4 = Very Much Like Me, 5 = Just Like Me. ^c*Barriers to Technology Integration Scale*: 1 = Not a Barrier, 2 = Minor Barrier, 3 = Moderate Barrier, 4 = Major Barrier. ^d*Technology Anxiety Scale*: 1 = No Anxiety, 2 = Some Anxiety, 3 = Moderate Anxiety, 4 = High Anxiety, 5 = Very High Anxiety.

Instrumentation

The scales in the instrument included technology adoption for use in instruction, barriers to technology integration in instruction, and technology anxiety experienced while attempting to use technology in instruction (15, 7, and 9 items, respectively). The research instrument was developed by the authors after a research literature review. Instrument validity was evaluated by an expert panel of university faculty and secondary teachers. The instruments were pilot tested with teachers enrolled in a comprehensive graduate program in career and technical education. The Cronbach's alpha reliability coefficients for the scales were exemplary according to Robinson, Shaver and Wrightsman (1991): technology adoption - $\alpha = .96$, barriers - $\alpha = .81$, and technology anxiety - $\alpha = .97$.

Data Analyses

Descriptive statistics were calculated for research questions 1-4. The data for research question 5 was analyzed using forward multiple regression. Cohen's (1988) guidelines were used to interpret the effect sizes for the correlations and multiple regression.

Results

Demographic and Personal Characteristics

The FACS teachers' ages ranged from 26 to 60 years ($M = 46.12$, $SD = 10.09$) and almost all were female (91 or 98.9%). Teachers' years teaching experience ranged from 0 to 34 with the average teacher having 17 years experience ($M=16.69$, $SD=10.20$). The main technology training used by the teachers was "workshops/conferences" which was used by 88 or 94.6% of the teachers, followed by "self-taught," which was used by 85 or 91.4% of the teachers (Table 2).

Table 2
Sources of Technology Training Used by FACS Teachers

Source	#	%
Workshops/conferences	88	94.6
Self-taught	85	91.4
Colleagues	80	86.0
College courses	53	57.0

Note. The teachers were asked to check (Y) each type of technology training they had used.

Almost all FACS teachers had an email account at school (89 or 95.70%) and a computer with Internet connection both at school (90 or 96.8%) and at home (86 or 92.5%). Just over one-third had a digital video camera (32 or 34.4%). Approximately one-fourth of the teachers reported their students had school email accounts (24 or 25.8%) while few had a personal digital assistant (PDA, 5 or 5.4%) or a Global Positioning System (GPS, 4 or 4.3%) (Table 3).

Technology Adoption

The *Technology Adoption Scale* was utilized to measure teachers' adoption of technology for use in instruction. The instrument contained 15 items with responses recorded on a 5 point scale (Table 4): 1 = Not Like Me at All, 2 = Very Little Like Me, 3 = Some Like Me, 4 = Very Much Like Me, and 5 = Just Like Me.

The top rated scale item was "I have made physical changes to accommodate technology in my classroom or laboratory," which teachers indicated was "Very Much Like Me" ($M = 3.93$, $SD = .88$), with the second highest rated item being "I emphasize the use of technology as a learning tool in my classroom or laboratory," which they also indicated was "Very Much Like Me" ($M = 3.87$, $SD = .89$). The lowest rated item was "I incorporate technology in my teaching to such an extent that my students use technology to collaborate with other students in my class during the learning process," which they indicated was "Some Like Me" ($M = 2.73$, $SD = 1.19$). The scale mean was 3.45 ($SD = .85$) which indicates that the teachers perceived the items in the scale, as a whole, were "Some Like Me." The scale mean also indicates that FACS teachers had not adopted technology for use in instruction at either of the highest levels, "Just Like Me" or "Very Much Like Me."

Table 3

Technology Available to FACS Teachers for Use in Instruction

Technology Available for Use in Instruction	#	%
Teacher has computer with Internet connection at school ^a	90	96.8
Teacher has a school email account ^a	89	95.7
Teacher has computer with Internet connection at home ^a	86	92.5
Video Cassette, CD or DVD Recorder ^a	66	71.7
Laser disc or standalone DVD or CD players ^a	63	67.7
Interactive DVDs or CDs ^a	60	64.5
Teacher has access to enough computers in a classroom or lab for all students to work by themselves or with one other student	47	50.5
Digital video camera ^a	32	34.4
Students have a school email account	24	25.8
Personal Digital Assistant (e.g., Palm, IPAQ, Blackberry) ^a	5	5.4
GPS (Global Positioning System) ^a	4	4.3

Note. Teachers checked (Y) each technology type available for their use in instruction.

^aThe number of technologies available to each teacher ranged from 0 to 9 and was summed to create an available technology score for use in the regression analysis for research question 5.

Table 4
FACS Teachers' Responses to the Technology Adoption Scale Items

Item	<i>N</i>	<i>M</i>	<i>SD</i>
1. I have made physical changes to accommodate technology in my classroom or laboratory.	92	3.93	.88
2. I emphasize the use of technology as a learning tool in my classroom or laboratory.	92	3.87	.89
3. I discuss with students how they can use technology as a learning tool.	92	3.66	.84
4. I expect students to use technology to such an extent that they develop projects that are of a higher quality level than would be possible without them using technology.	92	3.60	1.16
5. I regularly pursue innovative ways to incorporate technology into the learning process for my students.	92	3.58	1.15
6. I expect my students to fully understand the unique role that technology plays in their education.	91	3.58	.98
7. I assign students to use the computer to do content related activities on a regular basis.	92	3.54	1.11
8. I expect my students to use technology so they can take on new challenges beyond traditional assignments and activities.	92	3.53	1.05
9. I expect my students to use technology to enable them to be self-directed learners.	91	3.44	1.02
10. I use technology to encourage students to share the responsibility for their own learning.	92	3.41	1.05
11. I design learning activities that result in my students being comfortable using technology in their learning.	92	3.37	1.06
12. I am more of a facilitator of learning than the source of all information because my students use technology.	92	3.26	1.04
13. I incorporate technology in my teaching to such an extent that it has become a standard learning tool for my students.	92	3.12	1.22
14. I use technology based games or simulations on a regular basis in my classroom or laboratory.	92	2.84	1.15
15. I incorporate technology in my teaching to such an extent that my students use technology to collaborate with other students in my class during the learning process.	92	2.73	1.19

Note. For items in the *Technology Adoption Scale* and for the total scale (scale interpretation ranges in parentheses): 1 = Not Like Me at All (1.00-1.49), 2 = Very Little Like Me (1.50-2.49), 3 = Some Like Me (2.50-3.49), 4 = Very Much Like Me (3.50-4.49), and 5 = Just Like Me (4.50-5.00). Scale *M* = 3.45 (*SD* = .85).

Technology Integration Barriers

The *Barriers to Integrating Technology in Instruction Scale* was used to measure the barriers that may prevent FACS teachers from integrating technology in instruction. The teachers responded to seven items using an anchored scale (Table 5): 1 = Not a Barrier, 2 = Minor Barrier, 3 = Moderate Barrier, and 4 = Major Barrier.

Table 5

Responses to Items in the Barriers to Integrating Technology in Instruction Scale

Item	<i>N</i>	<i>M</i>	<i>SD</i>
1. Availability of technology for the number of students in my classes.	92	3.16	1.03
2. Scheduling enough time for students to use the Internet, computers, or other technology in the teaching/learning process.	90	3.07	.92
3. Enough time to develop lessons that use technology.	92	2.96	.94
4. Availability of effective instructional software for the courses I teach.	91	2.76	.98
5. Availability of technical support to effectively use instructional technology in the teaching/learning process.	91	2.74	1.01
6. My ability to integrate technology in the teaching/learning process.	92	2.16	.96
7. Administrative support for integration of technology in the teaching/learning process.	90	2.06	1.04

Note. For items in the *Barriers to Technology Integration Scale* and for the total scale (scale interpretation ranges in parentheses): 1 = Not a Barrier (1.00-1.49), 2 = Minor Barrier (1.50-2.49), 3 = Moderate Barrier (2.50-3.49), 4 = Major Barrier (3.50-4.00). Scale $M = 2.68$ ($SD = .67$).

Teachers experienced moderate barriers when attempting to integrate technology in instruction (Scale $M = 2.68$, $SD = .67$). Moderate barriers were encountered with “Availability of technology for the number of students in my classes” ($M = 3.16$, $SD = 1.03$), and with “Scheduling enough time for students to use the Internet, computers, or other technology in the teaching/learning process” ($M = 3.07$, $SD = .92$). The barrier that was rated the lowest was a minor barrier - “Administrative support for integration of technology in the teaching/learning process” ($M = 2.06$, $SD = 1.04$).

Technology Anxiety

The anxiety FACS teachers feel when they think about using technology in their instruction was assessed using the *Technology Anxiety Scale*. The teachers recorded their responses to 12 items using an anchored scale (Table 6): 1 = No Anxiety, 2 = Some Anxiety, 3 = Moderate Anxiety, and 4 = High Anxiety, and 5 = Very High Anxiety.

Table 6

FACS Teachers' Technology Anxiety Scale Responses

Item	<i>N</i>	<i>M</i>	<i>SD</i>
1. How anxious do you feel when you cannot keep up with important technological advances?	92	2.51	1.14
2. How anxious do you feel when you are faced with using new technology?	91	2.49	1.12
3. How anxious do you feel when you are not certain what the options on various technologies will do?	92	2.45	1.10
4. How anxious do you feel when you try to understand new technology?	91	2.33	1.17
5. How anxious do you feel when you try to learn technology related skills?	92	2.29	1.13
6. How anxious do you feel when you try to use technology?	92	2.26	1.15

	Item	<i>N</i>	<i>M</i>	<i>SD</i>
7.	How anxious do you feel when someone uses a technology term that you do not understand?	92	2.25	1.16
8.	How anxious do you feel when you hesitate to use technology for fear of making mistakes you cannot correct?	92	2.24	1.13
9.	How anxious do you feel when you think about your technology skills compared to the skills of other teachers?	92	2.22	1.17
10.	How anxious do you feel when you fear you may break or damage the technology you are using?	92	2.20	1.25
11.	How anxious do you feel when you avoid using unfamiliar technology?	92	2.20	1.13
12.	How anxious do you feel when you think about using technology in instruction?	92	2.18	1.16

Note. For items in the *Technology Anxiety Scale* and for the total scale (scale interpretation ranges in parentheses): 1 = No Anxiety (1.00-1.49), 2 = Some Anxiety (1.50-2.49), 3 = Moderate Anxiety (2.50-3.49), 4 = High Anxiety (3.50-4.00), 5 = Very High Anxiety (4.50-5.00). Scale $M = 2.30$ ($SD = 1.00$).

FACS teachers experienced some anxiety as they integrated technology in their instruction. The scale mean (Scale $M = 2.30$, $SD = 1.00$) and all item means except one were in the “Some Anxiety” range. The highest level of anxiety was recorded for the item, “How anxious do you feel when you cannot keep up with important technological advances?” ($M = 2.51$, $SD = 1.14$). Their lowest anxiety level was reported for the item, “How anxious do you feel when you think about using technology in instruction?” ($M = 2.18$, $SD = 1.16$).

Variance in Technology Adoption

To determine if selected variables explained the variance in technology adoption for use in instruction, forward regression analysis was used, with the *Technology Adoption Scale* mean as the dependent variable. Six teacher demographic or personal variables were identified as potential explanatory variables based on a review of the research literature: age, years teaching experience, perceived barriers to technology integration, technology anxiety, training sources, and technology availability. The training sources used by FACS teachers are presented in Table 2. A training sources score was calculated by assigning one point for each of the four training sources. The technology types available for use in instruction are shown in Table 3. The technology availability score was computed by assigning one point for each of nine technology types.

It was determined *a priori* that only variables that were significantly correlated with the adoption scale score would be utilized in the forward regression due to the minimum observations per variable required for forward regression analysis. The correlations of the seven demographic and personal variables with the *Technology Adoption Scale* score are presented in Table 7.

Table 7

Correlations of Selected Variables with FACS Teachers' Technology Adoption Scores

Variable	<i>r</i>	<i>P</i>	<i>N</i>
Age	-.25 ^b	.021	88
Years Teaching Experience	-.18 ^a	.100	90
Barriers to Technology Integration	-.33 ^c	.002	87
Technology Anxiety	-.55 ^d	<.001	90
Technology Available	.30 ^c	.004	89
Training Sources:			
Self –taught	-.13 ^a	.210	90
Workshops/conferences	-.09 ^a	.381	90
College courses	.18 ^a	.100	90
Colleagues	-.13 ^a	.226	90

Note. For ease of reading, the specific notes are ordered by effect size as indicated in the specific notes.

^aTrivial association (Cohen, 1988). This descriptor has been assigned to all correlations less than .10 and to those over .10 that are not statistically significant. ^bSmall association (Cohen, 1988). ^cModerate association (Cohen, 1988).

^dLarge association (Cohen, 1988).

The *Technology Adoption Scale* score was moderately correlated with 4 of the 10 variables, namely, age ($r = .25$), barriers to technology integration ($r = -.33$), technology anxiety ($r = -.55$), and technology availability ($r = .30$). These correlations indicate that technology adoption increased as age, technology anxiety, and barriers to technology integration decreased. Technology adoption increased as technology availability increased. These four statistically significant variables were utilized as potential explanatory variables in the forward regression. According to Hair, Anderson, Tatham and Black (2006), at least 5 observations per variable were required, but 15-20 observations for each potential explanatory variable were desirable in a forward regression analysis. Based on these guidelines, the sample size was adequate for this analysis.

Regarding multicollinearity. Hair et al. (2006) stated, “The presence of high correlations (generally, .90 and above) is the first indication of substantial collinearity” (p. 227). None of the potential explanatory variables had a high correlation with any other independent variable. Hair et al. (2006) also stated that “The two most common measures for assessing both pairwise and multiple variable collinearity are tolerance and its inverse, the variance inflation factor [VIF]. . . . Moreover, a multiple correlation of .90 between one independent variable and all others . . . would result in a tolerance value of .19. Thus, any variables with tolerance values below .19 (or above a VIF of 5.3) would have a correlation of more than .90” (Hair et al., 2006, pp. 227, 230). None of the tolerance values observed was lower than .19 and none of the VIF values exceeded 5.3. Therefore, multicollinearity did not exist in the regression analysis (Table 8).

Table 8
Regression Analysis Model Explaining Variance in Technology Adoption in Instruction Scale Mean

	<i>S</i>	<i>DF</i>	<i>MS</i>	<i>F</i>	<i>P</i>
Regression	19.07	1	19.07	37.66	<.001
Residual	41.53	82	.51		
Total	60.60	83			

Explanatory Variable in Model	Change Statistics						
	<i>R</i>	<i>R</i> ²	Adjusted <i>R</i> ²	<i>SE</i>	<i>R</i> ² Change	<i>F</i> Change	<i>P</i> of <i>F</i> Change
Technology anxiety	.56	.32	.31	.71	.32	37.66	<.001

Variables Excluded From Model

Variable	Beta In	<i>t</i>	<i>P</i>	Partial <i>r</i>
Age	-.09	-1.00	.323	-.11
Barriers to technology integration	-.18	-1.96	.053	-.21
Technology availability	.17	1.86	.067	.20

Note. *N* = 83. Dependent variable: technology adoption. *Technology Adoption Scale*: 1 = Not Like Me at All, 2 = Very Little Like Me, 3 = Somewhat Like Me, 4 = Very Much Like Me, and 5 = Just Like Me. *Technology Anxiety Scale*: 1 = No Anxiety, 2 = Some Anxiety, 3 = Moderate Anxiety, 4 = High Anxiety, 5 = Very High Anxiety. Technology Available variable ranged from 0 to 9 points. *Barriers to Integration Scale*: 1 = Not a Barrier, 2 = Minor Barrier, 3 = Moderate Barrier, 4 = Major Barrier. The single variable included in the multiple regression model represents a large effect size according to Cohen (1988): $R^2 > .0196$ - small effect size, $R^2 > .13$ - moderate effect size, and $R^2 > .26$ - large effect size.

“Technology anxiety,” by itself, explained 32% of the variance (R^2) in technology adoption in instruction. Technology adoption increased as technology anxiety decreased (Standardized $b = -.56$). A regression model that explains 32% of the variance represents a large effect size (Cohen, 1988). The other three variables examined in the regression analysis, “Age,” “Barriers to technology integration,” and “Technology Available,” did not explain additional variance in technology adoption (Table 8).

Conclusions, Recommendations and Discussion

Most teachers have a computer with Internet connection at school, a school e-mail account, and a computer with Internet connection at home. Over half have a VCR, CD, or DVD Recorder; laser disc play or standalone DVD or CD players; interactive DVD or CD players, and access to enough computers in a classroom or lab for all students to work by themselves or with another student. Over one-third of the teachers have a digital video camera for instructional use. One-fourth of the teachers work in schools where students have school e-mail accounts. Few have a personal digital assistant (PDA) or a global positioning system (GPS).

Most FACS teachers are self-taught or utilize workshops/conferences and colleagues as technology training sources, while slightly over half use college courses. These conclusions are similar to those by Redmann and Kotrlík (2004), with one exception -- FACS teachers utilize

colleagues as a training source at a much higher level than the level reported for other secondary career and technical education teachers in the 2004 study.

FACS teachers have adopted technology for use in instruction at a moderate level. Keane (2002) stated the FACS curriculum will continue to be revised because it will not be valid unless it reflects societal trends. As the use of technology in instruction continues to increase, Keane stated that FACS professionals should “. . . grasp the latest concepts for use in their classrooms” (p. 43). The FACS teachers’ level of technology adoption in instruction may relate to the concerns voiced by Budin (1999) when he indicated that teachers should debate how technology should be incorporated into the curriculum, what teachers should know about the use of technology in teaching, and how the impact of technology should be assessed.

Moderate barriers to technology integration and some technology anxiety are experienced by FACS teachers as they integrate technology in their instruction. This conclusion partially or completely supports the conclusions reported in several studies (BECTA, 2003; Croxhall & Cummings, 2000; Mumtaz, 2000; Redmann & Kotrlik, 2004; Williams, 2000) and also agrees with the conclusions of a National Center for Education Statistics study in which it was concluded that teachers were encountering barriers as they attempted to integrate technology in instruction (Smerdon et al., 2000).

Teachers’ technology anxiety, by itself, explains a large proportion of the variance in FACS teachers’ technology adoption. Age, barriers to technology integration, and technology availability were significantly correlated to technology adoption but do not explain significant variance in teachers’ use of technology in instruction beyond the variance explained by technology anxiety. In addition, years teaching experience and technology training sources (self-taught, workshops/conferences, college courses, colleagues) were not significantly correlated to technology adoption. These conclusions partially support the research reported by Redmann and Kotrlik (2004) in which technology adoption was related to technology anxiety.

The conclusions above indicate that FACS teachers have room for improvement when it comes to integrating technology in instruction. Dexter, Doering and Riedel (2006) stated that teachers must be able to effectively unite technology with instruction. Technology should not be incorporated in instructional activities simply for the sake of using technology – it should contribute to FACS instructional content objectives. Unfortunately, it is often used more for administrative purposes rather than for the purpose of enhancing instruction. Dexter et al. concluded by stating that our understanding of best practices will change as new technology tools emerge. FACS professionals should continue research on teaching and learning, and the appropriate role of technology in this process.

FACS teachers, other teachers, administrators, and students must develop a shared vision (Park & Ertmer, 2008) of the uses and advantages of technology integration in instruction. Administrators need to take a proactive approach in their encouragement and support of all teachers as they integrate technology in the teaching/learning process. All stakeholders -- local school districts, state departments of education, college faculty, and others -- should provide leadership to the integration of technology in instruction.

FACS teachers must be proactive in their approach to technology integration in instruction. Teachers’ continuous effort to learn is a key component. They must continue to use well-informed colleagues, conferences, workshops, college courses, and self-directed learning to stay on the cutting edge. Proactive efforts on the part of FACS teachers should result in increased technology adoption.

Researchers should seek to identify pre-service and in-service opportunities for enhancing FACS teachers' ability to integrate technology in instruction, which will also involve researchers asking several key questions. Which technology has the greatest potential to positively impact student learning? What should the structure of FACS teacher education look like in a technology enhanced environment, with special emphasis on the newer and more educationally productive technology on the horizon? What funding, support, and other factors will impact the educational effectiveness of any attempt to enhance the integration of technology in FACS curricula? The answers to these questions should lead to the creation of a productive future for FACS, and ultimately, the preparation of students prepared for the modern technological world.

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