EXAMINING IPOD USE BY TEXAS AGRICULTURAL SCIENCE AND TECHNOLOGY TEACHERS

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Abstract

The purpose of this study was to establish baseline data regarding the adoption of iPods and similar technologies by agricultural science and technology teachers. The population consisted of all agricultural science and technology teachers in Texas. A sample of 310 was randomly drawn from the population. Study findings reveal that while agricultural science and technology teachers have knowledge of iPods, mp3 players and related technologies, there is little support for them to actually create their own podcasts, use them in the classroom, or promote them for student use. It was concluded that teachers were generally "late adopters" or "laggards," while students were "innovators" or "early adopters." Both teachers and students alike have access to computers and Internet connections, with a large number of teachers reporting that students own iPods or mp3 players which could be utilized for academics. Teachers reported strong interest in pre-produced curricula and FFA materials, particularly for training materials for career development events, which could be used on iPods or mp3 players. Recommendations for encouraging teacher adoption and use of iPods and similar technologies were provided.

Introduction and Theoretical Framework

The study of technology adoption and distance education across agricultural education is not new. This area has been examined closely in regard to the adoption of distance education technologies, barriers to technology adoption, and educational effectiveness at both the university and high school level. However, what is new and constantly changing is the technology itself. iPods™ and similar technologies offer portability and flexibility of content like never before. As shared by Donnelly and Berge (2006), podcasting, which is a method to disseminate audio content on both computers and devices such as MP3 players, provides an opportunity to "…cut through the dense text of the Internet and offers a human connection during distance training" (n.p.). Students are able to download and take content with them to be viewed at a time and place of their choosing. However, access to content provided in this manner is limited to the content that teachers select to provide.

Barriers to using instructional technologies have been examined by multiple researchers (Berge, Muilenburg, & Haneghan, 2002; Gammill & Newman, 2005; Murphrey & Dooley, 2000; Nelson & Thompson, 2005). Barriers often include lack of release time to develop instructional materials for delivery using technology, lack of administrative support and incentives, and lack of skill and expertise to develop materials. Li and Lindner (2007) reported that teaching experiences and distance education experiences positively impacted the adoption of distance education practices and thus increasing these experiences could in fact encourage adoption.

Understanding barriers to using technologies, as illustrated by Nelson and Thompson (2005), is important because teachers often teach as they are taught. Thus,

if preservice teachers are not exposed to a variety of technologies in preservice programs, it is possible that they will not select to use new technologies such as the iPod in their classrooms. In fact, a study by Kotrlik, Redmann, and Douglas (2003) revealed that "teachers perceptions of barriers to the integration of technology, … [is] a strong predictor of the extent to which agriscience teachers integrate technology in the teaching/learning process" (p. 78). In addition, the incorporation of technology into actual lessons and course delivery by teachers requires planning. As reported by Ball, Knobloch, and Hoop (2007), this planning is influenced by the knowledge and experience of the teacher, in addition to other factors.

While "how-to" articles are abundant in regard to using technology, specifically the use of portable media devices, instructors often do not have time to research and learn how to use these new technologies. Kotrlik et al. (2003) found that while agricultural science teachers were active in exploring and adopting technology for teaching, they were not very active in later phases such as experimentation and advanced integration of technology. The authors further stated that integration of technology into the educational process is necessary in order to provide quality education. However, as stated by Williams (2006), "Principles of sound pedogogy are the same in face-to-face and distance classes" (p. 14).

Encouraging the adoption and use of technologies such as the iPod and related devices requires an understanding of teacher use of these technologies. The theoretical base for this study rests upon Rogers' diffusion of innovation research. Rogers (2003) described five stages that one goes through in the innovation-decision process: knowledge, persuasion, decision, implementation, and confirmation. Understanding where an individual is within the innovation-decision process can be helpful when developing strategies to encourage or discourage adoption. In fact, there are multiple concepts that should be taken into account at each of the stages. Thus, determining what stage a teacher is at can determine the best strategy to use. Understanding the attitudes and beliefs of agricultural science and technology teachers is critical in understanding how technologies such as the iPod are being adopted.

Rogers (2003) unmistakably indicated that the research is not clear as to whether needs precede awareness of an idea or innovation or if awareness actually creates a need. Given Roger's model of diffusion, it is clear that understanding both the needs of teachers and recognizing their level of knowledge and use of iPod and related devices is critical. This understanding can shed light on the extent to which these technologies may be useful in particular settings.

It is important to recognize that types of knowledge fall into three primary areas: What is the innovation? How does the innovation work? and Why does the innovation work? Rogers (2003) explained that individuals who have an awareness of an innovation may then be motivated to gain additional information that exposes how the innovation works and why. It is recognized that all individuals do not adopt innovations in the same manner or at the same rate. Rogers classified individuals into "adopter categories" based on individual innovativeness. These categories included: innovators, early adopters, early majority, late majority, and laggards. While one must be aware that there are exceptions to these categories, it is helpful to think about individuals in categories to facilitate understanding of the adoption process for a given set of individuals. Each of these groups possesses unique characteristics in regard to "socioeconomic status, personality values and communication behavior" (p. 287). Understanding where agricultural science and technology teachers fit within these categories in regard to iPod and related devices can assist in understanding the adoption process.

Additionally, it is important to understand how agricultural science and technology teachers perceive the innovation itself. Rogers (2003) listed five attributes of innovations of which one needs to be aware: "relative advantage, compatibility, complexity, trialability, and observability" (p. 221). Each of these attributes can impact adoption. Scheduling problems and students occupied by other programs, classes, and

interests have been identified as two particular recruitment issues of high school agricultural education programs (Myers, Breja, & Dyer, 2004). It is possible that the use of new technologies such as the iPod could address these issues through increased flexibilty of content delivery. Multiple studies (Miller & Honeyman, 1993; Miller & Miller, 2005; Moore & Wilson, 2005), over the past several years have indicated the importance of asynchronous methods such as sending videotapes to students. In some ways, technologies such as the iPod are merely changing the way in which the media can now be provided. Instead of ―mailing" a videotape to a student, a teacher is able to ―post" a video or audio clip on the Internet for the students to download and view.

In addition, the portability and playback controls of an iPod vs. a traditional videotape player provide increased flexibility. Material delivered on iPod devices can be similar to materials previously described by Roberts and Dyer (2005a) in relation to content delivered for online learning. The difference lies in the portability of the content. A previous description of asychronous content was described as ―mimic[ing] the traditional lecture" (Roberts & Dyer, 2005a, p. 3). iPod and similar devices allow that lecture to be transported to a location of a student's choosing using a device of which they are familiar. However, it is not known if teachers perceive this characteristic of ―flexibilty" as a beneficial attribute of the iPod adding to relative advantage and compatibility. Understanding how teachers perceive these characteristics can assist one in impacting the rate of adoption. As shared by Rogers (2003), ―change agents and diffusion scholars must understand how potential adopters perceive new ideas" (p. 266).

Use of eLearning technologies across educational settings continues to increase. With the development of increasingly smaller mobile devices, such as the iPhone by Apple, there are increasing opportunities. As shared by Merrett (2006), the iPod was released in October 2001. Since that time, multiple formats and editions have been released. In fact, it has been reported by Ross (2007) that more than 70 million iPods have been sold since Apple introduced the device. However, as shared by Panettieri (2007), social networking and streaming music/video are what students were most interested in. One example of the breadth of adoption is that Panettieri reported that ―more than half of Harvard Medical School students carry personal digital assistants (PDAs) such as iPods, Palm handheld PCs, and smart phone devices …" (p. 40). However, it is not known to what extent certain technologies are being adopted across agricultural science in high school settings. Awareness of agricultural science and technology teachers' knowledge, access, and attitude toward iPods and similar technologies can assist those that are preparing materials for use in educational settings and providing training for preservice teachers and others. iPod technologies refers to portable digital audio/video players designed and marketed by Apple. There are also competing mp3 players such as the Zune mp3 player from Microsoft, the Sony mp3 player, SanDisk Sansa mp3 player, and the iRiver mp3 player. It is believed by many that portable digital audio/video players have tremendous potential for education. However, it is not known to what degree they have been adopted or exactly how they are being used. To what extent are agricultural science and technology teachers posed to utilize this technology? If materials were made available for use/delivery on devices such as the iPod, would the teachers use them? This study sought to assist in answering these questions.

Purpose and Objectives

The purpose of this study was to establish baseline data regarding the adoption of iPod and similar technologies by agricultural science and technology teachers. Three objectives guided this inquiry: (a) Describe agricultural science and technology teachers' knowledge of iPods and similar technologies; (b) Describe agricultural science and technology teachers' access to iPods and similar technologies; and (c) Describe agricultural science and technology

teachers' attitudes towards iPods and similar technologies.

Methodology

The objectives of this study were met using a mailed questionnaire. The population of interest was all agricultural science and technology teachers in Texas (N =1605) determined by the *Directory of Texas Agricultural Science and Technology Teachers* (Instructional Materials Service, 2007). A census of the population was deemed impractical and unnecessary, so a sample of 310 was randomly drawn from the population (Krejcie & Morgan, 1970) by using a random selection function in Microsoft Excel.

A 35-item questionnaire was developed from a review of the literature and consisted of four sections: knowledge, access to technologies, attitudes, and demographic information. Items related to teachers' knowledge and access to technologies were accompanied by a finite set of options (two to four), depending on the question. Items related to teachers' attitudes were accompanied by a 5-point summated rating scale. Content and face validity of the instrument was determined by a panel of university faculty with requisite expertise, but not involved in the current study (Gall, Gall, & Borg, 2003). Reliability of the instrument was determined by a test-retest procedure using a pilot test with 26 preservice teachers at Texas A&M University. This procedure yielded a coefficient of stability of .89. Although preservice teachers are somewhat different in age and experience than current teachers, this group was deemed appropriate for reliability analysis. As noted earlier, validity was established through a panel review of the instrument.

Questionnaires were delivered using the tailored design method (Dillman, 2000). Teachers in the sample were sent a prenotice letter, followed a few days later with the questionnaire and cover letter. Approximately 10 days later, a thank you postcard was sent. Two weeks later, a replacement questionnaire and second cover letter were sent to teachers who had not responded. This set of questionnaires was printed on a different color paper to allow for easy differentiation from the first mailing. Following these procedures, 130 responses were received (41%). Because of the low response rate, double-dipping non-response procedures were implemented (Lindner, Murphy, & Briers, 2001; Miller & Smith, 1983). A random sample of 10% (n = 19) of the non-respondents was contacted by telephone and provided responses to the items on the questionnaire. No differences were found between respondents and non-respondents; thus, the data collected by telephone was pooled with the previous data collected, yielding a total of 149 responses (48%). Given that the double-dipped sample was not different from the original respondents, the data collected was deemed representative of the population and generalized to the broader population (Lindner et al.; Miller & Smith).

Results and Findings

The average teacher was a male (81.1%), just over 38 years old (SD = 10.40), and had been teaching for 13.7 years (SD = 9.93) (Table 1). Beyond classroom instruction, the vast majority of teachers prepared leadership development event (LDE) teams (94.5%), career development event (CDE) teams (94.5%), traveled with students to local stock shows (96.6%), and traveled with students to major stock shows (90.4%). When asked to rate their proficiency with computer-related technologies, the majority of teachers (69.2%) rated their skill level as intermediate. Only 2.1% classified themselves as non-users. The researchers intentionally allowed participants to define computer proficiency from their own unique perspective.

Objective 1: Describe Agricultural Science and Technology Teachers' Knowledge of iPods and Similar Technologies

Nearly all the teachers (97.9%) were aware of iPods or mp3 players, and over one-half (53.1%) were aware of podcasts (Table 2). However, less than one-fifth (19.9%) actually owned an iPod or mp3 player and only 16% indicated they had access to these devices at school. The

majority of teachers (60.0%) had the ability to use media management software, such as iTunes or Windows Media Player. A much smaller portion had the ability to create audio clips (26.9%) and video clips (24.1%).

Table 1
Description of Agricultural Science and Technology Teachers

	M	*SD*
Age (*n* = 145)	38.69	10.40
Years Teaching (*n* = 146)	13.71	9.93
	f	%
Gender (*n* = 143)		
Male	116	81.1
Female	27	18.9
FFA and SAE activities		
Preparing LDE teams (*n* = 146)	138	94.5
Preparing CDE teams (*n* = 146)	138	94.5
Traveling with students to local stock shows (*n* = 146)	141	96.6
Traveling with students to major stock shows (*n* = 146)	132	90.4
Proficiency with computer technologies (*n* = 146)		
Nonuser	3	2.1
Novice	20	13.4
Intermediate	101	69.2
Advanced	22	15.1

Table 2
Agricultural Science and Technology Teachers' Knowledge of iPods and Similar Technologies

	n	*f*	%
Aware of iPods or mp3 players	145	142	97.9
Aware of podcasts	143	76	53.1
Owns an iPod or mp3 player	146	29	19.9
Access to an iPod or mp3 player at school	145	24	16.6
Ability to use media management software (iTunes, etc.)	145	87	60.0
Ability to create audio clips	145	39	26.9
Ability to create video clips	145	35	24.1

The majority of teachers *never* used iPods or mp3 players to listen to audio clips, including songs (54.5%), or watch video clips (55.9%) (Table 3). Very few teachers used iPods or mp3 players *daily* to listen to audio clips (8.3%) or watch video clips (2.8%). While on a *monthly* basis, only a few teachers listened to audio clips (18.6%) but over a quarter watched video clips (25.5%).

Objective 2: Describe Agricultural Science and Technology Teachers' Access to iPods and Similar Technologies

Agricultural science and technology teachers overwhelmingly had access to a computer lab (93.8%) and access to the Internet in their classroom (95.1%) (Table 4). However, just over a third (36.1%) had wireless access to the Internet in their classroom. The majority of teachers did have computers in their classroom for student use (65.3%). Very few schools issued laptops to students (13.2%), issued PDAs to students (0.7%), or issued iPods or mp3 players to students (0.7%). Only 5% of schools used podcasts.

Table 3
Agricultural Science and Technology Teachers' Frequency of Use of iPods and Similar Technologies (n = 145)

	Audio clips[a]		Video clips	
How often do you download or listen to	*f*	%	*f*	%
Daily	12	8.3	4	2.8
Weekly	27	18.6	23	15.9
Monthly	27	18.6	37	25.5
Never	79	54.5	81	55.9

[a]including songs.

Table 4
Agricultural Science and Technology Teachers' Access to Technologies at School

	n	*f*	%
Internet access in classroom	144	137	95.1
Wireless internet access in classroom	144	52	36.1
Computers for student use in classroom	144	94	65.3
Access to computer lab	144	135	93.8
School uses podcasts	141	7	5.0
School issues laptops to students	144	19	13.2
School issues PDAs to students	144	1	0.7
School issues iPods or mp3 players to students	143	1	0.7

To *watch or listen* to audio or video clips, nearly the same portion of teachers had access at home (61.1%) and at school (63.9%) (Table 5). However, fewer teachers had access to create audio or video clips at home (41.7% and 34.7%, respectively) than at school (59.7% and 59.0%, respectively).

Teachers were also asked to survey their students to see how many owned iPods or mp3 players. Note that only two-thirds (67.1%) of the teachers provided this data, so inferences are questionable (Table 6). The majority of teachers (58%) indicated that at least one-half their students owned an iPod or mp3 player. The greatest percentage (68%) said that between 25% and 75% of their students owned one of the devices. No teachers indicated that none of their students owned an iPod or mp3 player.

Objective 3: Describe Agricultural Science and Technology Teachers' Attitudes Toward iPods and Similar Technologies

Teachers expressed moderate interest in curricula materials and in-service training for iPods and mp3 players (Table 7). Teachers were most interested in ―modifiable curricula and FFA materials" (M = 3.45, SD = 1.18), but slightly less interested in ―Pre-produced curricula and FFA materials" (M = 3.36, SD = 1.17). Teachers were also moderately interested in ―In-service training on creating audio and video clips" (M = 3.39, SD = 1.27).

Teachers did express that iPod and similar technologies had uses in agricultural science education (Table 8). Teachers expressed the greatest use would be for ―training materials for FFA competitions" (M = 4.02, SD = 1.14). Teachers also expressed that these devices could be used for ―videos shown during class time" (M = 3.69, SD = 1.13) and ―Pre-produced video lessons for absent students" (M = 3.70, SD = 1.19). ―Self-produced *audio* recordings of class for absent students" (M = 3.15, SD = 1.30) and ―Self-produced *video* recordings of class for absent students" (M = 3.12, SD = 1.26) were also indicated as useful.

Table 5
Agricultural Science and Technology Teachers' Access to iPod and Similar Technologies

	Home		School	
Where do you have access to	*f*	%	*f*	%
Watch/listen to audio/video clips (n = 144)	88	61.1	92	63.9
Create audio clips (n = 144)	60	41.7	86	59.7
Create video clips (n = 143)	50	34.7	85	59.0

Table 6
Agricultural Science and Technology Students' Owning iPods and Similar Technologies

How many students in your classes own iPods or mp3 players?	*f*	%
100%	3	3.0
75.0% to 99.9%	18	18.0
50.0% to 74.9%	37	37.0
25.0% to 49.9%	31	31.0
0.1% to 24.9%	11	11.0

Note. Teachers were asked to indicate the enrollment in each class and the number of students that had iPods or mp3 players. Response rate was 67.1% (100 of the 149 teachers).

Table 7
Agricultural Science and Technology Teachers' Interest in Materials and Training (n = 143)

	M	*SD*
Pre-produced curricula and FFA materials for iPods or mp3 players	3.36	1.17
Modifiable curricula and FFA materials for iPods or mp3 players	3.45	1.18
In-service training on creating audio and video clips	3.39	1.27

Note. Scale ranged from 1 = *not interested* to 5 = *very interested*.

Table 8
Agricultural Science and Technology Teachers' Perceptions of Usefulness of iPods and Similar Technologies

	N	*M*	*SD*
Videos shown during class time	143	3.69	1.13
Pre-produced video lessons for absent students	143	3.70	1.19
Training materials for FFA competitions	144	4.02	1.14
Self-produced audio recordings of class for absent students	142	3.15	1.30
Self-produced video recordings of class for absent students	143	3.12	1.26

Note. Scale ranged from 1 = *not useful* to 5 = *very useful*.

Conclusions and Implications

Based on the findings of this study, it was concluded that agricultural science and technology teachers across Texas are comfortable with computer technologies and the majority perceive themselves to have intermediate to advanced proficiency in using computer technologies. It was also concluded that teachers are strongly aware of iPods, mp3 players, related technologies and the software used with said technologies. Teachers can be described as having completed the ―knowledge stage" of the innovation-decision process as described by Rogers (2003). They are aware of the innovation and maintain an understanding of how the innovation functions.

However, based on the low percentages (26% for audio and 24% for video) of teachers reporting the ability to create audio and video clips, it was concluded that the majority of agricultural science and technology teachers do not possess the abilities required to create media for portable media devices.

It was interesting that more than one-half of the respondents indicated that they ―never" download or listen to audio or video clips. It was concluded that while teachers are ―aware" of these computer technologies, they are not actively using them on a regular basis. It is possible that this ―lack of use" could be a result of ―lack of support" as shared in the Roberts and Dyer (2005b) study regarding support to create and deliver courses utilizing specific technologies.

Based on findings related to teacher access to technologies at school, it was concluded that agricultural science and technology teachers across Texas have access to the Internet in the classroom and computer labs. Many even have computers for student use in the classroom. However, it was further concluded that the majority of schools across Texas do not issue technologies such as laptops, PDAs, or mp3 players on a broad scale. While teachers could expect students to have access to iPod compatible materials viewed on a computer, they could not expect all students to have access to portable devices such as the iPod and similar technologies.

It was interesting to find that teachers reported the ability to listen/watch to audio/video as equally possible at school as at home. It was concluded that teachers who have knowledge and ability in regard to technology use seek access in different settings once they understand how it works.

Given that less than one-half of the respondents reported knowing how to create audio/video, it was concluded that the complexity of use at this level is high for the teachers in regard to the creation of content. In addition, respondents reported a greater ability to create audio/video clips at school than at home, which leads one to conclude that teachers felt their home computer hardware and/or software were not sufficient to complete these tasks.

Findings reveal that teachers are by far less likely to own and utilize an iPod than are their students. Of the teachers that responded regarding student iPod ownership, over one-half of these teachers reported that at least 75% of their students owned iPods. It was concluded that wide adoption of the iPod and similar technologies has taken place among the high school population. Students of agricultural science and technology teachers, according to Rogers (2003) adopter categories, are the ―innovators" and ―early adopters" of iPods and similar technologies, while the teachers themselves fall into the later adopter categories (i.e., ―late majority", ―laggards") of said technologies. Only 5% of the teachers reported that their schools used podcasts; thus, it was concluded that the majority of schools are not actively engaged in the creation of media for delivery on iPods or similar devices.

Based on findings in this study, it was concluded that teachers have a favorable attitude toward iPods and similar technologies and that they have an interest in using these types of materials. The highest interest appeared to be for modifiable curricula and FFA materials. Teachers prefer to have access to files that can be edited such as PowerPoint files, audio scripts in Microsoft Word, and audio recordings in an editable format. Access to these files would allow teachers to modify the curriculum. It should also be noted that the moderate interest expressed for in-

service training on creating audio and video clips reveals an opportunity. It was concluded that if training were offered, there might be a large percentage of agricultural science and technology teachers who would attend. Two attributes of the innovation could be enhanced through these training opportunities: trialability and observability. Providing opportunities for teachers who are familiar with the technology to demonstrate use of the technology to other teachers could further enhance their favorable attitude. In fact, the finding that teachers held a favorable attitude indicates that they have reached the ―persuasion" stage of the innovation-decision process as described by Rogers (2003).

Findings related to agricultural science and technology teachers' perceptions of usefulness of iPods and similar technologies reveal that teachers do find the devices to have a place in the academic environment. Teachers expressed that these devices could be useful in providing videos during class time, serving the needs of absent students, and providing training materials for FFA competitions. Thus, it was concluded that agricultural science and technology teachers do perceive iPod and similar technologies to be useful and also perceive ―flexibilty" as a beneficial attribute of the iPod.

In fact, it can further be concluded that teachers believe that one of the best uses for these devices is FFA training materials for competitions and CDE preparation. While teachers expressed interest and support for media that could be used on these devices, it is unclear if any of the teachers have actually engaged in a decision to either adopt or reject the use of such media. It was concluded that teachers had not reached the ―decision stage" in the innovation-decision process as decribed by Rogers (2003).

Recommendations

Several recommendations can be made utilizing the data collected. With only about a quarter of teachers surveyed having the ability to create audio and video clips on computers, it is possible that the technology utilized to create podcasts for iPods is too complex to learn on one's own. It is therefore recommended that workshops and professional development opportunities related to the use of iPods, podcasts, and mp3 players be provided for teachers. Participation may assist teachers to move beyond the persuasion stage of the innovation-decision process to the decision and/or implementation stage. Considering that teachers felt that iPods and podcasts would be most useful for delivering training materials for FFA competitions and CDE preparation, it is recommended that the National FFA Organization consider converting recordings of CDE finals to podcast or mp3 format and making them available to FFA chapters. A follow-up study could be conducted to see if availability in this format was found to be beneficial to the students or teachers and if not, what alterations could be made to make them more beneficial.

Access to iPods by both teachers and students is necessary for adoption and use; thus, it is recommended that additional studies be conducted to determine how access can be improved. In addition, similar studies could be conducted in other states to determine if these findings hold true for other populations. This study should also be replicated periodically to determine how the adoption rate has changed.

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