

Technology Acceptance Related to Second Life™, Social Networking, Twitter™, and Content Management Systems: Are Agricultural Students Ready, Willing, and Able?

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Technology has the potential to improve education but only if it is applied with purpose and consideration of the audience. Understanding technology's role in education goes beyond the comparison of tools; there is a need to better understand student acceptance of technology so appropriate educational scaffolding and support can be provided. The absence of technology acceptance can become a barrier to the adoption, successful implementation, and use of new technologies. Therefore, the theoretical framework was based on technology acceptance. Described in this study is agricultural students' acceptance and readiness to use specific technologies (i.e., Second Life™, social networking, Twitter™, and content management systems) as educational tools. The population was all students enrolled in eight courses at Texas A&M University during the Fall 2010 semester. A total of 716 completed surveys were analyzed. Findings revealed that students perceive each of the technologies studied (i.e., Second Life™, social networking, Twitter™, and content management systems) as unique entities that vary in regard to acceptance. Students overwhelmingly accept content management systems as a useful educational technology while Second Life™, Twitter™, and social networking are familiar but not as accepted. Findings reinforce the importance of instructors finding specific methods to successfully implement technology-specific educational tools.

Keywords: technology acceptance, education, Second Life™, social networking, Twitter™, course management systems

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Introduction

The use of technology to improve education and the teaching/learning process has been studied in the context of agricultural education from multiple perspectives. Extensive research has been conducted regarding the use of technology by teachers (Kotrlik & Redmann,

2009; Kotrlik, Redmann, & Douglas, 2003; Murphrey, Miller, & Roberts, 2009), the delivery of courses online (Alston & English, 2007), and the use of distance education for courses and programs (Roberts & Dyer, 2005a). In addition, specific aspects of technology use have been studied including the use of the Internet as a source of information (Rhoades,

Irani, Telg, & Myers, 2008), Web 2.0 technologies (Rhoades, Friedel, & Irani, 2008), and the use of illustrated web lectures (Roberts & Dyer, 2005b). In the study conducted by Rhoades, Irani et al. (2008), the authors call for continued research on this topic in order to enable effective use of the technologies.

Second Life™, social networking, Twitter™, and content management systems have each received various degrees of attention in the literature. While content management systems have been studied extensively in regard to comparison studies and effectiveness studies (Alston & English, 2007), other technologies have not. Only limited research has been conducted on the use of Second Life™ (a virtual world) as an educational tool. O'Connor (2010) examined graduate-level teacher-education courses that utilized Second Life™ and reported that “social and collaborative gains [are] possible” (p. 213). This finding indicated that potential exists for this technology to engage students not only in content but also in collaboration and in building social ties. Hargis (2008) stressed the importance of understanding “how we learn” (p. 62) in order to take advantage of the opportunities of using tools such as Second Life™ in education. The author compared informal learning (i.e., visits to museums, etc.) to that which can be experienced in Second Life™. In many ways, Second Life™ does away with racial and cultural issues while at the same time offering new opportunities for exposure and experience without leaving the comfort of one’s home. Rhoades, Irani, et al. (2008) reported high use of social networking (85.2% on Facebook) and high use of content management systems by agricultural students. The authors suggested that high use of social networking sites indicated a potential opportunity for instruction using these tools. In regard to Twitter™ (a tool that allows immediate communication to individuals and groups via 140-character text messages, known as microblogging), Shultz and Doerfert (2010) reported that students were familiar with the technology but did not use it regularly. Furthermore, the use of Twitter™ for educational purposes was not strongly noted. Content management systems have been studied in the context of distance education. Roberts and Dyer (2005a) reported that “content management software was the technology used

most to deliver courses” (p. 70) in distance education settings across agricultural education.

The National Research Agenda for Agricultural Education and Communication (Osborne, 2007) calls for continued research on “nonformal educational delivery systems,” “enhancing the effectiveness of agricultural and life science faculty,” and “enhance[ing] program delivery models for agricultural education” (p. 3). Understanding technology’s role in education goes beyond the comparison of tools; there is a need to better understand student levels of knowledge and technology cognizance so that appropriate educational scaffolding and support can be provided. The absence of technology acceptance can be a barrier to the adoption and successful implementation and use of new technologies; thus, there is a need to study the readiness and willingness of students to use new technologies for instructional purposes. This study sought to add to the knowledge base by documenting technology acceptance of agricultural students related to emerging technologies including Second Life™, social networking, Twitter™, and content management systems.

Theoretical Framework

The theoretical framework for this study was based on technology acceptance. Technology acceptance relates to predictions of technology use and factors that can impact use (Lederer, Maupin, Sena, & Zhuang, 2000). There have been multiple models used to study technology acceptance. Venkatesh, Morris, Davis, and Davis (2003) devised “core determinants of intention and usage” (p. 425) related to technology acceptance and identified this theory as the *Unified Theory of Acceptance and Use of Technology* (UTAUT). The UTAUT is based upon a review and rigorous evaluation and analysis of constructs presented in eight different models. The eight models include the Theory of Reasoned Action, the Technology Acceptance Model (TAM), the Motivational Model, the Theory of Planned Behavior (TPB), Combined TAM and TPB, the Model of PC Utilization, the Innovation Diffusion Theory, and the Social Cognitive Theory. The UTAUT theory takes into account a total of 32 constructs that were identified across the models and resulted in constructs that could determine “user

acceptance and usage behavior” (Venkatesh et al., 2003, p. 447).

The *Unified Theory of Acceptance and Use of Technology* (UTAUT) included five constructs that were identified as affecting a person’s intention and use of a given technology. These included performance expectancy, effort expectancy, social influence, facilitating conditions, and behavioral intention to use the system. *Performance expectancy* was defined as “the degree to which an individual believes that using the system will help him or her to attain gains” (Venkatesh et al., 2003, p. 447). Concepts such as “perceived usefulness,” “relative advantage,” “extrinsic motivation,” and “outcome expectations” are included in this construct (p. 447). *Effort expectancy* was defined as “the degree of ease associated with the use of the system” (p. 450). Concepts of “ease of use” and “complexity” are included in this construct (p. 450). *Social influence* was defined as “the degree to which an individual perceives that important others believe he or she should use the new system” (p. 451). This construct included aspects of “social factors,” “image,” and “social influence” (p. 451). *Facilitating conditions* was defined as “the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system” (p. 453). *Behavioral intention* was described as one’s intention to use a technology. Venkatesh et al. (2003) identified three constructs that were not direct determinants and therefore were not addressed in this study. These constructs included “self-efficacy, anxiety, and attitude” (p. 461).

Purpose and Objectives

The purpose of this exploratory descriptive study was to describe agricultural undergraduate and graduate students’ current level of technology readiness related to Second Life™, social networking, Twitter™, and content management systems. Three objectives guided the study:

1. Determine technology awareness of responding students based on self-assessment,
2. Document technology acceptance based on the UTAUT Model focused on Second

Life™, social networking, Twitter™, and content management systems, and

3. Determine relationships between technology acceptance and variables of interest (i.e., age, number of online courses taken, gender, educational classification (undergraduate or graduate), and weekly Internet use for educational purposes).

Methods and Procedures

Survey research methodology was implemented to achieve the objectives of the study. The instrument included three sections: (a) background/demographic information, (b) technology awareness, and (c) technology acceptance. Each section was developed based on a review of the literature. The instrument was reviewed for face validity and content validity by a team of five faculty members. The instrument was pilot tested with a group of 11 students enrolled in a course not included in the population. Minor grammar and layout modifications were made following review. Open-ended questions were included on the instrument but were not included as part of this manuscript.

Using the *Unified Theory of Acceptance and Use of Technology* (UTAUT) as the foundation for assessing technology acceptance, response items for 19 Likert-type questions were created with a 7-point Likert-type scale ranging from *Strongly Disagree* to *Strongly Agree* for each of the four technologies (i.e., Second Life™, social networking, Twitter™, content management systems) under study. According to Venkatesh et al. (2003), in regard to the UTAUT, “all internal consistency reliabilities (ICRs) were greater than .70” (p. 457). Thus, the instrument was determined to be reliable. Table 1 reveals the alpha coefficients ranging from .612 to .939 for the dependent variables based on the administration of the instrument for this study. According to Nunnally (1967), a modest reliability of .60 or .50 is sufficient during early stages of research. All constructs revealed acceptable reliability levels except for *facilitating conditions*. Close inspection of the construct revealed two statements that were not reliable and were thus removed from the construct, resulting in 17 statements that were analyzed as part of this study.

Table 1
Reliabilities by Construct and Technology (17 statements; 5 constructs) (N = 716)

Construct	Second Life™	Twitter™	Social Networking	CMS**
Performance Expectancy (4)	.930	.913	.859	.853
Effort Expectancy (4)	.906	.904	.846	.865
Social Influence (4)	.797	.753	.612*	.722
Facilitating Conditions (2)	.661*	.726	.864	.900
Behavior Intentions to Use (3)	.888	.927	.939	.904
Overall Reliability (17)	.897	.901	.862	.919

*Due to the low reliability, caution should be used in interpreting findings. **CMS = Content Management Systems

The population for this study was all students enrolled in eight courses at Texas A&M University during the fall 2010 semester. Courses included both undergraduate and graduate students. Course rosters were compared and duplicate students were removed from the complete listing of potential respondents. Students enrolled in more than one of the courses under study only completed the instrument once and thus were only counted once in regard to response rate. A total of 793 unique undergraduate and 50 unique graduate students were enrolled in the courses under study. Surveys were administered during normal class hours in face-to-face settings using a paper instrument.

Data were scanned into the PASW Statistics computer program. Instruments with excessive missing data were removed from the study. A total of 716 completed surveys were analyzed yielding a response rate of 85% for undergraduates (671 of 793) and 90% for graduate students (45 of 50). As shared by Lindner, Murphy, and Briers (2001), any response rate less than 100% has the potential for a “threat to external validity” (p. 51); however, the authors indicated that a response rate at the 85% response level does not require additional procedures. Given that the response rate for this study fell within the parameters noted, no additional procedures were performed. Data analysis included the calculation of frequencies, percentages, means, and standard deviations to describe initial findings. Further exploratory procedures including correlational and ANOVA procedures were utilized to describe data gathered through this study. Due to the nature of this study, the reader is

cautioned to limit inferences made from these findings towards other populations. The use of inferential statistics (ANOVA) was only deemed appropriate to describe findings of this study.

Demographic background of responding agricultural students

The responding sample included 716 students who were predominately undergraduates (93.7%) and female (66.3%). Regarding age, more than half of the respondents (57.3%) were 19 years old or younger, while 34.5% were age 20–22 years, and only 8.1% were 23 years old or older. More than fifty percent (51.3%) of the respondents reported having completed no online courses, while 18.1% reported having completed one course online and 30.6% reported having completed two or more courses online.

Findings

Objective 1: Technology awareness of students based on self-assessment

Technology awareness was assessed by asking students to report their use and comfort with technology. All students reported using email and a majority of students reported the use of social networking (97.5%), Internet access (99.7%), and YouTube (92.4%). Blogs, Twitter™, and virtual worlds were reportedly not used by a high percentage of students (Table 2).

Table 2
Students' Reporting of Internet-based Technology Use (N = 716)

	<u>No</u>		<u>Yes – Some</u>		<u>Yes – A Lot</u>	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
E-mail	0	0.0	117	16.3	599	83.7
Internet Access	2	0.3	96	13.4	618	86.3
Social Networks (<i>n</i> = 714)	16	2.2	131	18.3	567	79.2
YouTube (<i>n</i> = 713)	51	7.1	462	64.5	200	27.9
Blogs (<i>n</i> = 709)	560	78.2	123	17.2	26	3.6
Twitter™ (<i>n</i> = 710)	605	84.5	80	11.2	25	3.5
Virtual Worlds (<i>n</i> = 705)	664	92.7	36	5.1	5	0.7

The majority of students described themselves to be either intermediate (67.3%) or advanced (22.1%) computer users. More than 90% of students reported being comfortable with new computer technology and 87.4% reported having broadband Internet access at home. Less than 2% of the students reported dial up or no Internet access. Eighty-five percent of the students reported *consistently high* or *generally good* quality of Internet connection at home.

Objective 2: Technology acceptance of Second Life™, social networking, Twitter™, and content management systems

Student responses to statements based on the UTAUT model for each of four technologies (i.e., Second Life™, social networking, Twitter™, and content management systems) were unique for each of the technologies (Table 3). Results were based on a scale of 1 to 7, with 7 indicating strong agreement and 1 indicating strong disagreement.

Table 3
Student Technology Acceptance to Second Life™, Social Networking, Twitter™, and Content Management Systems (17 statements; 5 constructs) (N = 716)*

	<i>n</i>	<i>M</i> ***	<i>SD</i>
Second Life™ by Construct			
Performance Expectancy (4)**	707	2.74	1.32
Effort Expectancy (4)	705	4.41	1.56
Social Influence (4)	703	3.24	1.21
Facilitating Conditions (2)	694	5.07	1.74
Behavioral Intentions to Use (3)	704	2.46	1.49
Total Mean (17)	715	3.47	1.04
Social Networking by Construct			
Performance Expectancy (4)**	714	3.04	1.38
Effort Expectancy (4)	712	6.09	1.00
Social Influence (4)	710	4.91	1.05
Facilitating Conditions (2)	705	6.59	.81
Behavioral Intentions to Use (3)	709	6.49	1.09
Total Mean (17)	715	5.21	.79
Twitter™ by Construct			
Performance Expectancy (4)**	712	2.33	1.26
Effort Expectancy (4)	709	4.84	1.64
Social Influence (4)	705	3.47	1.26
Facilitating Conditions (2)	701	5.68	1.64
Behavioral Intentions to Use (3)	705	2.79	1.91
Total Mean (17)	714	3.65	1.10
Content Management Systems by Construct			
Performance Expectancy (4)**	716	5.86	1.02
Effort Expectancy (4)	714	6.11	.88
Social Influence (4)	712	5.80	.99
Facilitating Conditions (2)	707	6.55	.85
Behavioral Intentions to Use (3)	711	6.54	.87
Total Mean (17)	716	6.10	.75

*Means were calculated using original data, not summated; thus, there is the potential for all 716 student responses to be included in each construct mean. **The number of statements for each construct are indicated in () following the construct name. ***Scale was 1 = Strongly Disagree to 7 = Strongly Agree.

Second Life™.

Students indicated that Second Life™ was a technology supported by their institution (Facilitating Condition $M = 5.07$, $SD = 1.74$), but not a technology that would assist them in their education (Performance Expectancy $M = 2.7$, $SD = 1.32$). When looking at individual statements, it is interesting to note that students reported having the resources to use Second Life™ ($M = 5.44$, $SD = 1.93$) but did not report Second Life™ as being useful in their education ($M = 2.92$, $SD = 1.48$).

Social Networking.

A review of responses related to social networking revealed that students perceived this technology to be one that they can easily use (Effort Expectancy $M = 6.09$, $SD = 1.00$), plan to use (Behavior Intentions to Use $M = 6.49$, $SD = 1.09$), and is supported by the institution (Facilitating Conditions $M = 6.59$, $SD = .81$). However, respondents did not report social networking as beneficial to their education (Performance Expectancy $M = 3.04$, $SD = 1.38$).

Twitter™.

Based on responses, students did not perceive Twitter™ to be useful to their education (Performance Expectancy $M = 2.33$, $SD = 1.26$) and did not report intentions to use the technology (Behavior Intention to Use $M = 2.79$, $SD = 1.91$). Students reported neutral to slight agreement regarding ease of use (Effort Expectancy $M = 4.84$, $SD = 1.64$) and institutional support for use (Facilitating Conditions $M = 5.68$, $SD = 1.64$) of Twitter™. Students did not believe others expected them to use the technology (Social Influence $M = 3.47$, $SD = 1.26$).

Content Management Systems.

Content management systems were reported by students to be supported by the institution (Facilitating Conditions $M = 6.55$, $SD = .85$), assisted in their education (Performance Expectancy $M = 5.86$, $SD = 1.02$), and easy to use (Effort Expectancy $M = 6.11$, $SD = .88$).

Objective 3: Relationships between technology acceptance and variables of interest

Correlations were analyzed to determine relationships between technology acceptance of Second Life™, social networking, Twitter™, and content management systems based on the UTAUT and variables of interest in this study including age, number of online courses taken, gender, educational classification (i.e., undergraduate or graduate), and weekly Internet use for educational purposes. Through data analysis, relationships were identified between numerous variables of interest (Table 4). All relationships were described using Davis' (1971) descriptors. Discussion is limited to variables that demonstrated a moderate degree of relationship and were significant at a Cronbach's alpha level of .05. A substantial degree of relationship was seen between Second Life™ and Twitter™ ($r = .61$) and between social networking and content management systems ($r = .57$). Furthermore, there was a moderate degree of relationship between social networking and Twitter™ ($r = .35$) and a low degree of relationship with Second Life™ ($r = .21$). A moderate degree of relationship was revealed in variables of course and age ($r = .33$).

Table 4

Relationships Between Variables of Technology Acceptance and Variables of Interest

Variables	1	2	3	4	5	6	7	8
Age (1)	–	.33*	.18*	.03	.09	.02	.13*	.24*
^a Course (2)		–	.07	.09	.10*	.06	.06	.11*
Gender (3)			–	.09	.14*	.17*	.02	.06
^b Education (4)				–	.15*	.16*	.01	.01
Social Networking (5)					–	.57*	.21*	.35*
Content Mgmt Systems (6)						–	.07	.18*
Second Life™ (7)							–	.61*
Twitter™ (8)								–

*Denotes significance at .05; ^a Number of Online Courses Taken; ^b Classification (i.e., undergraduate or graduate)

The effects of age by group towards the variables of technology acceptance were investigated using ANOVA. Individual ANOVAs were implemented to determine the effects of age by group towards the identified variables of technology acceptance including Second Life™, social networking, Twitter™, and content management systems. Significance of the ANOVA model was seen in the effects of age towards social networking, Second Life™,

and Twitter™ (Table 5). To investigate the specific effects seen in analyses, a Tukey HSD analysis was utilized to further describe these findings. Although significance was shown through data analysis (ANOVA), no real significant difference was seen (Tukey HSD). It should be noted that although analysis depicts a significant difference between groups, use of the Tukey HSD tests insulated the analysis from making a Type I error as this finding depicts.

Therefore, no significance between age group and the construct of social networking was found. However, significance was found between Second Life™ and Twitter™ regarding age group. Tukey HSD further revealed that differences existed between groups 1 and 2 (i.e., ages 19 or younger and ages 20–22) and groups

1 and 3 (i.e., ages 19 or younger and ages 23 and older) respectively regarding Second Life™ and Twitter™. Therefore, data suggested a significant difference between age group and technology acceptance variables of Second Life™ and Twitter™.

Table 5
Means, Standard Deviations, and Analyses of Variance for the Effects of Age by Group on Technology Acceptance Variables

Source	Group 1 ^a Mean(SD)	Group 2 ^b Mean(SD)	Group 3 ^c Mean(SD)	df	F	p	η ²	Power
UTAUT								
Second Life™	3.35 (1.03)	3.61 (.98)	3.73 (1.17)	2	6.83	<.01*	.02	.92
Social Network	5.15 (.80)	5.30 (.72)	5.29 (.94)	2	3.10	<.05	.01	.61
Twitter™	3.41 (1.01)	3.97 (1.14)	4.04 (1.19)	2	25.11	<.01*	.07	1.00
Content M S	6.09 (.78)	6.14 (.69)	6.08 (.76)	2	.43	.65	.01	.12

*Significance at α < .05; ^a = 19 or younger, ^b = ages 20–22, ^c = ages 23 and older; Scale for groups were 1 = Strongly Disagree to 7 = Strongly Agree.

Further exploration investigated the effect that the number of online courses taken by participants (i.e., course group) had on technology acceptance. Significance was identified between course group and social networking and Twitter™ (Table 6). Data suggested a significant difference between groups regarding technology acceptance of social networking and Twitter™. Tukey HSD was utilized to further determine where differences existed. Differences between course

group and social networking were found between groups 1 and 3 (i.e., no online courses and two or more online courses). When undertaken between course group and the variables of technology acceptance of Twitter™, differences were found between the groups of 1 and 3 (i.e., no online courses and two or more online courses) and also among groups 2 and 3 (i.e., one online course and two or more online courses).

Table 6
Means, Standard Deviations, and Analyses of Variance for the Effects of Course Group (i.e., Number of Online Courses Taken) on Technology Acceptance

Source	Group 1 ^a Mean(SD)	Group 2 ^b Mean(SD)	Group 3 ^c Mean(SD)	df	F	p	η ²	Power
UTAUT								
Second Life™	5.14 (.82)	5.25 (.71)	5.32 (.78)	2	3.66	.03*	.03	.68
Social Network	6.06 (.76)	6.13 (.71)	6.16 (.72)	2	1.27	.29	.01	.27
Twitter™	3.45 (1.08)	3.35 (1.05)	3.60 (1.00)	2	2.74	.07	.01	.54
Content M S	3.58 (1.06)	3.55 (1.13)	3.86 (1.14)	2	2.33	<.05	.02	.84

*Significance at α < .05; ^a = no online course, ^b = 1 online course, ^c = 2 or more online courses taken; Scale for groups were 1 = Strongly Disagree to 7 = Strongly Agree.

Analyses were performed to understand and determine the effects of gender towards technology acceptance. Significant differences

were revealed between gender and social networking and content management systems (Table 7). Therefore, it is postulated that a

difference does exist when analyzing the effect of gender towards the variables of social

networking and content management systems based on technology acceptance.

Table 7

Means, Standard Deviations, and Analyses of Variance for the Effects of Gender on Technology Acceptance

Source	Group 1 ^a	Group 2 ^b	df	F	p	η^2	Power
	Mean(SD)	Mean(SD)					
UTAUT							
Second Life™	5.06 (.03)	5.29 (.69)	1	13.80	<.05*	.02	.96
Social Network	5.93 (.87)	6.16 (.66)	1	20.41	<.05*	.03	.99
Twitter™	3.45 (1.09)	3.48 (1.00)	1	.21	.65	.00	.08
Content M S	3.57 (1.11)	3.70 (1.10)	1	2.76	.10	.01	.40

*Significance at .05 alpha level; ^a = male, ^b = female; Scale for groups were 1 = Strongly Disagree to 7 = Strongly Agree.

The effect of the number of hours participants utilized the Internet for educational purposes was investigated based on variables of technology acceptance. Significant differences were seen through ANOVA towards social networking and content management systems (Table 8). It should be noted that participants rated each variable (i.e., social networking and content management systems) more agreeable ($M = > 4.90$) than the variables of Second Life™ and Twitter™ ($M = < 3.75$) using a Likert-type scale of 1 = strongly disagree to 7 = strongly

agree (Figure 1). Tukey HSD determined that differences between social networking and Internet use for education were significant between groups 2 and 4 and also between groups 1 and 4. For the significant ANOVA between Internet use for education and content management systems, differences were shown through Tukey HSD between groups 1 and 4 (i.e., less than one hour and more than 10 hours), 2 and 4 (i.e., one to five hours and more than 10 hours), and 2 and 3 (i.e., one to five hours and six to 10 hours), respectively.

Table 8

Means, Standard Deviations, and Analyses of Variance for the Effects of Internet Use for Education on Technology Acceptance

Source	Group 1 ^a	Group 2 ^b	Group 3 ^c	Group 4 ^d	df	F	p	η^2	Power
	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)					
UTAUT									
Second Life™	4.95 (.72)	5.14 (.79)	5.27 (.77)	5.48 (.77)	3	5.33	<.05*	.02	.93
Social Network	5.89 (.67)	6.02 (.74)	6.19 (.76)	6.36 (.61)	3	6.56	<.05*	.07	.98
Twitter™	3.38 (1.22)	3.49 (1.01)	3.41 (1.02)	3.57 (1.16)	3	.60	.62	.01	.19
Content Mgmt	3.47 (1.17)	3.68 (1.07)	3.61 (1.14)	3.73 (1.17)	3	.51	.68	.01	.15

Note. Significance at .05 alpha level; Groups were categorized based on use of Internet for educational purposes each week: ^a = less than 1 hour, ^b = 1 to 5 hours, ^c = 6 to 10 hours, and ^d = more than 10 hours; Scale for groups were 1 = Strongly Disagree to 7 = Strongly Agree.

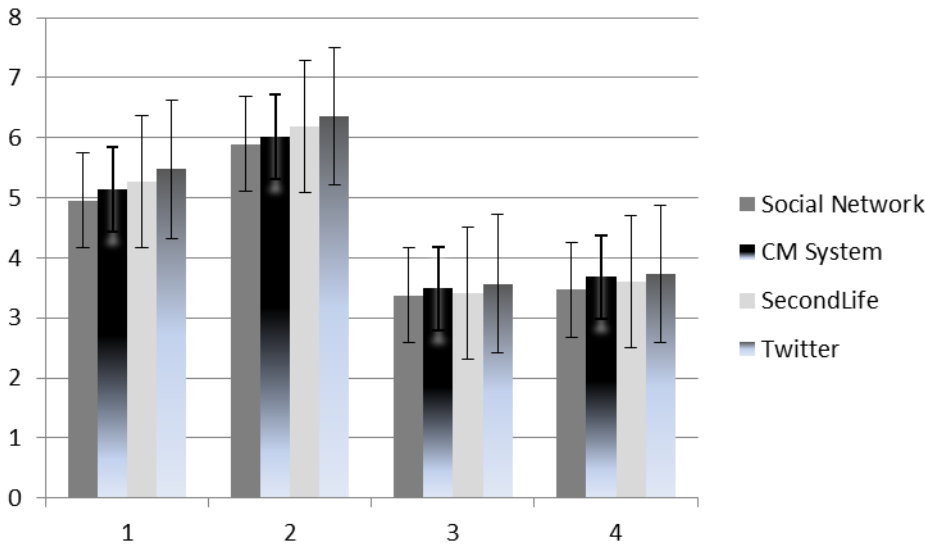


Figure 1. Technology acceptance variable means and standard deviations by Internet use for educational purposes grouping. The “x axis” depicts educational use of Internet groups where 1 = less than one hour, 2 = 1 to 5 hours, 3 = 6 to 10 hours, and 4 = more than 10 hours per week. The “y axis” depicts Likert scale ranking (UTAUT).

Data was further explored to determine the effects of educational classification (i.e., undergraduate and graduate) on technology acceptance. Significant differences were revealed by the effects of classification towards

the construct variables of Second Life™ and Twitter™ (Table 9). Therefore, data suggested that classification significantly effects perceptions of Second Life™ and Twitter™.

Table 9
Means, Standard Deviation, and Analyses of Variance for the Effects of Educational Classification by Group on Variables Measuring Technology Acceptance

Source	Group 1 ^a	Group 2 ^b	df	F	p	η ²	Power
	Mean(SD)	Mean(SD)					
UTAUT							
Second Life™	5.20 (.78)	5.39 (.89)	1	2.53	.11	.02	.85
Social Network	6.10 (.75)	6.11 (.72)	1	.00	.95	.00	.10
Twitter™	3.43 (1.02)	4.08 (1.08)	1	16.80	<.01*	.08	.96
Content M S	3.61 (1.05)	4.32 (1.15)	1	17.94	<.01*	.09	.94

*Significance at .05 alpha level; ^a = undergraduate classification and ^b = graduate classification. Scale for groups were 1 = Strongly Disagree to 7 = Strongly Agree.

Conclusions

It can be concluded that the responding sample represents both male and female students along with both undergraduate and graduate

students. The male/female percentage of respondents (33.7%/66.3%, respectively), although not explicitly representative of the population of the College of Agriculture and Life Sciences that reported males at 48.9% and

females at 51.1% (Texas A&M University, 2010), are a sample drawn from intact classes in the College of Agriculture and Life Sciences. Based on the large sample size ($N = 716$) the researchers believe that findings are representative but caution the reader when making generalizations. Ethnicity was not taken into consideration given that the broader population was predominately white (73%). The respondents were evenly divided as to whether or not they had previously completed an online course.

Objective 1 Technology awareness of students based on self-assessment

Students overwhelmingly reported having quality Internet access at their homes and feeling comfortable with computer technologies. Thus, it can be concluded that there are opportunities to use emerging technologies to provide educational opportunities. Based on findings, technology access or exposure is not a limiting factor in the use of technology for education. However, it is important to note that a majority of students reported no use of blogs, Twitter™, or virtual worlds. It can be concluded that these three technologies are not in high use by this population and that students may require more orientation to these technologies if they are used for educational purposes.

Objective 2 Technology acceptance based on the UTAUT Model

Technology acceptance can directly impact the adoption and use of technologies for specific purposes. Findings revealed that students perceive each of the technologies studied (i.e., Second Life™, social networking, Twitter™, and content management systems) as unique entities that vary in regard to their personal acceptance. Students in this study have overwhelmingly accepted content management systems as a technology that can assist in their educational efforts. On the other hand, Second Life™ and Twitter™ were not accepted by these same students as technologies that can assist in their education. While students were comfortable with the technologies and did not report inability to use the technologies, they currently do not see value in the use of these technologies for education. Additionally, social networks were reported by students to be in high use but not for educational purposes.

Objective 3 Relationships between technology acceptance and variables of interest

Variables of interest for this study included age, number of online courses taken, gender, educational classification, and weekly Internet use. Based on findings, it was concluded that students who had more experience with technologies had more positive perceptions of the technologies. An increase in age was linked to a more positive perception of Second Life™ and Twitter™ and graduate students had consistently higher perception scores than undergraduate students for all four categories. It was concluded that the more online courses taken and increased time spent on the Internet, the more likely it was that students had a more positive perception of all four technologies studied. Finally, it was concluded that female students had more positive perceptions of all four technologies than male students.

Implications and Recommendations

What do these conclusions mean for agricultural education and the use of emerging technologies for instructional purposes? Based on data gathered through this exploratory study, it is important to recognize that while instructors may see value in using Second Life™, social networks, and Twitter™ as innovative, instructional tools, results of this study indicate that students currently do not recognize the same value. Perhaps the wisdom of Confucius (circa 450 BC) and his statement of "Tell me, and I will forget. Show me, and I may remember. Involve me, and I will understand" comes into play as students have not yet truly engaged with blogs, Twitter™, and virtual worlds for educational purposes. If true, instructors will need to consider strategies that will enable students to see and experience the value of utilizing these technologies for learning purposes. These strategies may include providing support and resources to assist students in mastering the technology as well as using the technology in ways that add value to the learning experience that are apparent to the students. This supports research conducted by O'Connor (2010) that indicated that students can struggle to be comfortable in using technology such as Second Life™.

Potential instructional challenges and opportunities were also revealed through these

findings. Use of emerging technologies can increase interaction (Alston & English, 2007; O'Connor, 2010), which can involve the learner, enable a deeper understanding of content, and enhance retention of content. However, without special attention to how these technologies are employed in the learning environment, it is possible that students will not achieve the gains described through simple lack of technology acceptance. Emerging technologies continue to provide opportunities for enhancing the breadth and depth to post-secondary educational programs (Rhoades, Friedel, et al., 2008; Hargis, 2008). However, based on findings from this study, technology acceptance related to Second Life™, social networking, and Twitter™ for educational purposes are lacking. Efforts to include these technologies in the classroom must take this lack of acceptance into consideration. Fortunately, students reported that “ease of use” and “institutional support” were not issues; thus, the critical component will be demonstrating the educational value of technology use.

This study contributes to the body of scholarship related to educational delivery systems, improving the effectiveness of agricultural faculty, and improving delivery models that are topics noted as areas of needed study in the National Research Agenda (Osborne, 2007, p. 3). However, there is a need to continue this line of research to determine the overall educational effectiveness of emerging technologies. Shultz and Doerfert (2010) reported that although students were familiar with Twitter™, they did not use it on a regular basis. Once again, this study noted that Twitter™ was not accepted by students as a technology that will assist them in their educational endeavors. Conversely, Rhoades, Irani, et al. (2008) reported a high use of social networking (85.2% on Facebook) and suggested that this level of use indicates a potential opportunity for instruction using these tools. However, the results of this study did not support that conclusion. Although students find personal value in social networking, they do not see value in the application of this technology for educational purposes. Thus, implementation and use of these technologies need to take into account how students perceive the technologies so that appropriate activities and information is provided to encourage understanding of the educational value in the use of the technology.

Careful examination of factors including age, experience with technology, and gender revealed important items for consideration by both instructors and researchers. Based on the conclusion that students who had more experience with technologies had consistently higher perceptions of them, it is recommended that instructors take heed and provide opportunities for all students to utilize new technologies. It is possible that use of the technologies could in fact enable positive perceptions that in turn could facilitate learning. Based on the conclusion that students classified as graduate students and those reporting an older age reported a more positive perception of Second Life™ and Twitter™, it is recommended that these groups of students be offered learning opportunities utilizing these new technologies. Given that this study found “online courses taken” and “time an individual spent on the Internet” to impact perceptions of technology, there are implications related to the online delivery of entire degree programs. Additionally, because female students had more positive perceptions of Second Life™, social networking, Twitter™, and content management systems than male students, females should be recognized and considered in future research focused on the use of technology to improve instruction.

The theoretical foundation of this study noted that technology acceptance relates to predictions of technology use and factors that can impact use (Lederer et al., 2000). Based on findings from this study, it is important to recognize the lack of acceptance for using social technology as a learning tool in education. This study used the Venkatesh et al. (2003) model that devised “core determinants of intention and usage” (p. 425) related to technology acceptance (*Unified Theory of Acceptance and Use of Technology*). Future research and application in agricultural education, as it relates to the UTAUT model, should utilize the construct *performance expectancy* by seeking ways to impact student perceptions and understanding of how certain technologies can assist in educational gains. For example, instructors may find educational gains (e.g., requiring assignments that utilize the technology) or personal gains (e.g., building personal networks or friend connections) of value for students. *Effort expectancy* (i.e., ease associated with the

use of the system) should be incorporated into technology-based instruction through tutorial sessions to assist students with learning how to use particular technologies effectively and efficiently. *Social influence* (i.e., an individual's perceived importance based on what they believe others perceive) could also be increased by involving change agents or influential students in demonstrating the value of incorporating emerging technologies into instruction. *Facilitating conditions* (i.e., the perceived value that the organizational and technical infrastructure exists to support use of the system) could be improved through additional or extra assistance from the instructor or computer lab personnel. Understanding the *behavioral intention* of students can assist instructors in being more prepared for student response to the use of emerging technologies.

The results of this study revealed questions for further research. Do students who are exposed to a particular technology in class settings continue to use the technology outside of class or is it a one-time experience? Does this exposure impact technology acceptance further as found in this study? Does acceptance

vary by use of technologies in a discipline? How does technology acceptance impact learning when instructors utilize one of the technologies studied? Based on findings, one can conclude that it will be critical to present the technology in a way that enables students to easily comprehend the educational benefits of using the technology. However, successful implementation may require additional technology-specific considerations. The results of this study indicate that students do not necessarily want to merge use of certain technologies for personal use with educational use.

In regard to this study, it is recommended that the construct of *facilitating conditions* be revisited to determine if future studies could include additional and/or alternative statements to increase the reliability of that construct. Additionally, future studies should consider the three constructs (i.e., attitude, self-efficacy, and anxiety) that were determined by Venkatesh et al. (2003) to not be direct determinants. It is possible that these constructs could impact agricultural students and help educators utilize technologies more effectively.

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