Journal of Agricultural Education
Volume 54, Number 3, pp. 171 – 185
DOI: 10.5032/jae.2013.03171

Student and Faculty Perceptions of ICT Use in Undergraduate Agriculture Courses

Donald M. Johnson
Leslie D. Edgar
Casandra K. Cox
University of Arkansas

Abstract

Students and faculty in a land-grant college of agriculture were surveyed to determine their perceptions of current and future Information and Communication Technology (ICT) use in undergraduate agriculture courses. There was a large, positive relationship ($r = .83$) between student and faculty perceptions of the extent to which 40 specific ICT tasks were required in undergraduate courses. Students and faculty ranked the same five ICT tasks (receive email, send email, search the Internet, submit assignments as email attachments, and use Blackboard© to acquire course information) as being the most frequently required. Students and faculty agreed that all database tasks and many of the intermediate to advanced spreadsheet, word processing, graphics, Internet, and miscellaneous tasks were seldom required in undergraduate agriculture courses. While a majority of students and faculty indicated that future ICT use should be maintained at the current level in each of seven broad ICT areas, there were significant ($p < .05$) differences between faculty plans and student recommendations for future use of the Internet, databases, computer graphics, and specialized applications. Students were undecided to moderately positive about their course-related ICT experiences. These results indicate a need to better integrate intermediate and advanced ICT tasks into undergraduate courses.

Keywords: ICT use; university agriculture faculty; undergraduate agriculture students

This project was funded through a Scholarship of Teaching and Learning Grant from the Wally Cordes Teaching and Faculty Support Center, University of Arkansas.

Claro et al. (2012) defined literacy in Information and Communication Technology (ICT) as "the capacity to solve problems of information, communication and knowledge in digital environments" (p. 1043) and indicated that ICT literacy requires both functional skills (mastery of ICT applications) and higher-order (synthesis and evaluation) cognitive skills. According to these researchers, mastery of functional skills is a prerequisite for ICT literacy since these serve as problem solving tools in digital environments. Thus, according to Claro et al. (2012), ICT literacy is not possible without functional ICT skills.

Researchers have noted that proficiency with ICT is a requirement for success in most well-paying careers (Grant, Malloy, & Murphy, 2009; Levy & Murnane, 2004; Stone & Madigan, 2007). Bresnahan, Brynjolfsson, and Hitt (2002) found that ICT skills played a large and widespread role in shifting relative wages among U.S. workers since 1980, with higher pay going to individuals with greater ICT skill levels. Both Graham (2001) and Shrestha (2009) noted that most college of agriculture graduates needed ICT skills to enter and advance in their professional careers. Pouratashi and Rezvanfar (2010) noted that higher education will continue to feel the pressure of educating graduates with appropriate ICT skills for the workforce. Their research also found that as students become familiar with specific ICT tasks they are more willing to use them.

Many in higher education believe students enter college already proficient in ICT skills and use (Kaminski, Switzer, & Gloeckner 2009).

However, research does not support this belief (Cox, Munise, Edgar, & Johnson., 2011; Edgar, Johnson, & Cox, 2012; Grant et al., 2009; Kaminski et al., 2009; Lee, 2003; Palaigeorgiou, Siozos, Konstantakis, & Tsoukalas, 2005; Pouratashi & Rezvanfar, 2010; Tesch, Murphy, & Crable, 2006; Van Braak, 2004; Verhoeven Heerwegh, & De Wit, 2010; Wallace & Clariana, 2005). These and other researchers have found that, while students perceived themselves to be ICT literate, most could not successfully complete fairly basic ICT tasks. Ratliff (2009) posited that many students have the "wrong" type of ICT skills for academic purposes. According to Ratliff, "students may be experts with chatting, Twittering, or social networking, but inexperienced in attaching a document to an email or creating an essay with word processing software" (p. 1). Other researchers have supported this finding (Settle, Telg, Baker, Irani, Rutherford, & Rhoades, 2011; Rhoades, Irani, Telg, & Myers, 2008).

Several recent studies support Ratliff's (2009) conclusions concerning student ICT skills. Verhoeven et al. (2010) discovered students' use of basic ICT skills changed little once they started at the university. The researchers noted that many students still did not know how to make graphs or do simple calculations in spreadsheets, automatically create a table of contents for a report, or make a presentation with PowerPoint or similar program. Tesch et al. (2006) found that 10% or fewer entering business students at Xavier University could correctly use absolute cell addresses in Excel® or properly insert a clip art image into a Word® document. Students at Northwest Missouri State University scored a mean of 53% correct on a basic competency assessment designed to allow them to test out of a required ICT literacy course (Hardy, Heeler, & Brooks, 2006). Of 164 students completing the exam, only three students (1.8%) achieved a score of 80% or higher and were able to test out of the course. The researchers concluded that "a majority of the students have not mastered computer concepts, word processing skills, spreadsheet skills, presentation skills, or database skills" (Hardy et al., 2006, p. 59).

The lack of ICT knowledge, competencies, and skills is not limited to students entering college. Kaminski et al. (2009) found that Colorado State University students' perceived ICT competency actually decreased over their college careers. Shrestha (2009) found that while graduating seniors in the College of Agriculture and Natural Resources at Michigan State University believed their academic majors had helped them develop technical skills required in their anticipated careers, they felt their programs had not been effective in developing their ICT skills.

Summers and Vlosky (2001) indicated both agriculture students and faculty agreed that course-related ICT use was "very important" to students' future competitiveness in the job market" (p. 84). Graham (2001) found that agricultural employers rated word processing, Internet, spreadsheet, database, graphics, accounting systems, and computer-assisted drafting (CAD) as important ICT skills. More recently, Alston, Cromartie, Wakefield, and English (2009) found that agricultural employers rated spreadsheets, word processing, Internet, accounting systems, and presentation graphics as "very important" ICT skills and database use and CAD as "somewhat important" ICT skills. Although desired ICT skills were not evaluated at specific task levels, these studies provide faculty with important information on broad areas of ICT use that should be emphasized in undergraduate agriculture courses.

Selwyn (2007) noted that "despite huge efforts to position computer technology as a central tenet of university education, the fact [remains] that many students and faculty make only limited formal academic use of ICT during their teaching and learning" (p. 84). Kaminski et al. (2009) concluded, "We [Colorado State University faculty] are not engaging our learners in advanced uses of technology for communication, sharing information, and problem solving" (p. 232).

Kuth and Vesper (2001) studied 125,000 graduates from 205 institutions and concluded that students making larger gains in ICT skills during college scored higher on each of 27 academic and social outcome measures when controlling for socioeconomic status. Based on these results, researchers recommended that all entering students become proficient in ICT early in their college careers and that universities examine how students use computers in their courses. Although Kaminski et al. (2009) noted an overall decline in self-perceived ICT skills from freshman to senior year, the researchers noted an increase in perceived skills in the two ICT areas most frequently required in courses: presentation software (PowerPoint©) and Internet use. This reinforces a common-sense notion that both initial learning and continued, periodic use of ICT skills are required in order to develop ICT skills necessary for career success. Sarkar (2012) called for a renewed focus on ICT skills in higher education to improve the competency of both faculty and students.

Theoretical Framework

The Technology Acceptance Model (TAM) is a theoretical framework that can be used to assess how classroom teachers are integrating ICT into their curriculum (Davis, 1986). TAM posits that acceptance and use of ICT depends on an individual's perceptions of the usefulness and ease of use of the technology (Davis, 1986). The theory of reasoned action (TORA) (Fishbein & Ajzen, 1975) provides the rationale for many assumptions seen in the TAM (Davis, 1993). Fishbein and Ajzen (1975) noted that attitudes are a function of beliefs, and those beliefs lead to behavioral intentions. If the intention is not changed, by some external factor, it will lead to specific behavior. The TAM extended the TORA model by looking at two specific attitudes important in technology adoption – perceived usefulness and perceived ease of use (Davis, 1993).

Davis (1993) viewed computer usage as being extrinsically motivated by gains in performance and associated rewards. Yi and Hwang (2003) contended that an individual who has a strong sense of capability in dealing with computers is more likely to accept new technology. The TAM framework has been used extensively to examine how technology systems are being perceived and used. Davis (1993), in a study of 112 users of two systems, found that "TAM fully meditated the effects of system characteristics on usage behavior" (p. 475) and that perceived "usefulness" was 50% more influential than "ease of use" in determining usage.

Venkatesh and Davis (2000) proposed an extension of the TAM to include seven additional factors affecting technology acceptance through their impact on either perceived usefulness or intention to use technology (Figure 1). Venkatesh and Davis successfully validated their extended TAM in longitudinal studies of technology adoption in four businesses. Across organizations, the seven additional factors explained 40-60% of the variance in perceived usefulness and 34-52% of the variance in intentions to use new technologies.

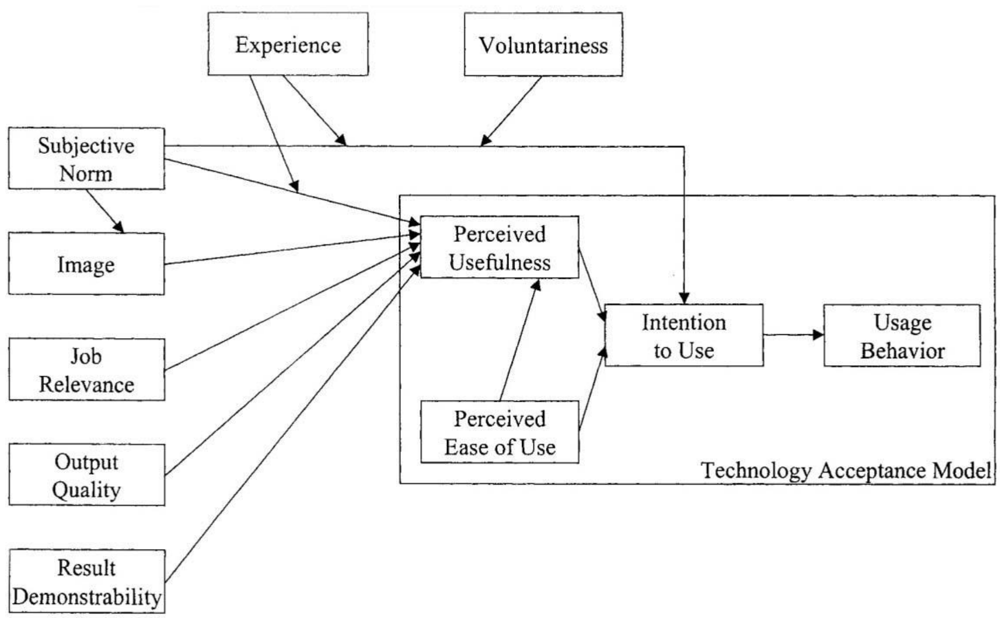

Figure 1. Extension of the Technology Acceptance Model (Venkatesh & Davis, 2000, p. 194)

For the current study, the Job Relevance (JR) factor in the extended TAM was of particular interest. Venkatesh and Davis (2000) found that JR acting alone explained 40% of the variance in intention to use technology. Given that guiding student learning through the completion of required curricular activities is the primary "job" of teaching faculty, the perceived relevance of ICT should be manifested in ICT tasks required in undergraduate agriculture courses as perceived by both faculty and students.

The *National Research Agenda* (Doerfert, 2011), developed by the American Association for Agricultural Education, calls upon agricultural education and communication faculty to "create programs that develop skills and competencies necessary . . . in the agriculture-related workforces in society" (para. 3). Through this charge and via the idea that postsecondary education programs should be producing students able and adept in ICT use, it is critical for educators to determine effective ways to increase ICT skills in college students before they enter professional careers. This study provides important data documenting the perspectives of both students and faculty concerning ICT use in undergraduate agriculture courses at one land-grant university. This information can serve as a framework both for improving the ICT skills of agriculture graduates at this university and promoting similar efforts at other universities.

Purpose and Objectives

The purpose of this study was to examine ICT tasks required in undergraduate agriculture courses at a land-grant university. Specific objectives were to:

1. Determine and compare the perceptions of students and faculty concerning ICT tasks required in undergraduate agriculture courses;
2. Determine and compare student and faculty perceptions of future ICT use in undergraduate agriculture courses; and
3. Determine student perceptions of factors related to ICT use in undergraduate agriculture courses.

Methods

The student population consisted of all undergraduate agriculture majors enrolled in junior- or senior-level agriculture courses (N = 1,914) at the University of Arkansas during the spring 2012 academic semester. Students enrolled in a stratified (by academic department), random sample of 12 upper-division courses were selected to participate in the survey. Upper-level courses were selected to ensure that respondents would be primarily juniors and seniors and would have completed a number of undergraduate agriculture courses prior to participating in the research. The researchers administered the instrument during the first two weeks of the spring semester. Prior to distributing the instruments in each course, the researchers explained the purpose of the study and informed students that participation was voluntary and that all responses would be anonymous. In order to eliminate unqualified and duplicate respondents the following were instructed to not complete the instrument: (a) new transfer students, (b) first-semester agriculture majors, and (c) students who had already completed the instrument in another class. The 12 selected courses had a total duplicated enrollment of 398 students and 235 students provided usable responses, resulting in a nominal, unadjusted response rate of 59%. Due to the anonymous nature of student responses, no follow-up of non-respondents was possible.

The population of faculty consisted of all instructors (N = 64) teaching one or more undergraduate agriculture course at the University of Arkansas during the fall 2009 semester as identified by official university records. The entire population of instructors was surveyed during the spring 2010 semester and 57 (89.1%) provided usable responses.

Although data were collected at different times for faculty (spring 2010) and students (spring 2012), meaningful comparisons were possible for two reasons. First, a longitudinal study (Edgar, Johnson, & Cox, 2012) of faculty in this college found minimal changes in required ICT use in courses between 1999 and 2009 and a majority of faculty did not foresee changing their course ICT requirements during the next two to three years. Second, while faculty responses were based on required ICT use in specific courses taught during a specific semester, students were asked to respond based on the extent to which specific ICT tasks had been required in all agriculture courses completed over their academic careers. Given the relative stability of faculty course-specific ICT requirements and students' more global assessment of required course ICT use across courses, the two groups provided unique, but complementary, perspectives on ICT use in undergraduate agriculture courses at this land-grant university.

Instrumentation

The faculty instrument was administered online in January 2010 and assessed required ICT use in a specifically identified course taught by each instructor during the fall 2009 semester. The instrument consisted of three parts. Part I listed 40 specific ICT tasks (divided into seven ICT areas) and asked respondents to indicate ("Yes" or "No") whether students enrolled in the identified course were required to complete each task. Part II listed seven broad areas of ICT use and asked faculty about their plans for required student use over the next two to three years with response options of decrease use, maintain current level of use, or increase use. Part III contained four items concerning respondents' academic rank, teaching experience and appointment, and self-perceived ICT skills relative to other agriculture faculty.

A panel of nine faculty members (one from each department in the college), including three faculty teaching the college ICT literacy course, examined the instrument and judged it to possess face and content validity. Five agriculture faculty at two land-grant universities completed paper versions of the instrument (at two to seven week intervals) to determine instrument stability (reliability). Part I and Part II had test-retest agreement percentages of 95% and 86%, respectively. The reliability of Part III was not assessed, since, according to Salant and Dillman (1994), responses to non-sensitive demographic items "are subject to little measurement error" (p. 87).

The student instrument, based on the faculty instrument, was formatted as a printed booklet and contained four parts. Part I listed the same 40 specific ICT tasks (divided into seven ICT areas) as in the faculty instrument and asked respondents to indicate the extent to which each task was required in undergraduate agriculture courses (using a 1 to 5 Likert-type scale where 1 = "Never" and 5 = "Always") they had completed. Part II listed the same seven broad areas of ICT use and asked respondents to indicate, for each, whether future course ICT task use should decrease, maintain at the current level, or increase. Part III contained 15 statements concerning factors related to student ICT use in undergraduate agriculture courses that students evaluated on a 1 to 7 Likert-type scale (1 = "Strongly Disagree" and 7 = "Strongly Agree"). Part IV consisted of four demographic items concerning respondent's age, transfer status, major, and self-perceived ICT skills relative to other agriculture majors.

The student instrument, based on the previously validated faculty instrument, was evaluated by a panel of experts (*N* = 3) in survey research and ICT instruction and was judged to possess face and content validity. The student instrument was pilot-tested with five undergraduate agriculture students not participating in the main study; these students successfully completed the instrument and indicated they had no difficulty in understanding the instructions, items, or response options. To assess instrument stability (reliability), the instrument was administered a second time (14 to 21 days later) to the same five students and the following reliability coefficients were obtained: Part I ($r = .65$), Part II ($r = .90$), and Part III ($r = .71$). Although the reliability coefficients for Parts I and III were lower than anticipated, McDowell (2006) indicated reliabilities of $r > .50$ are acceptable when the purpose of the research is to make group rather than individual comparisons. The reliability of the demographic items in Part IV was not assessed (Salant & Dillman, 1994).

Results

The typical student was a junior (37.3%) or senior (39.1%) majoring in animal science (33.6%), agricultural business (22.3%), or agricultural education, communication, and technology (17.6%). Almost two-thirds (62.2%) had begun their academic careers at the University of Arkansas. When comparing their own ICT skills to their classmates, 6.9% rated themselves as below average, 59.5% rated themselves as average, and 33.6% rated themselves as above average.

Faculty responses were received from instructors teaching courses in all nine academic departments in the college. The largest percentage of courses represented was at the junior level (40.4%), followed by courses at the senior (31.6%), freshmen (15.8%), and sophomore (12.3%) levels. The typical faculty respondent held the rank of professor (61.2%), had 10 or more years of university teaching experience (69.4%), and held a teaching appointment of 33% or less (67.4%). When faculty compared their own ICT skills to their colleagues, 65.3% rated themselves as average, 34.7% rated themselves as above average, and 8.2% rated themselves as below average.

Required ICT Use

Faculty reported requiring about 8 ($M = 8.46$; $SD = 6.20$) different ICT tasks in undergraduate agriculture courses. The six tasks faculty reported requiring in more than one-half of all courses (Table 1) were receive email (80.7%), send email (73.7%), search the Internet (64.9%), submit assignments as email attachments (57.9%), use Blackboard© to acquire course information (54.4%), and type a lab or project report (52.6%). Faculty indicated that 28 of the 40 ICT tasks were required in fewer than 25% of classes, while 18 were required in fewer than 10% of classes. The less frequently required ICT tasks included all database tasks and many intermediate to advanced spreadsheet, word processing, graphics, Internet, and miscellaneous tasks.

Student means for four specific ICT tasks were above 4.0, indicating that students perceived these tasks as being required "very often" to "always" in the undergraduate courses they had completed. These tasks were receive email ($M = 4.70$; $SD = 0.55$), send email ($M = 4.49$; $SD = 0.74$), use Blackboard© to acquire course information ($M = 4.33$; $SD = 0.77$), and search the Internet ($M = 4.11$; $SD = 0.87$). Mean student ratings for 31 of the 40 ICT tasks were less than 3.0, indicating students used them "sometimes" or less in undergraduate agriculture courses; 14 of the 41 tasks received mean rating of less than 2.0 indicating they were "rarely" or "never" required. The least frequently required tasks as perceived by students included all database tasks and many of the intermediate to advanced spreadsheet, word processing, graphics, Internet, and miscellaneous tasks.

Table 1

Frequency and Ranking of Required ICT Tasks as Reported by Faculty and Students

	Faculty (n = 57)		Students (n = 235)		
ICT Task (*ICT Area*)	% Requiring	Rank	M^a	*SD*	Rank
Receive electronic mail *from* instructor (*Email*)	80.7	1	4.70	0.55	1
Send electronic mail to instructor (*Email*)	73.7	2	4.49	0.74	2
Search Internet for information on a specific topic (*Internet*)	64.9	3	4.11	0.87	4
Submit course assignments as electronic mail attachments (*Email*)	57.9	4	3.73	1.12	5
Use Blackboard to acquire course information (*Internet*)	54.4	5	4.33	0.77	3
Type a lab or project report (*Word Processing*)	52.6	6	3.26	1.12	7
Download data to disk or hard-drive from the Internet (*Internet*)	40.4	7	2.88	1.27	11.5T
Create materials using presentation graphics software (e.g. PowerPoint) (*Graphics*)	33.3	8	3.23	1.11	8
Access a course web site (*Internet*)	31.6	9	3.28	1.17	6
Enter data into an existing spreadsheet (*Spreadsheet*)	29.8	10	2.74	1.11	14
Type a formal research paper (*Word Processing*)	28.1	11.5T	2.88	1.19	11.5T
Conduct a literature search using Agricola, ERIC, FirstSearch or similar database (*Miscellaneous*)	28.1	11.5T	1.19	1.10	39
Create charts and/or graphs using a spreadsheet (*Spreadsheet*)	22.8	13	2.57	1.10	16
Create a new spreadsheet (*Spreadsheet*)	22.3	14	2.67	1.15	15
Use spreadsheet functions (e.g. IF, MAX, MIN, etc.) (*Spreadsheet*)	17.5	15	2.40	1.11	17.5T
Write a single spreadsheet formula that performs a series of mathematical operations (*Spreadsheet*)	15.8	16	2.28	1.12	19
Write a spreadsheet formula that performs a single mathematical operation (*Spreadsheet*)	15.4	17	2.40	1.13	17.5T
Use Blackboard to submit assignments (*Internet*)	14.0	18	3.05	1.18	9
Use Internet-based communications to contact your instructor and/or classmates (e.g. IM, Facebook, Wiki, Blog) (*Internet*)	12.3	19	2.99	1.30	10
Participate in an email course discussion group or list serve (*Email*)	10.5	20.5T	2.86	1.23	13
Participate in an Internet-based threaded discussion group for class (*Internet*)	10.5	20.5T	2.08	0.97	23T
Type a business letter (*Word Processing*)	8.8	23T	2.19	1.18	20.5T
Download freeware (*Internet*)	8.8	23T	2.02	1.02	26
Use spreadsheet database functions (e.g. sort, query, etc.) (*Spreadsheet*)	8.8	23T	2.08	0.99	23T
Make drawings using computer-assisted drafting program (e.g. AutoCAD, TurboCAD, AutoSketch, etc.) (*Graphics*)	8.8	23T	1.53	0.84	34

Table 1 Continues

Table 1 Continued

	Faculty (n = 57)		Students (n = 235)		
ICT Task (*ICT Area*)	% Requiring	Rank	M^a	*SD*	Rank
Create visual illustrations using graphic-design programs (e.g. Adobe Illustrator, Adobe Photoshop, etc.) (*Graphics*)	8.8	23T	1.98	1.12	27
Use a computer simulation program (*Miscellaneous*)	7.0	27	1.30	0.59	38
Prepare a brochure or newsletter using word processing software (*Word Processing*)	3.5	30.5T	2.19	1.18	20.5T
Create a web page (*Internet*)	3.5	30.5T	2.08	0.97	23T
Enter data into an existing database	3.5	30.5T	2.04	1.01	25
Create a new database (*Database*)	3.5	30.5T	1.66	0.89	32
Sort and/or query a database (*Database*)	3.5	30.5T	1.68	0.88	31
Create a database report (*Database*)	3.5	30.5T	1.57	0.83	33
Write a computer program (*Miscellaneous*)	3.5	30.5T	1.17	0.53	40
Create a spreadsheet macro (*Spreadsheet*)	1.8	37.5T	1.97	1.00	28
Create PivotTables (*Spreadsheet*)	1.8	37.5T	1.52	0.81	35
Prepare a brochure or newsletter using layout program (Adobe In-Design) (*Graphics*)	1.8	37.5T	1.85	0.99	29
Transfer files from a personal computer to a mainframe computer (or vice versa) using file transfer software (e.g. Telnet or Ftp SshClient) (*Miscellaneous*)	1.8	37.5T	1.71	0.97	30
Use a financial management program such as Quicken (*Miscellaneous*)	1.8	37.5T	1.39	0.72	37
Do database programming (*Database*)	0.0	40	1.49	0.76	36

[a]Means are based on a Likert-type scale where 1 = never, 2 = rarely, 3 = sometimes, 4 = very often, and 5 = always.

Students and faculty tended to agree on the relative extent to which the 40 ICT tasks were required in undergraduate agriculture courses. Although rank-orders differed slightly, both groups identified the same five ICT tasks (send email, receive email, search the Internet, submit assignments as email attachments, and use Blackboard© to acquire course information) as being the most frequently required. Likewise, there was agreement between students and faculty on 10 of the 13 least frequently required ICT tasks. The Spearman rank-order rho correlation coefficient indicated a large, positive relationship (r = .83) between faculty and student perceptions of the relative frequency with which these ICT tasks were required.

Future ICT Use

Both faculty and students were asked about future ICT use in undergraduate agriculture courses. Faculty were asked about their plans for changes in required student ICT use in seven ICT areas during the next two to three years; students were asked to recommend changes in the same seven areas of ICT use. For each group, the response options were "decrease use," "maintain current level of use," or "increase use." Because of the small expected cell sizes, *Fisher's exact test* was used to determine if faculty and students differed significantly ($p < .05$) in their plans (faculty) and recommendations (students) for future ICT course use. Since *Fisher's exact test* calculates p directly, without reliance on the χ^2 distribution, only p values are reported for the tests of significance in Table 2 (Darlington & Carlson, 1987).

A majority of faculty and students responded with plans (faculty) or recommendations (students) to maintain the current level of course use in each ICT area. There were no significant differences between faculty plans and student recommendations for use of word processing, electronic mail, or spreadsheets. However, there were significant differences between faculty plans and student recommendations for use of the Internet, databases, computer graphics, and specialized applications. The percentage of faculty planning to increase Internet use (32.6%) was significantly higher than the percentage of students recommending increased use (17.2%). Conversely, the percentage of faculty planning to maintain the current level of required use of databases, computer graphics, and specialized applications was significantly higher than the percentage of students making this recommendation. For databases, this difference consisted of students recommending both decreased use (14.4%) and increased use (29.2%). For computer graphics and specialized applications the difference consisted of students wanting to decrease use, 10.3% and 12.0%, respectively.

Table 2

Faculty Plans and Student Recommendations for Changes in ICT Use in Undergraduate Agriculture Courses

	Faculty (n = 57)			Students (n = 235)			
ICT Area	Decrease (%)	Maintain (%)	Increase (%)	Decrease (%)	Maintain (%)	Increase (%)	*Fisher's exact p*
Word processing	0.0	77.6	22.4	0.9	85.0	14.2	.310
Electronic mail	0.0	82.0	18.0	1.7	81.6	16.7	.926
Internet	2.0	62.0	36.0	0.4	82.4	17.2	.002
Spreadsheets	4.1	63.3	32.6	11.6	56.5	31.9	.289
Databases	2.1	85.4	12.5	14.2	56.6	29.2	<.0001
Computer graphics	0.0	70.8	29.2	10.3	57.5	32.2	.023
Specialized applications	0.0	75.0	25.0	12.0	60.5	27.5	.012

Student Perceptions of ICT Use

Students agreed that computer assignments were appropriate in undergraduate agriculture courses and moderately agreed that requiring student computer use should be a priority; however, they were undecided if faculty made student computer use a priority or encouraged students to use computers (Table 3). Students agreed that the computer skills required in undergraduate agriculture courses would adequately prepare them for the workforce; however, they had only neutral to moderate agreement with the statement, "Agriculture courses well-prepare students in computer and information technology" (M = 4.52, SD = 1.36).

Students agreed they personally had the computer skills necessary for success in undergraduate agriculture courses. Interestingly, the item, "I have excellent computer skills," received a somewhat lower mean rating than the statement, "I have the computer skills necessary to be successful in agriculture courses," with means of 5.10 (SD = 1.42) and 5.75 (SD = 1.06), respectively. Students also rated their peers' computer skills (M = 4.53; SD = 1.14) lower than their own. Students moderately agreed that every agriculture student should own a laptop computer and complete a computer applications course early in their academic career.

Table 3

Student Perceptions of Factors Related to ICT Use in Undergraduate Agriculture Courses

Statement	*n*	*M*[a]	*SD*
I have the computer skills necessary to be successful in agriculture courses.	235	5.75	1.06
I believe the computer skills required in agriculture coursework will adequately prepare me for the workforce.	235	5.21	1.29
Agriculture students should complete a computer applications course early in their college career.	233	5.17	1.74
I have excellent computer skills.	234	5.10	1.42
I believe every agriculture student should own a laptop computer.	232	5.10	1.71
Most other students in my agriculture courses have excellent computer skills.	232	4.53	1.14
Agriculture courses prepare students well in computer and information technology.	233	4.52	1.36
My agriculture instructors make it a priority to include computer tasks in courses.	233	4.25	1.40
My agriculture instructors encourage me and other students to use personal computers in courses.	233	4.25	1.44
Requiring student computer use in agriculture courses should **not** be a priority.	232	3.13	1.74
Computer assignments are **not** appropriate in agriculture courses.	235	2.20	1.34

[a]Based on a scale where 1 = strongly disagree, 2 = disagree, 3 = moderately disagree, 4 = undecided, 5 = moderately agree, 6 = agree, and 7 = strongly agree.

Discussion, Conclusions, and Recommendations

This study assessed ICT skills – email, Internet, word processing, computer graphics, spreadsheets, and databases – required in undergraduate agriculture courses at a land-grant university. As reported by faculty, the typical undergraduate agriculture course required students to complete a mean of 8.46 (*SD* = 6.20) unique ICT tasks in fall 2009, with six specific tasks being required in 50% or more of all courses. These six ICT tasks were receive email, send email, search the Internet, submit course assignments as attached email files, use Blackboard© to acquire course information, and type a lab or project report. Less than one-half of courses required students to complete any tasks related to spreadsheets, computer graphics, miscellaneous use, or databases. By and large, students were not required to complete ICT tasks designed to extend class discussion and participation beyond the classroom, such as (a) use of course listserves, (b) discussion groups, or (c) wikis, blogs, and Facebook©. Although some courses required high levels of ICT use, overall, undergraduate agriculture courses at this university tended to require limited student ICT use with most required tasks being drawn from a narrow range of fairly low-level ICT skills.

Students reported the most frequently required ICT skills were receive email, send email, use Blackboard© to acquire course information, search the Internet, and submit course assignments as electronic mail attachments. These five ICT tasks were also ranked as the top five skills by faculty.

The major finding of this study is that both faculty and students at this land-grant university agreed that intermediate and advanced ICT tasks were seldom required in undergraduate agriculture courses. This is especially noteworthy given the innovative educational uses of ICT in disciplines as diverse as agricultural communications (Leggette, Rutherford, Sudduth, & Murphrey, 2012), agricultural economics (Leonard & Patterson, 2004; Schurle, Stroade, & Grunewald, 2004), agricultural technology (Johnson, 2004), animal and poultry science (Bagley & Johnson, 2007; Kloepper, Zweiacher, Curtis, & Evert, 2010), horticulture (Rhoades, Irani, Tignor, Wilson, Kubota, Giacomelli, &

McMahon., 2009), landscape architecture (Lee, 2009), and plant science (Maixner, Noyd, & Krueger, 2010). In addition to these discipline-specific examples of ICT use, opportunities exist for the educational use of technologies such as social media (Settle et al., 2011), podcasting (Lee, 2009), and simulations (Leggette et al., 2012). Yet, few agriculture faculty or undergraduate students in this land-grant university reported more than basic levels of ICT use.

By and large, faculty members planned to maintain their current levels of required ICT use in these courses during the next two to three years. Few faculty members planned to decrease use in any ICT area, while moderate increases were anticipated in each area. Thus, in the near future, required student use of ICT is likely to increase at a fairly slow rate. Opportunities for faculty development should be provided in areas of ICT interest where competencies and skills are lacking in an effort to increase adoption of course-relevant ICT tasks.

Less than half (47.4%) of students enrolled in agricultural courses during the spring of 2012 believed their ICT skills prepared them for the workforce. Additionally, only 51% of students believed that agriculture courses promoted professional ICT skills. Findings from this study support the need for University administrators and faculty to value and implement ICT skill development beyond the basics. Research indicates that students are entering college with ICT skills most suited for social networking (Ratliff, 2009). If agriculture students are to gain the level of ICT proficiency desired by graduates (Shrestha, 2009) and employers (Graham, 2001), it seems reasonable that students must first learn these skills and then be required to practice their use in appropriate courses throughout their undergraduate careers (Kuth & Vesper, 2001).

According to the extended TAM (Venkatesh & Davis, 2000) that provided the theoretical framework for this study, the ICT tasks required in courses should, in large measure, be determined by faculty perceptions of the relevance (Job Relevancy) of these tasks in preparing students for success in the course and ultimately the workforce. However, examination of the most commonly required tasks (as reported by faculty and students) indicated required ICT tasks primarily serve to facilitate course transactions (e.g. send and receive email, search the Internet, use Blackboard©) rather than to extend the course or enrich course content. Significantly, those technologies that extend the classroom in both time and space, such as listserves, threaded discussion groups, and Internet-based social networking, were among the least commonly required ICT tasks.

Nationally, institutions should ensure / enact policy regarding teacher and student competencies in ICT. ICT skills of importance and value should be integrated into course syllabi and instruction in an effort to create successful outcomes in teaching and learning that are content specific and can better prepare students for the workforce. Additionally, ICT tasks should be selected based on teaching and learning strategies appropriate for each course. Integration of ICT skills can be simple. In many courses students may already be completing assignments that can be logically connected to needed ICT skills. Postsecondary education efforts should focus on identifying potential ICT skills in each course and creating a strategy to increase necessary tasks in agriculture curriculum to improve students' ICT competencies.

The extended TAM theorizes that an individual's actual system usage is determined by behavioral intention, which, in turn, is jointly determined by perceived usefulness and perceived ease of use (Yi & Hwang, 2003). Thus, an important next step is to study employers' perceptions of ICT skills to determine their level of need and competency for each task. According to Sarkar (2012), development of ICT skills will become a greater need and focus in higher education in the future. In an effort to prepare for those changes, employers should be assessed and college courses should integrate necessary ICT skills accordingly.

While all instructors should be encouraged and assisted in integrating appropriate ICT requirements into their courses, required "ICT intensive" courses should be developed at either the department or college level. Assignments in these courses should be designed to require a variety of higher-level ICT tasks appropriate for the subject matter. The details of this or similar plans should be determined by the faculty, possibly through an ad hoc committee established for this purpose or by the college curriculum committee. If necessary, instructors should be trained on the importance of these skills in the workplace.

Instructors determine how, if, and when ICT skills will be integrated into their coursework. Additionally, instructors influence their peers. Therefore, future ICT skill development and competency success may be maximized when information and communication technology instructor "experts" are targeted to showcase how and when they integrated these skills into the classroom. Additionally, ICT insight and success may be found when ICT experts educate their peers on strategies for building personal competencies and skills in specific areas to be integrated into the classroom. Based on Mathieson's (1991) research that integrated the Technology Acceptance Model, the theory of planned behavior "ease of use" with technology played a large factor in acceptance and adoption. Therefore, it is critical that ICT training include easy, how-to guides for skill building and competency enhancement in the classroom.

Additional research should be conducted to determine if the extended TAM (Venkatesh & Davis, 2000) can serve as a predictor of ICT use in colleges of agriculture. Research should assess instructors' perceptions regarding job relevance and social norms in terms of ICT use in courses. Also, research should focus on output quality and result demonstrability in terms of student performance.

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DONALD M. JOHNSON is a Professor in the Department of Agricultural Education, Communications and Technology at the University of Arkansas, 205 Agriculture Building, Fayetteville, AR 72701, dmjohnso@uark.edu.

LESLIE D. EDGAR is an Associate Professor in the Department of Agricultural Education, Communications and Technology at the University of Arkansas, 205 Agriculture Building, Fayetteville, AR 72701, ledgar@uark.edu.

CASANDRA K. COX is an Instructor in the Department of Agricultural Education, Communications and Technology at the University of Arkansas, 205 Agriculture Building, Fayetteville, AR 72701, ccrumle@uark.edu.