Use of Required Information and Communication Technology Tasks in Undergraduate Agriculture Courses

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Abstract

Faculty members *(n = 63)* in a college of agriculture were surveyed to determine the information and communication technology (ICT) tasks they required students to complete in identified courses during the fall 2009 semester. A mean of 8.46 *(SD = 6.20)* tasks were required per course. The six tasks required in more than one-half of all courses were: receive email (80.7%), send email (73.7%), search the Internet (64.9%), send email attachments (57.9%), use Blackboard® (54.4%), and type a lab or project report (52.6%). Of 40 specific tasks, 19 were required in less than 10% of all courses. The least frequently required tasks included: program a database (0%), create an Excel® pivot table (1.8%), create a spreadsheet macro (1.8%), use file transfer software (1.8%), and create a web page (3.5%). There were significant *(P < .05)*, positive correlations between faculty members' self-perceived computer competency and the number of spreadsheet tasks required and between course level and the number of word processing, spreadsheet, computer graphics, miscellaneous, and total ICT tasks. A majority of faculty members planned to maintain their current level of required ICT use. Most undergraduate agriculture courses require a core of basic ICT tasks, but few intermediate or high-level tasks.

Introduction

Proficiency with information and communication technology (ICT) is a requirement for success in most well-paying careers (Grant et al., 2009; Levy and Murnane, 2004; Stone and Madigan, 2007). Bresnahan et al. (2002) found that ICT has played a large and widespread role in shifting relative wages among those in the top, middle, and bottom of the U.S. income distribution since 1980, with higher pay going to those with greater ICT skill levels. Most college of agriculture graduates will need ICT skills to enter and advance in their careers (Graham, 2001).

Many in higher education believe that students enter college already proficient in ICT use (Kaminski et al., 2009). However research (Grant et al., 2009; and Kaminski et al., 2009; Leonard and Patterson, 2004; Tesch et al., 2006; and Wallace and Clariana, 2005) does not support this belief. These 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 be inexperienced in attaching a document to an email or creating an essay with word processing software" (p. 1). 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 et al., 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" (p. 59). Johnson and Wardlow (2004) found that entering agriculture students at the University of Arkansas had fairly low levels of ICT knowledge and cautioned faculty not to assume that entering students possessed basic ICT skills.

The lack of ICT knowledge and skills is not limited to entering college students. 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 the technical skills required in their anticipated careers, they felt their programs had not been very effective in developing their ICT skills. 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, Kuth and Vesper (2001) recommended that all entering

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students become proficient in ICT early in their college careers and that universities examine how students use computers in their courses.

The purpose of this study was to examine the ICT tasks required in undergraduate agriculture courses at a mid-South land-grant university during the fall 2009 semester. Specific objectives were to:

1. Determine the number and type of unique ICT tasks required in undergraduate agriculture courses;

2. Determine the relationship between course and instructor characteristics and the number of unique ICT tasks required in undergraduate agriculture courses; and

3. Determine instructors' plans for required student ICT use in undergraduate agriculture courses over the next two to three years.

Methods

The population consisted of all undergraduate agriculture lecture courses *(N = 84)* taught at the [University] during the fall 2009 semester. Courses were identified using official records supplied by the dean's office. Sixty-four courses and their instructors were selected for the study using a two-step process. First, all courses taught by faculty members *(n =48)* teaching only one course in fall 2009 were selected for inclusion. Next, one course was randomly selected for each faculty member *(n = 16)* teaching two or more courses in fall 2009. Courses were selected in this manner so that the researchers could focus each respondent on one specific, identified course (rather than a generic or composite course) and still avoid asking faculty members to complete multiple surveys. Usable surveys were received from 57 faculty members for a response rate of 89%.

An emailed cover letter invited faculty to participate, identified the specific course for which responses were sought, and contained a hyperlink for accessing the survey. In order to reinforce that respondents were to base their responses on the ICT tasks required of students in the specified course, the first survey item asked respondents to list the course code and number of the course for which they were responding as identified in the email cover letter.

Data were collected using a three-part on-line survey. In Part One respondents indicated whether or not students enrolled in the selected course were required to complete each of 40 ICT tasks, grouped into seven areas, by selecting either a "Yes" or "No" response for each task. In addition to the specific tasks listed, each area of ICT use also contained an "Other (please specify):" response option. In Part Two, the respondents were asked to indicate their plans for required student ICT use in the course over the next two to three years. This section listed seven areas of computer use with the response options of "Decrease use," Maintain current use," or "Increase use." Part Three contained four items concerning the respondents' academic rank, teaching experience and appointment, and self-perceived level of ICT skills.

A panel of nine faculty members (one from each department in the college) examined the instrument and judged it to possess face and content validity. Five faculty members at two different land-grant universities completed paper versions of the instrument (at two to seven week intervals) to determine instrument stability. Part One had a test-retest agreement percentage of 95% and Part Two had a test-retest agreement percentage of 86%. The reliability of Part Three was not assessed since, according to Salant and Dillman (1994), "responses to non-sensitive demographic items are "subject to very little measurement error" (p. 87).

The survey data were analyzed using descriptive statistics (means, standard deviations, and percentages) and bivariate correlations. An alpha level of 0.05 was established a priori for all tests of statistical significance. SAS 9.2 statistical software (SAS Institute, 2008) was used for data analysis.

Results

Responses were received from faculty teaching courses in all nine academic departments in the college. The largest percentage of courses were at the junior level (40.4%), followed by courses at the senior (31.6%), freshmen (15.8%), and sophomore (12.3%) levels. This distribution of courses closely parallels the percentage of courses offered in fall 2009: junior (35.4%), senior (31.7%), freshmen (19.5%), and sophomore (13.4%). The typical faculty respondent held the rank of professor (61.2%), had 10 or more years of university teaching experience (69.4%), held a teaching appointment of 33% or less (67.4%), and rated their own ICT skills as average when compared to other faculty (65.3%).

Table 1. Required use of ICT Tasks in Undergraduate Agriculture Courses (n=57), by Area

ICT area	Mean	SD
Internet	2.47	1.89
E-mail	2.23	1.27
Spreadsheets	1.42	2.50
Word processing	1.07	1.12
Computer graphics	0.53	0.78
Miscellaneous tasks	0.42	0.71
Databases	0.14	0.52

The faculty respondents reported that a mean of 8.46 (SD = 6.20) different ICT tasks were required in undergraduate agriculture courses in fall 2009. The largest mean number of tasks were from the Internet (M = 2.47; SD = 2.50) and email (M = 2.23; SD = 1.27) areas, while the fewest were from the database (M = 0.14; SD = 0.52) and miscellaneous tasks (M = 0.42; SD = 0.71) areas (Table 1).

Over 50% of courses required one or more Internet, email, and word processing tasks; less than 50% of courses required any computer graphics, spreadsheet, miscellaneous, or database tasks. The six tasks required in 50% or more of all courses were receive email (80.7%), send email (73.7%), search the Internet (64.9%), submit course assignments as attached email files (57.9%), use Blackboard® to acquire course information (54.4%), and type a lab or project report (52.6%). Of the 40 specified ICT tasks, 27 were required in less than 25% of courses, while 19 were required in less than 10% of courses. Less than 15% of courses required students to use course listserves (10.5%), threaded discussion groups (10.5%), or Internet-based communications such as Facebook©, wikis, or blogs (12.3%) to participate in course activities or discussions. The least frequently required tasks were database programming (0.0%), use of file transfer software (1.8%), use of financial management software (1.8%), creating PivotTables (1.8%), creating spreadsheet macros (1.8%), or preparing a brochure or newsletter using layout software (1.8%) (Table 2).

There was no significant ($P > 0.05$) relationship between faculty rank, years of teaching experience, or FTE teaching and the total number of required ICT tasks. There was a significant ($P < .0.05$) positive correlation (r = .32) between self-perceived computer skills and the number of spreadsheet tasks required. Course level had a significant ($P < 0.05$) positive correlation with the number of word processing (r = .34), spreadsheet (r = .46), computer graphics (r = .36), miscellaneous (r = .33), and total (r = .35) computer tasks required.

Faculty members were asked about their plans for required ICT use in the specified courses over the next two to three years (Table 3). (Note: respondents were not asked about their plans for miscellaneous tasks.) More than 60% of respondents planned to maintain their current level of required use in each ICT area. Fewer than 5% of faculty intended to decrease required student use of any ICT area. More than 25% of faculty intended to increase required use of computer graphics (29.2%), spreadsheets (32.6%), and the Internet (36.0%) over the next two to three years.

Table 2. Specific ICT Tasks Required in Undergraduate Agriculture Courses *(n=57)*

Task	Required %	Not required %
Electronic mail	**84.2**	**15.8**
Receive electronic mail *from* you	80.7	19.3
Send electronic mail *to* you	73.7	26.3
Submit course assignments as "attached files"	57.9	42.1
Participate in an e-mail course discussion group or listserve	10.5	89.5
Other e-mail task(s)	0.00	100.0
Internet	**79.0**	**21.0**
Search the Internet for information on a specific topic	64.9	35.1
Utilize Blackboard to acquire course information.	54.4	45.6
Download data to disk or hard-drive from the Internet	40.4	59.6
Access a *homepage* developed for your course	31.6	68.4
Utilize Blackboard to submit assignments.	14.0	86.0
Utilize Internet-based communications to contact you (for example, instant messages, Facebook, Wiki, Blog)	12.3	87.7
Participate in a "threaded discussion group" for your class	10.5	89.5
Download freeware	8.8	91.2
Create a web page	3.5	96.5
Other Internet task(s)	7.0	93.0
Word processing	**57.9**	**42.1**
Type a lab or project report	52.6	47.4
Type a formal research paper	28.1	71.9
Type a business letter	8.8	91.2
Prepare a brochure or newsletter	3.5	92.5
Other word processing task(s)	14.0	86.0

Table 2. Continued

Computer graphics	**38.6**	**61.4**
Create materials using presentation graphics software	33.3	66.7
Make drawings using computer-assisted drafting program	8.8	91.2
Create visual illustrations using graphic-design programs (for example, Adobe Illustrator, Adobe Photoshop, etc.)	8.8	91.2
Prepare a brochure or newsletter using layout program (for example, Adobe In-Design)	1.8	98.2
Other computer graphics task(s)	0.0	100.0
Spreadsheet	**33.3**	**66.7**
Enter data into an existing spreadsheet	29.8	70.2
Create charts and/or graphs using a spreadsheet	22.8	77.2
Create a new spreadsheet	21.0	79.0
Write a spreadsheet formula that performs a single mathematical operation	19.3	80.7
Use spreadsheet functions (e.g. IF, MAX, MIN, etc.)	17.5	82.5
Write a single spreadsheet formula that performs a series of mathematical operations	15.8	84.2
Use spreadsheet database functions (e.g. sort, query)	8.8	91.2
Create a spreadsheet macro	1.8	98.2
Create PivotTables	1.8	98.2
Other task(s)	3.5	96.5
Miscellaneous	**33.3**	**66.7**
Conduct a literature search using Agricola, ERIC, FirstSearch or similar database	28.1	71.9
Use specialized applications	17.5	82.5
Write a computer program	3.5	96.5
Transfer files from a personal computer to a mainframe computer (or vice versa) using file transfer software (for example, Telnet or SshClient)	1.8	98.2
Use a financial management program such as Quicken	1.8	98.2
Other miscellaneous task(s)	0.0	100.0
Database	**8.8**	**91.2**
Enter data into an existing database	3.5	96.5
Create a new database	3.5	96.5
Sort and/or query a database	3.5	96.5
Create a database report	3.5	96.5
Do database programming	0.0	100.0
Other database task(s)	0.0	100.0

Discussion and Implications

The typical undergraduate agriculture course at this university required students to complete a mean of 8.46 ICT tasks in fall 2009, with six specific tasks being required in 50% or more of all courses. These six tasks were receive email, send email, search the Internet, submit course assignments as attached email files, use Black board® 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 use of course listserves, discussion groups, or wikis, blogs, and Facebook©. Undergraduate agriculture courses at this mid-south land-grant university tended to require limited student ICT use with most required tasks being drawn from a narrow range of fairly low-level ICT skills.

Faculty rank, teaching experience, and FTE teaching assignment were not significantly ($P > .05$) related to the number of ICT tasks required, either overall or by ICT task area. Self-perceived ICT competency had a significant ($P < .05$) positive correlation with the number of spreadsheet tasks required. Course level had a significant ($P < .05$) positive correlation with the number of word processing, spreadsheet, computer graphics, miscellaneous, and total ICT tasks required. Thus course level, as opposed to instructor characteristics, appears to be the best predictor of required student ICT use. While required ICT tasks did tend to increase in upper-level courses, the question arises as to whether overall and specialized ICT use requirements are sufficient to prepare graduates for effective ICT use in their careers (Graham, 2001). Further research in this area is needed.

Table 3. Instructors' Plans for Required ICT Tasks over the Next Two to Three Years

ICT area	Decrease use %	Maintain use %	Increase use %
Word processing	0.0	77.6	22.4
E-mail	0.0	82.0	18.0
Internet	2.0	62.0	36.0
Spreadsheets	4.1	63.3	32.6
Databases	2.1	85.4	12.5
Computer graphics	0.0	70.8	29.2

By and large, faculty members planned to maintain their current levels of required ICT use in these courses over 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 term, 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.

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 and Vesper, 2001).

In previous years, college goals at the University of Arkansas have focused on increasing the development and use of ICT skills in the classroom. Although it is not feasible or necessary to include every outlined skill in university curriculum, it is critical for administrators and faculty to understand the educational and workplace value of ICT skills. Nationally, institutions should ensure / enact policy regarding teacher competencies in ICT. ICT skills of importance and value should be integrated into course syllabi in an effort to create successful outcomes in teaching and learning that are content specific. Additionally, information and communication technology should be selected based on learning strategies and resources needed as necessary for the course.

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.

Finally, given the importance of ICT to career success (Graham, 2001) and graduating seniors' perceptions concerning inadequate ICT skills (Shrestha, 2009), other agriculture colleges and departments should examine required student ICT use in their courses. Information from such studies should prove useful in designing appropriate educational experiences to prepare graduates for career entry and advancement.

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