Journal of Agricultural Education
Volume 40, Number 2, pp. 28-37
DOI: 10.5032/jae.1999.02028

COMPUTER EXPERIENCES, SELF-EFFICACY AND KNOWLEDGE OF STUDENTS ENROLLED IN INTRODUCTORY UNIVERSITY AGRICULTURE COURSES

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Abstract

Students (n = 175) enrolled in three freshman-level agriculture courses at a land-grant university during the Fall 1998 semester were surveyed to determine their computer experiences, computer self-efficacy, and computer knowledge. The students reported a variety of computer experiences, with 74.3% having completed a computer use course and 62.3% owning a computer. Over one-half of the students had received formal instruction in word processing (68.6%), file management (42.8%) and spreadsheet use (54.8%). Fewer than one-half had received formal instruction in databases (42.3 %) presentation graphics (37.1 %), the Internet (37.1 %), electronic mail (35.4%) or computer programming (28.0%). The students had a below average level of computer self-efficacy. The overall score on the 35 item multiple choice test of computer knowledge was low, with a mean of 13.42 (38.3% correct). The number of computer topics studied was the best predictor of both computer self-efficacy (r = .48) and computer knowledge (r = .45). A substantial positive correlation (r = .67) existed between computer self-efficacy and computer knowledge.

Introduction

Computers are an integral and pervasive feature of modern society. According to the United States Department of Education (USDE, 1996):

> Computers and information technologies are transforming nearly every aspect of American life. They are changing the way Americans work and play, increasing productivity, and creating entirely new ways of doing things. Every major U.S. industry has begun to rely on computers. (p. 9)

Computers play an important and ever increasing role in agriculture (Odell, 1994). Thus, university agriculture programs must ensure that their graduates are competent in computer use (Langlinas, 1994). In a follow-up study of Pennsylvania State University agriculture graduates, respondents rated computer skills as slightly more important to job success than technical agriculture skills (Radhakrrishna & Bruening, 1994).

A study conducted for the College of Agriculture and Life Sciences at Cornell University (Monk, Davis, Peasley, Hillman, & Yarbrough, 1996) concluded that agricultural employers "have a high expectation of computer literacy in recent college graduates" (p. 12). More than 80% of the employers rated computer skills as either an "important" or "very important" factor considered in making employment decisions. The employers rated skills in using word processing, spreadsheet, database, and presentation graphics programs as the most important computer abilities needed by prospective employees. Similar results were found in agricultural employer studies conducted for the University of Arkansas (Graham, 1997) and the University of Nebraska (Andelt, Barrett, & Bosshamer, 1997).

As a result of the study by Monk et al. (1996), the College of Agriculture and Life Sciences (CALS) at Cornell University adopted the following statement on computer proficiency:

> All CALS students should graduate with a working knowledge of the following kinds of software: word processing, presentation tools, spreadsheet analysis, database management, and graphics. In addition, students need to be familiar with the World Wide Web, electronic mail, and possess the ability to search for and make effective use of information on the Internet. Finally, all CALS students should be sufficiently comfortable with these technologies so that they can continue to acquire skills that will be necessary for them in their area of interest after they leave campus. (p. 21)

Bekkum and Miller (1994) surveyed the deans of 71 land-grant colleges of agriculture to determine the strategies used to ensure that graduates were proficient in computer use. Of the 59 deans responding, 26 (44.1%) reported a college-wide computer requirement. An additional 20 (33.9%) deans reported that some (but not all) individual departments within their colleges had specific computer course requirements. All deans reported that computer application courses were available to their students.

Bekkum and Miller (1994) also asked the responding deans to indicate likely changes in computer requirements for agriculture students. Eleven (18.6%) deans believed that, in the future, less time would be required for basic computer skill development, since students would have developed these skills before entering college.

The assumption that students enter college already possessing basic computer skills is prevalent. According to Kieffer (1995),

> Many assume that students come to universities with adequate computer skills, and, since the computer is a tool for all disciplines, the only additional instruction needed could be included in courses across the curriculum. This attitude seems to have spread and computer literacy courses are often seen as unnecessary and obsolete. (p. 276)

Despite such optimism, just how common is computer use among pre-college students? A USDE (1996) report states that, "Computers and information technologies are not part of the way most American students learn" (p. 9). According to the most recent data from the USDE (1998), in 1996, 65.5% of 11" grade students reported using computers at school once a week or less.

Only seven states require students to complete a computer literacy course in order to graduate from high school (National Center for Education Statistics, 1997). In these seven states, the most common computer literacy requirement is a single semester course. Additionally, many colleges and universities do not include computer coursework as a requirement for admission.

Computer skills are important to both success in college (Kieffer, 1995) and to success in agricultural careers (Radhakrrishna & Bruening, 1994; Andelt, Barrett, & Bosshamer, 1997). Yet, the college of agriculture in which this study was conducted has no computer education requirement, is located in a university which does not require a computer course for admission or graduation, and is in a state with no computer requirement for high school graduation. Therefore, this study sought to determine the computer experiences, self-efficacy and knowledge of students enrolled in selected introductory courses within the College.

Purpose and Objectives

This study was conducted in order to accomplish the following four research objectives:

1. Determine demographic characteristics and computer-related experiences of students enrolled in selected introductory university agriculture courses;

2. Determine the computer self-efficacy of students enrolled in selected introductory university agriculture courses;

3. Determine the computer knowledge of students enrolled in selected introductory university agriculture courses as measured by scores on the exam portion of the Computer Experiences and Knowledge Inventory (CEKI).

4. Determine the relationship between demographic characteristics, computer-related experiences, computer self-efficacy, and scores on the exam portion of the CEKI for students enrolled in selected introductory university agriculture courses.

Methods

This census study was conducted using a descriptive-correlational design (Ary, Jacobs, & Razavieh, 1990). The population consisted of students enrolled in three purposefully selected freshman-level agriculture courses at a land-grant university during the first week of the Fall 1998 semester. These courses (Freshman Orientation, Introduction to Animal Science, and Introduction to Agricultural Economics) were selected because of the instructors' willingness to participate and the relatively high student enrollment in each course. According to official class rosters, the three courses had a total, unduplicated enrollment of 190 students; 175 (92.1%) of these students provided usable data. Since a random sample of students was not studied, the findings of this study should not be generalized beyond these respondents. However, the present study does provide essential information for both local decision-making and further research of a more generalizable nature.

Data were collected by student responses to the "Computer Experiences and Knowledge Inventory" (CEKI). The CEKI was developed by the researchers and consisted of three parts. Part One contained 21 items related to respondent demographics and previous computer experiences. Part Two was composed of eight Likert-type items requiring respondents to assess their self-perceived level of skill (1 = "no skill" and 5 = "high skill") in specific areas of computer use. Part Three consisted of 35 multiple choice items (with 5 response options, including a "Do not know" option) designed to measure computer knowledge in the areas of general computer knowledge (six items), Internet use (five items), word processing (eight items), file management (five items), spreadsheets (six items), databases (three items), and BASIC computer programming (two items). All items in Part Three were written so as to be answerable by persons familiar with common operating systems and application programs. In other words, the items were not software specific.

The CEKI was evaluated by a panel of five experts with experience in teaching introductory computer applications courses to college agriculture students and was judged to possess content validity. The instrument was pilot-tested with six high school seniors participating in an on-campus agricultural internship program during summer 1998. The participants reported no difficulty in interpreting the instructions or items contained in the CEKI.

Pilot-test reliability estimates were .90 (coefficient alpha) for Part 2, and .79 (KR-21) for Part Three of the instrument. For the main study, reliabilities of. 87 (coefficient alpha) and .8 1 (KR-21) were estimated for Parts Two and Three, respectively. The reliability of Part One of the CEKI was not assessed, since, according to Salant and Dillman (1994, p. 87), responses to non-sensitive, demographic items are subject to "very little measurement error."

Results

The results of this study are reported by objective.

Objective One – Demographics and Computer Experiences

Of the 175 respondents providing usable data, 58.3% were male and 41.7% were female. Reported ages ranged from 16 to 35 years, with a mean of 19.4 (SD = 2.43) and a mode of 18. High school graduating class sizes ranged from 14 to 900 students, with a mean of 212.21 (SD = 188.58) and a median of 130. Freshmen comprised 55.2% of the respondents, followed by sophomores (23 .0%), juniors (13.8%) and seniors (8.0%).

Nearly two-thirds (62.3%) of the respondents reported owning a computer. Almost all (96.2%) of the computers were either IBM (19.0%) or IBM-compatible (77.1%) machines. The Windows operating system (various versions) was used on 95.2% of the computers.

Approximately three-fourths (74.3%) ofther respondents had completed one or more courses in computer use. Of these, 75.4% had completed either one (44.6%) or two (30.8%) courses. The respondents reported having completed computer courses in high school (62.0%) college (16.3%), or both high school and college (21.7%).

Respondents who had completed one or more computer courses were asked to indicate if they had received instruction in selected computer topics. As shown in Table 1, the highest percentage ofrespondents had received instruction in word processing, while the lowest percentage had received instruction in computer programming. The mean number of topics the respondents reported having studied was 4.93 (SD = 2.14).

Table 1. Computer Topics Studied in Course(s) Completed by Respondents (n = 130).

Computer topic	Studied (%)	Not studied (%)
Word processing	92.3	7.7
File management	84.6	15.4
Spreadsheet use	73.8	26.2
Database use	56.9	43.1
Presentation graphics	50.0	50.0
Internet use	50.0	50.0
Electronic mail	47.7	52.3
Computer programming	37.7	62.3

Approximately one-fourth (25.7%) of the 175 respondents had not completed a computer course. When these students were included in the analysis, the overall percentage of students who had received formal instruction in each topic was: (a) word processing, 68.6%; file management, 62.8%; spreadsheet use, 54.8%; database use, 42.3%; presentation graphics, 37.1%; Internet use, 37.1%; electronic mail, 35.4%; and computer programming, 28.0%.

The respondents were also asked if they had ever completed a course where computer use was expected, but was not the primary focus of the course. Overall, 52% had completed one or more courses that required computer use. Among freshmen, 45.8% had completed such a course, compared to 59.0% of the combined sophomore, junior and senior respondents.

Objective Two __ Self-Perceived Computer Skills

The respondents rated their self-perceived level of skill in eight areas of computer use, using a five-point Likert-type scale (1 = "no skill" and 5 = "high skill"). As shown in Table 2, the respondents felt they had the highest level of skill in word processing, and the lowest level of skill in computer programming.

Table 2. Self-Perceived Levels of Skill in Selected Areas of Computer Use (N = 175)

Area of Computer Use	Self-Perceived Skill Level						
	None (%)	Below average (%)	Average (%)	Above average (%)	High (%)	Mean	SD
Word processing	1.7	12.6	46.3	22.3	17.1	3.41	0.97
Electronic mail	5.1	22.9	34.9	22.9	14.3	3.18	1.10
Internet use	2.3	22.4	44.8	17.2	13.3	3.17	1.00
File management	4.6	23.4	41.1	19.4	11.4	3.10	1.03
Spreadsheet use	5.1	22.9	34.9	22.9	14.3	2.67	1.14
Presentation graphics	23.6	31.0	28.2	10.9	6.3	2.45	1.15
Database use	28.0	29.7	29.7	9.1	3.4	2.30	1.08
Computer programming	50.3	29.7	16.0	3.4	0.6	1.74	0.89

Responses to the eight individual items reported in Table 2 were summed and averaged to arrive at a composite measure of computer self-efficacy (CSE) for each respondent. The distribution of scores for the variable CSE was positively skewed (skewness = 0.40), with a mean of 2.75 (SD = 0.76), and a median of 2.63.

Obiective Three - Commuter Knowledge

The distribution of scores for the 35 item exam portion of the CEKI was positively skewed (skewness = 0.63) with a range of from two (5.7% correct) to 31 (88.6%). The mean number of correct responses was 13.42 (38.3%) with a standard deviation of 5.47, and a median of 13 (37.1%). Overall, students scored a higher percentage of correct responses on the Internet and general computer knowledge sections. The lowest overall score was on the computer programming section. Table 3 summarizes student achievement on the exam section of the CEKI.

Obiective Four - Relationship Between Variables

Using the descriptors suggested by Davis (197 1), the correlations between respondent demographic characteristics, computer-related experiences and computer self-efficacy (CSE) and CEKI exam scores ranged from negligible to moderate (Table 4). All demographic variables, except for size of high school graduating class, had at least low, positive correlations with computer self efficacy and/or CEKI exam scores.

Table 3. Student Scores on the Exam Section of the CEKI by Area and Total (N = 175)

Exam area (number of items)	M	SD	% Correct
Internet use (5)	3.03	1.17	60.6
General computer knowledge (6)	3.25	1.46	54.2
Word processing (8)	2.96	1.78	37.0
File management (5)	1.74	1.20	34.8
Spreadsheet use (6)	1.57	1.49	26.2
Database use (3)	0.76	0.94	25.3
Computer programming (2)	0.10	0.33	5.0
Total (35)	13.42	5.47	38.3

Table 4. Relationship Between Selected Demographic Characteristics. Computer-Related Experiences and Computer Self-Efficacy and CEKI Exam Score

Variable	CSE	CEKI Exam Score
Age	.11*	.28*
Gender[a]	.08	.16*
College classification	.32**	.28*
Number in high school graduating class	.05	-.02
Completed a computer course[b]	.19*	.31**
Number of computer courses completed	.34**	.37**
Number of topics studied in computer course(s)	.48**	.45**
Own a computer[d]	.18*	.17*
Computer Self-Efficancy (CSE)		.67***

“Coded as Female = 0; Male = 1. [b]Coded as No = 0; Yes = 1. “Includes respondents ***not*** completing a computer course. [d]Coded as No = 0; Yes = 1.
* = low association.** = moderate association; ***substantial association (Davis, 197 1).

All of the computer-related experience variables had low to moderate correlations with computer self-efficacy and CEKI exam scores. The variables, number of computer courses taken and number of topics studied in computer course(s), were the computer-related variables having the highest correlation with both computer self-efficacy and CEKI exam scores. The correlation between computer self-efficacy and CEKI exam scores was substantial.

The data were further analyzed to examine differences in computer self-efficacy and CEKI exam scores both by college classification and within each classification by whether or not the students had completed a computer course.

These results are shown in Table 5. (Note: The results of this analysis should be viewed with caution because of the small proportion of junior and senior students included in the study.)

Table 5. CSE and CEKI Exam Scores by Class and Previous Commuter Course Status

Class	n	CSE		CEKI Exam Score		
Computer course?		M	SD	M	SD	% Correct
Freshmen	96	2.56	.70	12.07	4.85	34.5
No	29	2.42	.73	10.10	5.05	28.8
Yes	67	2.62	.67	12.92	4.53	36.9
Sophomore	40	2.78	.79	13.85	5.71	39.6
No	10	2.26	.62	9.60	2.67	27.4
Yes	30	2.96	.77	15.25	5.78	43.6
Junior	24	3.02	.79	15.25	5.16	43.6
No	3	2.79	.47	13.33	3.78	38.1
Yes	21	3.05	.83	15.52	5.35	43.6
Senior	14	3.41	.60	17.00	5.05	48.6
No	3	3.87	.70	14.66	3.88	41.9
Yes	11	3.28	.53	17.64	5.46	50.4

Mean CEKI exam scores increased with each increase in class level. Within each class, students who had completed at least one computer course scored higher on the CEKI exam than students who had not completed a computer course. Only the subgroup of seniors who had completed one or more computer courses scored above 50% on the CEKI exam.

Mean computer self-efficacy scores also increased with each increase in class level. Except for seniors, mean computer self-efficacy scores were higher within each class for those students having completed one or more computer courses.

Conclusions

The students participating in this study reported a variety of computer-related experiences. Almost two-thirds of the students owned a computer, and nearly three-fourths had completed one or more computer courses. However, over one-half of the students had not received formal instruction in database use, presentation graphics, Internet use, electronic mail, or computer programming. Between 30 and 45% of the respondents had not received formal instruction in word processing, file management, or spreadsheet use. Thus, it was concluded that these students have not participated in a common core of formal educational experiences related to the most commonly used computer applications.

Almost one-half (48%) of the respondents reported that they had never completed a course (other than a computer use course) where computer use was expected. When one considers the number of individual courses completed by the respondents, it becomes apparent that, despite the rhetoric, computer use is not a component of most courses, especially at the pre-college level.

Overall, the respondents perceived their level of competence in word processing, electronic mail, Internet use, and file management as slightly above average. They perceived their competence in spreadsheet use, presentation graphics, database use, and computer programming as below average. In each of the eight areas, fewer than 40% of the respondents perceived their skills as being either "above average" or "high." The overall mean of 2.75 for the composite variable, computer self-efficacy, was slightly below average (on a 1 to 5) scale. Based on these findings, it was concluded that a majority of respondents felt they possessed average to below average skills in the eight areas of computer use studied.

The mean score on the 3 5 item exam section of the CEKI was 13.42 (38.3% correct). Students scored highest on the Internet use (60.6% correct) and general computer knowledge (54.2% correct) sections of the exam. The mean percentage of correct responses for each of the remaining five sections of the exam was less than 40%, with a high of 37.0% for the word processing area, and a low of 5.0% for the programming area. Based on these results, it was concluded that the respondents were deficient in all areas covered by the CEKI exam, especially in word processing, file management, and spreadsheet and database use. (Note: Although knowledge of computer programming was extremely low, the researchers concluded this was not an essential area of computer knowledge for the vast majority of students or agricultural employees.).

Overall, freshman students in this study had a low level of computer knowledge (34.5% correct on the CEKI exam). It was concluded that these freshman students are not entering college with an adequate level of computer knowledge. Based on the low computer self-efficacy scores of these freshmen, it appears that the students also recognize they are lacking in computer knowledge.

Although CEKI exam scores increased with increases in class level, even at the senior level the mean CEKI score was low (Mean = 17.0 or 48% correct). Thus, even seniors may not be graduating with the level of computer knowledge desired by agricultural employers. However, it must be noted that juniors and seniors enrolled in these freshman-level courses may not be representative of all upper division students.

The number of computer courses completed and the related variable (r_{xy} = .65), number of topics studied in computer course(s), were the best predictors of both computer self-efficacy and CEKI exam scores. While it seems reasonable that increased computer self-efficacy and computer knowledge were the result of taking more computer courses and studying more computer topics, no such cause-and-effect relationship can be established from these correlational results.

A substantial positive correlation (r = .67) was found between computer self-efficacy and CEKI exam scores. Thus, it appears that students are reasonably good judges of their own computer abilities. This finding, together with the overall low level of assessed computer knowledge, suggests that students may perceive a lack of need for computer knowledge in their courses. This is supported by the finding that 48.0% of the respondents reported that they had never completed a single course (other than a computer applications course) where computer use was required.

Recommendations

Research concerning the computer experiences, computer self-efficacy, and computer knowledge of students in this College should be continued and expanded. In particular, this study should be replicated with randomly selected samples of both entering and graduating students. If future studies produce similar results, the following actions are recommended.

First, a computer applications course requirement should be established for all students entering the College. Students should be required to complete this course during their first year of enrollment. Second, because some students do appear to have a high degree of computer knowledge, a performance testing option should be available whereby students can test out of the computer course requirement. Third, deliberate efforts should be made to more fully integrate required computer use into courses throughout the College.

Finally, researchers and educators in other universities are encouraged to conduct similar studies. Such research will provide the data necessary to make sound decisions concerning computer education courses and requirements.

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