Computer Experiences, Self-Efficacy and Knowledge of Freshman and Senior Agriculture Students

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Abstract

Freshmen (n = 82) and senior (n = 75) agriculture students at a land-grant university were studied to compare their computer-related experiences, computer self-efficacy, and computer knowledge. Both freshmen and senior students reported a variety of computer experiences, with a majority in both groups owning a computer and having completed one or more computer courses. A higher percentage of seniors had studied each of eight computer topics than had freshmen. Seniors had a higher level of overall computer self-efficacy than freshmen. Seniors also scored higher (52.0% correct) on a 35-item computer knowledge exam than did freshmen (39.6% correct). Recommendations for enhancing the computer education of agriculture students were made as a result of this study.

Introduction

Computers play an important and ever increasing role in modern agriculture. In follow-up studies, university agriculture graduates consistently rate computer skills as being important to career success (Andelt, Barrett, & Bosshamer, 1997; Graham, 1997; Radhakrishna & Bruening, 1994). Yet, Heyboer and Suvedi (1999) found that recent (1993 - 1998) graduates of the College of Agriculture and Natural Resources at Michigan State University felt they had received less than satisfactory preparation in computer use, rating computers as the area in which they were least prepared for employment.

Agricultural employers also place significant importance on computer skills, with more than 80% indicating that computer skills are either an 'important" or "very important" factor considered when making employment decisions (Monk, Davis, Peasley, Hillman, & Yarbrough, 1996). Thus, university agriculture programs must ensure that graduates are competent in computer use (Davis, 1997; Johnson, Von Bargen, & Schinstock, 1995).

In a Cornell University study, Monk et al. (1996) determined that agriculture graduates should be proficient in word processing, presentation graphics, spreadsheet analysis, database management, technical graphics, Internet use and electronic mail. Further, students should be sufficiently comfortable with computer and information technologies so they can develop new computer skills throughout their careers. Researchers at the University of Wisconsin-Stout also found that abilities in these same areas are important for students in a wide variety of majors (Furst-Bowe et al., 1995).

Recognizing the importance of computers in agriculture, Bekkum and Miller (1994) surveyed deans at 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, less that one-half (44.1%) reported a college-wide computer education requirement. Further, 11 (18.6%) of the deans believed that, in the future, less time would be required for basic computer skill development, since students would have developed these skills prior to entering college. According to Kieffer (1995), many university faculty and administrators accept the premise that students enter college already possessing basic computer skills.

Johnson, Ferguson, and Lester (1999) tested this premise by assessing the computer experiences, self-efficacy and knowledge of students ($\underline{N}$ = 175) enrolled in three freshman-level agriculture courses at a land-grant university during the fall 1998 semester. The researchers concluded that the students had not completed a common core of computer experiences, lacked confidence in their computer skills, and had a low level of computer knowledge (as indicated by a mean score of 38.8% correct on a 35-item multiple choice exam). Student academic classification explained only about 10% of the variance in either computer self-efficacy or exam

scores. However, the researchers cautioned that the upper-division students enrolled in these introductory courses might not be representative of all upper-division agriculture students.

Johnson et al. (1999) noted a substantial positive correlation ($\underline{r} = .67$) between computer self-efficacy and computer knowledge and hypothesized that, while students recognized their lack of computer skills, they were not motivated to improve because computer skills are not regularly required in undergraduate courses. Subsequent research (Johnson, Ferguson, Wyatt & Lester, 2000) found that undergraduate agriculture courses tended to require a limited amount of student computer use, with most required tasks being drawn from a fairly narrow subset of basic computer skills. Brown and Kester (1993) posited that students tended to forget many of the skills learned in introductory computer courses because they did not use these skills in subsequent courses.

Given the importance that both graduates and employers place on computer skills, and the suggestion that computer skills decay because of disuse in subsequent courses, a clear need existed to examine and compare the computer experiences, self-efficacy and knowledge of freshman and senior agriculture students. The results of this study would provide information necessary for enhancing the computer experiences and skills of undergraduate agriculture students.

Objectives

The purpose of this study was to describe and compare the computer experiences, self-efficacy and knowledge of freshmen and senior agriculture majors in a land-grant university. Specific objectives were to:

1. Compare demographic and computer-related experiences of freshmen and senior agriculture majors;

2. Compare the computer self-efficacy of freshmen and senior agriculture majors;

3. Compare the computer knowledge of freshmen and senior agriculture majors; and

4. Determine the relationship between selected demographic and computer-related experiences and computer self-efficacy and knowledge of freshmen and senior agriculture majors.

Methods

Data were collected by administering the Computer Experiences and Knowledge Inventory (CEKI) in five sections of a course enrolling primarily freshmen (AGED 1011 - Freshman Orientation) and in eight purposively selected upper-division agriculture courses during the fall 1999 semester. These courses had a total unduplicated enrollment of 253

students; however, only students classified as freshmen (N = 84) or seniors (N = 74) were analyzed and reported for this paper.

The CEKI consisted of three parts. Part One contained 24 items related to student demographics and computer-related experiences. Part Two consisted of eight Likert-type items requiring respondents to assess their own level of skill (1 = "no skill"; 5 = "high skill") in eight specific areas of computer use. Part Three was composed of 35 multiple choice items (with five response options, including a "Do not know" option) designed to measure student 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.

The CEKI was evaluated by a panel of five experts with experience in teaching introductory computer applications to college agriculture students and was judged to possess face and content validity. For the present study, coefficient alpha reliability estimates were .78 (Part Two) and .82 (Part Three) for the freshmen students and .89 (Part Two) and .85 (Part Three) for the senior student group. The reliability of Part One was not assessed, since, according to Salant and Dillman (1994), responses to non-sensitive, demographic items are subject to little measurement error.

Results

The typical freshman student was an 18-year-old (Mdn) female (54.9%), who had graduated in a senior class of 130 (Mdn) students while maintaining an "A-minus" or higher grade average (63.8%). Poultry science (23.2%), horticulture and agricultural education (14.6% each), and pre-veterinary medicine (11.0%) were the most common majors for the freshmen students.

The typical senior was a 22-year-old (Mdn) male (74.3%), with a college grade point average of between 2.50 and 2.99 (41.3%). The most frequently reported majors were agribusiness (28.0%), poultry science (20.0%), and agricultural education and turf management (9.3% each).

Both freshmen and senior students reported a variety of computer experiences (Table 1). Over 70% of both freshmen and senior students reported owning a computer, with virtually all being PCs. Seniors (88.0%) were more likely to have completed a computer course than were freshmen (76.8%), although a majority in both groups had completed one or more computer courses. A majority of both freshmen (52.5%) and senior (62.7%) students had completed either one or two computer courses. Almost all (90.3%) of the freshmen completing computer courses had done so at the high school level, while a majority of senior students (95.4%) had either

completed computer coursework only in college (39.4%) or in both high school and college (56.1%).

Table 1. *Computer-Related Experiences of Freshmen and Senior Agriculture Students.*

	Freshmen		Seniors	
Variable	n	%	n	%
Own a computer	82	71.6	75	77.3
Type of computer:	58		57	
PC		96.6		94.7
MacIntosh		3.4		3.5
Both		0.0		1.8
Number of computer courses completed:	82		75	
None		23.2		12.0
One		23.2		28.0
Two		29.3		34.7
Three		15.9		13.3
Four or more		8.5		12.0
Where computer course(s) was/were completed:	62		66	
High school only		90.3		4.6
College only		4.8		39.4
Both high school and college		4.8		56.1

A majority (53.8%) of freshmen reported they had never taken a course (other than a computer course) where computer use was required. Among seniors, a majority reported that the use of spreadsheets (61.6%), databases (83.6%), and presentation graphics (57.5%) were required "not at all" or "seldom" in their college courses.

The students were asked to indicate whether or not they had studied selected computer topics. Over one-half of the senior students had studied seven of the eight topics, with computer programming being the only topic not studied by a majority of the seniors. Word processing, file management and spreadsheets were the only three computer topics that 50% or more of the freshmen reported studying. Small to large discrepancies existed between the percentage of seniors and freshmen having studied each of the eight computer topics, with a higher percentage of seniors having studied each topic. Overall, freshmen reported studying 4.0 (Mdn) of the eight computer topics, while seniors reported studying 6.0 (Mdn) of the eight topics.

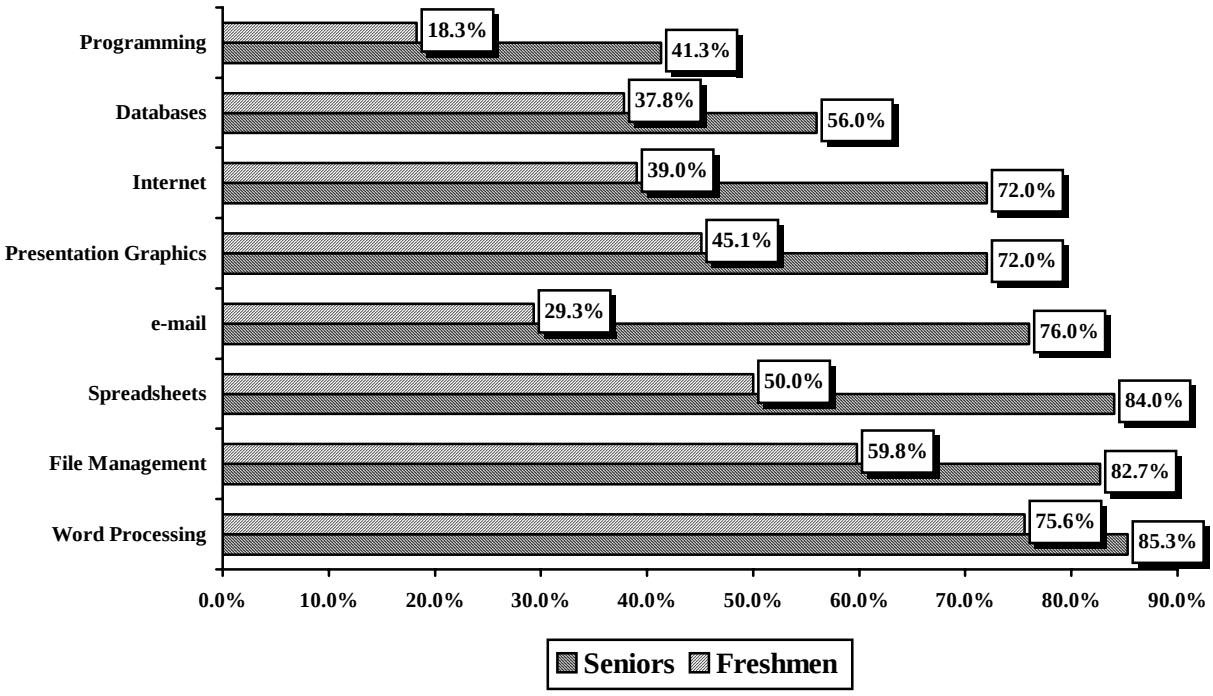


Figure 1. *Percentage of freshmen and senior students having studied selected computer topics.*

The students also rated their own level of skill in each of eight areas of computer use on a five-point Likert-type scale (1 = "no skill"; 5 = "high skill"). For ease in reporting, responses were collapsed into "below average skill," "average skill," and "above average skill" categories. Less than one-half of the freshmen rated their skills as above average for any of the eight areas of computer use. Conversely, a majority of seniors felt they possessed above average skills in word processing, Internet use, and electronic mail. A majority of freshmen rated their skills in computer programming, databases, presentation graphics, and spreadsheets as being below average. Computer programming and databases were the only areas where a majority of seniors rated their skills as below average. Table 2 summarizes student perceptions of their level of skill for each of the eight areas of computer use.

Responses to the eight individual items reported in Table 2 were summed and averaged (using the original 5-point scale) to arrive at an overall measure of computer self-efficacy (CSE) for the freshmen and senior student groups. For the freshmen, the mean CSE score was 2.78 (SD = .78); for the seniors, the mean CSE score was 3.19 (SD = .73).

Table 2. *Self-Perceived Computer Competency of Freshmen and Senior Agriculture Students.*

	Freshmen (n = 82)			**Seniors (n = 75)**		
Computer area	Below average %	Average %	Above average %	Below average %	Average %	Above average %
Word processing	8.5	42.7	48.8	4.0	36.0	60.0
File management	20.7	42.7	36.6	13.3	42.7	44.0
Internet use	17.1	50.0	32.9	10.7	33.3	56.0
Electronic mail	17.1	45.1	37.8	9.3	36.0	54.7
Spreadsheets	51.8	32.1	16.1	28.0	33.3	38.7
Presentation graphics	57.3	25.6	17.1	24.0	41.3	34.7
Databases	61.0	29.3	9.9	53.3	29.3	17.3
Computer programming	82.9	12.2	4.9	74.7	20.0	5.3

For freshmen, the mean score on the 35-item exam portion of the CEKI was 13.85 (SD = 5.12), or 39.6% correct. The mean score for seniors was 18.2 (SD = 6.22), or 52.0% correct. As shown in Figure 2, a higher percentage of freshmen scored in the lower score intervals, while a greater percentage of seniors scored in the higher score intervals.

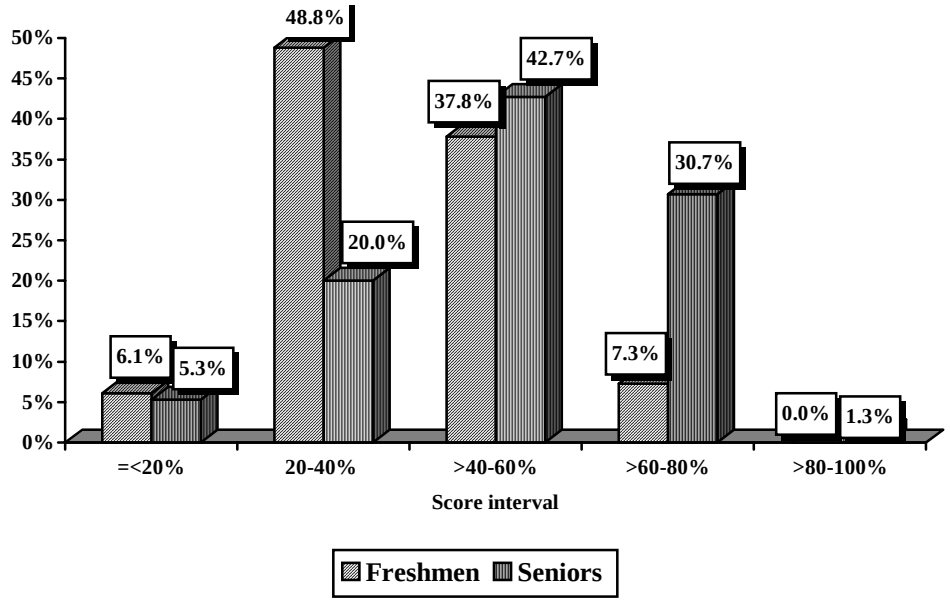
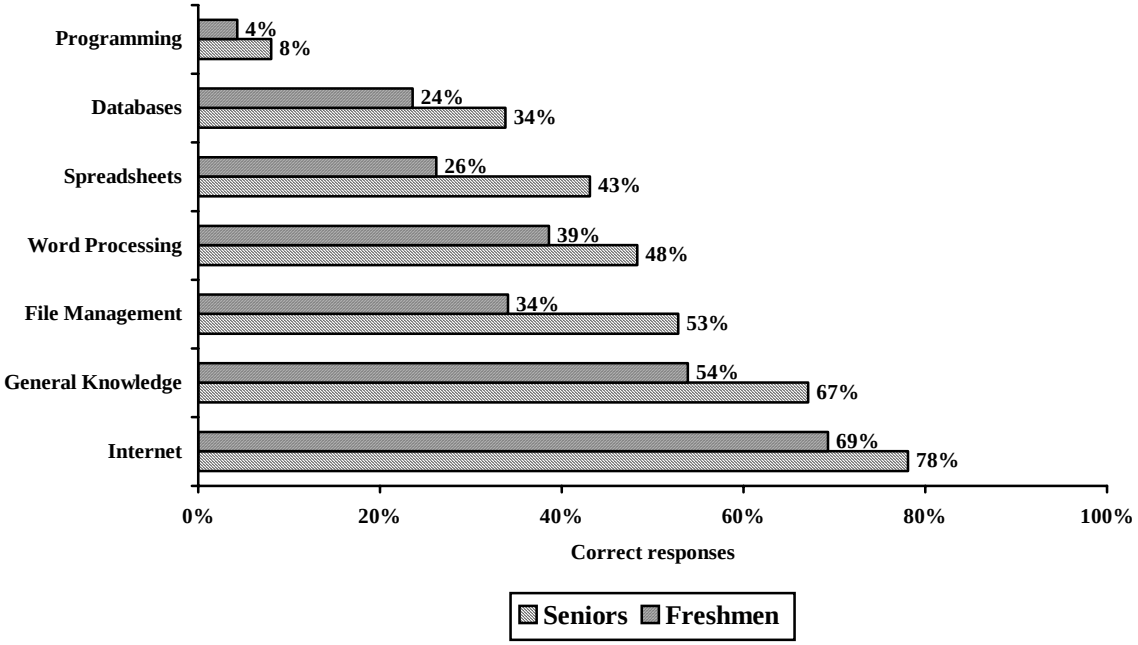


Figure 2. *Distribution of Grouped CEKI Exam Scores for Freshmen and Senior Students.*



Seniors scored a higher mean percentage of correct answers on each of the seven areas of the CEKI exam than did freshmen. Seniors averaged over 50% correct on the Internet use, general knowledge and file management exam sections. For freshmen, mean scores were above 50% correct for the Internet and general knowledge sections; scores were less than 40% for the remaining exam sections (Figure 3).

Figure 3. *Mean Scores on the CEKI Exam, by Section and Classification*

For freshmen, the relationship between demographic and computer experience variables and computer self-efficacy and CEKI exam scores ranged from negligible to substantial. Owning a computer had the highest correlation with computer self-efficacy (r = .46), while the number of computer topics studied had the highest correlation with CEKI exam scores (r = .30). A substantial positive relationship existed between computer self-efficacy and CEKI exam scores (r = .63).

For seniors, the relationship between demographic and computer experience variables and computer self-efficacy and CEKI exam scores ranged from negligible to moderate. The extent to

which respondents felt that computer use had been required in their college courses was the best predictor of computer self-efficacy (r = .51). College grade average was the best predictor of scores on the CEKI exam (r = .42). Finally, a moderate positive relationship existed between computer self-efficacy and CEKI exam scores (r = .35). Table 2 summarizes these relationships for both freshmen and senior agriculture students.

Table 3. *Relationship Between Selected Demographic and Computer Experience Variables and Computer-Self Efficacy and CEKI Exam Score for Freshmen and Senior Agriculture Students.*

	Freshmen (n = 82)		**Seniors (n = 75)**	
Variable	CSE	CEKI exam score	CSE	CEKI exam score
Age	-.11	.08	-.24	.01
Gender[a]	-.08	-.10	-.13	-.23
High school senior class size	.05	.07	---	---
High school grade average	.36	.15	---	---
College grade average	---	---	.15	.42
Completed computer course(s)[b]	-.01	.15	.05	.14
Number of computer courses completed	.28	.25	.10	.17
Number of computer topics studied	.34	.30	.16	.10
Computer-use required in HS courses [b]	.29	.07	---	---
Extent of required college computer use	---	---	.51	.27
Own a computer [b]	.46	.24	.20	.22
Computer self-efficacy (CSE)	---	.63	---	.35

[a]Coded as female = 0 and male = 1. [b]Coded as no = 0 and yes = 1.

Conclusions

Both freshmen and senior agriculture students in this study had a variety of computer-related experiences. A majority in both groups had completed one or more computer courses and owned a computer. However, a significant minority of both freshmen (23.2%) and seniors (12.0%) reported having never completed a computer course.

Significant percentages of freshmen had not received instruction in important areas of computer use. Fewer than one-half of the freshmen had studied presentation graphics, Internet use, e-mail, databases, or programming. Additionally, significant percentages of freshmen had not studied spreadsheets, file management or word processing. It was concluded that freshmen entering the College have not participated in a common core of formal educational experiences related to the most frequently used computer applications and operations.

While a higher percentage of seniors had studied each computer topic than had freshmen, significant percentages (ranging from 14.7% to 57.7%) of seniors also reported never having studied each topic. Thus, senior agriculture students may be graduating without the computer skills necessary for career success.

Freshmen had a slightly below average level of computer self-efficacy, while seniors had a slightly above average level of computer self-efficacy. While seniors tended to rate their skills higher, both groups were most confident of their abilities in word processing, file management, Internet use and electronic mail. A majority of freshmen reported below average skills in spreadsheets, presentation graphics, databases and programming. Over one-half of the seniors reported below average skills in databases and programming, while approximately one-fourth reported below average skills in spreadsheets and presentation graphics. A significant percentage of both freshmen and seniors lack confidence in their ability to use common computer applications.

Although seniors scored higher than freshmen on the CEKI exam, a majority of students in both groups scored 60% or less. The mean score for freshmen was 13.85 (39.6% correct); for seniors the mean score was 18.2 (52.0% correct). Apparently, freshmen enter the College with a low level of computer knowledge, while seniors exit with a higher, but still low, level of computer knowledge.

For freshmen, owning a computer was the best predictor of computer self-efficacy, while, for seniors, the extent to which college courses had required the use of computers was the best predictor. For seniors, college grade average was a fairly good predictor of CEKI exam scores, however, high school grade average was a relatively poor predictor of freshmen exam scores. Computer self-efficacy explained approximately 40% of the variance in freshmen CEKI exam scores; for seniors, computer self-efficacy explained only about 12% of the variance in these scores. It appears that freshmen were more realistic than seniors in assessing their own computer skills. With the exception of computer self-efficacy (freshmen only), no particularly powerful predictors of computer knowledge were identified. Johnson et al. (1999) also found computer self-efficacy to have a substantial positive relationship ($\underline{r} = .67$) with CEKI exam scores for students enrolled in introductory university agriculture courses.

Recommendations

Efforts must be made within this College to enhance the computer knowledge of both entering and graduating students. In order to accomplish this objective, the following recommendations are made.

The elective College computer course (AGME 2903 - Computer Applications in Agricultural, Food & Life Sciences) should be examined and possibly revised to ensure that the content and assignments provide students with the experiences necessary to develop sufficient skills in commonly used computer applications. AGME 2903 should then be made a required course for students enrolled in the College. However, because some students already have a high level of computer knowledge, a performance testing option should be available whereby students can test out of this requirement.

Finally, systematic efforts should be made to more fully integrate required student computer use into undergraduate agriculture courses. While all instructors should be encouraged and assisted in integrating computer use into their courses, consideration should be given to developing and implementing a number of "computer-intensive" courses into the curriculum. Assignments in these courses should be designed to require a variety of higher-level computer skills that enhance the learning and application of academic subject matter. One or more of these computer-intensive courses should be required for graduation.

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