

STUDENTS ENROLLED IN SELECTED UPPER-DIVISION AGRICULTURE COURSES: AN EXAMINATION OF COMPUTER EXPERIENCES, SELF-EFFICACY AND KNOWLEDGE

Donald M. Johnson, Professor
James A. Ferguson, Professor Emeritus
Melissa L. Lester, Assistant Professor

University of Arkansas

Abstract

Students (E = 169) enrolled in eight upper-division agriculture courses at a land-grant university were surveyed during the Fall 1999 semester to determine their computer experiences, computer self-efficacy, and computer knowledge. The students reported a variety of computer experiences, with 79% having completed a computer course and 66% owning a computer. Over one-half of the students had received formal instruction in word processing (76%), file management (71%), spreadsheets (71%), electronic mail (64%), presentation graphics (62%), Internet use (62%), and databases (51%). Computer programming was the only topic that a majority (66%) of respondents had not studied. The students had a slightly above average level of computer self-efficacy. Students felt they had the highest level of skills in wordprocessing, electronic mail, and Internet use, with more than 50% rating their skills in these areas as above average. The overall score on the 35 item multiple choice test of computer knowledge was fairly low, with a mean of 17.6 (50.3% correct). Nearly three-fourths (72.7%) of the students scored 60% or less on the test. There was only a low association ($r = .29$) between computer self-efficacy and computer knowledge. Recommendations for enhancing student computer experiences are offered.

Introduction

Computers are an integral and pervasive feature of modern society. According to the United States Department of Education (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 also play an important and ever increasing role in agriculture (Odell, 1994). In follow-up studies, university agriculture graduates

consistently rate computer skills as being important to career success (Andelt, Barrett, & Bosshamer, 1997; Graham, 1997). 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 (Radhakrishna & Bruening, 1994).

Employers of university agriculture graduates also place significant importance on computer skills. In a study of 150 employers of recent Cornell University agriculture graduates, 83% indicated that computer skills were either an "important" or "very important" factor considered in making employment decisions (Monk, Davis, Peasley, Hillman, & Yarbrough, 1996). Given the prevalence and importance of computers in both agriculture and society, university agriculture programs must ensure that graduates are

competent in computer use (Davis, 1997; Johnson, Von Bargen, & Schinstock, 1995; Langlinas, 1994). Yet, Heyboer and Suvedi (1999) found that recent agriculture graduates (1993 - 1998) of Michigan State University felt they had received less than satisfactory preparation in computer use, and rated computers as being the area in which they were least prepared for employment.

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, graduates should be comfortable enough with computer and information technologies so that they could continue to learn new computer skills throughout their careers. Researchers at the University of Wisconsin-Stout also found that abilities in these same areas were important for both academic and career success for students in a wide range 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 of these colleges were proficient in computer use. Of the 59 deans responding, less than 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 before entering college. According to Kieffer (1995), many university faculty members and administrators accept the premise that students enter college already possessing basic computer skills.

Johnson, Ferguson & Lester (1999) tested this premise by assessing the computer experiences, self-efficacy and knowledge of students ($N = 175$) enrolled in three freshman-level agriculture courses at a land-grant university during the fall 1998 semester. The results

indicated 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). These results were in agreement with those of Gordon and Chimi (1998) who found that students entering a college of business lacked sufficient computer skills and recommended continuation of the introductory computer literacy course requirement.

Both agriculture graduates (Andelt et al., 1997; Graham, 1997; Radhakrishna & Bruening, 1994) and employers (Davis, 1997; Johnson et al., 1995; Langlinas, 1994; Monk et al., 1996) strongly agree that computer skills are important for career success. Yet, research indicates that students entering (Johnson et al., 1999) and graduating from (Heyboer and Suvedi, 1999) colleges of agriculture may lack the computer skills necessary for career success.

This study was undertaken to examine the computer experiences, self-efficacy and knowledge of students enrolled in upper-division agriculture courses in one land-grant university. The results would provide information necessary for enhancing the computer education of students enrolled in the college.

Objectives

This study was conducted to determine:

1. The demographic characteristics and computer-related experiences of students enrolled in selected upper-division university agriculture courses;
2. The computer self-efficacy of students enrolled in selected upper-division university agriculture courses;
3. The computer knowledge of students enrolled in selected upper-division

university agriculture courses, as measured by scores on the exam portion of the Computer Experiences and Knowledge Inventory (CEKI); and

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

Methods

This study was conducted using a descriptive-correlational design (Ary, Jacobs, & Razavieh, 1990). The population consisted of students enrolled in eight upper-division "capstone" courses offered in seven agriculture departments within the College. These courses were purposively selected (after consultation with department representatives) in order to gain access to students from a wide range of majors. Official class rosters indicated a total, unduplicated enrollment of 185 students in these courses; 169 students provided usable data for a 91.3% response rate. Because 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 both for local decision-making and further research.

Data were collected by student responses to the "Computer Experiences and Knowledge Inventory" (CEKI) (Johnson et al., 1999). The CEKI was administered during the first two weeks of the fall 1999 semester by each course instructor during a regularly scheduled class period. The CEKI consisted of three parts. Part One contained 24 items related to respondent demographics and previous computer 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 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 to college agriculture students and was judged to possess face and content validity. In a previous study involving students enrolled in introductory undergraduate agriculture courses, reliability estimates of .87 (coefficient alpha) and .81 (KR-20) were obtained for Part Two and Part Three, respectively, of the CEKI (Johnson et al., 1999). For the present study, reliability estimates of .88 (coefficient alpha) and .85 (KR-20) were obtained for Parts Two and Three, respectively. The reliability of Part One 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 typical respondent was a 22-year-old (median), male (67%), classified as a senior (44%). (An additional 31% were graduate students, while 22% were juniors and 2% were sophomores.) Over one-half (56%) of the students indicated a grade point average of 3.0 or higher (self-reported). The most common reported majors were agribusiness (21%), poultry science (19%), and animal science and crop science (11% each).

The respondents reported a variety of computer-related experiences. Nearly two-thirds

(66%) of the respondents owned a computer, with virtually all computers being personal computers (96%) and using various versions of the Windows® operating system (98%). Approximately four out of five (79%) students had completed a computer course, with the largest percentage (34%) having completed two courses. As shown in Figure 1, a majority of the

respondents had received formal instruction in seven of the eight computer topics studied. However, a substantial percentage of students, ranging from 24% for word processing to 66% for computer programming, reported never having received formal instruction in each of the eight computer topics.

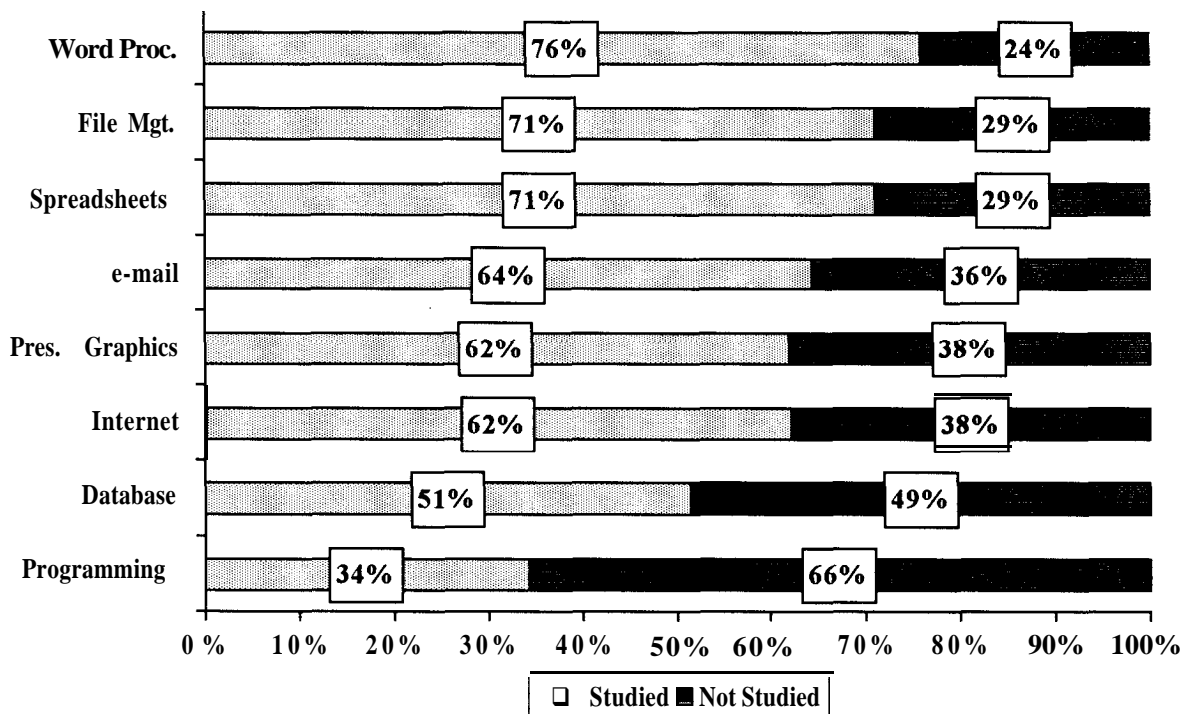


Figure 1. Percent of respondents having studied selected computer topics (n=168).

In order to assess the students' academic computer use in a global fashion, the respondents were asked to indicate the extent to which courses completed at this university had required the use of four common computer applications. (Note: A number of first semester graduate students did not respond to this item since they were not graduates of this university.) As shown in Figure 2, word processing was the only computer application that a majority of the respondents felt was required either "fairly often" or "often" in their courses. A majority of respondents reported that the use of databases, spreadsheets, and presentation graphics were required "not at all" or "seldom" (Figure 2.)

The respondents were also asked to rate

their own level of skill in each of the eight areas of computer use on a 5-point Likert-type scale (1 = "no skill"; 5 = "high skill"). These five response categories were subsequently collapsed into three categories for reporting purposes (1 & 2=Below average; 3=Average; 4 & 5=Above Average). Over half of the respondents rated their skills in word processing, e-mail, and Internet use as being "above average." A majority of the students felt that they had either "average" or "above average" skills in file management, spreadsheet use, and presentation graphics. Conversely, a majority of respondents felt they had "below average" skills in database use and computer programming. Although a minority, a sizable percentage of students rated their skills in using spreadsheets and

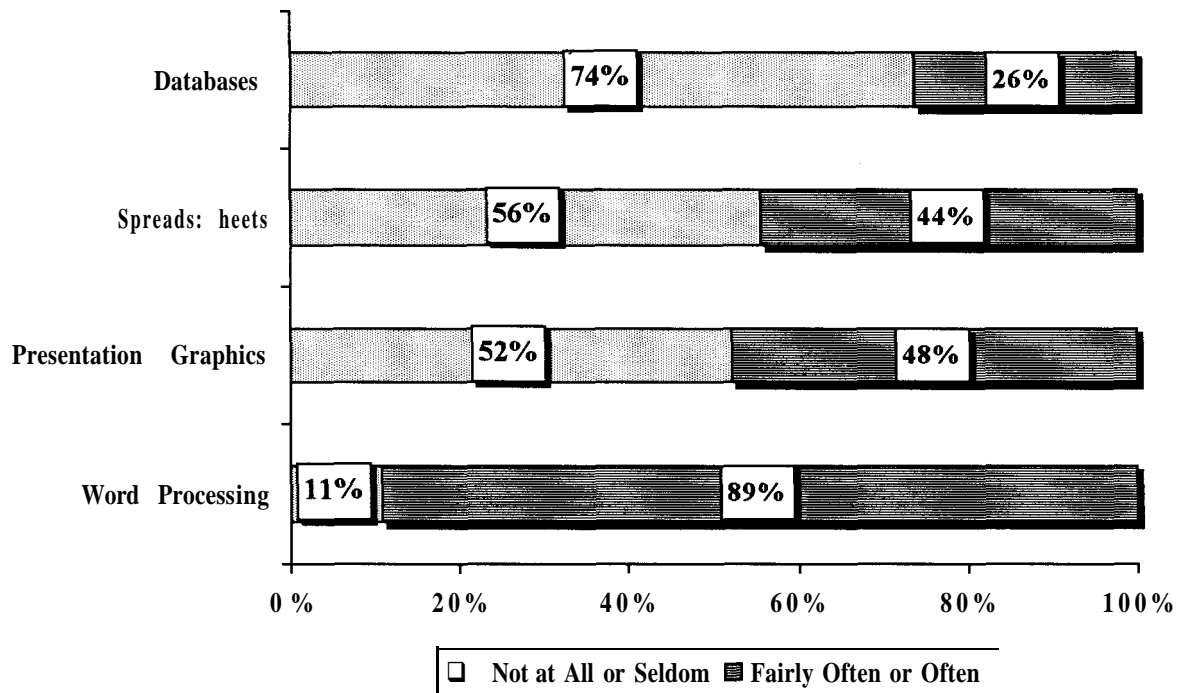


Figure 2. Extent to which courses completed at this university required the use of selected computer applications ($n = 147$).

presentation graphics as being “below average.”

Responses to the eight individual items reported in Figure 3 were summed and averaged (using the original 5-point scale) to arrive at a composite measure of computer self-efficacy (CSE) for each respondent ($\alpha = .88$). The distribution of scores for the variable CSE was slightly positively skewed (skewness = .38) with a mean of 3.14 ($SD = .73$) and a median of 3.00.

The overall score on the CEKI was 17.6 (50.3% correct) with a standard deviation of 6.2, and a median of 17.0 (48.6% correct). Nearly three-fourths of the students (72.7%) scored 60% or less correct on the CEKI exam, while less than 3% scored above 80% correct. The distribution of scores is shown in Figure 4. On the individual components of the CEKI exam, students scored the highest percentage of correct answers on the Internet and general knowledge sections, and lowest on the computer programming section.

Overall, scores for the database, spreadsheet, word processing, and programming exam sections were less than 50% correct (Figure 5).

The relationships between selected respondent demographic and computer-related characteristics and scores on the CEKI exam and computer self-efficacy ranged from negligible to moderate, using the descriptors suggested by Davis (1971). Age and gender had negligible correlations with CEKI exam scores, while grade point average (self-reported) and the number of computer courses completed had moderate, positive correlations with CEKI exam scores. All remaining variables, including computer self-efficacy, had low, positive correlations with CEKI exam scores. College classification, having completed a computer course, and self-reported grade point average all had negligible correlations with computer self-efficacy. The extent to which the respondents felt they had used computers in their college courses had a moderate positive

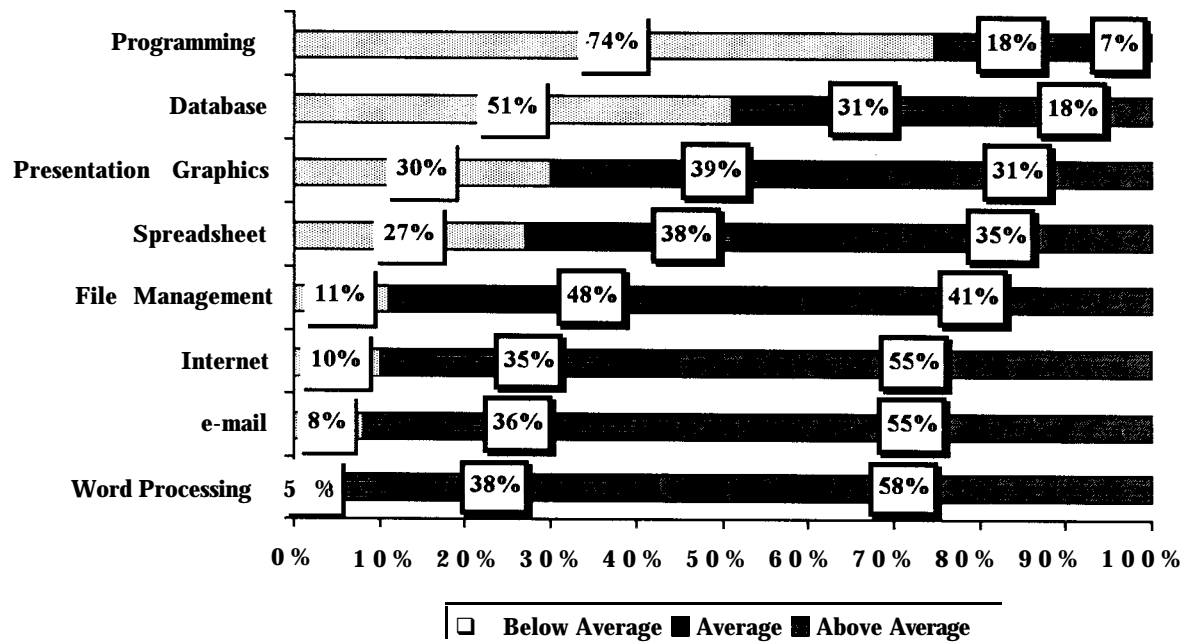


Figure 3. Self-Perceived level of skill in selected areas of computer use ($n = 169$).

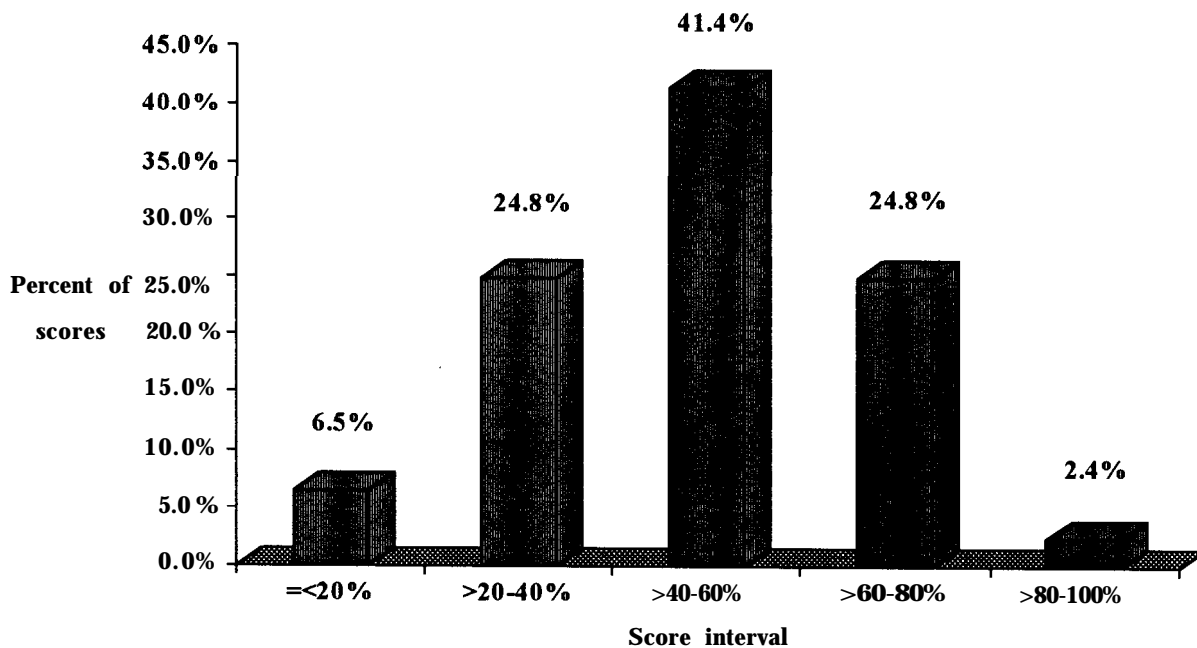


Figure 4. Distribution of grouped scores on the exam section of the CEKI ($n = 169$).

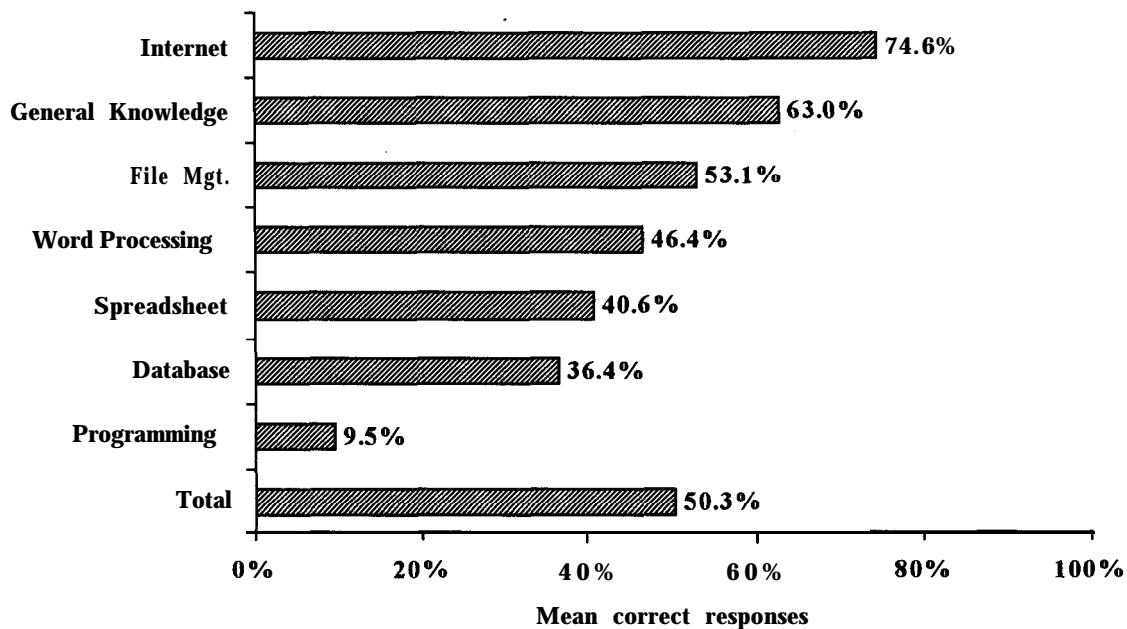


Figure 5. Mean scores on the CEKI exam, by section and total ($n = 169$).

Table 1. Relationship between selected variables and CEKI exam scores and computer self-efficacy.

Variable	CEKI exam score	CSE
Age	-.01 ^a ($n=166$)	-.10 ^{a*} ($n=163$)
Gender ^b	-.02 ^c ($n=168$)	.14 ^{c*} ($n=165$)
College classification	.15 ^{d*} ($N=169$)	.01 ^d ($n=166$)
Completed a computer course ^e	.27 ^{c*} ($n=169$)	.09 ^c ($n=166$)
Number of computer courses completed ^f	.36 ^{a**} ($n=169$)	.23 ^{a*} ($n=166$)
Number of topics studied in computer courses ^f	.22 ^{a*} ($n=169$)	.29 ^{a*} ($n=166$)
Extent of perceived college computer use	.29 ^{d*} (11'147)	.49 ^{d**} ($n=146$)
Own a computer ^e	.20 ^{c*} (11'168)	.20 ^{c*} ($n=165$)
Grade point average (GPA)	.31 ^{c**} ($n=167$)	.01 ^c ($n=164$)
Computer self-efficacy (CSE)	.29 ^{a*} ($n=166$)	1.0 ($n = 166$)

^aPearson correlation. ^bCoded as female = 0; male =1. ^cPoint-biserial correlation. ^dSpearman correlation.

^eCoded as no = 0; yes =1. ^fIncludes respondents *not* completing a computer course. * = low association; ** = moderate association (Davis, 1971).

correlation with computer self-efficacy, explaining 24% of the variance. The remaining variables had low, positive correlations with computer self-efficacy. Table 1 summarizes these results.

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 80% had completed one or more computer use courses. Yet, fairly large percentages (from 24% to 66%) of respondents had never received formal instruction in each of the eight computer areas studied. Thus, it was concluded that students enrolled in these upper-division agriculture courses have not participated in a common core of educational experiences related to the most commonly used computer applications.

The respondents reported that, of four common computer applications, word processing was the only application they were required to use “fairly often” or “often” in the courses they had completed at this university. This is congruent with the findings of Brown and Kester (1993) who posited that students tended to forget many of the skills learned in introductory computer courses because these skills are not used in subsequent college courses. It appears that courses at this university do not require a wide variety of computer tasks.

The students felt they had the highest levels of skill in word processing, electronic mail, and Internet use, with over 50% rating their abilities as above average. According to a study by Johnson, Ferguson, Wyatt, and Lester (2000), these are the three categories of computer use tasks most commonly required in undergraduate agriculture courses. As would be expected, students seem to develop confidence in those abilities that are most commonly required and used.

A majority of students felt they had average or above average skills in file management, spreadsheet use, and presentation graphics. However, a sizeable minority of students felt their skills were below average in spreadsheet use (27%) and presentation graphics (30%), while a majority of students rated their database and programming skills as below average. According to Johnson et al. (2000), these are four of the areas of computer use least commonly required in undergraduate agriculture courses, again supporting the hypothesized relationship between use (or lack of use) and self-efficacy.

For the overall group, the mean CSE score was 3.14, indicating an average level of computer self-efficacy. Based on these findings, it was concluded that most students are somewhat confident of their overall computer skills, especially those involving the more common applications. However, many students lack confidence in both their overall computer abilities and in specific areas of computer use.

The mean score on the 3 5-item exam section of the CEKI was 17.6 (50.3% correct). Almost three-fourths (72.7%) of the students scored 60% or less, with nearly one-third (31.3%) scoring 40% or less. Conversely, only 2.4% scored above 80% on the CEKI exam. Thus, it was concluded that students enrolled in these upper-division agriculture classes vary widely in computer knowledge, with many having a fairly low level of computer knowledge.

Students scored highest on the Internet (74.6% correct), general computer knowledge (63.0% correct), and file management (53.0% correct) sections of the CEKI exam. The mean percentage of correct responses for each of the four remaining sections of the exam was less than 50%, with a high of 46.4% for word processing and a low of 9.5% for programming. Based on these results, it was concluded that, with the possible exception of Internet use, students were

deficient in their knowledge of all areas covered by the CEKI exam. (Note: Although scores were especially low in the computer programming area, the researchers acknowledge that this is not an essential area of computer knowledge for the vast majority of students or agricultural employees.)

While all variables except age and gender had a low to moderate correlation with scores on the CEKI exam, none was a particularly robust predictor, with the best (number of computer courses completed) explaining only approximately 13% of the variance in scores. The variable computer self-efficacy explained less than 9% of the variance in CEKI exam scores, indicating that students in these upper-division agriculture courses are not very good judges of their own computer knowledge. This is in contrast to previous research which found a substantial correlation ($r = .67$) between computer self-efficacy and CEKI exam scores for students enrolled in selected freshman-level agriculture courses (Johnson et al., 1999).

The extent of perceived college computer use was the best predictor of computer self-efficacy, explaining 24% of the variance. This finding offers some support for the hypothesis that students tend to develop confidence in those computer skills that they use most frequently. On the other hand, students who had more confidence in their computer skills may simply be more likely to have used these skills in their courses.

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 a representative sample of graduating agriculture majors. 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. However, because some students do appear to have an adequate level of computer knowledge, a performance testing option should be available whereby students can test out of the computer course requirements.

Second, deliberate, systematic efforts should be made to more fully integrate required computer use into courses throughout the College. The results of this study and a separate study by Johnson et al. (2000) indicate that undergraduate agriculture courses tend to require limited student computer use with most required tasks being drawn from a narrow range of fairly low-level computer skills. If agriculture students are to gain the level of computer proficiency desired by employers (Davis, 1997; Johnson et al., 1995; Langlinas, 1994; Monk et al., 1996), it seems reasonable that students must first learn these skills and then tasks requiring use of these skills must routinely be incorporated in subsequent courses. Experimental or quasi-experimental research should be conducted to determine the effects of required computer activities on the development of student computer skills and computer self-efficacy.

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

References

Andelt, L.L., Barrett, L.A., & Bosshamer, B.K. (1997). Employer assessment of the skill preparation of students from the College of Agricultural Sciences and Natural Resources, University of Nebraska-Lincoln: Implications for teaching and curriculum. *NACTA Journal*, *41*(4), 47-53.

Ary, D., Jacobs, L.C., & Razavieh, A.

(1990). Introduction to research in education. Fort Worth, TX: Harcourt Brace College Publishers.

Bekkum, V.A. & Miller, W.W. (1994). Computer proficiency for undergraduate students in agriculture. NACTA Journal, **38(2)**, 43-46.

Brown, B., & Kester, D. (1993). College students and computers. (ERIC Document Reproduction No. ED3 6629 1).

Davis, J.A. (1971). Elementary survey analysis. Englewood Cliffs, NJ: Prentice-Hall.

Davis, P. (1997). What computer skills do employers expect from recent college graduates? T.H.E. Journal, **25(2)**, 74-78.

Furst-Bowe, J., Boger, C., Franklin, T., McIntyre, B., Polansky, J., & Schlough, S. (1995). An analysis of required computer competencies for university students. Journal of Research on Computing in Education, **28(2)**, 175- 189.

Gordon, G.M., & Chimi, C.J. (1998). Should the introductory information systems course be removed from the business school curriculum? A preliminary investigation. (ERIC Document Reproduction No. ED43 14 13).

Graham, D.L. (1997). Employer follow-up study. Unpublished manuscript. Fayetteville, AR: Dale Bumpers College of Agricultural, Food & Life Sciences, University of Arkansas.

Heyboer, G., & Suvedi, M. (1999). Perceptions of recent graduates and employers about undergraduate programs in the College of Agriculture and Natural Resources at Michigan State University: A follow-up study. Proceedings of the 26th National Agricultural Education Research Conference, 14-26.

Johnson, B., Von Bargen, K., & Schinstock, J. (1995). Shifting the curriculum paradigm in a land-grant college. In Lunde, J.P.

(Ed.). Reshaping curricula: Revitalization at three land-grant universities. Bolton, MA: Anker Publishing Company, Inc.

Johnson, D.M., Ferguson, J.A., Lester, M.L. (1999). Computer experiences, self-efficacy and knowledge of students enrolled in introductory university agriculture courses. Journal of Agricultural Education, **40(2)**, 28-37.

Johnson, D.M., Ferguson, J.A., Wyatt, N.G., & Lester, M.L. (2000). Computer tasks required in undergraduate agriculture courses: a report to the curriculum committee. Unpublished manuscript. Fayetteville, AR: Dale Bumpers College of Agricultural, Food & Life Sciences, University of Arkansas.

Kieffer, L.M. (1995). Establishing a computer literacy requirement for all students. (ERIC Document Reproduction No. ED 392436).

Langlinas, S. J. (1994). Integrating computer application techniques into agriculture curriculum. In Watson, D.G., Zazeuta, F.S., & Harrison, T.V. (Eds.). Computers in agriculture, 1994. St. Joseph, MI: American Society of Agricultural Engineers.

Monk, D., Davis, P., Peasley, D., Hillman, P., & Yarbrough, P. (1996). Meeting the needs of CALS students for computing capabilities: Final report of the Ad Hoc committee on College of Agriculture and Life Sciences student computing competencies. Ithaca, NY: College of Agriculture and Life Sciences, Cornell University.

Odell, K. S. (1994). Microcomputer utilization in West Virginia secondary school agriculture programs. In Watson, D.G., Zazeuta, F.S., & Harrison, T.V. (Eds.). Computers in agriculture, 1994. St. Joseph, MI: American Society of Agricultural Engineers.

Radhakrishna, R.B., & Bruening, T.H. (1994). Pennsylvania study: Employee and student

perceptions of skills and experiences needed for careers in agribusiness. NACTA Journal, **38**(1), . 15-18.

Salant, P. & Dillman, D.A. (1994). How to

conduct your own survey. New York: John Wiley.

United States Department of Education. (1996). Getting America's students ready for the 21st century: Meeting the technology literacy challenge. Washington, DC: Author.