Differences in Computer Experiences, Computer Self-Efficacy, and Computer Knowledge of Undergraduate Students Entering a Land-Grant College of Agriculture by Gender and Year

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Abstract

The purpose of this study was to determine if differences existed between selected computer experiences, computer self-efficacy, and computer knowledge based on gender and the year in which they enrolled in college among students in a land-grant college of agriculture between 1999 and 2001. The subjects consisted of students enrolled in AGED 1011, Agriculture Freshman Orientation, during the fall semesters of 1999, 2000, and 2001. Data were collected by student responses to the AComputer Experiences and Knowledge Inventory@ (CEKI). There were virtually no differences by year on any computer-related variable. A majority of students had not received formal instruction in Internet or electronic mail use, spreadsheets, presentation graphics, databases or computer programming. Only about one-half of the students reported ever completing a course, other than a computer applications course, where computer use was required. When students were grouped by gender, little difference was found in their computer-related experiences. However, significant interactions were found between year and gender for computer-related experiences. For the variable computer self-efficacy, there were no significant differences for the main effects of year and gender, or the interaction of year and gender. Regardless of year or gender, students tended to have average or below average levels of computer self-efficacy. Many students entering college lack confidence in their computer skills. There were no significant differences by year or gender, or the interaction of year and gender, in computer knowledge. Students had a low level of knowledge across all groupings.

Introduction and Theoretical Framework

Computer technology is integral to modern society, including the agriculture industry. A report by the United States Department of Education (USDE, 1996) noted that computers and information technologies are transforming nearly every aspect of American life and that every major U.S. industry relies on computers.

Because computers are critical the industry of agriculture, university agriculture programs must ensure that their graduates are competent in computer use (Langlinas, 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, Ahave a high expectation of computer literacy in recent college graduates@ (p. 12). More than 80% of the employers rated computer skills as either an Aimportant@ or Avery 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).

According to Kieffer (1995), many university faculty members and administrators accept the premise that students entering college are already competent in basic computer applications and tasks. Yet, recent research (Johnson, Ferguson, & Lester, 1998,1999) does not support this conclusion. In fact, research even suggests that students graduating from colleges of agriculture may not have adequate computer skills and knowledge (Heyboer & Suvedi, 1999; Johnson et al., 2000).

Additionally, prior experiences with computers may be related to gender. McNair, Kirova-Petrova, and Bhargava (2001), in a report on strategies for minimizing gender bias related to instruction about computers, declared that females come to school with less computer experience than do male students. These authors suggested that such bias is culturally and institutionally based in society and in our educational systems. Calvert (1999) summarized this problem by noting that boys show more positive attitudes toward computers, attend more computer classes, use computers more often, and have more access to computers than girls.

Toward a possible explanation of such differences between groups, efficacy theory suggests that task involvement and persistence are greater when individuals are confident (have a high level of self-efficacy) of their ability to successfully complete a task (Bandura, 1982). Thus, individuals having a high level of computer self-efficacy should be more likely to engage in computer tasks and to show persistence in completing computer tasks despite possible difficulties. Individuals with a low level of computer self-efficacy should be more likely to avoid computer tasks or to give up on a computer task in face of performance obstacles. According to Kinzie, Delecourt, and Powers (1994), ASelf-efficacy is predictive of future engagement with computer technologies, and …... experiences with computers affect future use only through their effects on self-efficacy.@ Clearly, the need exists to explore the relationships between computer experiences, computer self-efficacy and measures of computer skills and knowledge. Such research would add to the theory base of research in computer education.

Purpose and Objectives

The purpose of this study was to determine if differences existed between selected computer experiences, computer self-efficacy, and computer knowledge based on gender and the year in which they enrolled in college among students in a land-grant college of agriculture between 1999 and 2001. The specific objectives of the study were to:

1. Describe students' computer-related experiences and to determine if significant differences existed by the main effects of year and gender, or by the interaction of year and gender.

2. Describe students' level of computer self-efficacy and to determine if significant differences existed by the main effects of year and gender, or by the interaction of year and gender.

3. Describe students' computer knowledge (as indicated by scores on the 35-item exam portion of the CEKI), and to determine if significant differences existed between students for the main effect of year and gender, or by the interaction of year and gender.

Methods

This was a descriptive study. The subjects consisted of students enrolled in AGED 1011, Agriculture Freshman Orientation, during the fall 1999 semester (N = 84), the fall 2000 semester (N = 73), and the fall of 2001 semester (N = 52). In 1999, all 84 students provided usable responses for a 100% response rate; in 2000, 69 students provided usable responses for a 94.5% response rate, and in 2001 52 of 52 students provided usable responses for a 100% response rate. The AGED 1011 course was selected because all students enrolled were either entering freshmen or new transfer students having completed fewer than 24 semester credit hours.

Data were collected by student responses to the AComputer Experiences and Knowledge Inventory@ (CEKI). The CEKI, which was developed by the researchers and was used in previous studies (Johnson, et al., 1998, 1999, 2000), 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 = Ano skill@; 5 = Ahigh skill@) in specific areas of computer use. Part Three consisted of 35 multiple choice items (with 5 response options, including a ADo 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 any of the common operating systems and application programs.

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 face and 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 (computer self-efficacy), and .79 (KR-20) for Part Three (computer knowledge) of the instrument.

For this study, coefficient alpha reliability estimates of .89 (1999 group), .86 (2000 group), .91 (2001 group), and .89 (combined) were obtained for Part 2 of the CEKI. The KR-20 reliability estimates for Part 3 were: .78 (1999 group), .72 (2000 group), .85 (2001 group), and .79 (combined). 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 Avery little measurement error."

The data were analyzed using descriptive, nonparametric, and inferential statistics. An a priori alpha level of .05 was established for all tests of statistical significance. The use of inferential statistics was based on the assumption that the students included in this study were a time and place sample representative of past, present and future undergraduate students entering this college of agriculture. According to Oliver and Hinkle (1982, p. 200), ASuch an assumption permits the use of inferential statistics, and, if made, must be defended by the researcher as being reasonable." Based on the consistent findings of previous research (Johnson et al., 1998, 1999, 2000) concerning the computer experiences, self-efficacy, and knowledge of students entering this college, the researchers felt such an assumption was warranted.

Results

Of the 205 students who participated in this study in the three years of interest, 107 (52%) were female and 98 (48%) were male. There were 195 (95%) students who classified themselves at freshmen and 10 who were classified as sophomores or juniors.

The first objective was to describe students' computer-related experiences and to determine if significant differences existed by the main effects of year and gender, or by the interaction of year and gender. As shown in Table 1, there were no significant differences by year in the percentages of students completing computer course(s), studying specific computer topics, completing coursework that required computer use, or owning a computer. The only significant difference by gender was that a higher percentage of males (52.0%) than females (37.4%) reported having studied Internet use.

Table 1.
Chi-Square of computer experiences by year and by gender.

	By Year				By Gender			
	1999 n=84	2000 n=69	2001 n=52		Female n=107	Male n=98		Overall N=205
Computer experience	% Yes	% Yes	% Yes	χ^2	% Yes	% Yes	χ^2	% Yes
Completed comp. course	77.4	78.3	84.6	1.31	75.7	83.7	2.00	79.5
Studied this comp. topic:								
File mgt.	59.5	63.8	59.6	.34	57.0	65.3	1.48	61.0
Word proc.	76.2	78.3	75.0	.19	73.8	79.6	.95	76.6
Internet	40.5	42.0	53.8	2.56	37.4	52.0	4.45*	44.4
Elect. mail	31.0	39.1	48.1	4.05	32.7	43.9	2.71	38.0
Sprdshts.	51.2	47.8	50.0	.17	46.7	53.1	.82	49.8
Pres. graph.	45.2	42.0	51.9	1.19	44.9	46.9	.09	45.8
Databases	38.1	42.0	36.5	.43	35.5	42.9	1.16	39.0
Prgming.	19.0	13.0	13.5	1.28	15.0	16.3	.07	15.6
Completed crs(s). req. comp. use	47.6	56.5	50.0	1.25	47.6	55.1	1.14	51.2
Own comp.	71.1	80.6	84.6	3.86	70.5	85.6	6.63*	77.7

*∀ $\leq$ .05

Overall, nearly 80% of the respondents had completed a computer course (79.5%) and owned a computer (77.7%). A majority of the students had studied word processing (76.6%) and file management (61.0%). Fewer than half of the students had studied spreadsheets (49.8%), presentation graphics (45.8%), Internet use (44.4%), databases (39.0), electronic mail (38.0%), or computer programming (15.6%).

When computer-related experiences were examined by gender within years (Table 2), no significant differences were found for either the 1999 or the 2000 student groups. However, within the 2001 student group, a higher percentage of males than females had completed a computer course (96.7% vs. 68.2%, respectively) and had studied file management (73.3% vs. 40.9%), word processing (86.7% vs. 59.1%), Internet use (70.0% vs. 31.8%), and electronic mail (60.0% vs. 31.8%).

Table 2.
Chi-Square of computer-related experiences by gender across years.

	1999 N=84			2000 N=69			2001 N=52		
Computer experience	Female n=46 % Yes	Male n=38 % Yes	χ^2	Female n=39 % Yes	Male n=30 % Yes	χ^2	Female n=22 % Yes	Male n=30 % Yes	χ^2
Completed comp. course	76.1	78.9	.10	79.5	76.7	.08	68.2	96.7	7.91*
Studied this comp. topic:									
File mgt.	60.9	57.9	.08	61.5	66.7	.19	40.9	73.3	5.54*
Word proc.	76.1	76.3	.00	79.5	76.7	.08	59.1	86.7	5.15*
Internet	41.3	39.5	.03	35.9	50.0	1.38	31.8	70.0	7.45*
Elect. Mail	28.3	34.2	.34	38.5	40.0	.012	31.8	60.0	4.04*
Sprdshts.	54.4	47.4	.41	43.6	53.3	.65	36.4	60.0	2.84
Pres. graph.	47.8	42.1	.27	41.0	43.3	.04	45.4	56.7	.64
Databases	41.3	34.2	.44	35.9	50.0	1.38	22.7	46.7	3.14
Prgming.	13.2	23.9	1.56	7.7	20.0	2.26	9.1	16.7	.63
Completed crse(s) req. comp. use	40.9	55.3	1.68	56.4	56.7	.00	45.4	53.3	.32
Own computer	60.0	84.2	5.88*	73.7	89.7	2.68	86.4	83.3	.09

*∀ ≤ .05

To further investigate the interaction of gender and year by the variable "number of computer courses completed," a two-by-three factorial ANOVA. These data are presented in Table 3. The analyses revealed a statistically significant interaction for gender and year at the 0.05 alpha level ($F = 3.92$, $df = 2$, $p = .02$).

Table 3.
Factorial ANOVA of number of computer courses completed by gender, year, and interaction of gender and year.

	Females			Males			Overall		
Year	n	Mean	S.D.	n	Mean	S.D.	n	Mean	S.D.
1999	46	1.65	1.37	38	1.63	1.20	84	1.64	1.28
2000	39	1.49	1.17	30	1.20	.92	69	1.36	1.07
2001	22	1.23	.97	30	2.13	1.28	52	1.75	1.23

Source	df	S.S.	M.S.	F	p
Between Groups					
Groups	5	16.93	3.39	2.40	0.04*
Residual	199	281.15	1.41		
Within Groups					
Gender	1	1.93	1.93	1.36	0.24
Year	2	4.45	2.23	1.58	0.21
Gender x Yr.	2	11.06	5.53	3.92	0.02*

* ∀ ≤ .05.

The second objective was to describe students' level of computer self-efficacy and determine if significant differences existed by the main effects of year and gender, or by the interaction of year and gender. To accomplish this objective, respondents rated their self-perceived level of skill in each of eight areas of computer use (file management, word processing, Internet use, electronic mail, spreadsheets, databases, presentation graphics, and programming) using a 1-5 Likert-type scale (1 = "no skill, 2 = "below average skill", 3 = "average skill", 4 = "above average skill", and 5 = "high skill"). The responses to these eight items were summed and averaged to create a composite measure of computer self-efficacy for each respondent.

As shown in Table 4, there were no statistically significant differences in computer self-efficacy by the main effects of year or gender, or by the interaction of year and gender. When viewed as a group or within all possible sub-groupings, the respondents tended to have an average or slightly below average level of computer self-efficacy (range = 2.70 – 3.02) (F = 0.64, df = 5, 197, p = 0.67).

Table 4.
Factorial ANOVA of differences in computer self-efficacy by gender, year, and interaction of gender and year.

	Females			Males			Overall		
Year	n	Mean	S.D.	n	Mean	S.D.	N	Mean	S.D.
1999	46	2.82	.76	37	2.73	.80	83	2.78	.78
2000	39	2.79	.68	30	2.70	.77	69	2.75	.72
2001	21	2.79	.74	30	3.02	.88	51	2.92	.83

Note: Scale = 1-5. No significant difference for main effect; no interaction effect. ∀ = .05.

The final objective was to describe students' computer knowledge (as indicated by scores on the 35-item exam portion of the CEKI), and to determine if significant differences existed between students for the main effect of year and gender, or by the interaction of year and gender. As shown in Table 5, there were no statistically significant differences in computer knowledge by the main effects of year or gender or by the interaction of year and gender. Both overall and within all possible sub-groupings, students averaged less than 50% correct on the 35-item computer knowledge exam ($F = 0.85$, $df = 5, 199$, $p = 0.52$).

Table 5.
Factorial ANOVA for differences in CEKI scores by gender, year, and interaction of gender and year.

	Females			Males			Overall		
Year	n	Mean	S.D.	n	Mean	S.D.	N	Mean	S.D.
1999	46	14.30	4.96	38	13.39	5.32	84	13.89	5.11
2000	39	14.23	5.03	30	15.10	4.20	69	14.61	4.68
2001	22	16.09	6.06	30	14.60	6.20	52	15.23	6.12

Note: Possible range of scores = 1-35. No significant difference for main effect; no interaction effect. ∀ = .05.

Conclusions and Recommendations

Objective one was to describe students' computer-related experiences and to determine if significant differences existed by the main effects of year and gender, or by the interaction of year and gender. The first major conclusion to be drawn from this study is that there were virtually no differences by year on any computer-related variable for students enrolled in AGED 1011, Agriculture Freshman Orientation. Despite well-publicized, rapid changes in computer technologies, these results indicate that students entering this College vary little in computer experiences from year to year. Thus, the exponential growth in students= computer experiences and knowledge predicted by some futurists may be somewhat overstated. Colleges of agriculture should continue to base computer education requirements and expectations on reality rather than perceptions.

Across years the students in this study reported a variety of computer experiences. Approximately three-fourths had completed one or more computer courses and owned a computer. A majority of the students had received formal instruction in word processing and file management. However, a majority of students had not received formal instruction in Internet or electronic mail use, spreadsheets, presentation graphics, databases or computer programming. Only about one-half of the students reported ever completing a course (other than a computer applications course) where computer use was required. Thus, it was concluded that these students had not completed a common core of educational experiences related to the most commonly used computer applications and tasks. Professors teaching introductory courses should take this into account as they plan computer-related assignments.

When students were grouped by gender, little difference was found in their computer-related experiences. A significantly higher proportion of males than females received formal instruction in Internet use. This difference seems to be of little practical importance, unless courses require significant Internet use.

In the 2001 group, a significantly higher proportion of males than females had completed a computer course, and a significantly higher proportion had also received formal instruction in word processing, file management, Internet use, and electronic mail. There was also a significant interaction between year and gender, and the number of computer courses completed, with males completing more computer courses than females.

While these data for 2001 do not establish a trend, this finding is consistent with the literature, which indicates that males are more likely than females to participate in computer-related activities. Further research should be conducted to verify this finding, and if supported, action will be necessary to enhance female participation in computer-related activities.

Objective two sought to describe students' level of computer self-efficacy and to determine if significant differences existed by the main effects of year and gender, or by the interaction of year and gender. There were no significant differences for the main effects of year and gender, or the interaction of year and gender, on computer self-efficacy. Regardless of year or gender, students tended to have average or below average levels of computer self-efficacy. Many students entering college lack confidence in their computer skills. This finding is especially troubling given the relationship between low computer self-efficacy and avoidance of computer tasks.

Objective three sought to describe students' computer knowledge and to determine if significant differences existed between students for the main effects of year and gender, or by the interaction of year and gender. No significant differences were found. Regardless of grouping, students scored less than 50% correct on the exam portion of the CEKI. Thus it was concluded that, overall, entering students have a fairly low level of computer knowledge. Taken together with the finding concerning computer self-efficacy, the researchers recommend that a college-wide computer applications course requirement should be established for all students entering the college of agriculture. Students should be required to complete this course during their first year of enrollment. However, because some students do appear to have an acceptable level of computer knowledge, a performance testing option should be considered to allow students to test out of this required course.

This study provided information about computer abilities of students entering the college of agriculture. Data should continue to be collected to establish trends about students' knowledge of computers, computer self-efficacy. This information will aid instructors in designing optimal learning environments, with the use of computer technologies.

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Differences in Computer Experiences, Computer Self-Efficacy, and Computer Knowledge of Undergraduate Students Entering a Land-Grant College of Agriculture by Gender and Year

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What are students' computer-related experiences and do significant differences exist by year and gender or by the interaction of year and gender? What are students' level of computer self-efficacy and do significant differences exist by year and gender or by the interaction of year and gender? What is the level of student computer knowledge and do significant differences exist by year and gender or by the interaction of year and gender. This descriptive study examined students enrolled in Agriculture Freshman Orientation during the Fall semesters of 1999, 2000, and 2001. The Computer Experiences and Knowledge Inventory (CEKI) was used to collect the data and had been used in previous studies. Validity and reliability for the instrument has been established in prior studies and through pilot testing and reliability estimates for this study were included in the paper. The authors are to be commended for conducting a well designed and executed study. The fact that this study includes data from three years is particularly impressive.

Of the students participating in this research, 52% were female and 95% were freshmen. The only significant difference reported by gender in computer experiences was that males reported a higher percentage of having studied Internet use. It is interesting that for 1999 and 2000, no significant differences were found when computer-related experiences were examined by gender within years. However, for 2001 significant differences were found for five different computer-related experiences (completed a computer course, studied file management, word processing, Internet use, and electronic mail). In all cases, males reported having these experiences at a higher rate. What does this mean? Why only for the year 2001?

The authors conclude that computer related experiences of students entering the College of Agriculture vary little from year to year. They further conclude that the "exponential growth in students computer experiences" predicted by some experts might be somewhat overstated. From this the recommendation is made that Colleges of Agriculture should continue to base computer education requirements and expectations on reality rather than perception. Is this recommendation appropriate given that the study was conducted at one Land-Grant University?

Questions that come to mind concerning this research are:

- What recommendations do the authors have for professors teaching courses that might enhance students' acquisition of computer-related experiences?
- What action can be taken to enhance female participation in computer-related activities?
- Does computer-related activities lead to improvement in student performance/learning?