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Computer Access, Usage, and Literacy of Undergraduates in the Agricultural Sciences

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Abstract

As the use of information technology to deliver agricultural science education increases, particularly in higher education, educators must examine factors that affect student access to and use of the technology. This study examined computer access, usage, and perceived computer literacy among undergraduates. Student computer access, usage, and literacy impact a host of higher education issues,

including curriculum planning, infrastructure support, and educational equity. The population included 142 students enrolled in a freshmen seminar in the College of Agricultural Sciences at The Pennsylvania State University. The findings indicated that the majority of students owned a computer (57%), almost 25% more than the national average. Owners overwhelmingly accessed the Internet through a university connection and reported being more computer literate than non-owners. Students from farm, rural-nonfarm, or suburban backgrounds were more likely to be computer owners than were urban students. Lack of access to a computer in computer labs was the most cited computer problem causing frustration.

Introduction

Increasing evidence suggests computer access can impact both the learner's educational attainment and employability. Based on student achievement in an agricultural technical writing course, Newman et al. (1996) concluded the World Wide Web was a useful educational tool. In a Delphi study of agricultural educators identified for their expertise in using information technology, Murphy and Terry (1995) concluded that the use of information technology would improve instruction. In a meta-analysis of 254 studies which compared student learning (in various subjects) between computer-based and traditional classes, Kulik and Kulik (1991) found the average student in a computer-based course achieved higher post-test scores than 62% of their contemporaries taught using traditional lecture and textbook instructional strategies.

The use of computers and other information technology is becoming common in virtually all career paths (Green and Gilbert, 1995). Several researchers have examined computer competency and employment issues. In a study conducted by the Penn State Student Affairs Assessment Office, 85.3% of the students felt that using computers would be important in their careers (Moore, 1997). In another recent study, more than 80% of employers noted computer skills were considered important in hiring decisions (Davis, 1997). Computer users earn 10 to 15% more than non-users in similar jobs (Krueger, 1993). Another study found that about 40% of executives and professionals in agriculture use computers (U.S. Dept. of Labor, 1993).

Computer ownership provides the highest level of access to information technology, hence the greatest advantage to enhancing a student's computer competencies and educational outcomes. Resmer et al. (1995) cited several advantages to ownership: unlimited accessibility, convenience, and personalization. In a study of undergraduate computer self-efficacy, attitude, and anxiety, Houle (1996) found that computer owners had a significantly higher computer self-efficacy.

Nationally, one-third of all college students own their own computers (Green, 1996). Computer access is viewed increasingly as central to the undergraduate experience. Beginning in fall 1998, the University of Florida and Virginia Tech joined a host of private and smaller public institutions that require computer ownership or access (Young, 1997). Because the value of computers as an instructional tool has been well-documented (Green and Gilbert, 1995; Resmer et al., 1995; Baker and Gloster, 1994; Kulik and Kulik, 1991), this study examined computer access, usage, and perceived computer literacy among undergraduates.

The purpose of this study was to examine student use of and access to computers. The objectives were to determine: 1) relationships among student computer ownership, usage, and perceived computer literacy, including a profile of student computer owners; 2) relationships between student computer ownership and computing location, and 3) factors that influence student computer use.

Methods

The design of the study was descriptive (Ary et al., 1996). The population included all students enrolled (N=176) in Ag 150: "Be A Master Student!" during fall semester, 1996, at The Pennsylvania State University. The course was taught at the University Park (main) Campus as well as at three of Penn State's Commonwealth (branch) Campuses: Altoona, Berks, and Hazelton.

The questionnaire was adapted from a communications technologies assessment used by a Penn State faculty team assessing the use of technology among nutrition undergraduates. Dillman's Total Design Method (1978) was used in developing the instrument for this study. Face and content validity were determined by a panel of eight experts composed of faculty and graduate students in agricultural and extension education.

Among the 176 students registered, 142 (81%) participated. Questionnaires were completed in class. Reliability was calculated for the 5-point Likert computer usage and ability subscale and found acceptable (Cronbach's alpha = 0.70). Cross tabulations using Cramer's V and phi statistical tests were used to determine the differences between subgroups, and the magnitude of relationships was described using conventions described by Davis (1971). Differences in responses were set *a priori* and considered significant at alpha = .05.

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Results

Objective 1 - Relationship Between Computer Ownership, Usage, and Ability

All AG 150 students (N=142) were computer users (Figure 1). More than 8 of 10 (82.4%) used computers at least once a day, with fewer than half (45.1%) using computers several times each day; less than one in five (17.6%) did not use computers daily. A moderate correlation (Cramer's V=0.45) was found between student computer ownership and frequency of computer use. Most computer owners reported using a computer several times a day (64.2%), compared to 19.7% of non-owners who did. Conversely, 3 out of 10 non-owners (27.9%) indicated using a computer weekly or monthly, just one out of 10 owners (9.9%) reported weekly or monthly use (Figure 1).

The majority of students used computers five or more hours each week (65%) with one-third using a computer ten or more hours each week (Figure 2). A low relationship (Cramer's V=0.29) existed between computer ownership and total hours of weekly computer use. One-half of the non-owners used a computer less than five hours each week, compared to less than one-fourth (23.4%) of the owners. A higher percentage of computer owners (40.3%) than non-owners (20.0%) used computers ten or more hours each week.

Overall, three-fourths (75.4%) of the students indicated they enjoyed using a computer for classwork (Table 1). A low, significant relationship (Cramer's V=0.23; $p \leq .05$)) existed between computer ownership and enjoyment in using a computer. A higher percentage of computer owners (81.5%) tended to enjoy using computers for

Table 1. Relationship among computer ownership, usage, and perceived computer literacy

Characteristic	Computer Owner		Computer Non-Owner		All Cases		Cramer's V[z]
	N	%	N	%	N	%	
Level of Enjoyment in Using A Computer for Classwork	(81)	(100)	(61)	(100)	(142)	(100)	
Enjoy	66	81.5	41	67.2	107	75.4	
Neutral	14	17.3	13	21.3	27	19.0	
Do Not Enjoy	1	1.2	7	11.5	8	5.6	0.23*
Ability to Use a Computer	(81)	(100)	(59)	(100)	(140)	(100)	
Above Average	35	43.2	9	15.3	44	31.4	
Average	39	48.1	42	71.2	81	57.9	
Below Average	7	8.7	8	13.5	15	10.7	0.30**
Computer Trouble-Shooting Skills	(80)	(100)	(59)	(100)	(139)	(100)	
Above Average	13	16.2	4	6.8	17	12.2	
Average	45	56.3	24	40.7	69	49.7	
Below Average	22	27.5	31	52.5	53	38	0.26**

[z]* or ** significant at the p=0.05 or p=0.01 level, respectively

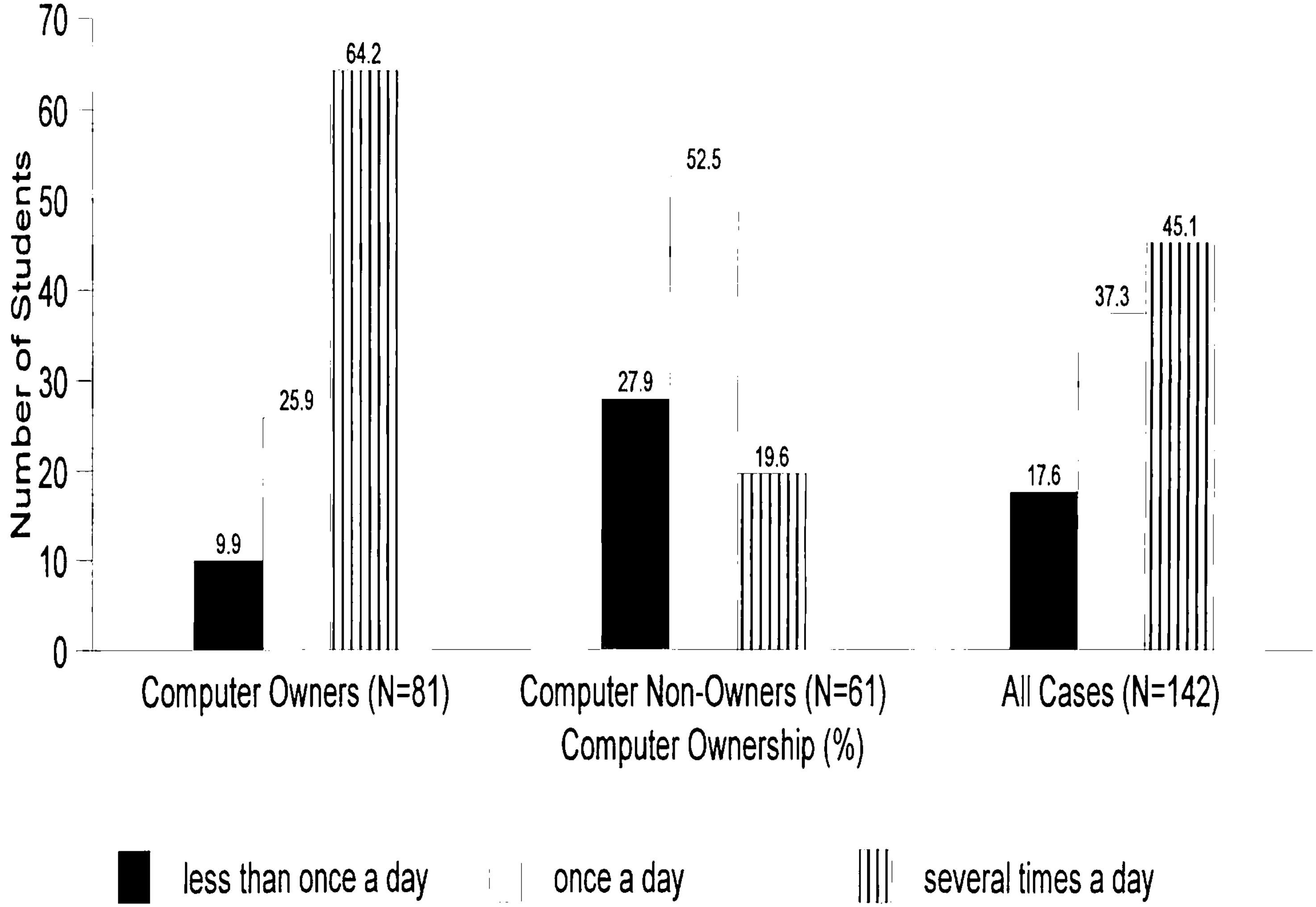

Figure 1. Frequency of student computer use among AG 150 undergraduates

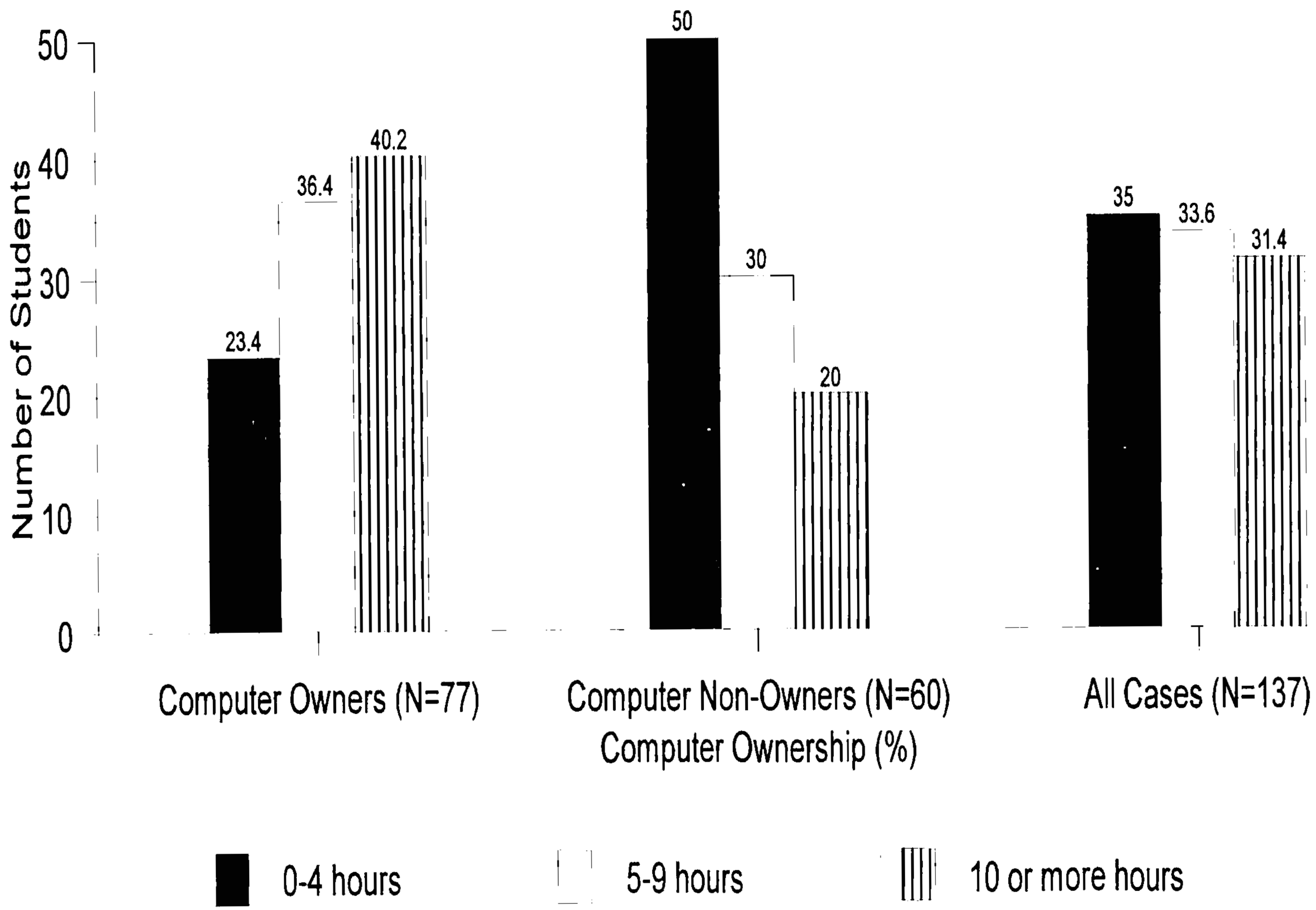

Figure 2. Total weekly hours of student computer use among AG 150 undergraduates

classwork than non-owners (67.2%). In addition, a higher percentage of non-owners (11.5%) did not enjoy using computers for classwork than computer owners (1.2%).

A moderate correlation (Cramer's V=.30; p≤.01) was found between computer ownership and ability to use a computer (Table 1). Significantly more computer owners rated their computer abilities as above average (43.2%) than did non-owners (15.3%). On the other hand, 86.5% of non-owners rated their ability to use a computer as average or below average, compared to 56.7% of the owners. Among all students, one in ten rated their computer ability as below average.

A low correlation (Cramer's V=.26; p≤.01) between computer ownership and computer trouble-shooting skills was found (Table 1). More than half of computer owners rated their trouble-shooting skills as average (56.3%), while the majority of non-owners rated their trouble-shooting skills as below average (52.5%).

While the findings that computer owners use computers more frequently and view themselves as more skilled than non-owners seem obvious, these findings beg important questions. If computer owners use their computers significantly more often for academic applications than non-owners, is their learning enhanced by the use of a computer? How much more competitive are they in the job market than non-owners?

Computer Owner Profile

Almost 6 of 10 students (57%) owned a computer. Almost 8 of 10 computer owners (79%) had PCs (Table 2).

Table 2. Computer owner's profile among AG 150 undergraduates

Characteristics	N	%
Computer Ownership Status	(142)	(100)
Computer Owner	81	57.0
Computer Non-Owner	61	43.0
Type of Computer Owned	(81)	(100)
PC	64	79.0
MAC	16	19.8
Both	1	1.2
Connection to the Internet	(80)	(100)
Connected	66	82.5
Not Connected	14	17.5
Commercial On-Line Service	(73)	(100)
Subscribe	31	42.5
Do Not Subscribe	42	57.5
Amount of RAM (Random Access Memory)	(79)	(100)
4 MB or less	2	2.5
5-15 MB	12	15.2
16 MB or more	25	31.7
Owner Did Not Know Amount	40	50.6

Yet, only one-half of all computer owners knew the amount of RAM (Random Access Memory) available on their machines, indicating that computer owners' knowledge may not be as sophisticated as the frequency data might suggest. This finding, coupled with the fact that most owners rated their skills as average or below, indicates that even among owners, computer skills can be strengthened for job readiness.

Although the majority of computer owners could connect to the Internet (82.5%), less than one-half (42.5%) subscribed to an on-line commercial service. This finding indicates that the majority of owners access the Internet through a connection in their dormitory room or by using a modem to connect to the Penn State computer system.

Objective 2 - Relationship Between Computer Ownership and Computing Location

A low correlation (Phi=.29; $p \leq .001$) was found between computer ownership and the use of on-campus computer laboratories. The association was that one in four computer owners (24.4%) did not use computer labs, while only two non-owners did not use computer labs. The vast majority of AG 150 students (84.8%) used computer labs; 21 students (15.2%) reported not using computer labs (Table 3).

A moderate correlation (Cramer's V=.31; $p \leq .01$) existed between enrollee's computer ownership and current residence. The association was that all students living at home owned a computer (19.8%) while on-campus and off-campus students were equally split in ownership status (Table 3).

A low relationship (Cramer's V=0.26; $p \leq .05$) was found between students' childhood home and their current computer ownership. Computer owners were significantly more likely to be from suburban (36.3%), farm (20.0%), and rural, nonfarm (37.4%) than urban students (6.3%); see Table 3.

Objective 3 - Factors that Enhance or Impede Computer Use for Coursework

The majority of students (79.3%) rated the computer institutional support available at Penn State as average or above average. When trouble-shooting software problems, students tended first to seek help from a friend (30%), lab technician (27%), or the person at the nearest computer (25.6%).

Students were asked to indicate up to three computer problems which caused them frustration. Access to a computer in the lab was the most frequently mentioned frustration (19.6%) cited by four of ten students (41.5%), yet lab hours and access to Penn State computer labs only comprised 8.6% of the total responses (Table 4). This finding is consistent with national data indicating that institutions nationwide average 22 students per in-lab computer (Green, 1996).

Summary

The findings yield broad implications for using information technology to improve instruction in the agricultural sciences, including curriculum planning, institutional computing infrastructure, and educational equity.

Curriculum Planning

Findings indicated that more than 70% of non-owners used a computer at least once a day and that one-half of non-owners used a computer at least five hours each week. Given such frequent computer use, faculty should ensure that computer-based instruction will engage students in course content, rather than simply be a tool for word processing. Word processing and other passive computing cannot compare with the Web's potential to support instructional objectives. Without using the Web for some portion of instruction, how will students learn to access, evaluate, and use on-line information? Instruction that stresses search strategies and information analysis could prove useful to enhancing student evaluative skills.

The mediocre perceptions of computing ability across all of the students in this study, coupled with the fact that most were in their first semester of post-secondary study, indicate the importance of incorporating computer instruction into the agricultural sciences curriculum. A 1993 study of schools/colleges of agriculture among the National Association of State Universities and Land-Grant Colleges (NASULGC) member institutions found that the majority of colleges/schools of agriculture did not have a computer education requirement (Bekkum and Miller, 1994). Regardless of whether or not computer courses are required, colleges of agricultural sciences should include computer applications in all introductory courses so that students are prepared to use technology throughout their undergraduate experience (O'Kane and Armstrong, 1997). Additional research is needed to assess the computer skills among college of agricultural sciences students as well as to pinpoint the specific computer skills needed in agricultural professions. The results of such research should provide further direction for curriculum planning.

Institutional Computing Infrastructure

The degree to which computers can enhance learning is well-established (Green and Gilbert, 1995; Resmer, et al., 1995; Baker and Gloster, 1994; Kulik and Kulik, 1991). Therefore, computer access, usage, and ability become

Table 3. Relationship between computer ownership and computing location

Characteristic	Computer Owner		Computer Non-Owner		All Cases		Cramer's V/Phi[z]
	N	%	N	%	N	%	
On-Campus Computer Lab Use	(78)	(100)	(60)	(100)	(138)	(100)	
Users	59	75.6	58	97.6	117	84.8	
Non-Users	19	24.4	2	3.3	21	15.2	0.29**
Current Residence	(81)	(100)	(61)	(100)	(142)	(100)	
On-Campus	53	65.4	50	82.0	103	72.5	
Off-Campus	12	14.8	11	18.0	23	16.2	
At Home	16	19.8	0.0	0.0	16	11.3	0.31*
Childhood Residence	(80)	(100)	(59)	(100)	(139)	(100)	
Urban	5	6.3	13	22.0	18	13.0	
Suburban	29	36.3	23	39.0	52	37.4	
Farm	16	20.0	10	17.0	26	18.7	
Rural, Nonfarm	30	37.4	13	22.0	43	30.9	0.26

[z] *, **, or *** significant at the p=0.05, 0.01, or 0.001 level, respectively

Table 4. Computer problems causing frustration among AG 150 undergraduates (N=142)

Areas of Frustration	f[z]	Percentage of Responses
Access to computer in lab	59	19.6%
Hardware limitations	41	13.6
Instructions not clear	39	13.0
Network limitations	32	10.6
Printing limitations	32	10.6
Getting lost on the WWW	31	10.3
Software limitations	30	10.0
Access to on-campus computer labs	13	4.3
Hours labs are open	13	4.3
Other	11	3.7
TOTAL RESPONSES	301	100.0

[z]up to three responses allowed

paramount issues for improving instruction. Colleges of agricultural sciences utilizing information technology for instruction must consider factors that support academic computing. Access to a computer in the lab was cited by 4 out of every 10 students (41.5%) as a source of frustration. This finding is supported by data that indicates institutions nationwide average 22 students per in-lab computer (Green, 1996).

Instructors in the agricultural sciences and technicians providing computer lab support services may be adept in using information technology to enhance the educational experience and job skills of agricultural undergraduates. However, the degree to which students can take advantage of these technologies hinges on access. Curriculum planning must include an assessment of the institutional computer resources which support student access and use.

Educational Equity

With greater computer access, training, and integration of computer applications into the curriculum, universities can respond to discrepancies in educational computing equity. One must not assume that on-campus computer labs with knowledgeable attendants equalize educational opportunities. Campuses need computer learning centers to assist those with little computer experience to succeed in today's high-tech campus and workplace.

Those involved in providing technical and educational support for computer labs, computer instruction courses, and courses requiring computer use must give attention to increasing the computing ability and trouble-shooting skills among all students, particularly among non-owners. Enhanced educational outcomes and employability, well-documented advantages of computer ownership (Kulik and Kulik, 1991; Krueger, 1993), must be attainable goals for all agricultural undergraduates. Otherwise, these findings indicate that computer applications integrated into the curriculum effectively disenfranchise non-owners, such as students from urban backgrounds who owned significantly fewer computers. Public universities should adopt a universal computer access policy that provides a computer and Internet access to every student 24-hours a day (Resmer et al., 1995). Student computer ownership requirements need not present a financial burden to students. A number of institutions offer flexible payment plans for student laptops that allow partial payment each semester (Jenny, 1995).

As evidence grows to support the fact that computer access positively influences a learner's educational competencies and employability (Davis, 1997; Resmer et al., 1995; Kruger, 1993), how do colleges of agricultural sciences respond? It is not enough to simply add hardware to existing computer labs, colleges must integrate computer applications into introductory courses and provide adequate educational and technical support. Through an examination of student computer access, usage, and ability, we can more fully understand the curriculum, infrastructure, and equity issues which impact undergraduate education in the agricultural sciences.

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Value Intensity Identification of Environmental Studies/Natural Resources Majors

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Abstract

Undergraduate major selection is one of the first steps in attaining a satisfying career. Research confirms that values play a critical role in the selection process, regardless of the academic endeavor. This study determined Environmental Studies/Natural Resources majors at the University of Nebraska-Lincoln have a significantly different identification of value intensity than a national sample of university students and this information is critical to recruitment, advising and career placement efforts. A one-sample z test revealed five of 21 sub-scales were statistically different for the University of Nebraska-Lincoln group.

Introduction

Values are standards which people deem desirable or worthy (Fritz et al., 1997). Values provide standards for behavior (Brown, 1996; Brown and Crace, 1996) and construct a foundation for interpreting experiences (The Seven Vectors, 1993) and judgment of oneself and others (Rokeach, 1973). One's behaviors and attitudes originate from value systems (Dodge, 1986). Motivation, life plans, and goal setting all emerge from one's value set (Hanna, 1995; Brown and Crace, 1996, Fritz et al., 1997) and serve as the basis for attributing worth. Individuals acquire their values through interactions with society (Brown and Crace, 1996) and more specifically from parents, family, and peers (Fritz et al., 1997).

Value development is a three-step process (Chickering, 1993). The first step is humanizing values--moving from immediate application of adamant beliefs and using principled thinking in countering one's own self-interest with the interests of one's fellow human beings. The second step is personalizing values--knowingly affirming core values and beliefs while respecting other points of view. The third step is development of congruence--aligning personal values with socially responsible behavior. Value personalization leads to congruence and congruence occurs when personal values are consistent with an individual's behavior and result in minimization of internal debate. The absence of congruence cultivates stress (Fritz et al., 1997).

Rokeach (1973) reports that values contain a cognitive dimension used in decision making. Therefore, values are central to life role selection (Brown and Crace, 1996). Brown and Crace purport values acclimate individuals to possibilities that provide desirable outcomes. Identification of possibilities related to values results in strategies to attain goals and cause action. Consequently, satisfaction occurs when individuals' choices and achievements coincide with their values (Brown, 1996; Brown and Crace, 1996).

Krumboltz et al. (1979) theorized that individuals will choose a career if they have been positively influenced and

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