DOCUMENT RESUME

ED 452 775 HE 033 994

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TITLE	Computing Experience and Good Practices in Undergraduate Education: Does the Degree of Campus Wiredness Matter?
PUB DATE	2001-04-00
NOTE	32p.; Paper presented at the Annual Meeting of the American Educational Research Association (Seattle, WA, April 10-14, 2001).
PUB TYPE	Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*Computer Uses in Education; *Educational Practices; Educational Technology; Higher Education; *Information Technology; *Undergraduate Students
IDENTIFIERS	*Access to Computers

ABSTRACT

Responses to the College Student Experience Questionnaire Fourth Edition (C. Pace and G. Kuh, 1998) from 18,844 students at 71 colleges and universities were analyzed to determine if the presence of computing and information technology influenced the frequency of use of various forms of technology and other educational resources and the exposure to good educational practices. Undergraduates attending "more wired" campuses as determined by the 1998 and 1999 Yahoo Most Wired Campus survey more frequently used computing and information technology and reported higher levels of engagement in good educational practices than their counterparts at less wired institutions. Nontraditional students benefited less than traditional students, but both women and men students benefited considerably from campus wiredness. An appendix contains the survey items that represent good educational practices. (Contains 4 tables and 45 references.) (Author/SLD)

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Prepared for presentation at the annual meeting of the
American Educational Research Association, Seattle, April 2001

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Abstract

Responses to the College Student Experience Questionnaire 4th Edition from 18,844 students at 71 colleges and universities were analyzed to determine if the presence of computing and information technology influenced the frequency of use of various forms of technology and other educational resources and the exposure to good educational practices. Undergraduates attending "more wired" campuses as determined by the 1998 and 1999 Yahoo Most Wired Campus survey more frequently used computing and information technology and reported higher levels of engagement in good educational practices than their counterparts at less wired institutions. Non-traditional students benefited less than traditional students, but both women and men students benefited comparably from campus wiredness.

Computing Experience and Good Practices in Undergraduate Education: Does the Degree of Campus Wiredness Matter?

Introduction

An increasingly technology-oriented workplace makes competence in computer and information technology essential (Gilbert, 1996; Green & Gilbert, 1995; Morrison, 1999; West, 1996). Thus, it is no surprise that computing and information technologies have proliferated on most campuses and now typically represents a substantial share of an institution's operating budget (Finkelstein, Frances, Jewett, & Scholz, 2000; Institute for Higher Education Policy, 1999). Continuously upgraded, the technology is supposed to add value to the student experience. E-mail, for example, promises to remove time and distance barriers between students and faculty members (Gilbert, 1995; D'Souza, 1992) and students are generally satisfied with this mode of communication, reporting that it has a positive effect on the learning process (D'Souza, 1992), especially when faculty members use email to elaborate on key points made during class discussions and provide feedback to students (D'Souza, 1992; Hawarth, 1999; Roach, 1999).

Assuming the benefits of email extend to the use of other forms of electronic technologies, it seems plausible that more is better, meaning that the more pervasive the technology the more students will use it and the more they will benefit. However, relatively few studies have looked specifically at the relationships between computing and information technology and the overall undergraduate experience. It's also possible that prospective students consider the degree to which an institution is "wired" (i.e., the availability of advanced forms of computing and information technology) when deciding to which schools they will apply and ultimately, the specific college they will attend (Armstrong, 2000; Bernstein, Caplan, & Glover, 2000; Jackson, 2000).

Some studies are encouraging, showing positive influences of the use of information technology on a broad range of desired outcomes of college (Flowers, Pascarella, & Pierson, 2000; Kuh & Vesper, 2001; Pew Internet and American Life, 2000). At the same time, others worry about potentially undesirable consequences of the overwhelming presence of computer and information technology (Upcraft, Terenzini, & Kruger, 1999). For example, Wen (2000) reported that as more and more adolescents grow up communicating via instant electronic messaging, chat rooms and email, they would be isolated from and have little experience with face-to-face human contact. Though the Internet offers almost unlimited access to information, some caution that it must not become "a substitute for hands-on learning" (Malveaux, 2000, p. 38). In addition, it is not clear whether the availability and use of technology promotes or discourages student engagement in good educational practices, behaviors that are linked with a host of desirable college outcomes (Chickering & Gamson, 1987). Haworth (1999) suggests that e-mail does not increase the frequency of student-faculty interaction, but rather allows it to take a different form. Peers and faculty members are the two most important agents of socialization for students in college (Pascarella & Terenzini, 1991; Weidman, 1989). One way to determine the impact of computing and information technology on the quality of undergraduate education is to examine the relationship between the degree to which a campus is wired and the level of student engagement in a range of empirically-derived good educational practices (Chickering & Gamson, 1987). Included among such good practices are student-faculty contact, peer cooperation, and active learning.

Purpose

This study examines the relationships between the availability of computing and information technology (wiredness), use of the technology, and student engagement in three good educational practices (faculty contact, peer cooperation, active learning). Two questions guide this study.

First, does highly accessible, advanced forms of computing and information technology have a demonstrable effect on students' experiences with this technology and their exposure to good educational practices? That is, do students use technology more frequently and interact more frequently with their teachers, engage in more cooperative peer activities, and have more active learning experiences on wired campuses compared with their counterparts at less wired campuses?

Second, does the degree of campus wiredness have differential effects on the experiences of different types of students (men and women, traditional age and older students)? Previous studies have reported certain differences in how men and women use computing and information technology (Kuh & Hu, in press; Pew Internet and American Life, 2000). However, it is not known whether there are differences in the relationships between campus wiredness and students' experiences with information technology and their exposure to good educational practices depending upon student characteristics such as gender or age.

Methods

Data Source and Instrument

The data used in this study are from the College Student Experiences Questionnaire (CSEQ) research program. The fourth edition of the CSEQ (Pace & Kuh, 1998) is designed for students attending four-year colleges and universities and gathers information about students' background (age, major field, and so forth) and their experiences in three areas. The first area is the amount of studying, reading, and writing students do and the time and energy (quality of effort) they devote to various activities measured by items contributing to 13 Activities Scales.

One of these scales, Computer and Information Technology (C&IT), is composed of nine items describing various forms and uses of computers and information technology that we will discuss later in the paper. The response options for all Activities items are: 1="never," 2="occasionally," 3="often," and 4="very often."

The second area includes 10 Environment items representing student perceptions of the extent to which their institution emphasizes important conditions for learning and personal development. Student responses are scored on a 7 point scale ranging from "strong emphasis" = 7 to a "weak emphasis" = 1.

The final set of questions asks students to estimate the extent to which they have made progress since starting college in 25 areas that represent desired outcomes of higher education. Response options for the Gains items are: 1="very little," 2="some," 3="quite a bit," and 4="very much."

The validity of self-reported information such as that obtained by the CSEQ has been thoroughly examined (Baird, 1976; Lowman & Williams, 1987; Pace, 1985; Pike, 1995; Turner & Martin, 1984). Generally, self-reported information is likely to be valid if five conditions are met: (1) if the information requested is known to the respondents, (2) the questions are phrased clearly and unambiguously (Laing, Sawyer, & Noble, 1988), (3) the questions refer to recent activities (Converse & Presser, 1989); (4) the respondents think the questions merit a serious and thoughtful response (Pace, 1985), and (5) answering the questions does not threaten, embarrass, or violate the privacy of the respondent or encourage the respondent to respond in socially desirable ways (Bradburn & Sudman, 1988). CSEQ items satisfy all these conditions. The questionnaire requires that students reflect on what they are putting into and getting out of their college experience. The items are clearly worded, well defined, and have high face validity. The nature of the questions refers to common experiences of students during the current school year, typically a reference period of about six months or less. The format of most response options is a simple rating scale that helps students to accurately recall and record the requested information, thereby minimizing this as a possible source of error. The Estimate of Gains items ask students to make a value-added judgment (Pace, 1990) and student responses to such questions are generally consistent with other evidence, such as results from achievement tests (Brandt, 1958; DeNisi & Shaw, 1977; Hansford & Hattie, 1982; Lowman & Williams, 1987; Pace, 1985; Pike, 1995). For example, Pike (1995) found that student reports to Gains items from the CSEQ were highly correlated with relevant achievement test scores and concluded that self reports of progress could be used as proxies for achievement test results if there was a high correspondence between the content of the criterion variable and proxy indicator. Based on their review of the major college student research instruments, Ewell and Jones (1996) concluded that the CSEQ has excellent psychometric properties and high to moderate potential for assessing student behavior associated with college outcomes.

The measure of the extent to which an institution is wired ("wiredness") was from the "most wired" survey of college campuses conducted by Yahoo! Internet Life magazine in 1998 and 1999, the same years the data for this study were collected. The "most wired" survey collects information about a variety of factors related to information technology access and infrastructures (e.g., number of wired classrooms and dorms), general institutional support (e.g., library resources, email accounts), administrative services (e.g., on-line course registration, advising), and student support (e.g., technical support, orientation). Although somewhat controversial, more than 1,000 institutions participated in the most recent survey (Young, 2000). Because the 1998 and 1999 rankings of campus wiredness for the 100 most wired campuses are somewhat unstable, we coded campus wiredness as a dichotomous variable. Thus, those colleges and universities that were ranked in either year were considered to be among the "more wired campuses" and those that were not ranked were categorized as "less wired."

Sample

The sample is composed of 18,344 undergraduates from 71 four-year colleges and universities who completed the 4th edition of the CSEQ in 1998 and 1999. The schools include 21 research universities (RU), 9 doctoral universities (DU), 22 comprehensive colleges and universities (CCU), 8 selective liberal arts colleges (SLA), and 11 general liberal arts colleges (GLA) as classified by The Carnegie Foundation for the Advancement of Teaching (1994). Although the mix of schools reflects the diversity and complexity of four-year colleges and universities, for all practical purposes the CSEQ database constitutes a convenience sample in that institutions administer the instrument in different ways and for different reasons. Women (63%), traditional-age students (92%), first-year students (48%), and students from private colleges are over-represented in the sample compared with the national profile of undergraduates attending four-year colleges and universities. About 77% were White students, 8% Asian Americans, 6% African Americans, 6% American Indians and students from other backgrounds and 4% Latinos. Also, more than half of the students were majoring in a pre-professional area, 17% in math and science, 10% in social science, and 8% in humanities. Almost one-fifth (19%) had majors from two or more of the major field categories. Among the 71 institutions in this study, 21 were more wired campuses with 29% of students and 50 were less wired campuses with 71% of students in the sample.

Variables

Because socioeconomic status (SES) and student ability are highly correlated and affect college outcomes (Pascarella & Terenzini, 1991), two control variables were created, student SES and academic preparation. SES was represented by level of parents' education and the amount parents contributed to college costs. This estimate of SES is not a robust measure of socioeconomic status, but it is the best approximation possible from the variables included on the CSEQ. Academic preparation is the sum of student self-reported grades and educational aspirations. In addition, institutional selectivity and control (public, private) were also controlled in all analyses with the selectivity measures taken from Barron's Profiles of American Colleges (1996). Student gender, race and ethnicity, major field, institutional type, and year in college were coded as dummy variables. The variables were coded as follows:

- Sex (0=women, 1=men);
- Age (0=traditional-age students under age 24, 1=students 24 and older);
- Race or ethnicity was coded as a set of dummy variables: Asian Americans, African Americans, Latinos, Whites, and Other Ethnicity (American Indians and others), with Whites as the omitted reference group;
- SES (the sum of parent education where 1=neither parent a college graduate, 2=one parent a college graduate, and 3=both parents college graduates and amount parents contribute to college costs where 1=none to 6=all or nearly all);
- Academic preparation (the sum of grades where 5=A and 1=C, C- or lower and educational aspirations where 2=expect to pursue an advanced degree after college and 1=does not expect to pursue an advanced degree);
- Major field (humanities, mathematics and sciences, social sciences, pre-professional, and students in two or more major fields, with pre-professional omitted as reference group);
- Institutional type (RU, DU, CCU, SLA, GLA with RU omitted as reference group);

- Institutional control (0=public, 1=private);
- Institutional selectivity (6=most competitive, 5=highly competitive, 4=very competitive, 3=competitive, 2=less competitive, and 1=not competitive);
- Year in college (first-year, sophomore, junior, and senior, with first-year omitted as reference group);
- Colleges and universities that were ranked in either year were considered to be among the "more wired campuses" (coded as 1) and those that were not ranked were categorized as "less wired" (coded as 0);
- Overall C&IT score (the sum of individual C&IT item scores). The psychometric properties for the computer and information technology scale are acceptable, with a reliability alpha of .78. The interrelationship between C&IT items ranges from .102 to .735. The nine C&IT items are:

    1. Used a computer or word processor to prepare reports or papers.
    2. Used e-mail to communicate with an instructor or other students.
    3. Used a computer tutorial to learn material for a course or developmental/remedial program.
    4. Participated in class discussions using an electronic medium (e-mail, list-serve, chat group, etc.).
    5. Searched the World Wide Web or Internet for information related to a course.
    6. Used a computer to retrieve materials from a library not at this institution.
    7. Used a computer to produce visual displays of information (charts, graphs, spreadsheet, etc.).
    8. Used a computer to analyze data (statistics, forecasting, etc.).

9. Developed a Web page or multimedia presentation.

- The engagement measures included the three good practice indicators: student-faculty contact, cooperation among students, and active learning. The items in each good practice indicator and the psychometric properties of the scales are presented in Appendix.

Data Analysis

The analysis was performed in two steps. First, we used analysis of covariance (ANCOVA) to estimate the impact of campus wiredness on the nature and frequency of computer and information technology use, including each of nine different uses ranging from "writing papers" to "developing web page and multimedia presentations" as well as an overall measure of use of C&IT defined as the sum of the frequency of the nine types of use. Then, we used multivariate analysis of covariance (MANCOVA) to estimate a covariate model of the influence of campus wiredness on the good practice variables, such as student-faculty contact, peer cooperation, and active learning. The independent variable was the dichotomized measure of campus wiredness (more wired was coded 1 and less wired coded 0). We then repeated the analyses for both men and women separately to determine whether the relationships between campus wiredness, uses of technology, and student engagement in the three good practices differed for men and women. Finally, we repeated these analyses for both traditional and non-traditional students.

We calculated the effect size of campus wiredness (more wired *vs.* less wired) on the outcome variables following Cohen's (1977) suggestions where anything below .20 was considered a trivial effect, between .20 and .50 a small effect; between .50 and .80 a medium effect; and above .80 a large effect.

Results

Table 1 presents the descriptive statistics of the indicators on computing experience and good practices for all students and students in more wired and less wired campuses. The three most frequent C&IT activities were using a computer for word processing, using e-mail to communicate with an instructor or classmates, and searching the Internet for course material (Table 1). The three least frequent C&IT activities were developing a Web page or multimedia presentation, participating in class discussions via an electronic medium, and retrieving off-campus materials. This trend is similar for students at both more wired and less wired campuses, but "using a computer tutorial" was among the least frequent activities for students at less wired campuses. Students at more wired campuses had slightly higher average scores on eight of nine computing items (tied for retrieving off-campus library materials) and the total computing experience. The three good practice measures also very slightly favored students at wired campuses.

(Insert Table 1 about here)

Tables 2 and 3 compare the computing experiences and exposure to good educational practices at more and less wired campuses by sex and age. Again, the same general patterns of using computer and information technology were evident. The three most frequent C&IT activities were using a computer for word processing, using e-mail to communicate with an instructor or classmates, and searching the Internet for course material. The three least frequent C&IT activities were developing a Web page or multimedia presentation, participating in class discussions via an electronic medium, and retrieving off-campus materials (or using computer tutorial). Men and women who attended a more wired campus had slightly higher average scores on eight of nine computing items (tied for retrieving off-campus library materials) and the total computing experience. Consistent with the findings reported by Kuh and Hu (in press), men used C&IT slightly more frequently than women and also preferred more advanced forms of C&IT. Women opted more often for word processing and e-mail, with men more frequently using visual displays, data analysis, and multimedia presentation options.

The general pattern of more frequent use of technology favoring more wired campuses was also true for traditional-age students. However, non-traditional (older) students showed a somewhat mixed pattern, though the overall computing score (C&IT) favored students at the more wired campuses with the advantage due primarily to the more frequent use of the more common forms of C&IT such as e-mail.

(Insert Tables 2 and 3 about here)

The differences in the three good practice indicators for students at more or less wired campuses were small and mixed in direction. Women had higher scores on the good practice indicators at both more and less wired campuses. Traditional-age students reported more contact with their faculty members and more interactions with their peers compared with older, non-traditional students. At the same time, non-traditional students were more engaged in active learning activities than were traditional students (Table 3).

To better understand the relationships between campus wiredness and student experiences with computing and information technology and good educational practices, we must control the potentially confounding effects of student background and institutional characteristics such as control and selectivity. Table 4 presents the results from the ANCOVA and MANCOVA analyses that take these confounding effects into account.

Overall, students on more wired campuses were much more likely to use computer and information technology (an effect size of .32). This means that students at the "more wired" schools had on average about a .32 standard deviation advantage in the overall use of computer and information technology compared with their counterparts attending less wired institutions. This pattern was consistent for all nine forms of the technology represented on the CSEQ, though the effect sizes were generally small and in some cases trivial. This pattern of computing experience was consistent for men, women, and traditional students. However, the degree of wiredness did not affect older, non-traditional students except with regard to the use of e-mail, which favored students at the more wired campuses.

(Insert Table 4 about here)

Statistically significant differences for student-faculty contact and active learning favored all but non-traditional students at the "more wired" campuses. However, because the effect sizes were lower than .20 these differences are not likely to have any practical importance. No differences were found with regard to peer cooperation for students as a whole or for any sub-group nor was campus wiredness related to the experiences of non-traditional students with any of the three good educational practices.

Limitations

This study is limited in several ways. First, the measures of C&IT and other student experiences used in the study were limited to those represented on the CSEQ. The CSEQ C&IT items do not exhaustive the ever-expanding range of possible computing and information technology available to students on many campuses that conceivably could affect their learning in positive or negative ways. For example, instructor-designed use of hypermedia and hypertext are not specifically mentioned nor are activities that represent non-educational uses of C&IT such as surfing the Web or playing games. Thus, these data do not shed light on such potential debilitating behaviors associated with C&IT such as Internet addiction or cocooning (Kandell, 1998; Reisberg, 2000).

Second, this study is based on a convenience sample of institutions participating in the CSEQ research program from a recent two-year period. If data from other institutions were available or a longer time period was covered perhaps the results would differ. Also, the measure of campus wiredness is based solely on the Yahoo! Internet Life survey. Other sources of data about the availability and use of C&IT might have yielded other results.

Discussion

Attending a wired campus seems to have positive though trivial in magnitude benefits on engagement in good educational practices. Although the use of computing and information technology for word processing and e-mail is practically universal, students attending a wired campus use these forms of technology even more than their counterparts elsewhere. In the case of e-mail this was also true for older students.

Kuh and Hu (in press) found that C&IT use was associated in complex, statistically significant ways with the overall amount of effort students devote to educationally purposeful college activities. Academic effort combined with C&IT use in turn yielded greater gains in certain areas (e.g., science and technology, vocational preparation, and intellectual development). Taken together, the findings of Kuh and Hu (in press) and this study confirm the popular view that C&IT use is positively related to college student learning and personal development. Equally important, the pervasive presence of C&IT at more wired campuses as determined in the present study did not have any negative effects, but ranged from benign to slightly positive on the outcome variables of interest. Even so, additional research is needed to determine the extent to which C&IT is being used for purposes that may be incompatible with the educational missions of postsecondary institutions, such as surfing the web, playing games, or for personal use (e.g., communicating with family, friends, and employers).

Several studies suggest that use of C&IT may differ depending on student background characteristics (Kuh & Hu, in press; Pew Internet and American Life, 2000). For instance, Kuh and Hu (in press) found that overall men more frequently used C&IT compared with women. But in terms of different types of C&IT use, women favored word processing and e-mail, with men more frequently using visual displays, data analysis, and multimedia presentation options. The findings in this study indicated the degree of campus wiredness benefited both women and men comparably with regard to their computing experiences and exposure to good educational practices. The only major difference related to student background characteristics was that non-traditional students seem to benefit less from campus wiredness than traditional students, with the single exception of e-mail use. Though some have argued that computing and information technology may be less accessible to students of color compared with White students (Malveaux, 2000), this was not the case in our previous study of C&IT use (Kuh & Hu, in press). This may be because accessibility to C&IT is less of a problem once students are in college. Additional research into these and related questions would be welcome.

We did not conduct any kind of cost-benefit analysis in assessing the merits of C&IT on student engagement in good educational practices or the frequency and satisfaction with the availability or use of the technology. The differences favoring students at the more wired campuses were generally so small so as to not be practically significant. Perhaps a careful examination of the investments made by more wired campuses in technology and additional measures of student learning outcomes would suggest that some of this money might be better spent on other types of resources (e.g., additional faculty members) if it can be demonstrated that other types of educational experiences yield greater benefits. But it is also possible that more precise estimates of campus wiredness would discover more sizeable differences in the magnitude of the relationships between C&IT and educationally purposeful student experiences. That is, this study divided institutions into only two groups (more wired, less wired). Should the rankings of wiredness become more stable, it would be prudent to determine if the strength of the relationships between C&IT and student experiences increases.

Conclusion

Computer and information technology represents a substantial investment of university resources that fortunately seems to be generally beneficial for virtually all types of students. The results of this study show that the degree of campus wiredness was positively associated with student use of computer and information technology, although the effect sizes were generally small in magnitude. The evidence also suggests that campus wiredness did not reduce student engagement in good practices such as student-faculty contact, cooperation among students, and active learning. In fact, students at more wired schools actually reported more contact with their teachers and more substantive interaction with their peers. In addition, there was no gender difference in the relationship between the degree of campus wiredness and student computing experience and engagement in good practices. That said, older, non-traditional students did not seem to benefit as much as their younger counterparts.

On balance, it appears that the presence of computing and information technology, even on campuses where it is especially prevalent, does not hinder the educational process. Additional research is needed to corroborate these findings and to better understand the effects of technology use on student learning and personal development.

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TABLE 1
Descriptive Statistics of Campus Wiredness, Computing Experience, and Good Practices

VARIABLES	All		More Wired		Less Wired	
	Mean (%)	S.D.	Mean (%)	S.D.	Mean (%)	S.D.
1. Used computer/word processor for paper	3.72	0.61	3.76	0.56	3.71	0.63
2. Used e-mail to communicate with class	3.41	0.92	3.61	0.76	3.33	0.97
3. Used computer tutorial to learn material	1.88	1.00	2.08	1.07	1.79	0.95
4. Joined in electronic class discussions	1.71	1.00	1.90	1.08	1.64	0.96
5. Searched Internet for course material	3.16	0.92	3.25	0.89	3.12	0.93
6. Retrieved off-campus library materials	1.80	1.01	1.80	1.03	1.80	1.00
7. Made visual displays with computer	2.36	1.06	2.47	1.07	2.31	1.05
8. Used a computer to analyze data	1.95	1.03	2.05	1.07	1.91	1.01
9. Developed Web page, multimedia presentation	1.63	0.94	1.72	1.02	1.59	0.91
C&IT Overall Score	21.61	5.19	22.65	5.36	21.19	5.06
GOOD PRACTICE INDICATORS						
Faculty-Student Contact	23.01	5.58	23.04	5.43	23.00	5.64
Student Cooperation	20.80	4.74	20.84	4.72	20.78	4.74
Active Learning	41.87	7.57	42.19	7.65	41.74	7.53
N	18,344		5,315		13,029	

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TABLE 2

Descriptive Statistics of Computing Experience and Good Practices By Gender in More and Less Wired Campuses

VARIABLES	Men				Women			
	More Wired		Less Wired		More Wired		Less Wired	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
COMPUTING EXPERIENCES								
1. Used computer/word processor for paper	3.72	0.60	3.66	0.61	3.79	0.53	3.74	0.61
2. Used e-mail to communicate with class	3.51	0.81	3.19	0.92	3.66	0.73	3.40	0.93
3. Used computer tutorial to learn material	2.09	1.05	1.86	1.00	2.07	1.08	1.76	0.94
4. Joined in electronic class discussions	1.94	1.09	1.68	1.00	1.88	1.07	1.61	0.95
5. Searched Internet for course material	3.23	0.87	3.10	0.92	3.27	0.90	3.13	0.94
6. Retrieved off-campus library materials	1.89	1.05	1.87	1.01	1.75	1.02	1.76	0.99
7. Made visual displays with computer	2.54	1.04	2.46	1.06	2.43	1.08	2.22	1.04
8. Used a computer to analyze data	2.22	1.09	2.15	1.03	1.95	1.05	1.77	0.96
9. Developed Web page, multimedia presentation	1.94	1.09	1.76	0.94	1.59	0.95	1.49	0.83
C&IT Overall Score	23.07	5.63	21.73	5.19	22.39	5.18	20.88	4.78
GOOD PRACTICE INDICATORS								
Faculty-Student Contact	23.01	5.58	22.98	5.58	23.05	5.34	23.00	5.55
Student Cooperation	20.46	4.83	20.35	4.74	21.06	4.63	21.03	4.67
Active Learning	41.21	7.58	40.67	7.57	42.77	7.64	42.36	7.36
N	1,987		4,777		3,328		8,252	

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TABLE 3

Descriptive Statistics of Computing Experience and Good Practices by Age at More and Less Wired Campuses

VARIABLES	Traditional				Non-Traditional			
	More Wired		Less Wired		More Wired		Less Wired	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
COMPUTING EXPERIENCES								
1. Used computer/word processor for paper	3.77	0.53	3.73	0.61	3.54	0.86	3.54	0.81
2. Used e-mail to communicate with class	3.64	0.72	3.39	0.92	2.94	1.10	2.66	1.12
3. Used computer tutorial to learn material	2.09	1.07	1.79	0.95	1.84	0.99	1.85	1.00
4. Joined in electronic class discussions	1.91	1.08	1.64	0.97	1.60	0.90	1.59	0.92
5. Searched Internet for course material	3.27	0.88	3.13	0.93	3.02	1.01	2.99	0.99
6. Retrieved off-campus library materials	1.80	1.03	1.79	1.00	1.90	1.07	1.91	1.01
7. Made visual displays with computer	2.47	1.07	2.31	1.05	2.40	1.07	2.33	1.07
8. Used a computer to analyze data	2.06	1.07	1.91	1.01	1.90	1.02	1.95	1.05
9. Developed Web page, multimedia presentation	1.73	1.02	1.59	0.91	1.60	0.87	1.63	0.91
C&IT Overall Score	22.74	5.32	21.27	4.98	20.74	5.76	20.44	5.68
GOOD PRACTICE INDICATORS								
Faculty-Student Contact	23.08	5.39	23.07	5.65	22.17	6.01	22.29	5.50
Student Cooperation	20.93	4.71	20.99	4.75	18.94	4.41	18.76	4.20
Active Learning	42.12	7.65	41.59	7.56	43.56	7.51	43.19	7.08
N	5,068		11,805		247		1,224	

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TABLE 4

Effect Size of Campus Wiredness on Student Computing Experiences and Good Practices

	All		Men		Women		Traditional		Non-Traditional	
ANOVA										
1. Used computer/word processor for paper	0.10	*	0.12	*	0.09	*	0.10	*	0.06	
2. Used e-mail to communicate with class	**0.23**	*	**0.31**	*	0.19	*	**0.23**	*	**0.29**	*
3. Used computer tutorial to learn material	**0.28**	*	**0.25**	*	**0.29**	*	**0.29**	*	0.00	
4. Joined in electronic class discussions	**0.24**	*	**0.26**	*	**0.24**	*	**0.26**	*	0.00	
5. Searched Internet for course material	0.17	*	**0.20**	*	0.16	*	0.18	*	0.01	
6. Retrieved off-campus library materials	0.09	*	0.11	*	0.07	*	0.09	*	0.09	
7. Made visual displays with computer	**0.23**	*	**0.20**	*	**0.25**	*	**0.23**	*	0.11	
8. Used a computer to analyze data	**0.20**	*	0.18	*	**0.22**	*	**0.21**	*	0.01	
9. Developed Web page, multimedia presentation	0.18	*	**0.24**	*	0.14	*	0.19	*	0.00	
C&IT Overall Score	**0.32**	*	**0.35**	*	**0.31**	*	**0.33**	*	0.13	
MANOVA										
Faculty-Student Contact	0.08	*	0.11	*	0.06	*	0.08	*	0.07	
Student Cooperation	0.02		0.06		0.00		0.02		0.04	
Active Learning	0.11	*	0.13	*	0.09	*	0.11	*	0.10	
N	18,344		6,764		11,580		16,873		1,471	

Note: Effect sizes over .20 were bolded; Less wired campuses were the reference group; * $p < .001$.

APPENDIX
CSEQ Items That Represent Good Practice in Undergraduate Education

STUDENT-FACULTY CONTACT

The alpha coefficient for computing experience is 0.82, and the item intercorrelations range from 0.03 to 0.58.

1. Asked a librarian or staff member for help in finding information on some topic.
2. Asked your instructor for information related to a course you were taking (grades, make-up work, assignments, etc.).
3. Discussed your academic program or course selection with a faculty member.
4. Discussed ideas for a term paper or other class project with a faculty member.
5. Discussed your career plans and ambitions with a faculty member.
6. Socialized with a faculty member outside the classroom (had a snack or soft drink, etc.)
7. Participated with other students in a discussion with one or more faculty members outside of class.
8. Worked with a faculty member on a research project.
9. Used e-mail to communicate with an instructor or other students.
10. Met with a faculty member or staff advisor to discuss the activities of a group or organization.
11. Talked with a faculty member, counselor or other staff member about personal concerns.

COOPERATION AMONG STUDENTS

The alpha coefficient for computing experience is 0.70, and the item intercorrelations range from 0.03 to 0.61.

1. Worked on a class assignment, project, or presentation with other students.
2. Tried to explain material from a course to someone else (another student, friend, co-worker, family member).
3. Met other students at some campus location (campus center, etc.) for a discussion.
4. Played a team sport (intramural, club, intercollegiate).
5. Worked on a campus committee, student organization, or project (publications, student government, special event, etc.).
6. Worked on an off-campus committee, organization, or project (civic, group, church group, community event, etc.).
7. Managed or provided leadership for a club or organization, on or off the campus.
8. Discussed with another student, friend, or family member why some people get along smoothly, and others do not.
9. Asked a friend for help with a personal problem.

ACTIVE LEARNING

The alpha coefficient for computing experience is 0.82, and the item intercorrelations range from 0.01 to 0.49.

1. Gone back to read a basic reference or document that other authors had referred to.
2. Made a judgment about the quality of information obtained from the library, World Wide Web, or other sources.
3. Participated in class discussions using an electronic medium (e-mail, list-serve, chat group, etc.).
4. Took detailed notes during class.
5. Contributed to class discussions.
6. Developed a role-play, case study, or simulation for a class.
7. Tried to see how different facts and ideas fit together.
8. Summarized major points and information from your class notes or readings.
9. Applied material learned in a class to other areas (your job or internship, other courses, relationships with friends, family, co-workers, etc.).
10. Used information or experience from other areas of your life (job, internship, interactions with others) in class discussions or assignments.
11. Worked on a paper or project where you had to integrate ideas from various sources.
12. Used a dictionary or thesaurus to look up the proper meaning of words.
13. Used a campus learning lab or center to improve study or academic skills (reading, writing, etc.).
14. Read articles or books about personal growth, self-improvement, or social development.
15. Read articles about scientific or mathematical theories or concepts in addition to those assigned for a class.
16. Identified with a character in a book, movie, or television show and wondered what you might have done under similar circumstances.
17. Taken a test to measure your abilities, interests, or attitudes.

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