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Student Experiences with Information Technology and their Relationship to Other Aspects of Student Engagement

Thomas F. Nelson Laird
Research Analyst
Indiana University Center for Postsecondary Research
1900 East Tenth Street
Eigenmann Hall, Suite 419
Bloomington, IN 47406-7512
tflaird@indiana.edu
Phone: 812.856.6056

George D. Kuh
Chancellor's Professor and Director
Indiana University Center for Postsecondary Research

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Abstract

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Considerable efforts have been made to get students to use information technology for educational purposes. This study uses data from the 2003 administration of the National Survey of Student Engagement (NSSE) to investigate the relationships between student uses of information technology and other forms of student engagement. The results suggest that there is a strong positive relationship between using information technology for educational purposes and other effective educational practices such as active and collaborative learning and student-faculty interaction. The results also raise questions about whether engagement with information technology should be viewed as a form of engagement in and of itself. Perhaps when students use information technology it increases the opportunities for other types of engagement.

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On college campuses across the country, students, faculty, and administrators are using computers, the internet, and other forms of information technology for various educational purposes. No longer are email, the World Wide Web (WWW), and word processing flashy new tools used by a select few. Rather, using these tools is now as commonplace as using a telephone or backpack. It appears that we have, indeed, reached a point where certain applications of information technology are as ubiquitous as many just a decade ago predicted (Dolence & Norris, 1995; Green, 1996).

The results from studies of student information technology use for academic purposes are promising. For example, The Institute for Higher Education Policy (1999) reported that using email for academic work grew from 8% in 1994 to 44% by 1998. The percentage of courses using the internet doubled from 15% in 1996 to 30% by 1998. A more recent national survey found that 84% of college students owned a computer and that 99% used the internet, with 66% doing so daily (Student Monitor, 2003). Students appear to use the internet to communicate with others and to find materials and assistance with their coursework (Hu & Kuh, 2001; Student Monitor, 2003).

Given the relative speed with which computers and the internet have made their way into higher education, many question whether these technologies offer educational benefits. The limited evidence to date, mostly from classroom-level investigations, suggests that students' use of information technology has a positive effect on several important educational outcomes. For example, a study of course redesign projects at several institutions suggests that the incorporation of technology into a course results in greater learning, measured in various ways, for students in

the redesigned course compared to similar courses without the redesign (Twigg, 2004). Similarly, the few studies on general college populations (i.e., not at the classroom-level) indicate that student use of information technology positively affects a variety of outcomes such as student self-reported gains in general education, personal development, and intellectual development (Hu & Kuh, 2001; Kuh & Hu, 2001; Kuh & Vesper, 2001).

However, some studies show mixed results. For example, Flowers, Pascarella, and Pierson (2000) found that using information technology positively influenced cognitive development for two-year college students, but not necessarily for students at four-year colleges. The researchers conjectured that the mixed findings may be associated with students from higher socioeconomic backgrounds being advantaged in terms of information technology use (Gladieux & Swail, 1999). In addition, those with higher ability levels (Dillon & Gabbard, 1998) and those attending institutions that are more "wired" (Hu & Kuh, 2001) are also more likely to use and benefit from information technology.

Differential use of information technology by different types of students has led to questions about the possible negative effects of information technology. For example, Reisberg (2000) suggests that uses of information technology may distract students from participating in empirically confirmed effective educational practices. Arguably, certain technologies, such as gaming machines like Nintendo or Xbox, and applications such as downloading music may have few educational benefits. At the same time, there is evidence to suggest that educationally purposeful uses of information technology, such as emailing faculty members or other students about assignments, can promote collaboration among students (Alavi, 1994; Oblinger & Maruyama, 1996) as well as foster more frequent contacts between students and faculty (Hu & Kuh, 2001; Kuh & Hu, 2001; Wingard, 2004).

If using information technology is potentially an effective educational practice, what is its relationship to other such practices? Kuh and Hu (2001) suggest that using information technology has a strong positive relationship with an overall measure of student engagement. In a study of "best wired campuses" (institutions that have made large investments in technology), students report slightly more frequent contact with faculty and participate more in active learning activities compared with their counterparts attending less wired campuses (Hu & Kuh, 2001). These results point to a positive link between information technology use and engagement in effective educational practices.

Most of the extant research treats student use of information technology as a separate form of student engagement. However, as Kennedy (2000) suggests, perhaps information technology is an avenue for students to increase their engagement in areas such as active and collaborative learning or student-faculty interaction. "Used appropriately and in concert with powerful pedagogical approaches, technology is supposed to enhance student learning productivity" (Kuh & Vesper, 2001, p. 87). There is evidence that this is the case (e.g., Kuh & Hu, 2001; Twigg, 2004), but it is not clear, especially now that technology use is so commonplace, whether we should be treating student uses of information technology as separate from other forms of engagement or as one of several avenues to promote or enhance other forms of student engagement with effective educational practices.

Purpose of the Study

This study expands our understanding of the relationships between students' uses of information technology and their involvement in other educationally effective practices that prior research shows lead to desired educational outcomes. Our exploration proceeds along two paths. The objective of the first is to develop a scale that measures student use of information

technology and to test the direction and strength of its relationships with other established indicators of student engagement. The objective of the second path is to examine the merits of shifting our perspective to view particular uses of information technology as a component of other forms of student engagement rather than a form in and of itself. That is, we seek to determine whether engagement with information technology is its own form of engagement or whether information technology is a mechanism through which students engage is existing effective educational practices. For example, emailing faculty about academic matters has been treated as a way that students use information technology for educationally relevant purposes. However, from another perspective, we could conceptualize use of email as a way for students to create more opportunities for interacting with their instructors.

Methods

Data Source

The data for this study come from the 2003 administration of the National Survey of Student Engagement (NSSE), an annual survey of college students at four-year institutions that measures students' participation in educational experiences that prior research has connected to valued outcomes (Chickering & Gamson, 1987; Kuh, 2001a, 2003). About 350,000 first-year students and seniors were randomly selected from files provided by the 437 participating colleges and universities. The NSSE standard sampling scheme calls for an equal number of first-year and senior students to be selected with the size determined by the number of undergraduate students enrolled at the institution. Students at about three-quarters of the institutions had the option of responding either via a traditional paper questionnaire or online. About a quarter of the colleges and universities opted to administer only online (students received an introduction letter through the mail and all further contact was online).

Response rates at the participating institutions ranged from 7% to 78% with an average institutional response rate for NSSE 2003 of 43%. The response rates at paper schools (institutions where students had the option of completing either the paper or the Web version of the survey) were similar to those of Web-only schools (institutions where students only had the option of completing the survey online) with averages of 43% and 44%, respectively. About 48% of the respondents completed the paper version of the survey and approximately 52% completed it using the Web.

The survey itself, *The College Student Report*, focuses on how much students participate in effective educational practices. For example, students are asked to identify how often they make class presentations, participate in a community-based project as a part of a course, and work with faculty members on activities other than coursework. In addition, students identify the degree to which their courses emphasize different mental processes (e.g., memorizing and synthesizing), how many hours per week they spend studying, working, or participating in co-curricular activities, as well as how they would characterize their relationships with people on campus (to see the survey visit the NSSE website, www.iub.edu/~nsse).

Because the NSSE survey is intentionally short, it is not possible to examine every worthwhile topic in depth. In addition, the behaviors and conditions represented by the survey items were selected because of their demonstrated relationship to desired learning outcomes. Because the research literature linking information technology and learning is sparse, few of the survey questions address this area. For example, only two items on the core survey in 2003 focus on the frequency with which students utilize information technology (i.e., how often have you used an electronic medium to discuss or complete an assignment and how often have you used e-mail to communicate with an instructor).

Each year, NSSE tests new survey items. In 2003, based on inquiries from several groups (e.g., librarians) and from large universities, a series of items about students' experiences with information technology were added to the end of the online survey to further investigate students' experiences with information technology and test items for possible inclusion in future administrations.

Measures

The technology items in Table 1 were developed over a few months. To identify behaviors and activities related to information technology worth exploring, we sought advice from several experts. Based on their suggestions and the available literature we developed a series of questions that represented a wide range of information technology uses that had the potential to enhance student learning as well as some that could conceivably be counterproductive, such as Game Boys. From a pool of about 30 items we selected about 20 and circulated them to our expert panel. After receiving their feedback and making final revisions we ultimately decided to include 18 on the 2003 online version of NSSE. The experimental information technology items that are the focus of this study include questions about the frequency with which students use information technology (e.g., computers and the WWW) for academic and non-academic purposes, the amount of time students spend online, and the amount their instructors use and require the use of information technology (see Table 1 for the complete list of items tested in 2003).

Beyond the technology items, two other groups of measures are used in this study. Each year, NSSE calculates national and institutional performance on five clusters of effective educational practice (Kuh, 2001a, 2003). They are: academic challenge, active and collaborative

learning, student-faculty interaction, enriching educational experiences, and supportive campus environment.

Academic challenge measures the amount and difficulty of the academic work required of students, the amount of time they devote to preparing for class, and their perceptions of the degree to which the institution emphasizes academic achievement. Active and collaborative learning is a measure of the frequency with which students work independently or with peers to solve problems, inside and outside the classroom and participate in other activities that encourage them to connect their learning to real world problems (e.g., community service). Student-faculty interaction reflects the frequency with which students interact or work with their instructors in and outside of class. Enriching educational experiences measures students' participation in a wide array of activities that have educationally beneficial effects on many students. Supportive campus environment is a measure of the degree to which students' perceive that their institution supports their academic and social needs and the quality of relations among different groups on campus (other students, faculty, administrators).

The scores for each of the five clusters, commonly known as benchmarks of effective educational practice, are based on students' responses to 42 core survey items that are grouped to measure student engagement in each of these areas. Using the item groupings (see National Survey of Student Engagement, 2003), student-level scales that parallel the benchmarks were created for this study. The reliability of each scale is reported in Table 2.

Additionally, the analyses will use the 22 items from the first question on the core survey. Many of these items are used in the construction of the scales described above. The question stem and response categories for these items are identical to those of most of the technology items and consequently these items provide the base for an exploratory factor analysis (described

below) that examines whether engagement with information technology is a stand alone concept or a part of other forms of engagement.

Sample

The sample for this study consists of over 60,000 students from more than 420 four-year colleges and universities across the country. Out of the total sample, approximately 60% are female, 74% are white (5% African American, 6% Asian, 4% Hispanic, 1% Native American, and 11% other racial/ethnic background), and 56% are first-year students. In addition, 16% have transferred from another institution, 72% live on campus, and 94% are full-time students.

All of the students completed the online version of the NSSE survey including the experimental information technology questions. Typically, online completers differ from those students who fill out the paper survey. For example, a larger percentage of women (70%) and students of certain racial/ethnic groups (African American, Latino/a, and American Indian) fill out the paper version of the survey. Also, paper completers are more likely to be older, part-time, live off campus, have parents with less formal education, and have transferred from a different institution. These differences might explain why paper completers score slightly lower on four out of the five established indicators of student engagement than those that fill the survey out online.

Analyses

As mentioned earlier, we explore the relationships between student engagement with information technology and other indicators of student engagement along two distinct lines. First, we examine, at the item level, how students' uses of information technology relate to other aspects of engagement. Additionally, factor analysis on the technology items is used to derive information technology engagement scales. Several of the technology items are not used in this

factor analysis, which like prior factor analyses using NSSE data (e.g., Kuh, 2001b) employs principle components extraction with an oblique rotation (Promax). Item 2i (see Table 1) was dropped because it is about librarians more than about information technology. Items 4 and 5 were dropped due to the lack of variability in these items and the greater amount of missing responses. Items 6a and b were dropped because their scale of measurement was different and the nature of the questions differs markedly from that of the other items (if left in the analysis, these two items form their own factor). Item 7 was dropped due to the marked difference in the content of the question from those included.

The relationships between the engagement with information technology scales and the five established NSSE scales are explored using partial correlations that control for student background characteristics (e.g., gender, race, and parental education) and several aspects of their collegiate experience (e.g., transfer status and membership in a social fraternity or sorority). In creating the technology scales in this way and correlating them with the other scales, we have assumed that engagement with information technology is a separate, but related, form of student engagement.

In our second line of inquiry we abandon the assumption that engagement with information technology is a separate construct and explore how the factor structure of question 1 from the core survey changes with the inclusion of several of the technology items. Four technology items (2a, b, c, and d) were selected for inclusion in this factor analysis. Given that question 1 from the core survey had 22 items, we made an effort to keep the number of technology items added at around 4 or 5, the approximate number of items per factor that comes from an analysis on the question 1 items alone. The top 4 loading items from the one-factor solution for the technology item factor analysis (see Table 5 in the results) were selected as they form a coherent

cluster of items that may hang together as a separate indicator of engagement with technology. As with the other factor analyses in this study and prior analyses using NSSE data (e.g., Kuh, 2001b), those for this part of the analysis use principle components extraction with an oblique rotation.

Results

In general, students' responses to the technology items suggest that many students use information technology regularly for personal and academic uses and to communicate with other students and instructors. For example, of the respondents to the technology items, 73% of first-year students and 69% of seniors spent more than 5 hours per week online for any reason; whereas almost two-fifths (38% and 39% for first-year students and seniors, respectively) spent more than 5 hours per week online doing academic work. Most students (first-year students, 78%; seniors, 81%) report that instructors frequently (often or very often) require the use of information technology (e.g., WWW, internet, computer conferencing, etc.). Over half of all students (first-year students, 51%; seniors, 58%), frequently communicated with classmates online in order to complete academic work. In addition, 80% of first-year students and 86% of seniors frequently used the WWW to obtain resources while slightly fewer (71% of first-year students and 79% of seniors) made judgments about the quality of those resources.

One troubling note is that a sizeable majority (87%) of all students say that their peers at least "sometimes" copy and paste information from the WWW or internet for reports/papers without citing the source. Between one quarter (25% of first-year students) and about three tenths (31% of seniors) said their peers did this frequently.

Those students who frequently (often or very often) use information technology for classroom-related activities or assignments are more likely than their counterparts to report that

their courses frequently ("quite a bit" or "very much") emphasize higher order thinking skills, a component of academic challenge. For example, of those students who frequently communicated with classmates online to complete academic work, 84% said their courses regularly emphasized applying theories or concepts to practical problems or in new situations compared to 70% for those who did not frequently communicate with classmates online. Those same students also were more likely to report more frequent interactions with faculty; that is, 64% said they "frequently" discussed grades or assignments with an instructor compared with only 44% of those who infrequently communicated with classmates online. Similarly, of those students who frequently use their institutions' library websites to obtain resources, 77% report that their courses emphasize synthesizing and organizing ideas, information, and experiences and 43% report discussing career plans with faculty frequently. The comparable figures for students who infrequently use their institutions' library websites are 63% and 27% respectively.

In addition, students who report that their instructors either frequently require the use of information technology or frequently use it in class are more likely to report frequently working in groups outside of class. For example, of those students who report that their faculty frequently use information technology in class, 59% indicate that they frequently work in groups outside of class (with or without technology). This compares to 41% for those students who report that their faculty infrequently use information technology in class. It also appears that most students spend a portion of their time studying online. Of those students who spend more than 10 hours studying per week, 47% spend more than 5 hours and fully 98% spend at least an hour per week online for academic purposes.

Engagement with Information Technology Scale

Table 4 presents three possible factor solutions from the analysis performed on a subset of the technology items (as described in the methods section, several items were not included in the analyses for reasons related to item content and missing data). The two and three factor solutions split the technology items into a group of classroom-related items and a set (or two) related to using information technology to find resources and communicate with faculty. The cross-loading of a few of items in these two solutions coupled with the relatively low reliability of the second or second and third groups of items led us to favor the single factor solution. When taken as a single group of items, the technology items create a scale that is reliable (α = 0.83) and that we interpret as a general indicator of students' engagement with information technology for academic purposes.

By taking the four highest loading items (2a – d in Table 1) from the one factor solution in Table 4, we created a short version of the scale that is reliable at a comparable level to the large scale (α = 0.79), but with far fewer items. This short version of the scale contains only classroom-related items, which are the items used in the subsequent factor analysis with other core survey items. It is included in this section for comparison purposes.

After controlling for student background characteristics (e.g., gender, race, and parents' education) and several characteristics of students' collegiate experience (e.g., transfer status and major), the partial correlations in Table 5 indicate that engagement with information technology is positively associated with the five aspects of student engagement derived from the core survey. It is most strongly associated with academic challenge, active and collaborative learning, and student-faculty interaction (partial correlations range from 0.41 to 0.48) and the relationships are approximately as strong as those that exist among the five other engagement scales.

The partial correlations between the short version of the scale and the other engagement scales are generally weaker than those for the long version. However, the relationship between the short version and active and collaborative learning is only slightly less and remains the strongest of the relationships. This result is not surprising given the content of the items and it foreshadows the results of the factor analysis that contains the items from the short version of the information technology scale and items from question 1 from the core survey, the question that contains the active and collaborative learning items.

Factor Analysis with Technology and Core Survey Items

Table 6 reports the results of two factor analyses. The first is an analysis of only those items from question 1 on the core survey. This analysis was performed to compare to previous analyses on the items (see Kuh, 2001b) as well as to provide a base for comparison to the second analysis which includes four of the experimental technology items.

Without the technology items included, the factor structure remains largely the same as in previous analyses (see Kuh, 2001b). Four factors are extracted and, after rotation, define largely the same groups of items. Three items load differently in the analysis for this study than in the previous work. The core survey item about using email to communicate with an instructor (one of the two core items about information technology) previously loaded higher on the first factor, a factor largely defined by student-faculty interaction with a few items that can be viewed as active learning items (these load lowest on the factor). In this analysis, it loads slightly higher on the second factor, a factor defined by collaborative learning items, than on the first factor. The item about the frequency with which students participated in a community-based project does not load highly on any factor in the previous analysis or the first analysis for this study, but switches from loading on the second factor in the previous analysis to the first factor in this study.

Similarly, the item about including diverse perspectives in class loads on factors three and four, but switches from loading higher on factor four, a collection of items about the amount of effort students put into their coursework, in the previous analysis to loading slightly higher on factor three, a factor largely about diverse interactions, in this analysis.

When the four experimental technology items are added into the analysis, the factor structure is still largely the same as in the first analysis, something that remains the case even if three, five, or six factors are extracted. Since they are about students' use of information technology to collaborate with others and give class presentations, it is mot surprising that the experimental technology items load with the collaborative learning factor in the second analysis. In fact, the experimental items become the highest loading items on that factor and the two lowest loading items from the first analysis end up loading higher on factor one. The result is a group of items that is squarely about student collaboration with peers for academic purposes.

Interestingly, the collaboration group of items from the first analysis is only marginally reliable as a scale ($\alpha = 0.65$). However, with the addition of the experimental technology items and the shifting of two items out of the grouping, the resulting scale is more reliable ($\alpha = 0.79$), suggesting that this grouping more clearly identifies the concept underlying the items.

Notably absent from this analysis is a single factor containing all of the technology-related items. In the four factor solution, the four experimental items and the core survey item about using an electronic medium to work on an assignment load on factor two, but the item about emailing an instructor loads highest on the student-faculty interaction factor. Even if the analysis allows for five factors, the experimental technology items all still load over 0.47 on the collaborative learning factor, while the two core tech items and one faculty interaction item split off to form a factor on which one of the experimental items also loads above 0.50. The four

factor solution is preferred over the five factor solution because that fifth factor did not seem distinct or meaningfully different from the first two factors.

Limitations

The primary limitations of this study relate to the sample and to the information technology items used in the study. Only students who completed the NSSE 2003 survey online were given the experimental technology items. It is possible that these students, many of whom chose to take the survey online, use information technology more frequently than those who filled out the paper version of the survey (Carini, Hayek, Kuh, Kennedy, & Ouimet, 2003). Because all of the data used in this study come from the online administration of NSSE 2003, it is not possible for us to test whether students who choose to use the web are more engaged with information technology. There is, however, some indication in the results that the two groups differ in their background characteristics and levels of engagement in other areas. Consequently, the results of this study might change slightly if we were able to repeat the analyses within the broader sample. For example, the correlations between the engagement with information technology scale and the other engagement scales might not be as strong in the entire NSSE 2003 sample.

The items used in the technology scale were not a priori developed for the purpose of exploratory factor analysis with other engagement items. Had they been developed with such a purpose in mind, different questions about student uses of information technology may have been included that would have consequently altered the results of the study. For example, items could have been worded to link more directly technology use and each of the five clusters of educationally effective practices. Questions could be asked about whether students receive support from services available through a campus website (Supportive Campus Environment) or

about whether students participated in a course or program to learn a new computer technology (Enriching Educational Experiences). Nonetheless, that a reliable scale was derived from the technology items indicates that some meaningful aspects of the student experience are being captured. Moreover, we were judicious in our selection of items for the factor analysis with core survey items and technology items and keep the conclusions drawn from this analysis bounded by both the limitations and the exploratory nature of the investigation.

Discussion and Implications

Many campuses have invested substantial amounts of resources to make various forms of information technology accessible to students. The relatively high frequency with which students are using information technology for educational purposes and the positive relationships between students' academic uses of information technology and multiple aspects of student engagement suggest that those investments are paying off. The findings from this study and others (e.g., Kuh & Hu, 2001; Twigg, 2004) indicate using information technology is associated with desirable outcomes. At the same time, information technology introduces opportunities for mischief, such as cyber plagiarism—students' inappropriate use of material taken without attribution from online sources. Reisberg (2000) catalogues other worrisome side effects of overuse of information technology that are worthy of further investigation.

The relative strength of the positive relationships between academic uses of information technology and engagement, particularly academic challenge, student-faculty interaction, and active and collaborative learning, suggest that, at the very least, there is overlap between these constructs. That both technology-related and non-technology-related collaborative learning items factor together and produce a reliable scale, suggests that areas of engagement like student-faculty interaction and collaborative learning may well be related to information technology.

That is, students who frequently use information technology are likely to have more frequent interactions with faculty members.

Asking students about their technology use may produce more reliable measures of other forms of engagement in effective educational practice. This seems to be the case, for example, for collaborative learning. Should future analyses show that in addition to being reliable, such measures are also better predictors of student outcomes, then it may make sense to modify certain questions aimed to measure various dimensions of student engagement. That said, there is also the possibility that such combined measures will not perform as well as predictors of other behaviors of interest. Kuh and Hu (2001) found that the effects of using information technology on several outcome measures were quite small when an overall measure of student engagement was in the model. This "mediation" of the effect of engagement with information technology may result from both measures explaining the same variance in the dependent variables, an indication that engagement with information technology may simply be an additional measure of students' overall engagement. Obviously, further investigation is needed.

Conclusion

With students using information technology on a daily basis for their academic and non-academic pursuits, there is a need to understand the educational effects of this use. The results of this study suggest that using information technology for educational purposes is linked to how today's college students engage in effective educational practices (e.g., active and collaborative learning) more generally.

As researchers and practitioners in the field of higher education, we are faced with choices on how to measure and conceptualize students' engagement with information technology. Is information technology an avenue for engagement in other areas, is it its own form of

engagement, or is it possibly both of these? The results of this study prompt us to consider how established indicators of student engagement may benefit from tying information technology items to activities related to collaborative learning, for example. In doing so, however, two things should be kept in mind. First, measuring students' engagement in information technology may not add to our ability to explain educational outcomes above and beyond what is already captured by other measures of student engagement. If this is the case, we need to ask whether value is added by their inclusion. Second, we should not be boxed in by what we already measure. It is important to ask if there are ways students engage information technology that are independent of the established indicators of engagement represented by the NSSE survey and other instruments.

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Table 1.
Experimental Information Technology Items Used on the Online Version of NSSE 2003

Item	Wording
1	How often do your instructors require you to use information technology (WWW, internet, computer conferencing, online testing, multimedia, etc.), *other than word processing*, to complete course assignments?
2a	Used computer and information technology when making class presentations?
2b	Communicated with classmates online to complete academic work?
2c	Worked in teams during class using information technology?
2d	Worked in teams outside of class using information technology to complete course assignments?
2e	Used email to ask an instructor to clarify an assignment?
2f	Expressed ideas to a professor via email that you did not feel comfortable saying in class?
2g	Used your institution's library website to obtain resources for your academic work?
2h	Used another library (local library, another institution's library) website to obtain resources for your academic work?
2i	Asked a librarian at your school for help in obtaining resources for your academic work?
2j	Used the WWW to obtain resources for your academic work?
2k	Made judgments about the quality of information you find on the WWW for use in your academic work?
3	How often do your instructors use information technology in the classroom?
4	How many courses are you taking this semester that are offered *entirely* online via the WWW, internet or email?[a]
5	To what extent do you gain new insights into course material from online discussions?[b]
6a.	Spending time online (WWW/internet/email) for any reason?[c]
6b	Spending time online (WWW/internet/email) doing academic work?[c]
7	How often do you think other students at your institution copy and paste information from the WWW or internet into reports and papers without citing the source?

Note: Except where noted, variables were measured on a 4-point scale (1=Never, 2=Sometimes, 3=Often, 4=Very Often)
[a] Responses range from 1=0 to 5=4 or more
[b] Responses for this item were 1=Very little, 2=Some, 3=Quite a bit, 4=Very much
[c] Responses for this item were 1=0, 2=1-5, 3=6-10, 4=11-15, 5=16-20, 6=21-25, 7=26-30, 8=More than 30

Table 2.
Reliabilities of the Clusters of Effective Educational Practices (Student-Level Scales)

Scale	Cronbach's α
Academic Challenge (11-item scale)	0.71
Active and Collaborative Learning (7-item scale)	0.63
Student-Faculty Interaction (6-item scale)	0.76
Enriching Educational Experiences (12-item scale)	0.56
Supportive Campus Environment (6-item scale)	0.76

Note: Component items for each scale are described in National Survey of Student Engagement, 2003

Table 3.
Students' Experiences with Information Technology

Variable	First-Year Students	Seniors
Instructors *frequently* (often or very often) require you to use information technology (WWW, internet, computer conferencing, online testing, multimedia, etc.), *other than word processing*, to complete course assignments	78%	81%
Frequently used computer and information technology when making class presentations	56%	75%
Frequently communicated with classmates online to complete academic work	51%	58%
Frequently worked in teams during class using information technology	31%	36%
Frequently worked in teams outside of class using information technology to complete course assignments	41%	58%
Frequently used email to ask an instructor to clarify an assignment?	58%	79%
Frequently expressed ideas to a professor via email that you did not feel comfortable saying in class	26%	29%
Frequently used your institution's library website to obtain resources for your academic work	55%	64%
Frequently used another library (local library, another institution's library) website to obtain resources for your academic work	18%	27%
Frequently asked a librarian at your school for help in obtaining resources for your academic work	24%	26%
Frequently used the WWW to obtain resources for your academic work?	80%	86%
Frequently made judgments about the quality of information you find on the WWW for use in your academic work	71%	79%
Instructors frequently use information technology in the classroom	65%	69%
Taking 1 or more courses this semester that are offered *entirely* online via the WWW, internet or email	11%	10%
Gain new insights into course material from online discussions quite a bit or very much	35%	33%
Spend greater than 5 hours per week online (WWW/internet/email) for any reason?	73%	69%
Spend greater than 5 hours per week online (WWW/internet/email) doing academic work?	38%	39%
Think other students at your institution frequently copy and paste information from the WWW or internet into reports and papers without citing the source?	25%	31%

Table 4.
Factor Loadings for Technology Items

	Factor Solutions					
	Three			Two		One
Item wording	F1	F2	F3	F1	F2	F1
Worked in teams outside class using information technology	0.77			0.81		0.74
Worked in teams during class using information technology	0.76			0.80		0.67
How often do your instructors use information technology in the classroom	0.69			0.69		0.58
Communicated with classmates online to complete academic work	0.68			0.72		0.71
How often do your instructors require you to use information technology	0.67			0.67		0.64
Used computer and information technology when making class presentations	0.67			0.69		0.67
Used another library website to obtain resources for your academic work		0.73			0.63	0.38
Expressed ideas to a professor via email that you did not feel comfortable saying in class		0.66		0.31	0.34	0.54
Used your institution's library website to obtain resources for your academic work		0.62	0.36		0.76	0.41
Used email to ask an instructor to clarify an assignment	0.34	0.53		0.40	0.38	0.66
Made judgments about the quality of information you find on the WWW			0.81		0.71	0.53
Used the WWW to obtain resources for your academic work			0.79		0.60	0.57
% var. explained	36.21	10.96	9.46	36.21	10.96	36.21
Cronbach's alpha[a]	0.82	0.63	0.72	0.83	0.63	0.83

Note: Factor analyses performed using Principle Components extraction with Promax (oblique) rotation (N=63,540).

[a] Cronbach's alpha calculated using those items that load over 0.30 on a factor. Items that load on two factors were included in alpha calculations only for the factor on which they load the highest.

Table 5.
Partial Correlations between Engagement Scales (N=62,586)

Scales	1	2	3	4	5	6
1. Engagement with IT	1.00					
2. Engagement with IT-Short	0.86	1.00				
3. Academic Challenge	0.42	0.33	1.00			
4. Active & Collaborative Learning	0.47	0.45	0.47	1.00		
5. Student-Faculty Interaction	0.42	0.32	0.46	0.54	1.00	
6. Enriching Educational Experiences	0.33	0.26	0.38	0.42	0.48	1.00
7. Supportive Campus Environment	0.31	0.27	0.34	0.32	0.39	0.31

Note: Partial correlations calculated controlling for gender, race, age, parents' education, class (first-year or senior), transfer status, living on campus, social fraternity/sorority membership, participation in athletics, full-time/part-time status, and major.

Note: Correlations between scales nearly identical (differences less than 0.05) to partial correlations.

Table 6.
Factor Loadings for Core Survey Items (Q1) and Select Technology Items

	Analysis on Q1				Analysis with Tech Items			
Item wording	F1	F2	F3	F4	F1	F2	F3	F4
Talked about career plans with a faculty member or advisor	0.79				0.81			
Discussed ideas from your readings or classes with faculty members outside of class	0.77				0.79			
Worked with faculty members on activities other than coursework	0.77				0.80			
Discussed grades or assignments with an instructor	0.57				0.60			
Received prompt feedback from faculty on your academic performance	0.56				0.56			
Tutored or taught other students (paid or voluntary)	0.51				0.55			
Asked questions in class or contributed to class discussions	0.49				0.58			
Participated in a community-based project as part of a regular course	0.30				0.39			
Worked with other students on projects during class		0.73				0.40		
Worked with classmates outside of class to prepare class assignments		0.70				0.57		
Made a class presentation		0.54				0.32		
Used an electronic medium to discuss or complete an assignment		0.49				0.45		
Put together ideas or concepts from different courses when completing assignments		0.39			0.34			
Used e-mail to communicate with an instructor	0.34	0.34			0.34	0.30		
Had serious conversations with students who are very different from you			0.91				0.90	
Had serious conversations with students of a different race or ethnicity than your own			0.91				0.90	
Included diverse perspectives in class discussions or writing assignments			0.42	0.41			0.40	0.45
Discussed ideas from your readings or classes with others outside of class	0.35		0.39		0.38		0.37	
Prepared two or more drafts of a paper or assignment before turning it in				0.77				0.79
Come to class without completing readings or assignments		0.36		-0.69				-0.60
Worked on a paper or project that required integrating ideas from various sources		0.34		0.53				0.60
Worked harder than you thought you could to meet an instructor's standards				0.45				0.43
Technology Items								
Used computer and information technology when making class presentations						0.71		
Communicated with classmates online to complete academic work	*Variables not included in this analysis*					0.76		
Worked in teams during class using information technology						0.79		
Worked in teams outside class using information technology						0.85		
% var. explained	26.23	6.87	6.01	5.64	25.27	8.26	5.71	5.00
Cronbach's alpha[a]	0.78	0.65	0.70	0.57	0.84	0.79	0.79	0.62

Note: Factor analyses performed using Principle Components extraction with Promax (oblique) rotation (n = 63,407).
[a] Cronbach's alpha calculated using those items that load over 0.30 on a factor. Items that load on two factors were included in alpha calculations for the factor on which they load the highest.