Interactive Technology and Effective Educational Practices

Allison BrckaLorenz and Amy K. Garver

Indiana University

Center for Postsecondary Research

National Survey of Student Engagement

Authors' Note

Correspondence concerning this article should be addressed to Center for Postsecondary Research, Indiana University, Eigenmann Hall Suite 419, 1900 East Tenth Street, Bloomington, IN, 47406-7512

Abstract

Using data from the 2009 National Survey of Student Engagement, this study explored the effect of students' general use of interactive technology tools on their engagement in effective educational practices. In particular, a range of demographic and academic variables were examined to better understand characteristics of students who tended to be frequent users of interactive tools (e.g., collaborative editing, on-line portfolio, blogging) for the purposes of learning. Results revealed differences in subpopulations of students, specifically, by major and among international students. Findings also confirmed that students using interactive technologies were engaging in more collaborative behavior with both their peers and instructors, with the largest effect sizes occurring for Student-Faculty Interaction among first-year students. Implications for future research and practice were discussed.

Interactive Technology and Effective Educational Practices

Technology is more accessible now to college students than any other time in history. In a nation-wide longitudinal study of college students' uses of and skills with technology, results indicated that in 2005 over 96% of first-year and senior students owned a computer, and by 2007, the ownerships of laptop computers increased 18% (Kvavik & Caurso, 2005; Salaway, Caruso, & Nelson, 2007). With the additional rise of Web 2.0 tools (e.g., Google Docs, YouTube, Blogs), students have the ability to not only consume information but also create and broadly share information over the Web (Downes 2005; Thompson, 2007). Technology has become engrained in the daily lives of today's college students (Junco & Cole-Avant, 2008). Often referred to as digital natives or the Net Generation, many students are often simultaneously blogging, playing video games, texting, or checking social network sites while preparing for class or doing homework (Coffman & Klinger, 2007; Prensky, 2001). However, increased dependency on technology has led some to discuss its broad impact on college student learning. For example, Dede (2005) argued technology may have a negative effect by serving as a distraction and lessening the quality of effort that students need to gain deeper levels of understanding. In contrast, others have claimed interactive technologies can be used in ways to harness motivation for learning by personalizing course material so that it becomes more relevant to the lives of students (Coffman & Klinger, 2007; Lee, Magjuka, Liu, & Bonk, 2006).

In an effort to better understand technology's broad impact on student learning, the aim of this study was to determine if frequent use of interactive tools, in relation to academic work, had a positive or negative effect on students' engagement in effective educational practices. Further, this study examined which interactive tools were more frequently used by students, and if differences existed by various subpopulations. The findings from this exploratory study will

help to identify populations of students who are more frequent users of innovative learning technologies as well as provide empirical evidence for its impact on student engagement.

Interactive Technology and Associated Learning Outcomes

Although some studies have explored the effect of students' general use of technology on educational practices (Nelson Laird & Kuh, 2005; Salaway, Caruso, & Nelson, 2007), most tended to focus on a specific tool, such collaborative editing software, blogs, or student response systems, and its role in producing desirable learning outcomes associated with a particular course. For example, in the following study a faculty member required the use of a collaborative editing tool in an undergraduate human physiology course. With the use of the collaborative editing tool, Fitzpatick (2004) found class participation increased for female students when compared to their male counterparts and other females from a previous course. Additionally, the results revealed an increase in student learning in the areas of creativity, enhanced understanding, critical thinking, group skills, and overall interest in the subject matter.

In a study of a general psychology course at the University of Massachusetts Dartmouth, Shapiro (2009) found that the use of clickers (i.e., student response systems) increased attendance when compared to using extra credit as motivation for attendance. Clickers also helped students better comprehend information. In an online course, Klein (2009) hypothesized that the use of student response systems, coupled with other teaching methods, helped to promote active and collaborative learning in the passive online learning environment. Bain and Przybyla (2009) examined student perceptions to better understand the influence student response systems had on in-class and out-of-class behaviors of students. The authors administered surveys and compared the responses of students in one section of a management information systems course that used clickers to the responses of students in a section that did not use clickers. Clickers were

found to positively influence enjoyment, motivation, comprehension, and general classroom engagement. Additionally, final grades in the course that used clickers were significantly higher than the final grades in the same course without clickers. In this study, however, clickers were found to have virtually no effect on student attendance.

Another relevant study revealed positive effects on reflective and integrative learning skills among students when blogs were appropriately incorporated into courses (Downes, 2004). Specifically, Downes (2004) suggested that blogs can solicit engagement among students that is not only reflective but also critical, inquisitive, and reactive. He further pointed out that in order for blogging to be successful in the classroom, faculty and students must embrace its worth as an educational tool. Yet, despite its potential benefits, according to a national study (Salaway, Caruso, & Nelson, 2007) only a small percentage of students (8.9%) reported using blogs for academic purposes.

Interactive Technology Use among Subpopulations of College Students

Despite technology's wide accessibility among college students and its potential benefits for learning, descriptive statistics reported in the 2005 and 2007 EDUCAUSE Center for Applied Research (ECAR) nationwide studies (Kvavik & Caurso, 2005; Salaway, Caruso, & Nelson, 2007) offered that very few students claimed using interactive technology tools for academic purposes. This was true even though a majority of students believed it made positive contributions to teaching and learning. In fact, according to results in the 2005 and 2007 reports, students indicated that they preferred only a "moderate" amount of technology as it related to their academics, and suggested the face-to-face interaction with faculty was an important component to their learning (Kvavik & Caurso, 2005; Salaway, Caruso, & Nelson, 2007).

Findings such as these raise the question as to who is actually using and benefitting from these interactive technologies.

Often literature that examines the demographics of technology users tends to focus on students' preferences or comfort with the technology. For example, according to the 2007 ECAR study results, female and younger students reported a lesser preference for technology in the classroom (Salaway, Caruso, & Nelson, 2007). This finding was indicative of conclusions made by other studies which implied women were more affected by perceived ease of use than men as well as individuals who espoused more feminine values such as personal relationships (Srite & Karahanna, 2006; Venkatesh & Morris, 2000).

In a longitudinal study of 445 individuals from five organizations, Venkatesh and Morris (2000) revealed gender differences in self-efficacious beliefs about ease of technology use. That is, women were more strongly influenced by perceptions of ease of use; and as time and experience increased, their assessment of ease of use went up while the men's perception went down. Alternatively, perceived usefulness was found to be more salient among men and their decision to use the new technology. Based on these findings, Venkatesh and Morris (2000) argued that women were more likely to make a balanced decision about technology by considering multiple inputs while men, on the other hand, were only concerned with productivity and outputs.

In contrast, Srite and Karahanna (2006) found a stronger relationship for perceived ease of use among individuals who held masculine values (i.e., emphasized goals for advancement, competitiveness, and performance) than their counterparts who espoused more feminine values (i.e., emphasized goals for warm personal relationships, comfortable work environment, and

quality of life). This study suggested that other individual traits, besides demographic characteristics such as age and gender, were also likely to moderate the effect of technology use.

Using structural equation modeling, Argarwal and Prasad (2000) found level of education and prior experience with similar technology directly influenced users' beliefs about ease of use. However, number of years in the workforce (a proxy for age) was, surprisingly, not significant. Furthermore, the effect of individual characteristics on perceived usefulness was moderated through their beliefs about ease of use. Argarwal and Prasad (2000) attributed this finding to the benefits of a training session that perhaps exposed users to additional functionalities. The authors also claimed one of the major implications of this study was identifying characteristics of individuals that were more likely to use new technologies. That is,

> Individuals who have greater familiarity with technology, in general, those with higher education levels, and those who have greater prior experience with similar technologies are likely to have more positive beliefs about new technologies. These are kinds of individuals organizations might wish to recruit or target as they introduce new technologies (Argarwal & Prasad, 2000, p. 385).

Interestingly, in a study about user acceptance of Web Course Tools (WebCT), Ngai, Poon, and Chan (2007) found no relationship with college students' rate of use and their positive or negative attitude toward using the tool. Instead, they concluded that it was more imperative to foster self-confidence among students and alleviate any misconceptions concerning the technology. Furthermore, Ngai, Poon, and Chan. (2007) proposed that "peer support, peer pressure, and e-learning culture in the institution, infrastructure pressure from lecturers, availability and accessibility" (p. 264) were all present factors that may have influenced students' level of technology use. Although these studies give evidence for some of the demographic

characteristics, personal values, and situational context that describe users of technology, far more can be done to identify what types of students are using and benefiting from the use of interactive technologies.

Purpose

The purpose of this study is to better understand two major concerns apparent in the literature. First and foremost, do college students who frequently use integrative technology, for purposes of learning, experience greater gains in other areas associated with academic success (e.g., collaborative learning, student-faculty interaction)? Secondly, which interactive technologies are most and least often used by college students and do individual differences exist among them? In order to examine the identified gaps, this study analyzed data collected from first-year and senior students who responded to the National Survey of Student Engagement (NSSE) in 2009. Because the core NSSE survey does not collect much information about students' use of technology, NSSE researchers included a set of extra items about innovative technology to investigate the relationship between students' uses of the tools and their engagement in effective educational practices. Specifically, the research questions for this study are as follows:

1. What types of interactive technology are used most and least often by first-year and senior undergraduate college students?
2. How does the use of these technologies vary by student subpopulations?
3. How does student use of interactive technologies relate to educationally effective student engagement?

Methods

Data Source and Sample

Data for this study are from the 2009 administration of the National Survey of Student Engagement (NSSE). The NSSE survey asks students how often they engaged in various good educational practices, what were their perceptions of their college environment, and how they perceived that they have developed while in college. The 2009 NSSE was administered to a random sample of first-year and senior college students at 640 participating institutions in the United States and Canada. Students attending 58 of these institutions were given an additional set of items at the end of the survey asking about their use of various technologies. The sample for this study consisted of 10,163 (48%) first-year students and 11,128 (52%) senior students. The majority of students were white (FY: 75%, SR: 77%) and were from doctoral granting (FY: 37%, SR: 42%) or master's granting (FY: 36%, SR: 36%) institutions. Students were from a wide variety of disciplinary classifications—the largest groupings of seniors, for example, were from business (23%), arts and humanities (13%), and social science (13%) major fields of study. Additional percentages of students by various demographics can be found in Table 1.

[Table 1 Here]

Variables

The primary independent variable in this study is students' use of interactive technologies. The Interactive Technology scale is made up of nine items measuring how often during the students' current school year did they use a variety of technologies in their courses. Items in this scale involve the use of technologies such as blogs, student response systems, and collaborative editing software. The complete list of items and response options can be found in Table 2. Students received an Interactive Technology scale score if they answered at least six of

the nine interactive technology items. Responses were scored 1=Never, 2=Sometimes, 3=Often, and 4=Very Often, resulting in Interactive Technology scale scores ranging from 1 to 4, with lower scores implying less use of interactive technologies. For first-year students, the Cronbach's alpha for the Interactive Technology scale was .85 and was .84 for seniors.

[Table 2 Here]

The dependent variables in this study are four of NSSE's benchmarks of effective educational practice: Level of Academic Challenge, Active and Collaborative Learning, Student-Faculty Interaction, and Supportive Campus Environment. Level of Academic challenge is a collection of items measuring such things as how much reading and writing students do, how much time they spend preparing for class, and how often they engage in higher order thinking activities such as synthesis or analysis. Active and Collaborative learning focuses on students working together on various projects and students actively engaging in class material such as through presentations or asking questions in class. The Student-Faculty Interaction benchmark contains items about students and faculty interacting in various ways such as by talking about career plans or working on a research project together. Supportive Campus Environment contains items about the institution such as providing the support they need to succeed academically and items about relationships with people at their institution. These benchmarks have been found to have a significant impact on student learning, student satisfaction, and overall success and persistence in college (Astin, 1993; Kuh, G. D., 2003; National Survey of Student Engagement, 2007; Pascarella & Terenzini, 2005). Complete lists of items within these benchmarks as well as Cronbach's alpha reliabilities can be found in Table 3.

[Table 3 Here]

A wide variety of student-level and institution-level characteristics were used to answer the second research question as well as act as serve as controls in answering the third research question. Student-level characteristics included gender, first-generation status, age, citizenship, transfer status, enrollment status, fraternity or sorority membership, student-athlete status, living situation, race or ethnicity, primary major field, and grades. Institution-level characteristics included private/public control and Carnegie classification. More information about these variables as well as how they were coded can be found in Table 4.

[Table 4 Here]

Analysis

Analyses for all three research questions were computed separately for first-years and seniors in order to highlight similarities and differences in the first-year and senior experience. Frequency percentages were computed for each item within the Interactive Technology scale to answer the first research question about determining what types of technologies were most and least often used by college students. The response options “often” and “very often” were collapsed and referred to as “frequent” use. Evidence for the second research question, how these technologies were used by different subpopulations, was gathered through the use of t-tests comparing the mean scores of students by dichotomous characteristics such as gender and age. A Cohen’s d effect size was also calculated for these dichotomous subpopulations. For characteristics with more than two categories, such as race, ANOVAs and Tukey’s post-hoc tests were calculated.

Evidence for the third research question, about how using technologies related to educationally effective activities, was gathered using several multivariate OLS regressions to determine the relationship between the use of interactive technologies and NSSE’s benchmarks

of effective educational practice. Models in this study included all student-level and institution-level characteristics. All continuous dependent and independent variables were standardized before being entered into the regression models so that the unstandardized coefficients could be interpreted as effect sizes (Rosenthal & Rosnow, 1991).

Limitations

The generalizability of this study was somewhat limited by the self-selection of institutions that participate in NSSE. Although students within an institution were selected randomly to receive a survey invitation, and a large number of institutions agreed to include these additional technology items, the selection of institutions was not randomly selected. Institutions invited by NSSE to receive these additional technology items were specifically chosen to represent a variety of institution types. The number of schools within each Carnegie classification is as follows: two research universities (very high research activity), four research universities (high research activity), six doctoral/research universities, ten master's colleges and universities (larger programs), six master's colleges and universities (medium programs), three master's colleges and universities (smaller programs), six baccalaureate colleges-arts and sciences, ten baccalaureate colleges-diverse fields, and nine other. So although the range of institution types is well-represented, these institutions still chose to participate in NSSE and further let NSSE administer these additional items.

Results

Frequency of Use

The interactive technologies that both first-year and senior students most frequently reported using in their courses were collaborative editing software (FY: 28%, SR: 22%), student-response systems (FY: 26%, SR:16%), and on-line student video projects (FY: 19%. SR: 15%).

From these results we can see that first-year students report using these technologies in their classrooms more often than senior students. First-year students least frequently used video games (6%), video conferencing (6%), and online survey tools (9%). Senior students least frequently used video conferencing (4%), video games (5%), and blogs (7%). Both first-year and senior students used these latter technologies with approximately the same frequency, for example, only 5% of both first-years and seniors reported frequently using video games, simulations, or virtual worlds in their courses. The percentages of students reporting their frequent (collapsed responses of "often" and "very often") use of these technologies can be found in Table 5.

[Table 5 Here]

Subpopulation Differences

First-year students. For first-year students, several t-test comparisons by given student-level or institution-level characteristics did not have significant ($p < .05$) differences such as by enrollment status, social fraternity or sorority participation, transfer status, and students at private or public institutions. Other differences by subpopulation were significantly different, but the effect sizes were trivial such as for first-generation status, age, and campus-living situation. Differences by gender and student-sponsored athletics were significant and small. These results suggested that male students and student-athletes use interactive technologies slightly more than females and non-athletes, respectively.

An unsurprisingly significant and small-medium effect-size difference suggested that students taking at least some of their classes entirely online use interactive technologies more often than students taking no such classes. The most surprising significant and medium-large effect-size difference was by students' citizenship status. International or foreign national

students used interactive technology noticeably more than their US citizen peers. ANOVA and post hoc Tukey's comparisons suggest additional differences in students' use of interactive technologies. Students with lower grades (mostly B's and mostly C's) used interactive technologies more often that students with higher grades (mostly A's). White students used interactive technologies significantly less than their minority peers, particularly Asian, Asian American, or Pacific Islander students.

In addition, results by major should be interpreted with caution as many first-year students may change or remain 'undecided' about their major, but there were noticeable differences in the use of interactive technologies. That is, students in arts and humanities or physical science fields used interactive technologies noticeably less than students in professional or business fields. Also, students at baccalaureate-granting institutions used interactive technologies less than students at master's granting institutions who used interactive technologies less than students at doctoral granting institutions. More specific information about these results can be found in Tables 6 and 7.

[Table 6 and Table 7 Here]

Senior students. For senior students, only two t-test comparisons by the given student-level or institution-level characteristics did not have significant ($p < .05$) differences. These comparisons were by gender and student-athlete status. Many of the significant differences, however, only had trivial effect sizes such as for comparisons by age, enrollment status, fraternity or sorority participation, transfer status, and students at publicly or privately controlled institutions.

Significant and small effect sizes suggest that first-generation seniors may have used more interactive technologies than their non-first-generation peers; and that students living

within driving distance of campus used interactive technologies more often than students living on or within walking distance of campus. As with first-year students, larger effect size differences occurred when looking at students taking online classes and international or foreign national students. A significant and medium effect-size difference suggested that students taking at least some of their classes entirely online used more interactive technologies than students not taking any entirely-online classes. Similar to fist-year students, a significant and medium-large effect size difference among seniors suggested that international or foreign national students used interactive technologies more often than their US citizen peers.

Additionally, ANOVA and post hoc Tukey's comparisons offered additional differences in students' use of interactive technologies. Likewise with the first-year experience, seniors earning higher grades (mostly A's) used interactive technologies less often than students with lower grades (mostly B's or mostly C's), and White students used these tools less often than their minority peers. Students in major fields such as physical science, engineering, and arts and humanities used interactive technologies less often than students in business, professional, or education fields. Also, senior students in baccalaureate granting and master's granting institutions used interactive technologies less often than students at doctoral-granting institutions. More information about these results can be found in Tables 8 and 9.

[Table 8 and Table 9 Here]

Relationship between Technology and Engagement

For first-year and senior students, significant ($p < .001$), positive relationships existed between the Interactive Technology scale and all four of NSSE's benchmarks of effective educational practices. Effect sizes greater than .2 but less than .3 are interpreted as small-medium, and effect sizes greater than .3 but less than .4 are interpreted as medium sized. These

interpretations follow from NSSE's contextualization of effect sizes when using NSSE benchmarks of effective educational practices (http://nsse.iub.edu/pdf/effect_size_guide.pdf).

The smallest relationships, small-medium effect sizes, were between Interactive Technology and Supportive Campus Environment followed by Level of Academic Challenge. The relationships between the Interactive Technology scale and these two benchmarks are slightly greater for seniors than for first-year students. The relationships between the Interactive Technology scale and the remaining benchmarks, Active and Collaborative Learning and Student-Faculty Interaction, were slightly stronger for first-years than seniors. A small-medium effect size for seniors and a medium effect size for first-years occurred between Interactive Technology and Active and Collaborative Learning, and medium effect-size relationships were found between the Interactive Technology scale and Student-Faculty Interaction. Unstandardized beta coefficients for the Interactive Technology scale can be found in Table 10.

[Table 10]

Discussion

This study begins to understand the impact of interactive technologies in college classrooms by examining how such technologies are currently being used. Although the results of this study suggested that some interactive technologies are used more often than others, most of the interactive technologies were not used often by most students. This could be because higher education has been slow to adopt such technologies. It is quite possible that a future survey of these items will report that far more of these technologies are being used in college classrooms. Due to the fast changing nature of technology, future studies building on the present study should continue to periodically collect data in order to continue understanding the current state of these technologies.

Future studies using this study's data should also look at individual types of interactive technologies to see if certain interactive technologies have stronger or weaker relationships with other educationally effective practices or if certain subpopulations of students use some types of interactive technologies more or less. Additionally, once researchers have a more solid sense of what educational technologies are being used in today's college classrooms, future studies of interactive technologies can begin to focus on best pedagogical practices and effects on various learning outcomes. For example, large percentages of students reported using collaborative editing software and student response systems—best practice research on interactive technologies may want to start with closer examinations of these technologies.

This study agrees with previous research that has shown a link between students using technology and students' increased collaboration with other students and interactions with their instructor (e.g., Nelson Laird & Kuh, 2005; Salaway, Caruso, & Nelson, 2007). As interactive technologies are, by definition, interactive, it makes sense that slightly larger effects occurred between the Interactive Technology scale and the benchmarks Active and Collaborative Learning and Student-Faculty Interaction. These results suggest that students using interactive technologies are engaging in more collaborative behavior with both their peers and instructors. These are encouraging results given that collaborative learning is known to be an educationally beneficial practice for undergraduate education (Pascarella & Terenzini, 2005; Kuh, 2001; Chickering & Gamson, 1987). The largest effect sizes occurring for Student-Faculty Interaction may suggest that students use and view these technologies as a way to promote interaction with their faculty members, particularly for first-year students.

The most valuable finding from this study may be the positive connection between students' use of interactive technologies and student-faculty interaction, particularly for first-year

students. First-year students are less likely to interact with their faculty members (Bean & Kuh, 1984; Kuh & Hu, 2001), but experience gains in personal and social development as well as general education knowledge when they interact with their faculty members inside and outside of class (Umbach & Wawrzynksi, 2005). If interactive technologies are a way for all students, especially first-year students, to interact with their faculty members more often and in meaningful ways, the benefits of such interactions would be far greater than the costs of developing and implementing the use of such technologies on college campuses. This evidence of a positive relationship between interactive technologies and effective educational practices can provide motivation for future studies of such technologies to investigate best practices for the use of these technologies as well as give confidence to institutions and instructors interested in adopting such technologies in their classrooms.

Although little is known about the characteristics of students using interactive technologies, some of the findings about who was or was not using interactive technologies in this study were a little surprising. For example, some of the research reviewed here suggests that traditionally aged students would be inclined to use interactive technologies more often than their older peers, but evidence from this study suggests that that may not be true. Results from this study also suggest that students in fields such as physical science or engineering, which could lend themselves to using more technology, actually use interactive technologies less often than students in business or professional fields. It could be that such fields have less need for tools that enhance communication and collaboration than fields which are typically viewed as more collaborative.

It was also unclear as to why racial or ethnic minority students used interactive technologies less often than white students. The most surprising result of this study, however,

was the finding that international or foreign-national students used interactive technologies in their courses noticeably more often than their US citizen peers. Valuable future research might inquire as to whether or not these latter two groups are using interactive technologies as a way to connect with their campus, peers, and instructors in a way that significantly enhances their college experiences. In general, more research needs to be done to better understand the conditions in which these differences are supported.

Tangential but perhaps valuable for future research in this area is another line of thinking that explores salient differences among subpopulations of people in their propensity to adopt innovative technology (Davis, 1993; Agarwal & Prasjad, 1999; Straub, E, 2009; Strite & Karahanna, 2006; Venkatesh & Morris, 2000). In a review of the most prominent adoption theories, Straub (2009) derived three common conclusions. He stated,

> First, technology adoption is a complex, inherently social, developmental process. Secondly, individuals construct unique (but malleable) perceptions of technology that influence the adoption process. Lastly, successfully facilitating a technology adoption needs to address cognitive, emotional, and contextual concerns (p. 645).

Here, Straub (2009) pointed out that the decision to adopt a certain technology is largely dependent upon a collection of personal and social factors. Conclusions from these models are aligned with our findings that the propensity for technology use can vary by a wide-range of student and institutional characteristics. In other words, differences found across institutional and disciplinary contexts as well as among subpopulations of students offer some support to the notion that technology usage is dependent upon personal values and situational factors (e.g., Technology Acceptance Model, Roger's Diffusion of Innovation Model). Together, using results from this study and guided by theories of technology adoption, future researchers may start to

unpack the conditions in which college students are electing to use interactive technologies to enhance their learning in college classrooms.

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Table 1 Sample Descriptives

		First Year (%)	Senior (%)
Female		66	65
First generation		32	34
Age 23 or younger		93	65
Living on or near campus		73	39
International or foreign national student		5	4
Full-time enrollment		94	83
Social fraternity or sorority		11	14
Student athlete		11	7
Transfer student		10	43
Taking at least some entirely online classes		11	30
Race	Asian, Asian American, Pacific Islander	4	4
	Black or African American	11	9
	White	75	77
	Hispanic or Latino	6	5
	Other	4	5
Major	Arts & Humanities	13	13
	Biological Sciences	8	7
	Business	17	23
	Education	10	10
	Engineering	5	5
	Physical Science	4	3
	Professional	15	11
	Social Science	12	13
	Other	18	16
Grades	Mostly A's	43	48
	Mostly B's	46	46
	Mostly C's	11	6
Institutional Carnegie classification	Doctoral granting	37	42
	Masters granting	36	36
	Baccalaureate granting	17	14
Privately controlled institution		56	50

Table 2 Interactive Technology Scale Items

During the current school year, about how often did you use the following technology in your courses? (Never, Sometimes, Often, Very Often)
Video games, simulations, or virtual worlds (Ayiti, EleMental, Second Life, Civilization, etc.)
Videoconferencing or Internet phone chat (Skype, TeamSpeak, etc.)
Blogs
On-line portfolios
On-line survey tools (SurveyMonkey, Zoomerang, etc.)
On-line student video projects (using YouTube, Google Video, etc.)
Instant messaging/chat room
Student response systems (clickers, wireless learning calculator systems, etc.)
Collaborative editing software (Wikis, Google Docs, etc.)

Table 3 NSSE Benchmarks of Effective Educational Practice

Level of Academic Challenge (Cronbach's α=.73 for first-year students and α=.76 for seniors)
During the current school year, about how much reading and writing have you done (None, 1-4, 5-10, 11-20, more than 20)
Number of assigned textbooks, books, or book-length packs of course readings
Number of written papers or reports of 20 pages or more
Number of written papers or reports between 5 and 19 pages
Number of written papers or reports of fewer than 5 pages
During the current school year, how much has your coursework emphasized… (very much, quite a bit, some, very little)
Analyzing the basic elements of an idea, experience, or theory, such as examining a particular case or situation in depth and considering its components
Synthesizing and organizing ideas, information, or experiences into new, more complex interpretations and relationships
Making judgments about the value of information, arguments, or methods, such as examining how others gathered and interpreted data and assessing the soundness of their conclusions
Applying theories or concepts to practical problems or in new situations
In your experience at your institution during the current school year, about how often have you done… (very often, often, sometimes, never)
Worked harder than you thought you could to meet an instructor's standards or expectations
About how many hours do you spend in a typical 7-day week doing…(0, 1-5, 6-10, 11-15, 16-20, 21-25, 26-30, more than 30)
Preparing for class (studying, reading, writing, doing homework or lab work, analyzing data, rehearsing, and other academic activities)
To what extent does your institution emphasize… (very much, quite a bit, some, very little)
Spending significant amounts of time studying and on academic work
Active and Collaborative Learning (Cronbach's α=.66 for first-year students and α=.66 for seniors)
In your experience at your institution during the current school year, about how often have you done… (very often, often, sometimes, never)
Asked questions in class or contributed to class discussions
Made a class presentation
Worked with other students on projects during class
Worked with classmates outside of class to prepare class ass
Tutored or taught other students (paid or voluntary)
Participated in a community-based project (e.g., service learning) as part of a regular course
Discussed ideas from your readings or classes with others outside of class (students, family members, co-workers, etc.)
Student-Faculty Interaction (Cronbach's α=.71 for first-year students and α=.74 for seniors)
In your experience at your institution during the current school year, about how often have you done… (very often, often, sometimes, never)
Discussed grades or assignments with an instructor
Discussed ideas from your readings or classes with faculty members outside of class
Talked about career plans with a faculty member or advisor
Received prompt written or oral feedback from faculty on your academic performance
Worked harder than you thought you could to meet an instructor's standards or expectations
Which…have you done or do you plan to do before you graduate from your institution (done, plan to do, do not plan to do, have not decided)
Work on a research project with a faculty member outside of course or program requirements

Supportive Campus Environment (Cronbach's α=.79 for first-year students and α=.80 for seniors)
To what extent does your institution emphasize… (very much, quite a bit, some, very little)
Providing the support you need to thrive socially
Providing the support you need to help you succeed academically
Helping you cope with your non-academic responsibilities (work, family, etc.)
Mark the box that best represents the quality of your relationships with people at your institution
Relationships with other students (*unfriendly, unsupportive, sense of alienation…friendly, supportive, sense of belonging*)
Relationships with faculty members (*unavailable, unhelpful, unsympathetic…available, helpful, sympathetic*)
Relationships with administrative personnel and offices (*unhelpful, inconsiderate, rigid…helpful, considerate, flexible*)

Table 4 Student-Level and Institution-Level Characteristics

Student-Level Characteristics	
Gender	Male=0, Female=1
First-Generation Status	Students whose mother and father did not complete a degree of higher education=1, students whose mother or father did complete a degree of higher education=0
Age	Students 23 or younger=1, students 24 or older=0
Citizenship	International students or foreign nationals=1, not = 0
Transfer status	Started college at the current institution=0, Started college elsewhere=1
Enrollment Status	Part-time=0, Full-time=1
Fraternity or sorority membership	Fraternity or sorority member=1, not a member=0
Student-athlete	Student-athlete=1, not a student-athlete=0
Living situation	Lives in a dormitory, fraternity or sorority house, or other campus housing, or within walking distance=1; Lives within driving distance=0
Race or ethnicity	African American/Black, Asian/Pacific Islander, Hispanic/Latino, Caucasian/White, American Indian, Multiracial, Other; dummy coded 0 = not in group, 1 = in group with Caucasian/White left out as reference group
Primary major field	Arts and Humanities, Biological Sciences, Business, Education, Engineering, Physical Science, Professional, Social Science, Other; dummy coded 0 = not in group, 1 = in group with Education left out as reference group
Grades	Mostly A's, Mostly B's, Mostly C's; dummy coded 0 = not in group, 1 = in group with Mostly A's left out as reference group
Institution-Level Characteristics	
Private/public control	Public = 0, Private = 1
Carnegie classification	Doctoral granting, Masters granting, Baccalaureate granting; dummy coded 0 = not in group, 1 = in group with doctoral granting left out as reference group

Table 5 Percentage of Students' Frequent[1] Use of Interactive Technologies

	First-Year (%)	Senior (%)
Video games, simulations, or virtual worlds (Ayiti, EleMental, Second Life, Civilization, etc.)	5.5	5.2
Videoconferencing or Internet phone chat (Skype, TeamSpeak, etc.)	6.1	4.3
Blogs	9.4	7.2
On-line portfolios	11.5	11.8
On-line survey tools (SurveyMonkey, Zoomerang, etc.)	9.3	8.1
On-line student video projects (using YouTube, Google Video, etc.)	18.9	15.3
Instant messaging/chat room	12.4	13.3
Student response systems (clickers, wireless learning calculator systems, etc.)	25.6	15.8
Collaborative editing software (Wikis, Google Docs, etc.)	27.7	22.4

Table 6 First-Year Dichotomous Comparison Information

	Mean	SD	*p*	|*d*|
Female	1.48	.53	<.001	.14
Male	1.56	.59		
First generation	1.53	.57	.001	.07
Not first generation	1.49	.54		
Age 23 or younger	1.51	.55	.032	.08
Age 24 or older	1.46	.53		
Living on or near campus	1.49	.53	<.001	.08
Within driving distance of campus	1.54	.60		
International or foreign national student	1.79	.68	<.001	.48
US citizen	1.49	.54		
Full-time enrollment	1.51	.55	.070	.09
Part-time enrollment	1.46	.56		
Social fraternity or sorority	1.53	.57	.201	.05
Not in a social fraternity or sorority	1.50	.55		
Student athlete	1.55	.56	.003	.10
Not a student athlete	1.50	.55		
Transfer student	1.50	.56	.830	.02
Not a transfer student	1.51	.55		
Taking at least some entirely online classes	1.63	.65	<.001	.24
Taking no classes entirely online	1.49	.54		
At a privately controlled institution	1.50	.54	.361	.02
At a publicly controlled institution	1.51	.57		

[1] Frequent refers to students that reported using Interactive Technologies in their courses “Often” or “Very Often”

Table 7 First-Year Homogeneous Subsets[2]

Grades	Mostly A's	1.43			
	Mostly B's		1.56		
	Mostly C's		1.56		
Race	White	1.46			
	Other		1.55		
	Black or African American		1.63	1.63	
	Hispanic or Latino			1.66	1.66
	Asian, Asian American, Pacific Islander				1.75
Major	Arts & Humanities	1.42			
	Physical Science	1.45	1.45		
	Biological Sciences	1.47	1.47	1.47	
	Engineering	1.48	1.48	1.48	
	Social Science	1.48	1.48	1.48	
	Education	1.50	1.50	1.50	1.50
	Professional		1.53	1.53	1.53
	Other			1.55	1.55
	Business				1.57
Institutional Carnegie classification	Baccalaureate granting	1.40			
	Master's granting		1.47		
	Doctoral granting			1.55	

[2] Means from Tukey post hoc analyses for groups in homogeneous subsets are displayed, p = .05.

Table 8 Senior Dichotomous Comparison Information

	Mean	SD	*p*	|*d*|
Female	1.43	.50	.129	.04
Male	1.45	.55		
First generation	1.48	.56	<.001	.12
Not first generation	1.42	.49		
Age 23 or younger	1.42	.50	<.001	.08
Age 24 or older	1.47	.56		
Living on or near campus	1.39	.48	<.001	.14
Within driving distance of campus	1.46	.54		
International or foreign national student	1.71	.67	<.001	.48
US citizen	1.43	.51		
Full-time enrollment	1.44	.52	.013	.07
Part-time enrollment	1.41	.52		
Social fraternity or sorority	1.48	.51	.001	.09
Not in a social fraternity or sorority	1.43	.52		
Student athlete	1.47	.52	.105	.08
Not a student athlete	1.43	.52		
Transfer student	1.46	.55	<.001	.07
Not a transfer student	1.42	.50		
Taking at least some entirely online classes	1.55	.61	<.001	.30
Taking no classes entirely online	1.39	.47		
At a privately controlled institution	1.41	.50	<.001	.09
At a publicly controlled institution	1.46	.54		

Table 9 Senior Homogeneous Subsets[3]

Grades	Mostly A's	1.39			
	Mostly B's		1.48		
	Mostly C's		1.51		
Race	White	1.40			
	Other	1.47			
	Black or African American		1.59		
	Hispanic or Latino		1.62		
	Asian, Asian American, Pacific Islander		1.65		
Major	Physical Science	1.27			
	Engineering	1.31			
	Arts & Humanities	1.33	1.33		
	Biological Sciences	1.34	1.34		
	Social Science		1.40	1.40	
	Business			1.48	1.48
	Other				1.49
	Professional				1.50
	Education				1.54
Institutional Carnegie classification	Baccalaureate granting	1.37			
	Masters granting	1.38			
	Doctoral granting		1.47		

Table 10 Unstandardized Beta Coefficients for the Interactive Technology Scale[4]

	Level of Academic Challenge	Active and Collaborative Learning	Student-Faculty Interaction	Supportive Campus Environment
First-Year	.231	.301	.343	.208
Senior	.271	.281	.315	.243

[3]Means from Tukey's post hoc analyses for groups in homogeneous subsets are displayed, $p = .05$.
[4]Models control for all student-level and institution-level variables. All continuous dependent and independent variables were standardized before being entered in the model. Dependent variables are the given NSSE benchmarks of effective educational practice. $p < .001$ for all coefficients.