Engaging Online Learners: A Quantitative Study of Postsecondary Student Engagement in the Online Learning Environment

Pu-Shih Daniel Chen
University of North Texas
Kevin R. Guidry
Indiana University Bloomington
Amber D. Lambert
Indiana University Bloomington

Please address all correspondence to:
Pu-Shih Daniel Chen
University of North Texas
Department of Counseling and Higher Education
1155 Union Circle #310829
Denton, TX 76203
(940) 369-8062
Daniel.Chen@unt.edu

Paper presented at the
Annual Meeting of the American Educational Research Association
San Diego, April 13 – 17, 2009

Engaging Online Learners: A Quantitative Study of Postsecondary Student Engagement in the Online Learning Environment

Pu-Shih Daniel Chen
University of North Texas
Kevin R. Guidry
Indiana University Bloomington
Amber D. Lambert
Indiana University Bloomington

Widespread use of the Web and other Internet technologies in postsecondary education has exploded in the last 10 years. Although a significant amount of literature exists on student engagement in traditional face-to-face environments, there is relatively little research into student engagement in the online learning environment. In 2008, the National Survey of Student Engagement (NSSE) developed a set of experimental questions to investigate the nature of student engagement in the online environment. Approximately 17,000 randomly selected first-year and senior college students at 45 baccalaureate degree-granting institutions responded to this set of questions. The researchers discuss the definition of student engagement for the online learning environment, the development of the NSSE online learning questions, findings, and implications for postsecondary education.

The Internet and other digital technologies have become thoroughly integrated in the lives of today's college student. A recent study by EDUCAUSE (2007) suggests that the vast majority of students at baccalaureate degree-granting institutions own and use their own computers. Online course management systems such as Blackboard, D2L, or Sakai are nearly ubiquitous on American colleges and universities and wireless Internet access permeates most college classrooms (Green, 2007). Outside the classroom, Internet connections are available in virtually all on-campus residence halls and online social networking websites like Facebook.com and MySpace.com are used by an estimated 79-95% of all American college students (Ellison, 2007).

Most college freshmen now arrive on campus with their own personal computer, digital music player, cell phone, and other digital devices. As technology becomes a natural part of modern life, more and more college students opt to take online or hybrid courses using readily-available communication technologies. Moreover, many students expect instructors of traditional face-to-face classes to utilize the latest Internet technologies such as online course management systems and collaborative Internet technologies to enhance learning experience.

The widespread adoption of digital technologies and online courses has caused many researchers to question the impact of online learning environment on student learning and engagement. The concept of student engagement is not new to educators. Research has shown that what students do during college counts more in terms of learning outcomes than who they are or even where they go to college (Kuh, 2004). In the *Seven Principles for Good Practice in Undergraduate Education*, Chickering and Gamson (1987) argued that good college education should promote student-faculty interaction, cooperation among students, active learning, prompt

feedback, time on task, high expectations, and respect for diverse talents and ways of learning. Although Chickering and Gamson's propositions were well received and later became the foundation of the current engagement movement in higher education, it is still largely unclear of how to operationalize these principles and measure their impacts in an online learning environment.

Recent research suggests that there is a positive correlation between students' use of computers and the Internet and self-reported gains in general education and personal and intellectual development (Nelson Laird & Kuh, 2004; Hu & Kuh, 2001; Kuh & Hu, 2001; Kuh & Vesper, 2001). Echoing Jenkins's "participation gap" idea (2006), other research has suggested that characteristics such as socioeconomic status (Gladieux & Swail, 1999) and institutional resources (Hu & Kuh, 2001) play a significant role in students' use of and the impact of computers and the Internet. Although the online learning environment is believed to have enhanced student learning, little empirical research exist to connect the dots between learning technologies and traditional notions of student engagement. This study investigates the nature of student engagement in the online learning environment to find out if the use of the Internet technology has an effect on student engagement. Specifically, the following research questions guide this study:

1. How often do college students in different types of courses use the Internet technologies for course-related tasks?
2. Do individual and institutional characteristics affect the likelihood of taking online courses?
3. Does the relative amount of technology employed in a course have a relationship with student engagement, learning approaches, and student self-reported learning outcomes?

Methods

The data for this study come from the 2008 administration of the National Survey of Student Engagement (NSSE). Since the inception of the NSSE in 2000, more than a million first-year students and seniors at more than 1,100 baccalaureate degree-granting colleges and universities have reported the time and energy that they devote to the educationally purposeful activities measured by the annual survey. Participating institutions use their student engagement results to identify areas where teaching and learning can be improved. NSSE results are positively correlated with such desired outcomes as critical thinking and grades (Carini, Kuh, & Klein, 2006; Kuh, 2004; Ouimet et al., 2004; Pike, 2006). The conceptual framework and psychometric properties of the NSSE and the development of NSSE scales have been amply documented (Kuh, 2004; Nelson Laird, Shoup, & Kuh, 2005).

In 2008, researchers at NSSE developed a set of 13 experimental questions to investigate the nature of student engagement in the online learning environment (see Appendix for these questions). This set of items was administered to students at 45 American baccalaureate degree-granting institutions. For the purpose of this study, institutions that only offer online courses were removed from the data set because there is no comparison among different course delivery

methods at an online institution. Since there is only one online-only institution in the pool of this study, removing this institution does not affect the general characteristic of the sample.

Respondents were asked to identify the number of classes in which participants were enrolled that were either conducted entirely online or conducted face-to-face with a significant online component. Survey respondents also reported on specific behaviors related to their collegiate experiences, including in- and out-of-class behaviors, time usage, and learning approaches that are known to contribute to desirable learning outcomes. To ensure data quality, students who reported taking more online or hybrid courses than the total number of courses taken were removed from the dataset and exclude from analysis.

To answer the first research question, descriptive statistics including means and standard deviations were reported for all of the survey items. The Kruskal Wallis Test (Siegel & Castellan, 1988), a nonparametric equivalent of the analysis of variance (ANOVA), was conducted to examine if statistically significant differences exist in students' technology use among different course delivery methods. Hierarchical Linear Modeling (HLM) was utilized to answer the second research question. The assumption underlying the HLM analysis is that institutions have a differential impact on student's course taking behaviors and technology usage. The benefit of using HLM is that it allowed us to partition the variance attributable to the individual and the variance attributable to the institution. The dependent variables for the HLM analysis will be the ratio of classes taken online. The independent variables include individual (Level 1) variables such as the student's gender, enrollment status (part-/full-time), ethnicity, major, and parental education. The institutional level variables (Level 2 variables) are dummy-coded 2005 Carnegie Basic classification, control (public/private), and urbanicity or locale.

The third research question, which addresses the impact of online course and course management system on student engagement, was answered using the Ordinary Least Squares (OLS) or the multiple regression analysis. A regression analysis is a statistical technique that allows the researcher to investigate the relationship between one dependent variable and several independent variables (Tabachnick & Fidell, 2007). The dependent variables for this analysis include four of the five NSSE Benchmarks (the level of academic challenge, active and collaborative learning, student-faculty interaction, and supportive campus environment), the three student self-reported Gain Scales (gain in general education, gain in personal and social development, and gain in practical competence), and the three Deep Learning Scales (higher order thinking, reflective learning, and integrative learning). One of the NSSE Benchmarks – enriching educational experiences – is excluded from the analysis because technology use is part of the benchmark. The independent variables include the percentage of classes taken online, the percentage of classes that were hybrid classes, a composite score of course-related technology use, and other controls for student and institutional characteristics.

For the purposes of this study, an online course is defined as a course that conducted entirely through the Internet without any face-to-face contact among instructor(s) and students. In contrast, a face-to-face course is defined as a course that conducted entirely in a physical classroom without using any Internet technology for course management or instructional purpose. A hybrid course is one that blends both online and face-to-face components in the same course. A hybrid course must include both face-to-face contacts among instructor(s) and students

and the use of the Internet technology for course management or instructional purpose. If the only utilization of the Internet technology in a face-to-face course is for communication purposes, the course is considered a face-to-face course rather than a hybrid course.

Results

The online learning experimental questions were attached to the end of the NSSE online survey and sent to students at 45 U.S. baccalaureate degree-granting institutions. The 45 institutions were randomly selected from the pool of institutions participated in the 2008 NSSE administration. Approximately 22,000 first-year and senior college students responded to this set of questions. However, about 4,500 students were excluded from analysis as we only included students who were randomly sampled in this study. We also excluded students from the one online-only institution for reasons described earlier. Finally, some students were excluded as their responses indicated that they may not have understood these questions in the manner intended by the researchers (when summed, their responses indicated that over 100% of their classes were online or hybrid classes); this indicates a potential reliability issue with these new questions that will be addressed when discussing this study's limitations.

Of the 17,819 respondents, 8,065 (45%) were first-year students with the remaining 9,754 (55%) seniors. Nearly 7,000 respondents (35%) were male and 13,000 (65%) female. The majority (97% for first-year students and 87% for senior students) of the surveyed students were enrolled full-time at their institution. Detailed student characteristics including gender, enrollment status, and race and ethnicity can be found in Table 1. Table 2 shows the institutional characteristics of the 45 participating institutions.

TABLE 1
Respondent demographics

		First-year		Senior	
		Count	Percentage	Count	Percentage
Gender	Male	2771	34%	3351	35%
	Female	5274	66%	6375	65%
Enrollment Status	Part-time	259	3%	1175	13%
	Full-time	7789	97%	8562	87%
Race or Ethnicity	African American or Black	676	8%	881	9%
	American Indian or other Native American	40	1%	60	1%
	Asian, Asian American, or Pacific Islander	483	6%	437	5%
	White (non-Hispanic)	5753	71%	7132	73%
	Hispanic, Mexican or Mexican American, Puerto Rican	279	4%	273	3%
	Other	124	2%	111	1%
	Multiracial	208	3%	194	2%
	No response	502	6%	666	7%

TABLE 2.
Institutional Characteristics

		Count	Percentage
Control	Public	14	31%
	Private	31	69%
Carnegie Classifications	Doctoral	8	19%
	Master's	16	38%
	Baccalaureate	18	43%
Urbanicity	City	27	60%
	Suburban	6	13%
	Town	7	16%
	Rural	5	11%

	Min.	Max.	Mean	Median	SD
Undergraduate enrollment	147	28,645	4,937	2,531	5,711

Descriptive Statistics

The first three questions of the survey asked students how many courses they took in the current academic year, how many of those used the Web or the Internet as the primary method to delivery course content, and how many of those courses were hybrid courses. Using those responses, we were able to classify course delivery methods into three categories: Web or Internet-only, face-to-face, and hybrid. As a result of this classification, respondents could take courses in 7 different combinations: Web-only, face-to-face only, hybrid-only, some Web and some hybrid, some Web and some face-to-face, some face-to-face and some hybrid, and all three delivery methods. As shown in Table 3, very few (2.1%) of the 17,819 students who adequately completed the survey took all their courses online. Some students (5.2%) took some online courses and some hybrid courses while a similar percentage (7.6%) enrolled in both online and hybrid courses. The majority (63.7%) took classes with at least some face-to-face component. Although some of those students were also enrolled in online (8.0%) or hybrid (34.9%) courses, one-fifth (20.8%) were only enrolled in face-to-face classes with no significant technology component. These seven groups were collapsed into five groups for later analyses: web-only, hybrid-only, some web, hybrid and face-to-face, and face-to-face-only.

TABLE 3
Distribution of course options

	First-year Students		Senior Students	
Course Delivery Method	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Web-only	90	1.1%	281	2.9%
Hybrid-only	628	7.8%	789	8.1%
Face-to-face-only	1,718	21.3%	1,988	20.4%
Web and hybrid	362	4.5%	561	5.8%
Web and face-to-face	573	7.1%	776	8.0%
Face-to-face and hybrid	1,699	21.1%	2,139	21.9%
All three delivery methods	2,995	37.1%	3,220	33.0%
Total	8,065	100.0%	9,754	100.0%

From the data in Tables 4 and 5 it is easily observed that students whom one would expect to use technology more often - students enrolled in online and hybrid classes - indeed more frequently used online learning tools and technologies than students who took face-to-face courses. More specifically, respondents who were enrolled in online courses more frequently used both synchronous and asynchronous communication tools in their courses. Compared with students in traditional face-to-face setting, online students also more frequently used electronic media to discuss or complete assignments. These differences were consistent for both first-year and senior students. One interesting finding is that students who took hybrid courses more frequently utilized the institutional web-based library resources in completing class assignment than students who only had online courses or those only had face-to-face courses. A probable explanation is that students who took hybrid courses are more familiar with doing research online than students who took only face-to-face courses.

We attempted to perform an analysis of variance (ANOVA) on the mean scores for these seven questions for both first-year and senior students to determine which, if any, of the apparent differences are statistically significant. These tests were abandoned as the assumptions of ANOVA, particularly homoscedacity, were only met in 2 of the 14 tests. A nonparametric test, the Kruskal Wallis Test, indicated that there are significant differences in the mean scores for each question among at least some of the groups of students. However, the very large number of respondents makes it difficult to make much meaning of the significant results of those tests given their sensitivity to the high number of respondents.

TABLE 4
First-year student engagement in online learning activities

	Web-only		**Hybrid-only**		**Some web**		**Hybrid and face-to-face**		**Face-to-face - only**	
	Mean	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD
How often: Discussed or completed an assignment using a **synchronous** tool like instant messaging, online chat room, video conference, etc.	**1.91**	1.174	**1.72**	.961	**1.62**	.886	**1.50**	.810	**1.45**	.824
How often: Discussed or completed an assignment using an **asynchronous** tool like e-mail, discussion board, listserv, etc.	**3.12**	1.091	**2.62**	.974	**2.46**	.931	**2.39**	.893	**2.00**	.928
How often: Used your institution's Web-based library resources in completing class assignments	**2.40**	.997	**2.60**	.910	**2.45**	.900	**2.44**	.861	**2.29**	.919
How often: Used the Internet to discuss with an instructor topics you would not feel comfortable discussing face-to-face or in a classroom	**1.70**	.993	**1.87**	.989	**1.78**	.940	**1.69**	.874	**1.62**	.882
How often: Used an electronic medium (listserv, chat group, Internet, instant messaging, etc.) to discuss or complete an assignment	**3.07**	1.095	**2.66**	1.044	**2.66**	1.037	**2.61**	1.001	**2.33**	1.047
How often: Used e-mail to communicate with an instructor	**3.40**	.761	**3.25**	.790	**3.25**	.781	**3.17**	.778	**3.04**	.824
To what extent does your institution emphasize using computers in academic work?	**3.56**	.781	**3.42**	.744	**3.33**	.780	**3.30**	.753	**3.15**	.821

TABLE 5
Senior student engagement in online learning activities

	Web-only		**Hybrid-only**		**Some web**		**Hybrid and face-to-face**		**Face-to-face - only**	
	Mean	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD
How often: Discussed or completed an assignment using a **synchronous** tool like instant messaging, online chat room, video conference, etc.	**2.05**	1.160	**1.62**	.921	**1.64**	.889	**1.51**	.812	**1.34**	.734
How often: Discussed or completed an assignment using an **asynchronous** tool like e-mail, discussion board, listserv, etc.	**3.29**	1.032	**2.82**	.986	**2.69**	.942	**2.58**	.915	**2.07**	.979
How often: Used your institution's Web-based library resources in completing class assignments	**2.72**	1.042	**2.81**	.964	**2.75**	.933	**2.77**	.939	**2.52**	1.020
How often: Used the Internet to discuss with an instructor topics you would not feel comfortable discussing face-to-face or in a classroom	**1.77**	1.086	**1.82**	.990	**1.74**	.933	**1.61**	.850	**1.48**	.819
How often: Used an electronic medium (listserv, chat group, Internet, instant messaging, etc.) to discuss or complete an assignment	**3.25**	1.018	**2.99**	1.009	**2.91**	.991	**2.81**	.979	**2.47**	1.067
How often: Used e-mail to communicate with an instructor	**3.67**	.604	**3.53**	.687	**3.47**	.691	**3.43**	.707	**3.28**	.788
To what extent does your institution emphasize using computers in academic work?	**3.72**	.594	**3.64**	.613	**3.49**	.716	**3.48**	.711	**3.37**	.799

HLM One-Way ANOVA Model

Prior to estimating the full two-level HLM to examine the effects of individual and institutional variables in the student's likelihood of taking online courses, we used the one-way ANOVA model or so-called "null model" to estimate the proportion of variance that exists between and within colleges. Table 6 presents the variance components. The proportion of variance between institutions ranges from 0.033 for first-year students to 0.157 for seniors. This indicates that institutional variables have more influence on seniors than first-year students in their decision to take online courses. This result also warrants further investigation into what individual and institutional variables may affect students' decision to take online courses.

TABLE 6
Variance components of dependent variable

	Ratio of online courses taken by the student	
	First-Year Students	Seniors
Total variance	.05929	.08028
Variance within institutions	.05731	.06767
Variance between institutions	.00198	.01261
Proportion between institutions	.033	.157

HLM Random Coefficient Regression Model

The second step of the modeling procedure is the creation of the random coefficient regression models, also known as the level 1 models or the individual level models. Table 7 presents the descriptive statistics of the independent variables included in the analysis. The Level 1 independent variables include student's gender (0 = male, 1 = female), enrollment status (0 = full-time, 1 = part-time), ethnicity (0 = White/Caucasian, 1 = Minority), first generation college student status (0 = at least one parent has a baccalaureate degree, 1 = neither parent has a baccalaureate degree), and a series of dummy-coded variables for major (with Arts, Humanities, and Social Sciences being the reference category).

HLM Intercept- and Slopes-as-Outcomes Models

In the third step in the modeling process, we built the between-institution model by allowing the intercept to vary by institution. We then modeled the intercept with institutional characteristics. Included in the Level 2 models are 2005 Basic Carnegie Classifications (doctorate granting universities, master's colleges and universities, baccalaureate colleges, and others) with the doctorate granting universities serving as the reference category. We also included institution control (public or private) and locale or urbanicity (city, suburban, town, and rural, of which city serves as the reference category). To avoid multicollinearity, we did not include the size of the institution as a control because the size of institution is highly correlated with the Carnegie Classification within our sample ($r = .71$, $p < .001$).

Table 8 illustrates the summary effects of individual and institutional variables on student's decision to take online courses. It is clear that the factors that affect online course

taking for first-year students and seniors are quite similar. For first year students, enrollment in a private institution slightly increases the likelihood ($p < .05$) of enrolled in online courses while enrollment in a master's colleges and universities slightly reduces ($p < .05$) the chance of enrolled in online courses compared with someone enrolled in a doctorate granting universities. Contrary to their effect on first-year students, institutional variables have no effect on senior students' decision to take online courses. Individual variables have more impact on senior students' decision to take online courses.

TABLE 7
Descriptive statistics for independent variables included in models

Individual Characteristics	First Year Students				Seniors				
	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.	Description
First generation college student	.38	.49	0	1	.42	.49	0	1	First generation college student is defined as neither parent has a baccalaureate degree from a college. 1 = first generation college student, 0 = all other
Female	.64	.48	0	1	.65	.48	0	1	Gender: 1 = female, 0 = male
Part-time enrollment	.03	.18	0	1	.13	.33	0	1	Enrollment status: 1 = enrolled part-time, 0 = enrolled full-time
Ethnical minority	.28	.45	0	1	.26	.44	0	1	Ethnicity: 0 = White/Caucasian, 1 = all other
STEM	.18	.39	0	1	.17	.37	0	1	Major: 1 = Science, Technology, Engineering, and Mathematics, 0 = all other
Arts, Humanities, and Social Sciences (reference)	.26	.44	0	1	.28	.45	0	1	Major: 1 = Arts, Humanities, and Social Sciences, 0 = all other
Business	.17	.37	0	1	.18	.39	0	1	Major: 1 = Business, 0 = all other
Professional	.12	.32	0	1	.13	.34	0	1	Major: 1 = Professional, 0 = all other
Other and undecided	.16	.37	0	1	.15	.36	0	1	Major: 1 = Other majors and undecided, 0 = all other

Institutional Characteristics	First Year Students				Seniors				
	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.	Description
Carnegie: Doctoral institution	.18	.39	0	1	.18	.39	0	1	Carnegie Classification: 1 = Doctorate-granting universities, 0 = all other
Carnegie: Master's institution	.36	.48	0	1	.36	.48	0	1	Carnegie Classification: 1 = Master's colleges and universities, 0 = all other
Carnegie: Baccalaureate institution	.4	.5	0	1	.4	.5	0	1	Carnegie Classification: 1 = Baccalaureate colleges, 0 = all other
Carnegie: Other	.07	.25	0	1	.07	.25	0	1	Carnegie Classification: 1 = Special focus institutions, tribal colleges, none-classified institutions
Private	.69	.47	0	1	.69	.47	0	1	Control: 1 = private, 0 = public
City	.6	.5	0	1	.6	.5	0	1	Urbanicity: 1 = city, 0 = all other
Suburb	.13	.34	0	1	.13	.34	0	1	Urbanicity: 1 = suburb, 0 = all other
Town	.16	.37	0	1	.16	.37	0	1	Urbanicity: 1 = town, 0 = all other
Rural	.11	.32	0	1	.11	.32	0	1	Urbanicity: 1 = rural, 0 = all other

TABLE 8
Coefficients from HLM for the ratio of courses taken online by the student

	First-Year Students		Seniors	
	Coefficient	p-value	Coefficient	p-value
Institution-Level Variables				
Intercept	.118	.001	.141	.001
Carnegie: Master's	-.01	.435	.004	.816
Carnegie: Baccalaureate	-.038	.016	-.03	.188
Carnegie: Other	-.039	.282	.27	.628
Private	.025	.043	.014	.408
Locale: Suburban	.016	.282	-.001	.992
Locale: Town	.003	.859	-.027	.27
Locale: Rural	.039	.075	.001	.995
Individual-Level Variables				
First generation college student	.013	.056	.013	.096
Female	-.01	.113	-.005	.421
Part-time	.093	.016	.086	.001
Minority	.035	.001	.047	.001
Major: STEM	-.02	.056	-.03	.041
Major: Business	.02	.032	.004	.778
Major: Professional	-.009	.307	-.046	.001
Major: Other and undecided	.001	.952	.008	.518
Variance Components				
Variance between institutions	.0006		.00539	
Variance between explained	69.70%		57%	
Variance within institutions	.05407		.06368	
Variance within explained	5.65%		5.90%	

Although individual variables affect both first-year and senior students' decision to take online courses, they tend to affect seniors more than first-year students. For first-year students, ethnic minorities ($p<.001$) and part-time students ($p<.05$) are more likely to enroll in online courses. The same effects can also be found with senior students (both $p<.001$). Additionally, seniors who major in the professional fields (e.g. education, nursing, occupational therapy…etc.) are also more likely to enroll in online courses ($p<.001$). Student major has no effect on first-year students' likelihood of taking online courses except for students in business ($p <.05$).

Multiple regression models

As can be seen in Tables 9 and 10, the total variance explained by the multiple regression models employed in this study is statistically significant in all cases and is quite substantial in many of those cases. For first-year students (Table 9), the variance explained by the models ranges from 12.3% to 32.1%, while for seniors it ranges from 11.1% to 26.2% (Table 10). Of the

variance explained the largest portion by far is students' use of learning technology. In contrast, the delivery method of the courses that students are enrolled in seem to have a statistically significant, but in most cases unsubstantial impact on the variance explained for the model.

TABLE 9
First-year students' partitioning of variance for the Deep Learning Scales, Gains Scales, and NSSE Benchmarks in multiple regression models

Variance due to:	Student[a] and institutional[b] characteristics	Delivery of courses[c]	Use of learning technology[d]	Total Variance Explained
Deep Learning Scales:				
Higher Order Thinking	.046***	.005***	.116***	.167***
Integrative Learning	.050***	.008***	.199***	.257***
Reflective Learning	.032***	.001	.090***	.123***
Gains Scales:				
Person and Social Development	.070***	.007***	.129***	.206***
Practical Competence	.075***	.009***	.164***	.248***
General Education	.059***	.010***	.126***	.195***
NSSE Benchmarks:				
Academic Challenge	.085***	.008***	.144***	.237***
Active and Collaborative Learning	.096***	.004**	.185***	.285***
Supportive Campus Environment	.076***	.013***	.102***	.191***
Student Faculty Interaction	.106***	.001	.214***	.321***

[a] Student characteristics include: gender, enrollment status, parents' education, grades, SAT scores, transfer status, age, membership in a fraternity/sorority, whether or not a student is a STEM field, race-ethnicity, and U.S. citizenship.
[b] Institutional characteristics include: Carnegie classification and control.
[c] Delivery of courses included: the percentage of courses a student was taking online and the percentage of courses a student was taking face-to-face with web-components.
[d] Use of learning technology included: a single scale combining the seven questions asking students about how often they used certain course-related technology.
** $p < .01$, *** $p < .001$

TABLE 10
Seniors students' partitioning of variance for the Deep Learning Scales, Gains Scales, and NSSE Benchmarks in multiple regression models

Variance due to:	Student[a] and institutional[b] characteristics	Delivery of courses[c]	Use of learning technology[d]	Total Variance Explained
Deep Learning Scales:				
Higher Order Thinking	.032***	.005***	.106***	.143***
Integrative Learning	.069***	.012***	.170***	.251***
Reflective Learning	.038***	.007***	.066***	.111***
Gains Scales:				
Person and Social Development	.091***	.004***	.119***	.214***
Practical Competence	.069***	.013***	.138***	.220***
General Education	.078***	.009***	.089***	.176***
NSSE Benchmarks:				
Academic Challenge	.045***	.013***	.132***	.190***
Active and Collaborative Learning	.082***	.015***	.165***	.262***
Supportive Campus Environment	.065***	.008***	.085***	.158***
Student Faculty Interaction	.074***	.010***	.161***	.245***

[a] Student characteristics include: gender, enrollment status, parents' education, grades, SAT scores, transfer status, age, membership in a fraternity/sorority, whether or not a student is a STEM field, race-ethnicity, and U.S. citizenship.
[b] Institutional characteristics include: Carnegie classification and control.
[c] Delivery of courses included: the percentage of courses a student was taking online and the percentage of courses a student was taking face-to-face with web-components.
[d] Use of learning technology included: a single scale combining the seven questions asking students about how often they used certain course-related technology.
** p < .01, *** p < .001

In all these models, the relationship between use of course-related technology is positive and relatively strong. Table 11 displays the relative influence of learning technology with other forms of engagement and students learning.

TABLE 11
Net effects[a] of use of learning technology on the Deep Learning Scales, Gains Scales, and NSSE Benchmarks in multiple regression models

Variance due to:	First-Year Students	Seniors
Deep Learning Scales:		
Higher Order Thinking	++	++
Integrative Learning	++	++
Reflective Learning	++	+
Gains Scales:		
Person and Social Development	+++	+++
Practical Competence	+++	++
General Education	++	+
NSSE Benchmarks:		
Academic Challenge	+	+
Active and Collaborative Learning	++	++
Supportive Campus Environment	+	+
Student Faculty Interaction	+++	+++

[a] Table reports results from ten multiple regression models (one per row). Student level controls include gender, enrollment status, parents' education, grades, SAT scores, transfer status, age, membership in a fraternity/sorority, whether or not a student is a STEM field, race-ethnicity, U.S. citizenship, the percentage of courses a student was taking online and the percentage of courses a student was taking face-to-face with web-components.. Institutional controls include Carnegie classification and control.
+ $p < .001$ and unstandarized $B > .3$ ++ $p < .001$ and unstandarized $B > .4$ +++ $p < .001$ and unstandarized $B > .5$

Discussion

The first research question asked: How often do college students in different types of courses use the Internet technologies for course-related tasks? First, it is important to note that most students had classes that were entirely or partially in the classroom. Very few were enrolled in all online courses and few were enrolled in hybrid-only or hybrid and online classes. Our finding is consistent with the perception that students who took online courses were more likely to use the Internet technology to enhance their learning and communication with faculty and other students. Our results also indicate that students who took hybrid courses more frequently utilized web-based library resources in completing assignments than students who took only online or face-to-face courses. Although the cause of this result is unknown, it does point out a fact that not all students who took online courses are aware of the learning resources that are available to them. Institutions must do a better job to ensure that students who took online courses are provided instruction on how to access the learning resources that are available to them online and offline. Institutions must also provide personal assistance in dealing with academic difficulties and technical problems to online students who do not have the benefit of personal contacts with faculty and fellow classmates as in the face-to-face classrooms.

Our second research question asked: Do individual and institutional characteristics affect the likelihood of taking online courses? The results of our HLM analyses indicate that individual and institutional characteristics do have small but significant effects on a student's likelihood of taking online courses. We understand that there are many personal and institutional factors that can affect a student's course taking behavior and we are not trying to imply a casual relationship in our study. Personal factors like jobs, child care, and finances can have significant impact on a

student's decision of which type of courses should he or she take. Nevertheless, we did find that some types of students, like ethnic minorities and part-time students were more likely to take online courses. We also found that senior college students majoring in professional fields more frequently enrolled in online courses than students of other fields. Do minority and part-time students take online courses because online courses offer better quality of education or because it is more convenient? If the reason is for convenience – and it probably is – then the institutions must take the responsibility to ensure online students receive high quality education and related resources like social interaction with faculty and other students and opportunities to receive personal assistance from faculty and staff. If not, another form of educational segregation may happen as more and more minorities and part-time/working students elect to take online courses.

Finally, in our third research question we asked: Does the relative amount of technology employed in a course have a relationship with student engagement, learning approaches, and student self-reported learning outcomes? While one should be hesitant to suggest a causal relationship between the use of information technology and deep learning, gains, and other forms of engagement, our results are suggestive. Specifically, these results suggest that even after controlling for student and institutional characters, there is a relationship that exists between students who engage in course-related technology and those who engage in other ways. Additionally, there appears to be a relationship between technology use and learning and other gains. It would seem that the use of course-related technology is another important concept under the umbrella of student engagement. Comparing results from the models for first-year students to those for seniors also suggests that use of technology has a stronger impact earlier in the college experience. Perhaps integrating technology into entry level courses could be beneficial in encouraging engagement in other ways and learning in college.

Limitations

The most significant limitation of this study is that the results are largely based on responses to an experimental set of questions that are relatively untested for their psychometric properties, including validity and reliability. While the questions have face validity, the researchers have not yet performed qualitative tests such as cognitive interviews to ensure that respondents understand the questions in the manner intended by the researchers. Additionally, institutions participated in this study were not randomly selected from the pool of four-year colleges and universities in the United States but from the institutions participating in NSSE in 2008. Although the sample does cover a wide range of higher education institutions in terms of the Carnegie classifications, size, control, and urbanicity, one must be cautious when generalizing the results to this study to any particular institution. Lastly, a large sample size like we have for this study (total of 17,819 first-year and senior students) can be both a blessing and a curse. On the one hand, a large randomly selected student sample improves the external validity of this study. On the other hand, a large sample size has the potential of making all statistical tests significant. From our point of view, however, we believe the benefits of a large sample outweigh the disadvantages.

Conclusion

Overall, the results of this study point to a positive relationship between course-related technology use and student engagement. Not only do students who utilize the Internet and online technology in their learning tend to score higher in the traditional student engagement measures (e.g. level of academic challenge, active and collaborative learning, student-faculty interaction, and supportive campus environment), they also are more likely to make use of deep learning approaches like higher order thinking, reflective learning, and integrative learning in their study. They also reported higher gains in general education, practical competence, and personal and social development. These results are encouraging signs that technology has a positive impact on student learning and engagement. On the other hand, new technology also brings new challenges for higher education institutions. As more and more minorities and part-time students elect to take online courses, ensuring the quality of online education becomes a mandate for social equity. It is also the responsibility of the institution to make certain that all online students receive adequate academic and technological support and they are made aware of all the online and offline resources available to them. Nobody would deny the fact that computers and Internet technology have offered educational opportunities for many people who would otherwise be excluded from the traditional higher education system. Now we must not only provide educational opportunities but also the highest educational quality for students old and young, White and nonwhite, rich and poor, and talented and disabled.

REFERENCE LIST

Carini, R. M., Kuh, G. D., & Klein, S. P. (2006). Student engagement and student learning: Testing the linkages. *Research in Higher Education*, 47(1), 1-32. Retrieved June 24, 2007, from http://www.springerlink.com/content/b8m6t51v83732308/fulltext.pdf

Chickering, A. W., & Gamson, Z. F. (1987). Seven principles for good practice in undergraduate education. *AAHE Bulletin*, 39(7), 3-7.

EDUCAUSE. (2007). *EDUCAUSE Core Data Service fiscal year 2006 summary report*. Retrieved July 30, 2008, from http://net.educause.edu/apps/coredata/reports/2006/

Ellison, N. (2007). *Facebook use on campus: A social capital perspective on social network sites*. Program presented at the Sixth Annual ECAR Symposium, Boca Raton, FL.

Gladieux, L. E. & Swail, W. S. (1999). *The virtual university and educational opportunity: Issues of equity and access for the next generation*. Washington, D.C.: College Board.

Green, K. (2007). *The 2007 Campus Computing Survey*. Retrieved July 30, 2008, from http://www.campuscomputing.net/sites/www.campuscomputing.net/files/2007-CCP_0.pdf

Hu, S., & Kuh, G. D. (2001, November 24). Computing experience and good practices in undergraduate education: Does the degree of campus "wiredness" matter? *Education Policy Analysis Archives, 9*(49). Retrieved July 30, 2008 from http://epaa.asu.edu/epaa/v9n49.html

Kuh, G. D. (2004). *The National Survey of Student Engagement: Conceptual framework and overview of psychometric properties*. Retrieved July 31, 2008, from http://nsse.iub.edu/2004_annual_report/pdf/2004_Conceptual_Framework.pdf

Kuh, G. D., & Hu, S. (2001). The relationships between computer and information technology use, student learning, and other college experiences. *Journal of College Student Development, 42*, 217-232.

Jenkins, H. (2006). *Convergence culture: Where old and new media collide.* New York: NYU Press.

Kuh, G. D., & Vesper, N. (2001). Do computers enhance or detract from student learning? *Research in Higher Education*, 42, 87-102.

Nelson Laird, T. F., Shoup, R., & Kuh, G. D. (2005, May). *Measuring deep approaches to learning using the National Survey of Student Engagement*. Paper presented at the Annual Meeting of the Association for Institutional Research, Chicago, IL. Retrieved June 24, 2007, from http://nsse.iub.edu/pdf/conference_presentations/2006/AIR2006DeepLearningFINAL.pdf

Ouimet, J. A., Bunnage, J. C., Carini, R. M., Kuh, G. D., & Kennedy, J. (2004). Using focus groups, expert advice, and cognitive interviews to establish the validity of a college student survey. *Research in Higher Education, 45*(3), 233-250.

Pike, G. R. (2006). The convergent and discriminant validity of NSSE Scalelet scores. *Journal of College Student Development, 47*(5), 550-563.

Siegel, S., & Castellan, N. J., Jr. (1988). *Nonparametric statistics for the behavioral sciences* (2nd ed.). Boston: McGraw-Hill.

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate Statistics* (5th ed.). Boston: Pearson.

APPENDIX

NSSE 2008 Online Learning Experimental Items

1. During the current school year, how many courses have you completed in total?
(Use a drop down menu for student to select from 0 to 20 or more)

2. During the current school year, about how many of these courses used the Web or Internet as the ***primary method*** to deliver course content?
(Use a drop down menu for student to select from 0 to 20 or more)

3. During the current school year, about how many of your courses were conducted face-to-face but had a Web component designed to promote interaction among students and instructors?
(Use a drop down menu for student to select from 0 to 20 or more)

4. In your experience at your institution during the current school year, about how often have you done each of the following?

Discussed or completed an assignment using a "**synchronous**" tool like instant messenger, online chat room, video conference, etc.	Very Often	Often	Sometimes	Never
Discussed or completed an assignment using an "**asynchronous**" tool like e-mail, discussion board, listserv, etc.	Very Often	Often	Sometimes	Never
Asked for help from a tutor or other students outside of required class activities	Very Often	Often	Sometimes	Never
Participated in discussions about important topics related to your major field or discipline	Very Often	Often	Sometimes	Never
Participated in course activities that challenged you intellectually	Very Often	Often	Sometimes	Never
Participated in a study group outside of those required as a class activity	Very Often	Often	Sometimes	Never
Participated in discussions that enhance your understanding of social responsibility	Very Often	Often	Sometimes	Never
Used your institution's Web-based library resources in completing class assignments	Very Often	Often	Sometimes	Never
Participated in discussions that enhance your understanding of different cultures	Very Often	Often	Sometimes	Never
Used the Internet to discuss with an instructor topics you would not feel comfortable discussing face-to-face or in a classroom	Very Often	Often	Sometimes	Never