Student Perspectives on the Importance and Use of Technology in Learning

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Under constant demands to improve the quality of higher education within an increasingly digital world, technology is often seen as a way to increase learning and collaboration on college campuses. The current generation of college students has grown up with technology, and these students are among the earliest adopters of new advances in technology (Jones, 2002; McHaney, 2011). Allowing students to connect to their campus community, collaborate with peers, acquire new information, and demonstrate their learning through technology is essential for college campuses seeking to meet the needs of today's college students. Though access and use of technology is highest in traditional age college students, disparity still exists in who uses technology and at what age they are exposed to it (Jones et al., 2009; Pew Research Center, 2012; Wilson, Wallin, & Reiser, 2003). Race, gender, age, socioeconomic status, among other factors, can impact the level of technical proficiency students come to college with and should be considered in how technology is implemented on college campuses (Goode, 2010; Hargittai, 2010; Huang, Hood, & Yoo, 2012). In order to effectively use technology to improve education, we must investigate how students are currently using technology, what they want from their colleges in the use of technology, how technology impacts educational outcomes, and how these factors differ for different student populations.

Our general purpose in this study was to investigate students' perceptions and uses of technology. Specifically, the following research questions guided this study:

1. How often do students use technology to connect and communicate with various people on campus?
    a. How does this technology use relate to the quality of relationships students have with various people on campus?
2. How important is it to students to have access to more or better technology for themselves or their instructors?

    a. How do these perceptions of importance vary by different types of students and students in different institutional settings?

3. To what extent has students' technology use enabled them to understand, demonstrate their understanding, or study on their own or with others?
    a. How does such uses of technology relate to other important forms of educationally effective engagement?

This study uses a large-scale dataset to explore these issues and provide information to institutions of higher education to effectively implement greater technology use among students.

Literature Review

Today's incoming students and entry level professionals are from the generation known as "Millennials", born between 1982 and 2002 (Coomes and DeBard, 2004). This generation is the largest in American history and is highly skilled in technology use and innovation. Growing up with technology and digital media has "fundamentally altered the way this rising generation reads, learns, processes information, and solves problems" (Howe and Nadler, 2010a). Not only are today's college students more likely to be exposed to technology at younger ages, but they are using internet and devices at higher rates and frequencies.

Living in a digital age, work, education, entertainment, and social connectivity are all experienced on the web. Becoming a commonplace activity, in 2012, ninety-six percent of 18-29 year olds used the internet (Pew Research Center, 2012). Individuals with higher levels of education used the internet more frequently; only 61% of individuals without a high-school diploma used the internet while 94% of individuals with some college and 97% with a college degree or higher were internet users (Pew Research Center, 2012). With technology as an integrated part of their academic and social lives, millennials are early adopters. College students utilize technology more frequently than other age

cohorts and adapt their usage more rapidly, with one-fifth of college students beginning to use computers before they are 8 years old (Jones, 2002; McHaney, 2011).

With increased innovation and technological developments, access becomes a concern. Campuses expecting technological fluency and seamless integration into the classroom must also acknowledge that there are students with limited skills and exposure. Students who own a computer during adolescence are more likely to interact with peers through the internet and are generally more comfortable using computer technologies in college (Jones, Johnson-Yale, Millermaier, & Pérez, 2009). Though millennials and college students are more likely than older generations and non-students to use the internet, access by gender and race varies. Frequency and form of technology use influence confidence, ability, and the learning curve for students on the internet. Jones et al. (2009) found that males spent more time online and were more likely to go online overnight than females. Confidence using web platforms and programs is higher among male participants in Huang, Hood, and Yoo's (2012) survey of technologies for learning. Preference for type of online activity also varies with males using alternative search engines and information sources, gaming, entertainment sites, and developing original pages (Huang, Hood, & Yoo, 2012; Jones et al., 2009). Females utilize mainstream information gathering tools and express higher confidence interacting through email or social media platforms (Huang, Hood, & Yoo, 2012; Jones et al., 2009). Interacting differently than males online, females use communicative, interpersonal, and educational platforms while males more often use the internet for task related and entertainment activity (Huang, Hood, & Yoo, 2012; Jackson et al. 2001 as cited in Jones et al., 2009). However, both male and female college students showed similar academic and email usage according to Fortson, Scotti, Chen, Malone, and Del Ben (2007).

Technology and internet use also varied by student racial demographics. Hargittai (2010) surveyed first-year college students at an urban university and found that females, Hispanics, and

students with lower socioeconomic status reported lower abilities, usage, and knowledge of the internet. White students are more likely to have experience with and access to the internet at home prior to college, and report higher frequency and levels of internet use than their peers (Goode, 2010; Hargittai, 2010). Black and Hispanic students are more likely to begin their internet experience at school while White students are more likely to first experience online use at home (Jones et al., 2009). The increasing gap between technology users and non-users is referred to as the "digital divide" separating students with prior experience or access to technology, typically White and/or male, from non- or infrequent users, predominantly females, minorities and lower socio-economic status communities (Jones et al., 2009; Wilson, Wallin, & Reiser, 2003). As the use of technology becomes an integrated part of a college education, it is important to understand if and how the digital divide is impacting the educational experiences of different populations of students. This study will explore which students are using technology and how technology is shaping their college experiences.

Relationship to Learning and Gains

College students that fall within the millennial generation are particularly skilled at various forms of technology connected with their social and academic lives. Not only do students check email and media messages daily for social reasons (Jones, 2002), but according to Jones et al. (2009), through their 7,421 survey respondents at 40 colleges and universities on internet familiarity and use, 81% of Hispanic, 85% of White, and 81% of Black student respondents reported that the internet benefitted their college experience. Students at the turn of the century were already reporting more reliance on the internet than university libraries, and utilized it as a major mechanism for communicating with faculty and classmates (Jones, 2002). Goode (2010) reports that students who are familiar with and have previously used various forms of technology can use these tools to aid in their academic experiences.

Furthermore, she posits that students with limited technological skills may actually struggle to succeed with certain coursework or assignments.

One area of technology use that is becoming increasingly integrated at the college and university level is course management software (CMS). CMS systems are utilized to increase efficiency with the distribution of course materials and offer an opportunity for increased communication online for distance and traditional education students (Harrington et al., 2003). Because students want a "blend of high tech and high touch" (Howe and Nadler, 2010b), increasing interactions with technology past email and web pages has broadened opportunities for students to engage with course material and college administrators and faculty. Responding to rapidly changing needs of students communicating in much different ways that previous generations is a complex task that must consider the reliability of information sources and how that information is delivered (McHaney, 2011). Meeting these technological demands of a changing student population can be challenging to faculty and administrators (Lowery, 2004), given potential differences in technological skills between students and staff.

Georgina and Olson (2007 sought to identify faculty perceptions of technology use at postsecondary education institutions. The majority of the respondents preferred teaching in a technology-enhanced space, and expressed proficiency with email correspondence with email and web browsing, but lacked the skills necessary to teach using social media. In order to maintain technology platforms that are desirable and appropriate for the skill level of students, faculty members either possess, or must be trained to acquire skills to manage these systems efficiently (Georgina and Olson, 2007). Georgina and Olson (2007) note that some faculty criticize the growth of digital learning environments for emphasizing information delivery rather student learning. Hartman (2008) supports this notion as well, stressing the emphasis on selecting the "right'' technologies while indicating that

there has not been enough demonstration of significant success of teaching improvement related to newer adoptions of technology use.

This perception of the success of information technology at increasing or positively enhancing student learning may not be shared by students, however. Through evaluation of student perceptions of technology use, Nelson Laird and Kuh (2005) report "there appears to be a strong positive relationship between using technology for educational purposes and involvement in effective educational practices such as active and collaborative learning and student-faculty interaction" (p. 211). In a recent study focused on how technology use can contribute to effectiveness of teaching and learning, Morrone, Gosney, and Engel (2012) reported that "iPads were found to increase student engagement by providing innovative and creative learning environments, despite the effort required—of both students and instructors—to make adjustments to the technology" (p. 1). Though this study revealed difficulties for faculty and students as they learned how to work with new technologies, the gains reported included relationship building between faculty and students participating in this learning curve together and increased student interest and creativity (Morrone et al., 2012). Additionally, and perhaps most relevant to the current study, this work reports benefit gains of "greater levels of student engagement, opportunities to create new kinds of learning environments and activities, and the ability to extend learning opportunities outside of the classroom" (Morrone et al., 2012, p. 2). The present research will further examine the relationship between technology and engagement by specifically looking at how technology use impacts educationally effective practices and the quality of relationships students develop with faculty, staff, and peers on campus.

Course Management

Technology use on university campuses is increasing beyond emails and web pages as administrators are challenged to meet the needs and demands of the incoming student populations in

regard to the format for which services are offered (Lowery, 2004). The National Association of Colleges and Employers (NACE) found that students want a "blend of high tech and high touch" (Howe and Nadler, 2010b) but are also entering college with a range of skills, while "there are currently no standard technology prerequisites for college freshmen" (Goode, 2010, p. 585). If a course includes a technology component, students who need more training or proficiency are charged to seek assistance on their own. Campuses are moving beyond basic access and personal computer use expectations to focus on using appropriate technologies for learning objectives and course experiences (Hartman, 2008). Increasing expectations of students on the classroom learning environment are met with challenges of adopting technologies, utility of applications in the educational setting, and learning curve for students and faculty.

Preference for format of internet interactions is extended to distance learning environments. Technology is used for distance education but not integrated at the same frequency for on-campus pedagogies (Georgina and Olson, 2007). Technology literacy has evolved from word processing and computer skills to interacting with various interfaces and platforms efficiently (Georgina and Olson, 2007). Contributing to the range of formats for interacting via distance with students, digital classrooms provide new opportunities for engagement; however, criticism of digital learning environments is that the emphasis is on information delivery and not student learning (Georgina and Olson, 2007). Considerations on how education is delivered though technology continue to evolve as students communicate differently than previous generations (McHaney, 2011).

Methods

Data

The data for this study come from the 2012 administration of the National Survey of Student Engagement (NSSE). NSSE was designed to measure student behaviors and the time and energy they

invest in activities that relate to student learning and development. More specifically, NSSE asks students how often they engage in various effective educational practices as well as their perceptions of their college environment and various gains while in college. The 2012 NSSE was administered to a sample of first-year and senior college students at nearly 570 colleges and universities in the United States and Canada. Students attending forty-two of these institutions were given an additional item set at the end of the survey asking students about how technology related to their learning in college. The extra item set consisted of fifteen items, twelve of which will be the focus of this study. See Table 1 for these additional items.

Table 1. NSSE 2012 Selected Technology Items

Component Items	Scale
How often have you used technology to connect and communicate with the following people? (Very often, Often, Sometimes, Never) a. Classmates b. Academic advisors c. Faculty d. Student services staff (campus activities, housing, career services, etc. e. Other administrative staff and offices	
How important are the following to you? (Very important, important, Somewhat important, Not at all important) a. That your instructors use new, cutting-edge technologies b. That more or better technology was available to learn, study, or complete coursework c. That you were better trained or skilled at using available technologies to learn, study, or complete coursework	**Technology Importance** $\alpha = .871$
During the current school year, to what extent has your use of technology enabled you to do the following? (Very much, Quite a bit, Some, Very little) a. Understand course materials and ideas b. Demonstrate your understanding of course content c. Learn, study, or complete coursework on your own d. Learn, study, or complete coursework with other students	**Learning Technology** $\alpha = .856$

Sample

The total sample for the current study consists of almost 7500 seniors at 42 institutions. About two-thirds (66%) of seniors were female, and about half (55%) were transfer students. Most (80%) were

enrolled full-time, and few (15%) were living on campus in a dormitory, other campus housing, or a fraternity or sorority house. About two-thirds (67%) of students where White (non-Hispanic), and the majority of students' grades were mostly A's (52%) or B's (43%). Students were from a wide variety of major fields with the largest proportions in Business (22%) or Social Science (15%) fields. About half (46%) of students were from privately controlled institutions, and most students (69%) were from Master's-granting institutions. For additional information about student demographics and institutional characteristics included in this study, see Table 2.

Table 2. Student and Institution Characteristics

		Seniors (%)
Female		66
Transfer student		55
Full-time enrollment		80
Living on campus		15
First generation		52
Age (24 or older)		46
Race or ethnicity	African American/Black	10
	Asian/Pacific Islander	3
	Caucasian/White	67
	Hispanic/Latino	9
	Other	5
Primary major field	Arts & Humanities	14
	Biological Sciences	7
	Business	22
	Education	11
	Engineering	3
	Physical Science	3
	Professional	10
	Social Science	15
Grades	Mostly A's	52
	Mostly B's	43
	Mostly C's	6
Institution Characteristics		
Control	Private	46
Carnegie Classification	Doctoral	10
	Master's	69
	Bachelor's	21

Measures and Analyses

Technology is broadly defined for this study. At the beginning of the technology extra item set, students were informed that by "technology" we meant any or all of the following:

- Hardware (desktop computers, laptops, tablets, smart phones, etc.)
- Software (word processing, spreadsheets, presentations, graphics, statistics, etc.)
- Online tools (communications, social networking, etc.)
- Websites (for course management, library resources, etc.)

Simple frequencies of items from the technology extra item set were used to answer the first research question about how often students use technology to connect and communicate with various people on campus. Pearson's *r* correlations were used to answer the sub-question about whether or not there was a relationship between students' use of technology to communicate and students' perceptions of their quality of interactions with other students/classmates, faculty members, and administrative staff and offices. The items about quality of interactions with people on campus can be found on the core NSSE survey instrument.

Simple frequencies of items from the technology extra item set were also used to answer the second research questions about how important it is to students to have access to more or better technology for themselves or their instructors. To answer the sub-question about whether or not these perceptions of importance differed by student characteristics, the three items about perceptions of importance were first combined to create the Technology Importance scale. See Table 1 for component items and Cronbach's alpha. Using this scale as the outcome variable, *t*-tests were used to determine significant differences between dichotomous characteristics and ANOVAs with Tukey post-hoc comparisons were used to determine differences between characteristics with more than two groups. Cohen's *d* effect size calculations were used to determine practical significance when significant

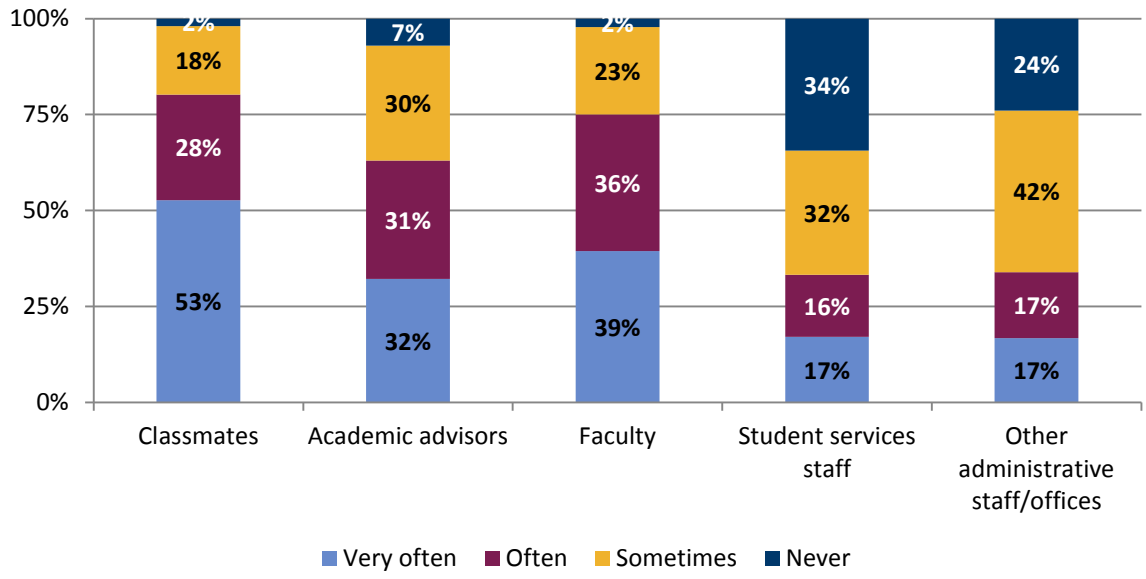
differences were found. The student demographics and institution characteristics used to look at differences are those featured in Table 2.

Simple frequencies of items from the technology extra item set were again used to answer the third research question about to what extent students' technology use enabled them to understand, demonstrate their understanding, or study on their own or with others. To answer the sub-question about relating technology use and other forms of engagement, technology items were combined to construct the Learning Technology scale. See Table 1 for component items and Cronbach's alpha. This scale was used as an independent variable in a series of OLS regression models. The dependent measures of these models included a wide variety of measures from the core NSSE survey. Four models featured NSSE Benchmarks of Effective Educational Practice: Level of Academic Challenge, Active and Collaborative Learning, Student-Faculty Interaction, and Supportive Campus Environment. Three models featured measures of deep approaches to learning: Higher-Order Learning, Integrative Learning, and Reflective Learning. Three models featured measures of student-perceived gains: Practical Skills, Personal and Social Responsibility, and General Education. And one model featured a measure of student-perceived satisfaction (the combined ratings of students' likelihood to return to their institution if they could start over and an overall evaluation of their educational experience). For more information about these measures see the NSSE web site: nsse.iub.edu. Each dependent measure was regressed on the student demographics and institutional characteristics featured in Table 2 as well as the Learning Technology scale. All continuous independent and dependent variables were standardized before entry into models so that standardized coefficients can be interpreted as effect sizes for the continuously measured Learning Technology scale.

Results

Our first research question asked how often students use technology to connect and communicate with various people on campus. Students most often use technology to communicate with classmates and faculty, least often with student-services staff and other administrative staff or offices. The majority of students frequently ('very often' or 'often') use technology to communicate with their classmates (81%) and faculty (75%). Around two-thirds (63%) of students frequently use technology to communicate with their academic advisors. Only a third of students frequently use technology for communication with other administrative staff and offices (34%) and student services staff (33%). See Figure 1 for more details on the frequency of these communications. Small positive relationships were found between students' frequency of use of technology in communications and students' perceptions of the quality of interactions with people. In other words, students that more frequently used technology as a communication tool had more positive relationships with their classmates ($r = .29$, $p < .001$), faculty ($r = .25$, $p < .001$), and administrative staff and offices ($r = .23$, $p < .001$).

Figure 1. How often students have used technology to connect and communicate with various people on campus

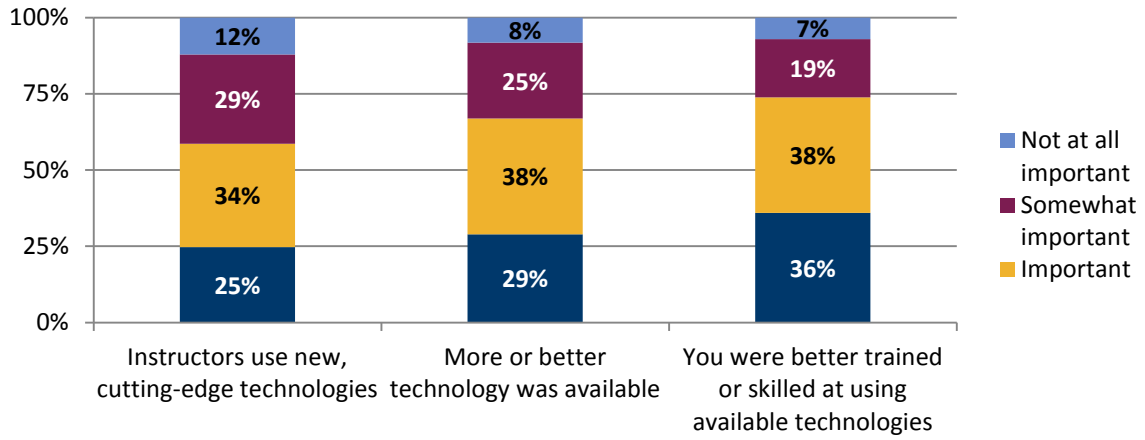


Our second research question asked how important it is to students to have access to more or better technology for themselves or their instructors. Of the questions asked, students thought it was most important that they were better trained or skilled at using the technologies that were already available to them. Nearly three-quarters of students (74%) found this to be important ('very important' or 'important'). Around two-thirds of students (67%) thought it was important that more or better technology was available to them. Although relatively the least important of these items, around three in five students (59%) still felt that it was important that their instructors use new, cutting-edge technologies. See Figure 2 for more details. Some differences were found on these items between various subgroups of students.

The following groups of students had significantly higher, although small, ratings of importance than their peers: transfer students (d = .15, p < .001), part-time enrolled students (d = .11, p < .001), students that live off campus (d = .24, p < .001), first-generation students (d = .17, p < .001), and older students (d = .25, p < .001). No differences were found on the importance ratings by gender or by students at private versus publicly controlled institutions. Students in Engineering, Professional, Business, and Education majors rated these aspects of technology similarly, and to be more important than students in Arts & Humanities, Biological Sciences, Physical Sciences, and Social Sciences majors (p < .001). The largest gap was between students in Engineering and students in Arts & Humanities majors (d = .55) suggesting that students in Engineering majors found these aspects of technology use to be noticeably more important than students in Arts and Humanities majors. Black, Latino/a, and Asian students also found these aspects of technology use to be more important than their White peers (p < .001) with Black students finding these aspects of technology use to be noticeably more important than their White peers (d = .40). Students with lower grades (mostly C's) also rated these aspects of technology use to be slightly more important than their peers with higher grades (mostly A's) (d = .12), with students that receive mostly B's falling in between. Students at doctoral granting institutions found

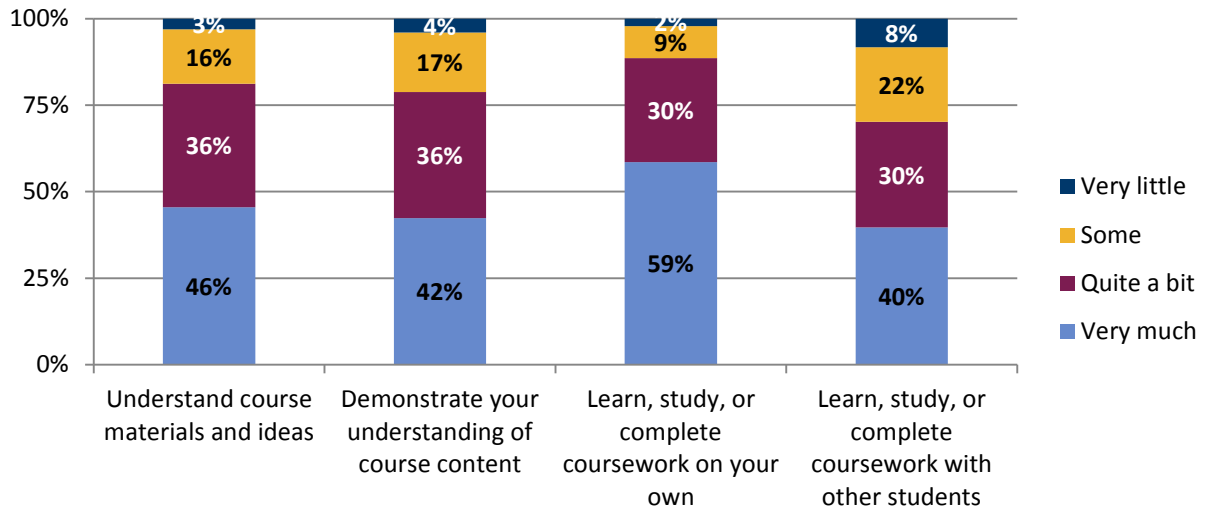
these aspects to be slightly more important than their peers at Master's-granting institutions (*d* = .12), with students at bachelor's-granting institutions falling in between.

Figure 2. How important students found various aspects of technology



Our third research question asked to what extent students' technology use enabled them to understand, demonstrate their understanding, or study on their own or with others. Nearly all students (89%) substantially ('very much' or 'quite a bit') used technology to learn, study, or complete coursework on their own. A slightly smaller proportion of students substantially used technology to understand course materials and ideas (82%) and demonstrate their understanding of course content (78%). Seven in ten students (70%) substantially used technology to learn, study, or complete coursework with other students. See Figure 3 for more details.

Figure 3. To what extent technology use enabled students to engage in various learning activities



The sub-question of our third research question asked how such uses of technology related to other important forms of educationally effective engagement. Technology use for understanding and learning was significantly and positively related to all forms of engagement measured here. The strongest relationships were between technology use and students' perceived gains in Practical Skills (β = .471) such as working effectively with others, acquiring work-related skills, and solving complex real-world problems; students' perceived gains in areas of General Education (β = .381) such as writing clearly and effectively, thinking critically and analytically, speaking clearly and effectively; and students' sense of a Supportive Campus Environment (β = .332), to what extent their institution supports them both academically and non-academically. See Figure 4 for more details on these relationships.

Figure 4. Relationships between technology use and engagement

	Standardized β
Benchmarks of Effective Educational Practice	
Level of Academic Challenge	.325
Active and Collaborative Learning	.281
Student-Faculty Interaction	.252
Supportive Campus Environment	.332
Student Perceived Gains	
Practical Skills	.471
Personal and Social Development	.364
General Education	.381
Deep Approaches to Learning	
Higher-Order Thinking	.311
Integrative Learning	.290
Reflective Learning	.206
Overall Satisfaction	.265

Discussion

This research supports the notion that technology is a significant part of students' day-to-day experiences and is significantly related to a number of effective educational practices and student outcomes. The vast majority of students are frequently interacting with faculty, advisors, and other students through technology, and greater use of technology to communicate increases the quality of the relationships students have with faculty, staff, and peers. As previous research suggests, there may be differences in preferences on the platforms students use to communicate with different people on campus (Jones, 2002). Campuses should explore whether students want to communicating with faculty and staff through social media, or if they are more comfortable communicating through email or course management systems.

In what students most want from their colleges, students most frequently reported wanting to improve their skills in using technology already available to them and having access to more and better technology. Fewer students reported wanting faculty to integrate more cutting edge technology into the classroom. The desire for increased competencies, more and better technology was strongest in

engineering majors. Providing the newest tools is important to students in technical majors like engineering both for their development in college and as a practical skill in the workplace. There were also differences in how much students valued technology use by ethnicity. Minority students, particularly Black students expressed a stronger desire for greater competency in existing technology and greater access to technology. This supports previous findings that minority students are more likely to experience technology as an integrated part of their education for the first time in college, and would therefore want greater access to technology and to learn how to better use that technology (Goode, 2010; Hargittai, 2010). This finding also illustrates the need for colleges and universities to provide technical support and training to students in the technologies used on campus and in the classroom. As we move to adopt new technologies and increase the use of technology in education, we run the risk of further alienating students through the digital divide unless we balance these advances with supports for students who are less experienced with technology.

Despite the challenge of making sure technology is accessible to students from different backgrounds, technology use in college is significantly related to a number of effective educational practices and student outcomes. Students overwhelmingly felt that technology has helped them to understand course material and demonstrate their understanding. Students also reported frequently using technology to study on their own and with peers. This use of technology to learn independently or collaboratively was related to student's self-reported gains, how supportive students felt the campus was, the level of academic challenge, student-faculty interaction, active and collaborative learning, deep approaches to learning, and student satisfaction.

Further Research

Next steps for this particular research study include looking at individual item differences between subpopulations of students to further add detail to our findings from the overall scale score

differences. Further analysis of the data for this study is complicated by the rapidly changing attitudes towards technology of faculty and students as well as the changes in technology itself. Research in this area will be benefitted by continual updates through relatively often data collection. The technological landscape is evolving rapidly with products, programs, and applications impacting how individuals gather information, connect with peers, and interact in the classroom. Challenges to integrating technology into the disciplines are linked to the constant innovation and development that limits the relevance of current technology. As faculties incorporate a new program or tool to their courses, they must not only learn how to utilize this advancement effectively for the learning environment but also must brace for it to inevitably become obsolete.

Due to, in part, the shifting landscape of technology, study of use and application in higher education struggles to grasp current trends or needs with the appropriate level of urgency for applying these findings. Questions to further explore include what challenges exist when integrating technology into various disciplines and how learning gains from technology use are measured. Also, the types of institutions, faculty, and student populations embracing technology use are changing as access grows. Previous research shows that exposure to the internet and hardware was limited to educational settings for minority populations, but as devices and programs become more prevalent in both academic and social culture, an increase in use and familiarity is anticipated.

Conclusion

Implementing educational technologies and integrating technology into the classroom can be a cumbersome and costly process for colleges. Despite this the evidence is clear that students are looking for opportunities to improve their competencies in technology and have greater access to new technology. In addition, increased use of technology is related to a number of aspects of student

engagement. All of these reasons make a strong argument for continuing to research technology and it's interaction with teaching and learning in higher education.

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