

Exploring Undergraduate Students' Skills, Level of Comfort, and Perceived Benefit of Using Technology for Learning

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Today's undergraduate students are unique for having grown up in a digital society. An emerging body of empirical research has attempted to understand how young people use technology in the academic context. Our research involved 111 students enrolled in 7 courses in the College of Education at a Mid-Atlantic university, and sought to understand college students' comfort level with, and the perceived benefits of, a variety of technologies for their academic study. Results indicated a significant relationship between the perceived benefit of a particular technology, and college/discipline, skill level, and frequency of use. Implications for the design of technology-supported learning opportunities in pre-service teacher education are discussed.

Keywords: digital natives, social psychology, technology beliefs, technology use, undergraduate students

INTRODUCTION

Today's undergraduate students are growing up in a society saturated with digital technologies such as the personal computer, Internet, and cell phones. Referred to as Millennials (Howe & Strauss, 2000), the Net Generation (Tapscott, 1998), or digital natives (Prensky, 2001), the popular discourse suggests that having grown up in this context, these students' classroom technology and learning expectations are unique (e.g., Roberts, 2005). However, a growing number of researchers argue there is little empirical evidence to support such claims (e.g., Bennett, Maton, & Kervin, 2008; Lohnes & Kinzer, 2007; Zimic, 2009). Indeed, some have begun to question the usefulness of generational labels to describe what constitutes a large, diverse group of young people (Herring, 2008; Hoover, 2009).

This debate raises questions regarding college students and their technology practices, with implications for the design of instruction and for educational policy as well as for our broader understanding of this generation. If we expect our students to engage in

meaningful, intentional learning in a technology-enhanced environment, we must understand our students' beliefs about the nature of this environment, their own roles in this space, and its contribution to what they perceive as learning in academia. In this study reported in this paper, we seek to build on the existing knowledge about Millennials' technology skills, and to explore their beliefs regarding the use of technology in their academic endeavors.

LITERATURE REVIEW

DEFINING THE MILLENNIALS

Generational theorists believe that the attitudes, behaviors, and beliefs of a generation's members are shaped, in part, by the defining events of that era (Smith & Clurman, 1997; Strauss & Howe, 1991). This idea is often used to frame discussions of the Millennial age cohort. Howe and Strauss (2000) described seven common characteristics of this generation: feeling special, sheltered by their parents, achievement oriented, confident, conventional, pressured, and team oriented. Lancaster and Stillman (2002) noted that Millennials generally display a high degree of optimism and confidence compared to the members of previous generations. Despite the positive emphasis, some Millennials reportedly feel more pressure to achieve in academic, athletic, and extracurricular arenas (Keeling, 2003). For the purposes of this paper, we define Millennials as young people born after 1982, although we acknowledge that the generational labels that have been attached to this age group may not always be useful (see Herring, 2008, for a critique of the generational approach).

CURRENT RESEARCH ON MILLENNIALS' ACADEMIC TECHNOLOGY USE

Given the claims and interest in this group of young people, a growing body of empirical research attempts to understand how young people use technology in the academic context. The EDUCAUSE Center for Applied Research (ECAR) conducts an annual study focusing on students' access to technology, skills with technology use, and preferences for technology integration into academics. In a recent version, Smith, Salaway, and Caruso (2009) reported that 44% of current undergraduates owned desktop computers, and 88% owned laptops; 90% text messaged daily. Researchers in Australia surveyed first year undergraduate students' access to and use of technology and similarly found a similar result that students had good access to technology such as desktop computer, laptop computer, and broadband internet access (Kennedy, Judd, Churchward, Gray, & Krause, 2008).

According to Smith et al. (2009), widely used technologies for academic work included the Internet for library research (95%), presentation software (94%), and spreadsheets (87%). Content creation lagged behind; 42% of students contributed to wikis, and 37% contributed to blogs. In a study of teens and social media, Lenhart, Madden, Smith, and Macgill (2007) found that 59% of young adults up to age 17 created content shared online, pointing to a discrepancy between content creation among college students for academic work, and content creation for everyday purposes.

Regarding preferences for technology integration, research suggested that technology preferences might be linked to specific subject area discourses. Selwyn's (1999) study of 96 students and 20 teachers from across various subject disciplines found that "students' attitudes towards [technology] were inexorably linked with their perceptions of the nature and content of their subject areas" (p. 34). Kennedy et al. (2008) found that students from Engineering, Architecture, Building and Planning were more likely to use certain

technologies such as building a web page, using web conferencing, and using social networking software, when compared to students from Arts.

Furthermore, students' personal experiences with technology do not always connect to their beliefs about the value of technology for teaching and learning. Lei (2009) reported that freshmen pre-service teachers believed that technology was important for daily life, teaching, and learning; however, they valued more traditional forms of teaching and learning, and were reserved about using technology to teach in their future classrooms. Lohnes and Kinzer (2007) found that students' attitudes towards teaching and learning in a liberal arts college influenced their preference for low levels of classroom technology use.

CONCEPTUAL FRAMEWORK

Preexisting beliefs play a role in students' attitudes toward college assignments and activities that require the use of technology, thus influencing student comprehension. This interest is grounded in socio-psychological perspectives on learners' epistemological beliefs -- their beliefs about the nature of knowledge and knowing (Andre & Windschitl, 2003; Hofer & Pintrich, 2002; Sinatra & Pintrich, 2003). Social psychologists conceptualize beliefs as memory representations consisting of networks of associations (Kritskaya, 2004) related to prior experiences. An attitude stems from a network of beliefs, which is shaped by prior experiences.

The notions of attitude and belief are tied to learning through the concept of intentionality. Active processing (careful reflection) on the presented material while studying requires an intentionally initiated action on the part of the learner in the service of developing knowledge or skills (Sinatra & Pintrich, 2003). Intention, in turn, is influenced by attitude and by subjective norms (such as perceived social pressure) (Ajzen & Fishbein, 2000; Dole & Sinatra, 1994; Petty & Cacioppo, 1984). Students who engage in a technology-enhanced activity intentionally seem more likely to experience comfort using technology, while appreciating its contribution to their understanding of both the process and the outcome of the activity (Hofer & Pintrich, 1997; Perry, 1981).

The focus on the learners' intent to engage with the learning activity should be at the center of the efforts of instructional designers. For example, the Millennials' everyday technology practices are characterized by the opportunity to roam freely through the Internet, and by the interactions between the digital environment and the individual's mind that are shaped by the individual's curiosities about people and objects (Strohecker, 2005). Such technology practices often conflict with the nature of the college online instructional environments where the rules and guidelines are set by the instructors or instructional designers. Characteristics of the Millennials' technology practices would thus point us in the direction of developing instructional environments that would not be restricted by instructor control. Knowledge of our students' beliefs about technology and academic learning, as well as their communicative and informal learning habits, must guide efforts in designing learning environments that harness their prior knowledge while scaffolding entry into meaningful engagements with content through technology.

PURPOSE AND RESEARCH QUESTIONS

The study presented below comprises an initial attempt in eliciting college students' habits already developed through their personal and academic interactions with digital media. We asked participants to reflect on their uses of technology for academic work in high school, their uses of technology for academic work since matriculation, and their beliefs about the value of using technology for their academic studies. The purpose of the study was not to examine their technology use within specific classroom contexts, but

rather to broadly understand student perceived comfort in, and benefit of, using technology in their academic studies. We employed a mixed method design for this study. The research questions examined in this study are:

1. What are our students' current technology use for academic work?
2. How do they perceive the benefits of using technology in their academic study and are there any differences in perceived benefits of technology for learning among students from different colleges/disciplines, and among students with different skill and their frequency of using various technologies?
3. How do students perceive their level of technology use and if there are any differences of perceived comfort level among students from different colleges/disciplines?

METHOD

SETTING AND PARTICIPANTS

The study was conducted at a comprehensive, Mid-Atlantic university in the United States. The university draws students primarily from the region, although enrollment includes students from across the U.S. and internationally. Both faculty and students at the college have access to a wide range of technology resources for learning and for instruction, including multimedia software, computer labs, Interactive White Boards, iPads, and others.

111 undergraduate students participated in this study. The students were enrolled in multiple sections of two courses situated in the College of Education: four sections of a required technology integration course for pre-service teachers, and three sections of a freshman general education course that was open to students from other disciplines. The participant group comprised a convenience sample; volunteers were solicited from five sections taught by the researchers, and two sections taught by a colleague. Given that the study focused on students' technology use in general, rather than its use within these specific courses, we consider the potential influence of researchers' characteristics as instructors minimal with respect to the nature of responses we received on the survey.

Demographics of the Participants. All participants (N=111) attended the University full-time (more than 12 credit hours per semester). The group comprised 90 female students (81.4%); 21 male students (18.6%); 55 freshmen (49.5%); 18 sophomores (15.9%); 28 juniors (25.2%); and 10 seniors (9.3%). The majority (64.8%) of the participants were enrolled in majors housed within the College of Education. Others colleges/disciplines represented include Fine Arts and Communications (1.9%), Health Professions (4.6%), Liberal Arts (16.7%), Science and Mathematics (8.3%), and Honors College (1.9%).

INSTRUMENT

This research employs a mixed method design collecting both quantitative data and qualitative data to help answer the research questions. Specifically, a survey instrument including Likert scale questions and open ended questions was utilized to collect data for our study. In creating the instrument, we adopted question items from existing surveys such as the University of Melbourne survey on students' skills with, and use of, a variety of technologies (Kennedy, Krause, Judd, Churchward, & Gray, 2006). We added sections addressing their beliefs about technology for academic study, students' technology experience in high school to understand how the college technology experience might vary from their prior experiences, and how the students' current practices may have been shaped by their prior experiences. In the end of the survey, we included open ended questions

asking students to describe their experiences with using technologies (see Appendix A for survey).

DATA ANALYSIS

The qualitative data from the open-ended questions about their beliefs regarding the value of technology for academic study were analyzed using the constant comparative method (Creswell, 2007; Glaser & Strauss, 1967). Multiple coding passes were conducted through the data led to the emergence of broad themes and categories. Our findings are described in detail below.

The quantitative data collected from the survey were analyzed using SPSS. In addition to the descriptive statistical analyses, Pearson Chi-Square tests were conducted in order to determine if there were any differences in perceived benefits of technology for learning among students from different colleges/disciplines and among students with different skill and comfort levels with various technologies. For this report, we extracted and further examined variables that showed a statistically significant relationship ($p < .05$).

RESULTS AND FINDINGS

RESEARCH QUESTION 1:

STUDENTS' CURRENT TECHNOLOGY USE FOR ACADEMIC WORK

Quantitative findings. Web search engines such as Google rated among the most frequently used technology among the students ($n=108$, 97%); many ($n=66$) reported using it several times a day. 92% of the students used presentation software in high school. This number increased to 93.8% when students described their use in the college setting. Least used technologies for academic work included: online audio (77% never used) and video (81% never used) recordings, RSS feeds to access course information (60% never used), and social bookmarking (64% never used).

Students used various technologies to communicate with each other several times a day, including email (35%), instant messaging (20%), cell phone (61%), social networking sites such as Facebook (59%), and video chat (13%). To communicate with instructors, many students used email (41% at least once a day); some students also used instant messaging ($n = 15$), social networking websites ($n = 11$), and video chats ($n = 4$) on an irregular basis.

Qualitative findings. The quantitative findings were supported by the open-ended analysis; communication, conducting research, accessing information, and time management and organization emerged as organizing categories for the benefits and possibilities that students saw for the use of technology in their academic work. These findings, with example student responses, are detailed below.

Communication. Students communicated with instructors using email, cell phones, and text messaging, to obtain information about the course, ask questions, etc. Some students used their email-enabled cell phones to receive course-related information via email. As one student indicated, "I use my cell phone to get important course information e-mailed directly to me." Although most instructors who participated in this study did not use cell phones or text messaging with their students, many students would prefer to receive course-related information this way. For example, one student expressed this desire by writing that "It would be cool if professors had a 'work cell' from the school so that all professors could see text msgs [sic]."

Students communicated with their peers using email, cell phones, text messaging, and to a lesser extent, Facebook and Instant Messaging. Again, convenience was a motivating factor behind using these technologies; for example, students wanted "to be able to contact

other students ASAP by cell phone;” another thought “Facebook would be helpful in allowing me to better communicate with my classmates.”

Conducting research. Students pointed to the Internet as crucial for conducting research. At the time of the study, many of the survey respondents were enrolled in a course that focused on research and writing, including instruction on best practices for accessing the library’s online resources. These online resources included APA style guides, the search interface for finding books in the library, and best practices for searching the subscription-only journal article databases owned by the library. While the context of the students’ responses must be taken into consideration, our finding is supported by existing research (i.e., Smith et al., 2009). Students wrote, “The internet is essential to doing research for school” and found “that the availability to access the library databases from anywhere, even off campus is very beneficial.”

Accessing information. Students appreciated the ways in which technology, particularly the Internet, offered them access to course information and resources that helped them to complete course assignments. One student summed up the prevailing attitude: “the internet provides a window of access to data that I could possibly need for studying/projects etc.” In addition, Blackboard – the university’s Learning Management System (LMS) – was mentioned as beneficial for making course related information available on an as-needed basis. For example, one student appreciated “Having access to email and blackboard just about 24/7 because I can get information I need right away and can get my questions answered within a fast pace time [sic].”

Time management and organization. Students used technology to help them keep track of their schoolwork, an especially important and pressing need for the freshmen participants. First-year students frequently identify time management and organization as necessary skills for being successful in college. Survey respondents overwhelmingly identified Blackboard as central for managing their time and assignments, and for organizing their schoolwork. For one student, “Using blackboard [sic] in college [helps me] feel more organized and less stressed because if I miss a class or forget about an assignment I can pull it up on blackboard or use it to email my professor.”

RESEARCH QUESTION 2:

STUDENTS’ PERCEPTIONS ON THE BENEFITS OF TECHNOLOGY

Overall Perceptions on the Benefits. Overall, most students believed that it was beneficial to their learning to use a computer to create documents, graphics, web pages, presentations, and movies. Most students strongly believed that it was beneficial to their learning to use the web to: access course information (87%), access university-based services (83%), search for information (83%), and communicate with instructors and other students (88%). Most students agreed or strongly agreed that it was beneficial to communicate with other students (78%) via instant messaging, but not necessarily with instructors (47%). Many students believed using blogs (65%) and wikis (52%) was beneficial to their learning, although only 60% believed that it would be beneficial to create their own blogs.

Differences in Perceived Benefits of Technology. Pearson Chi-Square tests were conducted in order to determine if there were any differences in perceived benefits of technology for learning among students from different colleges/disciplines, and among students with different skill and comfort levels with various technologies. Specifically, cross tabulation analyses were conducted to compare the ratings (1=Strong Disagree; 2=Disagree; 3=Neutral; 4=Agree; and 5=Strongly Agree) of students from seven difference colleges. Chi-Square tests (7x5) results from those cross tabulation analyses were reported in order to understand the differences among students from different

disciplines. Although most of the survey respondents were from the College of Education, findings from the literature review indicated the importance of comparing the responses of students between and among the other disciplines.

College/Discipline vs. perceived benefits. Our findings from the cross tabulation analysis (7x5 cross tabulation) suggest a significant difference among students from different colleges/disciplines regarding their perceived benefit of using various technologies. For example, when asked the degree to which it is beneficial to keep a blog as part of course requirements, 61.1% of Liberal Arts students agreed or strongly agreed, and none disagreed or strongly disagreed, while only 44.4% of Science and Mathematics students agreed or strongly agreed, and 33.3% strongly disagreed $\chi^2(24, n = 108) = 46.27, p < .05$ (See Table 1).

Table 1. Chi-Square tests for students' technology skills vs. perceived benefit

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	46.269 ^a	24	.004
Likelihood Ratio	39.282	24	.026
Linear-by-Linear Association	3.029	1	.082
N of Valid Cases	108		

Note. a. 30 cells (85.7%) have expected count less than 5. The minimum expected count is .07.

Table 2. Chi-Square tests for students' blog skills vs. perceived benefit

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	27.912 ^a	16	.032
Likelihood Ratio	29.385	16	.021
Linear-by-Linear Association	9.523	1	.002
N of Valid Cases	108		

Note. a. 16 cells (64.0%) have expected count less than 5. The minimum expected count is .11.

Skill level vs. perceived benefits. In addition to the disciplines, students with different skill levels also perceived the benefits of technologies differently. Students that rated their *skill level* as skillful or very skillful were also more likely to perceive benefits related to using technology tools. For example, we compared students who were at five different skill levels (1=Never Used; 2=Not Very Skillful; 3=Somewhat Skillful; 4=Skillful; 5=Very Skillful) with the use of blogs regarding their perceived benefit of blogs (1=Strongly Disagree; 2=Disagree; 3=Neutral; 4=Agree; 5=Strongly Agree). The findings from this analysis suggested that students who felt they were skillful or very skillful in using blogs strongly agreed that this tool was beneficial to their learning $\chi^2(16, n = 108) = 27.91, p < .05$ (see Table 2). We ran similar analysis for students who were at different levels with using email with other students regarding their perceived benefit of this email use and found significant results as well. In other words, students who reported that they were skillful or very skillful in using email with other students strongly agreed that this tool was beneficial to their learning $\chi^2(9, n = 108) = 20.90, p < .05$ (See Table 3); we found the same results with students who felt they were skillful or very skillful in using email with the course instructor (The reason that the degree of freedom for this results was 9 instead of 16 was because no students rated themselves as "Never Used" for the skill level and no students rated their perceived benefit of email as "Strongly Disagree," which makes a 4x4 cross tabulation table instead of 5x5).

Table 3. Chi-Square tests for students' e-mail skills vs. perceived benefit

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	20.896a	9	.013
Likelihood Ratio	13.895	9	.126
Linear-by-Linear Association	6.548	1	.011
N of Valid Cases	108		

Note. a. 13 cells (81.3%) have expected count less than 5. The minimum expected count is .03.

RESEARCH QUESTION 3:

STUDENTS' PERCEPTIONS ON COMFORT LEVEL OF USING TECHNOLOGIES

Quantitative Findings. Similar Cross Tabulation analyses (7x5 crosstab) were conducted to compare students from seven different colleges regarding their perceived comfort level of using various technologies. Our Chi-Square analysis indicated that differences existed among students from different colleges/disciplines regarding their perceived level of comfort in using various technologies. For example, 65.2% of College of Education respondents rated high on their comfort level with using a cell phone to email students, while 33.3% of Science and Mathematics respondents gave a positive response $\chi^2(24, n = 107) = 42.06, p < .05$. Students from the Science and Mathematics discipline also seem to be more uncomfortable than their peers in their use of instant messaging and blogs. 100% of Business and Economics respondents and 71% of Education respondents agreed or strongly agreed that they were comfortable contacting their professor through instant message, compared to 44.4% of Science and Mathematics respondents $\chi^2(24, n = 107) = 43.23, p < .05$. Likewise, 77.8% of Liberal Arts College respondents and 72.5% of College of Education respondents reported feeling comfortable contributing to a non-course related blog as part of their coursework, compared to 44% of Science and Mathematics respondents $\chi^2(24, n = 107) = 39.94, p < .05$. These findings suggest that there are differences among students from different disciplines regarding their perception of their comfort level of using technologies.

Qualitative Findings. The open-ended responses also provided some illumination in terms of the students' comfort with technology. In general, the open-ended responses indicated that while students enthusiastically used technology for communication and information seeking, they were less enthusiastic about using technology to create media. With the exception of PowerPoint, students did not mention creating media as a way of using everyday technology in their academics. Lei (2009) found similar results with pre-service teachers, who felt confident with basic technologies such as word processing, but less comfortable with more "advanced" technologies such as web page development, blogging, creating video files.

While a few students mentioned that learning Windows MovieMaker software, how to blog, and creating and using a wiki as highlights of their academic technology experiences, another group of respondents identified these as being among their worst technology experiences. One student described their experience with wikis: "I was uncomfortable with it and had difficulties completing a successful assignment with it."

When asked to describe their worst experience with using technology for school, several students responded that "not knowing" was a source of frustration: not knowing how to create a wiki, how to use a particular piece of software that was required for class, or, in the case of a non-traditional age student, knowing "less than people half my age" when it came to technology. Some students reported having little experience with these technologies prior to enrolling at the university, and characterized their experiences

learning how to use them as “uncomfortable” and “stressful.” The idea of “not knowing” ties into the notion of comfort, and merits further exploration in relationship to students’ relative ambivalence toward creating media for academic work.

DISCUSSION

In many ways, our findings reflect and support results from other surveys of student technology use. Students use technology to connect with each other and their professors; to access information; to conduct research; and, to a much lesser extent, to create media. Students appreciate the convenience of Information and Communication Technologies for staying connected, and the access to course information via email and Blackboard. Students also use technology to conduct research, and find it useful for time management and organization of their schoolwork.

Research grounded in socio-psychological perspectives on learners’ epistemological beliefs suggests that preexisting beliefs play a role in students’ attitudes toward assignments and activities that require the use of technology, thus influencing student comprehension. Our findings suggest that differences exist among students from college/discipline, skill level, and frequency of use regarding their perceived benefits of using various technologies. In other words, when students are frequent users of, and report being skilled users of, particular technologies, they see greater benefits in using those tools for academic work. Furthermore, the degree to which a student uses a particular technology and feels comfortable using it for academic work seems to be related to the college or discipline in which the student is enrolled. A fruitful avenue for future research would be to further explore the relationship between perceived benefit and comfort. Is being skilled with a technology the same as being comfortable with using it in an academic context?

Our research allows us to provide several preliminary recommendations for the design of technology-supported instruction in courses within Colleges of Education. First, we suggest that instructors conduct a learner analysis at the beginning of semester by implementing a survey similar to the one employed in this research. Such data are important for tailoring technology instruction to the skill levels present among the learners.

However, given the differences in perceived benefit of a technology among students with different skill level and frequency of use, we argue that a learner analysis should move beyond a simple measure of technology skills, to also inquire about the students’ prior experiences with, and expectations for, technology-supported instruction. Instructors may also wish to implement the survey again at the end of the class, and/or as an evaluation at the end of a program, in order to measure possible change of student perceptions over time. We believe that it is important to understand not only gains in technology skill, but also shifts in student beliefs about the perceived benefit of technology-supported instruction.

Second, if frequent users of technology are more likely to see a benefit of using that technology to further their learning, one obvious recommendation is to provide pre-service teachers with abundant opportunities to a) learn and refine technology skills, and b) practice and use these skills throughout the pre-service teacher curriculum. Specifically, we recommend that technology instruction address advanced media of production such as blogs, wikis, mashups, and digital storytelling. Creating and communicating through media is increasingly seen as necessary for successful, full participation in a digital world (Jenkins, 2006). Despite generational assumptions, students in our study as well as others (e.g., Lei, 2009) displayed discomfort with, and ambivalence toward, media creation. This issue may be exacerbated in future generations if young teachers are unable or unwilling to support their students’ creative communication through digital media. It may also imply that the way how students actually use or perceive the use of technologies may not match

the expectations that are associated with Net Generation or Digital Natives (Jones, Ramanau, Cross, & Healing, 2010). We suggest that teacher education programs have a role to play in ameliorating the “participation gap” (Jenkins, 2006, p. 3) between those who willingly engage and participate in media creation in academic instructional contexts, and those who might pursue media production only outside of academia, but may not see the benefit of media production as the context for their learning and professional development.

Third, in addition to providing students with opportunities to gain technology skills and increase the frequency with which they use certain technologies, there may also be a need to model exemplary uses of technologies that are taught to pre-service teachers. Students who engage in an activity intentionally seem more likely to experience comfort using technology, given that intention is influenced by attitude and by subjective norms (Ajzen & Fishbein, 2000; Dole & Sinatra, 1994; Petty & Cacioppo, 1984). Thus, as instructors, we need to provide students with opportunities to see how various technologies are effectively integrated in authentic learning environments, in order to make the underlying pedagogical intents visible to students, while at the same time creating opportunities for students to experience the benefit of those technologies in their own learning. Further research is needed to explore the instructors’ beliefs about the perceived benefit of technology for instruction and potential impact on students’ belief of benefit in their content areas.

Finally, our findings point to limitations and opportunities for future research. The majority of survey respondents were students enrolled in a College of Education; our results may not be generalizable beyond this broad disciplinary area. In addition, first-year students were over-represented due to the inclusion of the required general education course. Given the significance of college/discipline in our findings, a second phase of the survey should include a more diverse participant pool in terms of major and class standing.

Further, while survey data can paint a broad picture of this population, both quantitative and in-depth qualitative measures are necessary to move our understanding beyond the generational labels and assumptions that are often associated with research in the college context.

Specifically, in order to account for the origins of student beliefs about the use of technology within the academic setting, student study habits with respect to technology skills, and their perceptions of their comfort level using technology in academia, future research should explore assessment strategies that go beyond self-report scales, and which employ multifaceted instruments in line with those which have been advanced by recent studies of epistemological and ontological beliefs (e.g., Schraw & Olafson, 2008; Schommer-Aikins, 2008). In-depth interviews and observations can also provide unique insights into students’ beliefs (Perry, 1968; Baxter-Magolda, 1992; Belenky, Clinchy, Goldberger, & Tarule, 1986; Kitchener & King, 1981).

CONCLUSION

Teaching today’s undergraduate students in technology-enhanced instructional contexts demands an awareness of the range of students’ skills and perceptions related to both teaching and learning with technology. Our research suggests that differences exist in the beliefs about the value and role of technology among students of different skill level and comfort level with using technologies as well as among students from various disciplines. It is important not only to assess student skill level, but also to address these perceptions when designing technology-supported learning opportunities. Armed with a deeper understanding of students’ use of and beliefs about technology, colleges and universities will be able to make more informed decisions regarding the distribution of human, financial, and technological resources. At the same time such knowledge will allow

instructors to more effectively integrate technology in their instruction so as to meet the specific needs of the individual students, while enabling meaningful engagements with content through technology.

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APPENDIX A

Undergraduate Students' Use of and Beliefs about Technology

Adapted from Kennedy, G., Krause, K-L., Judd, T., Churchward, A., & Gray, K. (2006)

Instructions: the purpose of this questionnaire to collect information regarding undergraduate students' use of and beliefs about technology. Your responses to this questionnaire will help us better design technology-integrated curriculum for undergraduate students. Your participation is voluntary and confidential. It will take about 15 minutes to complete this questionnaire.

Background Information

Please respond to the following questions:

1. In what College are you enrolled (select one)?

- Business and Economics
 Education
 Fine Arts and Communication
 Health Professions
 Liberal Arts
 Science and Mathematics
 Honors College

2. Are you a full-time or part-time student? (Part-time is fewer than 12 credit hours per quarter/semester)

- Full Time Part Time

3. What is your class standing (select one)?

- Freshman
 Sophomore

- Junior
- Senior
- Other (please explain): _____

- 4. What is your major? _____
- 5. What is your year of birth? _____
- 6. Gender: Male Female
- 7. What is the zip code of your permanent address? _____
- 8. What is the highest level of education attained by your mother?
 - High School Diploma
 - Some College
 - Associate's Degree
 - Bachelor's Degree
 - Master's Degree
 - Doctoral Degree
 - Other

- 9. What is the highest level of education attained by your father?
 - High School Diploma
 - Some College
 - Associate's Degree
 - Bachelor's Degree
 - Master's Degree
 - Doctoral Degree
 - Other

Access to Technology

We are interested in how easily you have been able to access technology IN THE PAST, (not including your access at school). Please use the table below to indicate your level of access to different types of information and communication technologies PRIOR TO ENROLLING at Towson.

Type of Technology Access	Exclusively for my own use	Shared with other people	Limited or inconvenient access	No Access	Not Sure
Desktop computer					
Laptop computer					
Video game console (e.g. Xbox, Playstation, Wii)					
Cell phone					
Smart phone (e.g. iPhone, Palm, Blackberry)					
MP3 player (e.g. iPod)					
Digital still camera					

Digital video camera					
Dial-up internet access					
Broadband internet access (DSL or cable)					
Wireless internet access					
Printer					
Scanner					
Memory stick (e.g. flash drive, USB stick)					
CD burner					
DVD burner					

Use of Technology for Teaching and Learning in High School

Did you use any of the following technologies for school-related work in high school?
Please check all that apply.

- Spreadsheets (Excel, etc.)
 Presentation software (PowerPoint, etc.)
 Graphics software (Photoshop, Flash, etc.)
 Audio-creation software (Audible, GarageBand, etc.)
 Video-creation software (Director, iMovie, etc.)
 Programming languages (C++, Java, etc.)
 Webcasts
 Podcasts
 E-portfolios
 Discipline-specific technologies (Mathematica, AutoCAD, STELLA, etc.)
 Instant messaging
 Social networking websites (Facebook, MySpace, Bebo, LinkedIn, etc.)
 Wikis
 Blogs
 Online virtual worlds (Second Life, etc.)
 College or university library website
 Interactive whiteboard, slate, or pad
 Interactive whiteboard software (Promethean, SMART, etc.)
 Probeware (often used in high school science classes)
 webcam
 Learner response systems (Promethean, Interwrite, etc.)

Students' use of technology and their Technological Skill levels at Towson University

We are interested in your technology experience since enrolling at Towson University. Please rate your FREQUENCY AND SKILL LEVEL of technology use for your school related work at Towson University.

Social network site (e.g., Facebook, MySpace)																			
Video chat (e.g., Skype, AIM, iChat)																			
Comment on a course related blogs																			
Contribute to the development of a course related wiki																			
Create multimedia shows (e.g., PowerPoint)																			
Build web pages (e.g., Sharepoint, Frontpage, Dreamweaver)																			
Create audio (Audacity, iMovie, Movie Maker, Photo story)																			
Create Video (iMovie, Movie Maker, Photo story)																			
Create/edit digital photos (e.g., iPhoto, Photoshop, Paint)																			
Publish podcasts (e.g., using Podifier, Podcaster, PodProducer)																			

Your Beliefs about Technologies for Academic / University Studies

Below is a list of different ways in which technology could be used to help you with your studies at University. We are interested in whether you consider it beneficial to your learning to use the listed technologies as part of your academic studies. Please use the rating scales to indicate the extent to which you agree or disagree with each of the statements below (regardless of whether or not you have used each technology in the past). Please, keep in mind that all questions imply the use of technology AS PART OF YOUR COURSE REQUIREMENTS.

Please rate the degree to which you feel technology is BENEFICIAL to your learning.

Types of Technologies	Degree of Benefit				
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
A computer ...					
for general study					
to create documents					
to create graphics					
to create web pages (e.g. using Dreamweaver, FrontPage)					
to create and present multimedia shows (e.g. PowerPoint)					
to create and present audio/video (e.g. iMovie, MovieMaker)					
to play games					
A handheld computer (e.g. a PDA) as a personal organizer (e.g. diary, address book)					
The web ...					
to access a 'Course' or 'Learning Management System' (e.g., Blackboard)					

to download or access online audio/video recordings of supplementary content material					
to access University based services (e.g. enrollment, sign up for tutes, pay fees)					
to look up or search for information (e.g. online dictionaries, research libraries)					
to send or receive e-mail (e.g. from my instructor, from my classmates)					
for instant messaging to communicate/collaborate with other students in the course					
for instant messaging to communicate with the course instructor					
to upload and share MP3 files (podcasts)					
to upload and share photographs or other digital files related to your course					
for using web-conferencing (e.g. using webcam)					
to read and/or comment on other people's blogs or vlogs					
to keep my own blog or vlog as part of my course requirements					
to contribute to the development of a WIKI					
to receive alerts about course information (e.g. timetable changes, the release of new learning resources, changes in assessment)					
to contribute to another blog as part of my course requirements					
to contribute with other students to the development of a wiki as part of your course requirements					
My cell phone...					
to access web-based University services information or services (e.g. enrollment, sign up for tutes, pay fees)					
to send or receive course-related text messages/SMSs					
to take digital photos or movies					
as a personal organizer (e.g. diary, address book)					
to access web-based information related to the course					
to send or receive e-mail to/from the course instructor					
to send or receive e-mail from other students in the course					
to receive grades from the course instructor via text message					
to receive pre-class discussion questions from the course instructor via text message					
to receive administrative information about the course via text message (e.g. timetable or assessment changes, info. on new learning resources)					
Video-chat/video-conferencing...					
to communicate/collaborate with other students in the course					
to communicate with the course instructor					

Please rate the degree to which you are COMFORTABLE using technology as part of your course requirements.

Types of Technologies	Degree of Benefit				
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
A computer ...					
for general study					
to create documents					
to create graphics					
to create web pages (e.g. using Dreamweaver, FrontPage)					
to create and present multimedia shows (e.g. PowerPoint)					
to create and present audio/video (e.g. iMovie, MovieMaker)					

to play games					
A handheld computer (e.g. a PDA) as a personal organizer (e.g. diary, address book)					
The web ...					
to access a 'Course' or 'Learning Management System' (e.g., Blackboard)					
to download or access online audio/video recordings of supplementary content material					
to access University based services (e.g. enrollment, sign up for tutes, pay fees)					
to look up or search for information (e.g. online dictionaries, research libraries)					
to send or receive e-mail (e.g. from my instructor, from my classmates)					
for instant messaging to communicate/collaborate with other students in the course					
for instant messaging to communicate with the course instructor					
to upload and share MP3 files (podcasts)					
to upload and share photographs or other digital files related to your course					
for using web-conferencing (e.g. using webcam)					
to read and/or comment on other people's blogs or vlogs					
to keep my own blog or vlog as part of my course requirements					
to contribute to the development of a WIKI					
to receive alerts about course information (e.g. timetable changes, the release of new learning resources, changes in assessment)					
to contribute to another blog as part of my course requirements					
to contribute with other students to the development of a wiki as part of your course requirements					
My cell phone...					
to access web-based University services information or services (e.g. enrollment, sign up for tutes, pay fees)					
to send or receive course-related text messages/SMSs					
to take digital photos or movies					
as a personal organizer (e.g. diary, address book)					
to access web-based information related to the course					
to send or receive e-mail to/from the course instructor					
to send or receive e-mail from other students in the course					
to receive grades from the course instructor via text message					
to receive pre-class discussion questions from the course instructor via text message					
to receive administrative information about the course via text message (e.g. timetable or assessment changes, info. on new learning resources)					
Video-chat/video-conferencing...					
to communicate/collaborate with other students in the course					
to communicate with the course instructor					

Please list three important ways in which you think the technologies that you use in your everyday life could be most useful in your academic studies.

- 1.
- 2.
- 3.

Please, describe your experiences, if any, using technology in academic studies:

4. My best experience with technology for school was...
5. My worst experience with using technology in / for school was...

ACKNOWLEDGMENT

We would like to thank Scot McNary for his consultation on the statistics analysis for this research.