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Exploring the Perceptions of College Students on the Use of Technology: What Do They Really Think?

Colleen Marzilli[a]*, Julie Delello[b], Shelly Marmion[c], Rochell McWhorter[d], Paul Roberts[e]

[a,b,c,d,e] *The University of Texas at Tyler, 3900 University Blvd., Tyler, TX 75799, USA*

[a]*Email: cmarzilli@uttyler.edu*

[b]*Email: jdelello@uttyler.edu*

[c]*Email: smarmion@uttyler.edu*

[d]*Email: rmcwhorter@uttyler.edu*

[e]*Email: proberts@uttyler.edu*

Abstract

Technology is an essential component of learning in the 21st century. College professors and teachers hold many assumptions regarding the technological skills and knowledge that students possess while learning in the college setting. In this article, we explore the technology use and attitudes towards technology held by students enrolled in a regional public university offering online, face-to-face and hybrid instruction. The understanding of students' attitudes and use of technology is essential to informing the technological direction and pedagogical model in higher education from a traditional, lecture-based model to a technologically-enhanced model. In this study, we employed a mixed-method design using a faculty-developed, online survey, which highlighted student perceptions about technology for classroom instruction.

Keywords: Higher education; students; technology; future of technology.

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* Corresponding author.

E-mail address: cmarzilli@uttyler.edu.

1. Introduction

College professors and faculty often assume that students are digital natives [1] and have an acute understanding of technology. Today's students use an array of technologies on a daily basis including smartphones, laptops, tablets, smart watches, 3-D printing, and online games [2; 3]. Traditional college students have grown up in an era that has included technology as a fundamental way to live and learn [4] and thus, many educators are calling for changing the pedagogy by which these digital native students are taught [5]. However, research supports that students may use technology, but they may not be overly comfortable or willing to adapt to new technologies as quickly as the university and its professors might believe [6]. In fact, studies suggest that some students still prefer a traditional style of teaching with a professor as a lecturer [7] and the university offering face-to-face classes [8].

The United States President Barack Obama called for free community college for all [9], but with existing educational environments and brick and mortar classrooms, there is not adequate space to educate all potential college students [10]. With a limited number of physical seats available, colleges and universities are turning towards technology to increase access, enrollment, and retention in higher education [11]. There are many technology-based models that colleges and universities can implement such as hybrid, online, massive open online courses (MOOCs), and executive programs. College administrators are trying to meet the technology desires and comfort levels of students [12; 13] while maintaining high academic standards.

The purpose of this mixed-methods study is to report on students' experiences with technology in the higher education classroom. We also report student predictions on the future use of technology in higher education.

2. Review of the Literature

2.1. Technology and the contemporary college students

A decade ago, the Net Generation became a familiar term to those in higher education [14]. Net Gen students born between 1982 and 1991 were said to have had an intimate relationship with technology [15] including computers, the Internet, online resources, and instantaneous access [16]. Researchers suggest that students increasingly require a digital world as part of their learning and everyday environment [17].

A paradigm shift is occurring and institutions from grade school to higher education are becoming more aware that students are learning in new ways that require technology [18]. For many of today's students, technology has become an integral part of everyday life and their education can be completed anywhere and at any time. Also, there is a current push to create innovative environments that make the most out of available technologies to enhance student learning [19].

2.2. The instructional debate

Much debate centers on whether technology enhances learning [20; 6]. Researchers have determined that technology may be a distraction from learning the content [21]. Also, highlighted in recent research is the notion

that some students do not want or desire to have technologies integrated in their learning environment [22]. Technology may be seen as an add-on, unrelated to the real world [23]. Some students struggle to handle and manage the course content when expected to implement required technology tools and platforms [24]. This may be due to a lack of experience, especially for those accustomed to traditional brick and mortar classrooms [25].

Faculty members are expected to integrate technology into their classroom settings, whether face-to-face or online [26]. However, educators often feel apprehensive about technology lacking the necessary tools, training, or resources needed to integrate technology fully into the curriculum [27].Furthermore, researchers reported that there is a dearth of research on what constitutes effective technology-based instruction [25].

2.3. Community of practice framework

The conceptual framework for this research is that of the notion of a community of practice (CoP) as defined by researchers as "a [group] of people who share a concern or a passion for something they do and learn how best to do it better as they interact regularly" [28]. With technology and the rapid pace that shapes the dynamic educational environment, a CoP provides faculty members with the forum for exchanging ideas and knowledge about how students use technology [27].

3. Methodology

The researchers used a mixed-method paradigm that combines the strengths of both the quantitative and qualitative research methods [29]. Mixed-methods studies are increasingly being utilized in empirical work [30] for their utility in examining multiple sides of a phenomenon under investigation.

The quantitative data was collected to answer questions regarding participant demographics, their frequency of use and level of skill with various technologies and technical activities, which technologies they had encountered as part of their classes, and whether their instructors had adequate technical skills to use them effectively. In addition, participants were asked to indicate their general attitude towards the use of technology in course instructions. The qualitative portion of this study explored student perceptions of technology related to their learning in a higher education environment.

The following research questions were utilized regarding students' perceptions of technology:

- Are there differences across demographic variables related to student perceptions of technology?
- How are students report using technology within higher education?
- What are student perceptions of the most useful technologies for instruction in the higher education classroom?
- What do students perceive to be the challenges for using technology for learning in the higher education classroom?
- How do students perceive the use of technology in higher education to reflect real life experiences outside the classroom?
- What are the perceptions of higher education students concerning the use of technology in the future?

3.1. Participants

A sample of 148 students across five colleges including arts and sciences, business and technology, health sciences, engineering, and education and psychology participated in the survey. Institutional Review Board approval was obtained and student informed consent was given by all participants.

3.2. Instrumentation

Faculty members of one regional university utilized a mixed-methods survey to assess the students' self-reported level of skill and usage of technology in the classroom, student attitudes of the benefits and challenges towards technology in the classroom, the students' perceptions of technology use outside of the classroom, and the use of technology in the future. The survey also assessed the barriers to use and gathered students' predictions of the future of technology in the classroom. Before distribution, the survey was evaluated by five CoP members for content validity and clarity until consensus was reached. The students were emailed an invitation with a link to complete the online Qualtrics (qualtrics.com) survey. The instrument contained 40 categorical, quantitative questions and six qualitative questions. In accordance with mixed-methods studies [29], the open-ended questions were used to provide clarifying and substantive data to gather information about students' use and their projections of technology in the higher education environment.

4. Data Analysis

Following data collection, the resulting data were analyzed by the research team. The data included survey items of both a quantitative and qualitative nature and will be described next in further detail.

4.1. Data analysis of survey item responses

Frequencies were determined to describe the percentage of respondents choosing alternative responses describing their use and skill with various technologies, perceived effectiveness of use in classrooms, and their attitudes about such use. Additionally, Chi Square analyses were used to test for age and college differences in response patterns for the questions described above. Finally, a computed variable measured the total number of technologies each respondent had encountered in their classes and one-way ANOVA analyses were used to test for age and college differences in these totals. The Statistical Package for the Social Sciences (SPSS) 20 software was used for all quantitative analyses.

4.2. Data analysis of open-ended survey responses

Each of the excerpts collected from the online survey were arranged, numbered, and pasted to a typewritten page to create a transcript and then coded separately for content. Researchers described data reduction as the process of "selecting, focusing, simplifying, abstracting, and transforming the data into something meaningful and manageable" [31:10-12].

To provide the researchers with a more holistic look at student perceptions, the research team chose to use a

mixed-methods survey to examine the phenomenon under investigation that utilized [32]. In addition, the researchers established an audit trail of decisions made by the team [29]. Further, since the team was comprised of faculty members from various disciplines, the data analysis allowed for an interpretation across disciplines with peer debriefing among members of the team. The view of the participant through rich, thick data reduced the likelihood of researcher bias [33].

5. Results

5.1. Quantitative results

To answer Research Question One, *Are there differences across demographic variables related to student perceptions of technology?* One hundred forty-eight students responses were analyzed from the completed surveys. The major fields of study reported by the participants were categorized by college and were found to be distributed proportionally across the five colleges with the one exception that the College of Education and Psychology was significantly overrepresented, (χ^2 (4) = 12.21, $p < .05$). See Table 1 for the representation from each college and the university enrollment by college.

Table 1. College representation

College	Percent in Survey	% University enrollment*
Arts & Sciences	20.1	22.8
Business & Technology	15.8	19.7
Engineering & Computer Science	9.4	11.0
Education & Psychology	25.9	13.7
Nursing & Health Sciences	28.8	29.6

*3.7% undeclared enrollment

The respondents' ages ranged from 18 to 61 with a mean of 27.71. Of those, 33.8% fell within the age range of 18-21, 34.5% fell between 22 and 29, and the other 31.7% were 30 or above in age.

Most students indicated using a laptop (82.1%), while desktops were used by 11.7% and 6.2% used *Other*. Nearly half indicated the computer they used was between one and three years old, with about a quarter having younger computers and a quarter having older computers. Nearly 85% reported accessing the Internet with another device also.

Students were asked the frequency with which they used various forms of technology. In order of frequency (most to least number indicating *Frequent* use), frequent use was reported most for word processing software (96.6%), course management system (92.4%), text messaging (89.7%), the university website (80.8%), mobile apps (76.7%), social networking sites (77.2%), music downloads (55.2%), presentation software (52.7%), web-based conferencing (46.6%), spreadsheet software (41.7%), instant messaging (28.3%), the library website (28.1%), voice over Internet protocol (21.9%), contributing content to video websites (17.9%), contributing

content to Wikis (13.7%), using graphic software (9.7%), accessing online gaming (9.1%), using web-based programs (8.2%), contributing content to blogs (4.9%), using audio editing software (4.1%), using video editing software (3.4%), and accessing online virtual worlds (2.1%).

When asked whether they were using various forms of technology in their classes, the percentage of *Yes* responses, from highest to lowest is as follows: Word (97.3%), University website (85.8%), PowerPoint (79.7%), Library website (56.1%), Excel spreadsheet (52.0%), social networking sites (31.1%), Wikis (17.6%), instant messaging (13.5%), simulations or educational games (11.5%), podcasts (10.1%), E-portfolios (9.5%), discipline specific technologies (8.8%), blogs (8.8%), programming languages (8.1%), video creation software (6.8%), audio creation software (5.4%), and online virtual worlds (4.1%).

Students were asked to indicate their level of skill with a number of technologies or technical activities. The modal response was *Expert* for the following technologies: Use of the course management system, Use of Word, Use of PowerPoint, and Surfing the Internet. The modal response of *Fairly skilled* was given for: Use of the university website, use of the library website, use of Excel, performing computer maintenance, and evaluating the credibility of online information. *No skill* was not the modal response for any item.

Students were asked which of several statements regarding technology best described their own attitude. *Moderate technology is great* was the most frequently chosen statement (49.7%), followed by *Extensive technology is better* (35.9%), then *Exclusively technological is best* (10.3%), and finally *Wish I didn't have to use* (4.1%).

Finally, students were asked about their instructors' use of technology and how many used it effectively. *Most* was chosen by the largest group (58.3%), followed by *Some* (38.9%) and *None* (2.8%). Asked if their instructors *Provide adequate training for the technology used in class*, *Some* was most frequently chosen (46.9%), followed by *Most* (30.1%) and *None* (23.1%). When asked if their instructors *Have adequate skills to facilitate the use of technology*, *Some* was again most frequently chosen (50%), followed by *Most* (37.9%), and *None* (12.1%).

Chi squares were computed to compare various responses across the three different age categories and across the five colleges in which their majors were housed. The oldest age group (30 or older) reported more frequent usage of desktop computers (χ^2 (4) = 16.29, p = .003), and less frequent use of other devices to access the Internet (χ^2 (2) = 6.4, p = .04). No differences across colleges were found for these items.

Although reported usage of a few of the technologies produced age differences at the .05 level, none held up to Bonferroni adjustment. Technology usages between students across colleges produced three differences after adjustment: students in the College of Engineering and Computer Sciences (CECS) reported significantly less usage of text messaging (χ^2 (8) = 17.72, p = .023), and most frequent use of graphics software (χ^2 (8) = 26.33, p = .001); those in the College of Business & Technology reported significantly more use of presentation software than students in other colleges (χ^2 (8) = 21.9, p = .005), and more frequent use of graphics software compared to students in all colleges except CECS (χ^2 (8) = 26.33, p = .001).

In reporting their skill level with various technologies and technological activities, three differences across age were produced after Bonferroni adjustment. The youngest age group more frequently claimed expertise with the course management system (χ^2 (4) = 22.01, $p < .001$), Word (χ^2 (2) = 11.84, $p = .003$), and surfing the net (χ^2 (2) = 17.09, $p < .001$). No differences among students across colleges held up to adjustment.

In responding to the statements regarding the role technology plays in learning, two statements produced significant Chi Squares across age categories after Bonferroni adjustments: For the statement *Use of technology creates excitement and I am more involved in the course*, the youngest age group was more likely to agree than the older two groups (χ^2 (4) = 13.32, p = .01). For the statement *Use of technology trains me for my job when I graduate*, the middle age group (ages 22-29) were the most likely to agree (χ^2 (4) = 13.29, p = .01).

Students were asked which of 17 different technologies they used in their classes, earning a score from 0 to 17 on *Class use* depending on how many they checked. The mean number of technologies for which they reported usage in class was 5.06 (SD = 2.37). One-way analysis of variances (ANOVA) were computed to compare *Class use* across age categories and across colleges. Neither set of tests found differences in the overall use of technology across these categories.

5.2. Qualitative results

Data from the six open-ended questions were divided into three categories including opportunities, barriers, and the future. Using hand coding of recurring extracts for each of the three categories, researchers individually coded the data and came together to identify themes based on the similarity principle [34].

5.2.1. Students' use of technology

To answer Research Question Two, *How are students using technology within higher education*? , the research team reviewed one hundred eleven (N=111) open ended responses, and six themes emerged. The themes were: *Construction of Assignments, Storing Information, Accessing Information, Researching, Communication, and Studying* (see Table 2). The first theme that emerged, *Construction of Assignments* included the use of a computer to complete assignments, with student comments which could be grouped into three software classes. These most software tools include (a) the use Office software, a word processor, spreadsheet and/or desktop presentation tool (b) the use of discipline specific software such as AutoCAD, Mathematica and ProE; (c) the use of online labs or simulations. The most common student reflection conveyed the idea of using a word processor to write assignments.

The second theme, *Storing Information* included not only the saving of data files to the student's computer or cloud storage, but also the submission of assignments and/ or discussion board posts in the Content Management System (CMS) software. The third theme *Accessing Information* includes entering the CMS to view information to include content, assignments and grades. Student also used technology to gain access to electronic textbooks, journals and information provided electronically by textbook publishers and other course support providers.

The fourth theme is *Researching.* Students described using the Internet to research for a wide variety of applications. For instance, they utilized Internet platforms to conduct research for coursework. The fifth theme, *Communication* referenced both asynchronous types, such as discussion boards and email, and synchronous forms of communication, such as video conferencing and other methods of direct communication. The final theme that emerged was *Studying*, in this theme students referenced using the Internet to gain an understanding, clarify unclear information, or access web-based study tools such as practice quizzes.

Table 2: Selected student comments from research question #2

Theme	Student Extracts
Construction of Assignments	• I write lab reports in Word with charts inserted from Excel or hand-drawn and scanned into the computer. • I use technology by making PowerPoints • Simulations, Graphs, Advanced calculations etc. • Excel to make complex computations • Homework in MyOMLab • I'm journalism major so I am constantly writing papers using Word/Pages. I'm also in broadcasting courses so I use Final Cut Pro and editing software consistently.
Storing Information	• Submission of assignments through blackboard, emailing, checking grades, downloading PowerPoint slides • Post on discussion boards, upload course work • I frequently have to upload videos and assignments online • Submission of assignments through blackboard • Delivering assignments • Presentations: Creating poster presentations, voiced-over power points
Accessing information	• I access Blackboard to look at grades and to see posted course documents. • My teacher's notes are posted online and easy to access • I use PowerPoint to open and print out the PowerPoints one of my professors posted before the lecture.
Researching	• I have used technology to conduct research • I often research online for projects in school. • Researching projects or information online • Looking up: Federal Codes and specifications
Communication	• Interviewed for admission via Skype • I also use various technologies for research for class, along with IM, email, discussion boards, etc.

	• Communication with students across the country
Studying	• I use technology to study for my tests • The Internet is very helpful to get a grasp on things I do not understand • Studying, online books, extra quizzes to aid studying

5.2.2. Most useful technologies for instruction

To answer Research Question Three, the research team analyzed the responses to the open ended question: *What are the most useful technologies for instruction in the higher education classroom*?. The data suggested that students have a preference for a variety of technology tools and platforms. The eight themes that emerged from the 35 different technologies listed by students were *Content Management Systems (CMS), Asynchronous Platforms, Online Access, Presentation Software, Audio-Video Sharing, Synchronous Forums, Emerging Technologies, and Hardware* (see Figure 1).

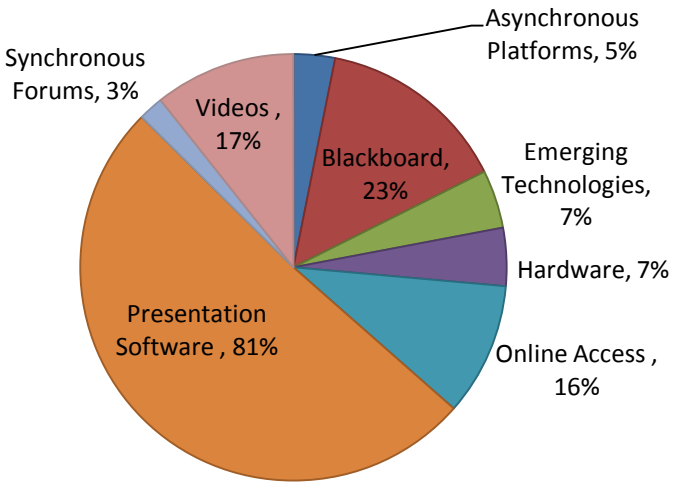

Figure 1: Usefulness of technology

One theme that emerged from the data was based upon the *content management system (CMS)* Blackboard for student and faculty interaction within the classroom environment and online. Across institutions of higher education, Blackboard is the most commonly used CMS [35; 36]. In our study, we found that although most of the students (92%) use Blackboard frequently, in the open-ended question, only 23% of the students conveyed that the CMS Blackboard (23%) was useful. For those students who gave feedback, comments varied from "I love Blackboard, but some professors barely use it or don't use it at all" to "I like blackboard except for the fact that not all my professors use it… I think it's beneficial to put everything on it so that we can go back and review if we need to and we have exactly what the professor is going over."

The second theme revolved around the term *asynchronous platforms*. According to researchers, asynchronous e-

learning, typically guided through the use of media such as e-mail and discussion boards, facilitates interactions between students and teachers, especially when time constraints exist for both parties [37]. Our findings indicated that a small percentage of students (5%) reported that suite of CMS tools supported by the university were found useful including Pearson Learning Suite (eCollege), blogs, emails, and discussion boards. This may be due to lack of CMS use by the instructor as reported by some students.

The third theme of *online access* included feedback from 16% of students regarding being able to access and complete their coursework through the Internet. For example, one student reported, "I like the tests online as well as slides in class and also being able to listen to lectures on line." Another student commented, "Being able to listen to lectures outside of class" through Blackboard Mobile was useful. Other students noted that "instant access to my work and grades" and "online accessibility of notes/announcements" were important to them. One student reported, "The online databases of articles available are incredibly useful. They are a great way to incorporate research into classes."

The fourth theme that emerged from the data involved *presentation software* such as Microsoft PowerPoint. In an earlier survey question, 81% of students stated they used the presentation software program Microsoft PowerPoint for their coursework. Some students, (27%) also noted they found it a useful instructional tool. For example, one student commented, "Sometimes in the larger classes it's difficult to hear the professor, so PowerPoint presentations with important facts on them help me a lot." Another student responded, "PowerPoint is very helpful. I learn better if I can see the information as I am taught." Another student commented that "voiced over power points" were useful. One student commented they liked the cloud-based presentation software "Prezi".

Also, of all the students surveyed, 17% reported that theme five, the use of *audio-video sharing* (e.g. YouTube, Tegrity, Podcast) for classroom instruction, was beneficial. For instance, a student commented, "Tegrity- I love being able to go back & watch the lectures as much as I need to… having the visuals to go along with my notes is so much better than just recording sound & trying to study." Another student reported, "Videos and Tegrity recordings can be useful."

The sixth theme that developed from the open ended questions was that of *synchronous forums.* According to Delello et al., "Synchronous discussions allow users to communicate with one another in "real-time" through phones, instant messaging (IM), screen-sharing, videoconferencing, and face-to-face discussions with the convenience of distance education" (38: 54]. In this study, a few students (3%) reported the use of video conferencing (e.g. Skype, Collaborate, Webcasts, and Elluminate) to be useful for course instruction.

We expected to find students using more *emerging technologies* (theme seven); however only 7% reported that interactive websites, games, animations, and simulations were useful tools for classroom instruction. One student noted, "Simulation experiences would be great if used more as a primary teaching tool rather than an ad[d] on." Another student reported using the discipline specific software programs Matrix Laboratory (MATLAB), Multisim, and Digital Works.

The eighth and final theme was *hardware* as 7% of students reported that iPads, laptops, Smart Boards, and Elmos were useful tools. For example, one student commented, "I love the iPad and Smart Boards. They get the students engaged in learning." Another student noted, "The usage of iPads seem very useful, you can download apps and books to help you study."

As to the usefulness of technology, it is uncertain as to whether students know all the technologies that might benefit them. Student remarks varied between from "I'm not sure" to "I find most all technologies useful."

5.2.3. Barriers to using technology

The fourth research question, What do students perceive to be the challenges for using technology for learning in the higher education classroom? and was answered by a combination of three separate survey questions: 1)*What technologies do you find the least useful to teaching?, 2) Are there problems with technology in classes that have interfered with teaching and learning?,* 3) *What barriers do you experience when using technology for educational purposes?* Two hundred eighty-six (286) student responses were collected and eight themes emerged from the analysis of the data (see Table 3).

The first barrier was titled *distracted by technology*. Students expressed they had a hard time paying attention or were distracted by the unauthorized use of technologies in the classroom. Specifically social media sites such as Facebook and the use of the Internet and games were reported. For example, one student noted, "Everyone can access social networking sites at any time and this is very distracting." It is not surprising that students, who are more connected than ever before [39] highlighted the notion that they were distracted by the use of technology. Weimer noted that we are living in the age of distractions and that much of the distractions occur due to personal technology use in classrooms [40], and, research has suggested that for many students, these distractions affect a student's time on task [41]. Students need a solution, but what can we do about this—limit technology or teach students the expectations for using it? Is it an opportunity to incorporate technology into our instruction?

The second and third themes revolved around a *lack of faculty knowledge lack of student knowledge*. Several students indicated that instructors had a lack of knowledge about technology. For example, one student commented, "Some teachers do not know how to effectively present using technology." In another instance, a student noted, "Either the teacher doesn't really understand how to use it at all, or they think they do and discover later that they don't." If faculty do not embrace technology, they cannot expect students to do what the faculty member is not [42]. In addition, there were also students who self-reported that they also had a lack of knowledge in particular areas of technology as noted in the following quotes "Since I am an older student, it takes me a little longer to learn and process new technology" and "Maybe on occasion I don't know how to do more advanced computer functions my task calls for."

The fourth theme was titled *time consumption.* Our data showed that, although many students found technology applications useful, some students also found the use of particular platforms to be time-consuming. For instance, one student wrote, "Discussion board… This does not replace having a conversation. The requirement to post

publishable thoughts and comments with references is time consuming and stressful."

The fifth theme was based upon *access to the Internet*. In this theme, the students reported that it was sometimes difficult to use technology due to the failure of Internet connectivity or having a lack of access to the Internet. For example, students reported "slow Internet connection, malfunction, being disconnected" and the "website goes down unexpectedly" as concerns. One student noted, "Sometimes the Internet loses the connection and kicks me out of an online quiz or test" while another student conveyed, "I hate having to spend hours in the library completing this or that assignment because there is absolutely no way to do the work outside of Internet/computer access."

Another barrier discovered in this study was one of *online learning*. As online learning continues to grow, students in asynchronous learning environments, who are accustomed to in-class discussions, may long for the traditional face-to-face environment. For example, in this study, one student wrote, "Not getting the face-to-face time with teachers. I know you can still visit them in their offices but reading a textbook still isn't the same as in-class lecture." The use of technology may be a barrier if it undermines face-to-face contact and has little impact on student learning [16].

The seventh and theme was titled, *inappropriate or lack of use of technology*. Some students reported that instructors either used technology inappropriately or that professors simply disregarded the technology completely. For example, some students noted frustration with the way their professors used the CMS on campus as reflected in the following excerpt, "Blackboard might be a useful tool if their instructors would use it" and "I don't find Blackboard that useful because most professors refuse to use it. They make one and then we never use it the entire semester." Other students were candid in their remarks, stating that technology had replaced good teaching. For example, one student wrote, "Being thrown the book electronically and set a test date and then let the computer grade the test… That is some easy money… Maybe I need my doctorate." Another student noted frustration when "the teacher posts stuff but never teaches it."

The eighth and final theme was *Unreliable or Outdated Platforms/Tools*. In this study, we found that many of the students felt that the platforms on campus were out of date or not supported. For example, one student remarked, "The technology is not what is current to industry." Another student noted, "When the computer doesn't work… we have to wait on an IT guy to come and fix it."

Table 3: Barriers for using technologies in the higher education classroom

Theme	Explanation/Rule for Inclusion	Student Extracts
Distractions	Students remarked that technologies such as social media can be a distraction.	• Students could use technology for other things and get distracted (like going to Facebook) • Some students are distracted by other things on their iPads (ex.

		Internet, games, etc.)
Lack of Faculty Knowledge	Students remarked that faculty had a lack of knowledge about technology.	• Many of the teachers don't know how to use it [ITV] or the sound is messed up so we lose valuable class time with them trying to get it working. • Yes, most professors (especially in Arts & Sciences) don't have a clue when it comes to technology
Lack of Student Knowledge	Students remarked they had a lack of knowledge about technology	• The typing or keyboarding… I am not fast enough. • Some of the programs I was never taught how to properly use such as Excel and PowerPoint.
Time Consuming	Students felt the technology was time-consuming.	• Youtube clips are a waste of class time they should be assigned if needed to watch at home/ dorm
Internet Access	Students felt the Internet access on campus was unreliable.	• I don't always have access to the Internet so it's sometimes difficult to do as much research as I would like.
Online Learning	Students preferred traditional learning over online classrooms or electronic materials.	• Staring at a computer for extended periods of time makes my eyes hurt. I can read a textbook a lot longer than I can stare at a computer. This would be a barrier for me.
Inappropriate or lack of use of technology	Students felt that faculty did not use technology or used it inappropriately.	• This semester I've really felt like we've been just left to teach ourselves. One class actually put all of the lectures online & then expect us to just watch them in our spare time
Unreliable or Outdated Platforms/Tools	Students found the tools to be dated or not useful.	• I rarely make it through a class where we've had an online/technology related project, without spending at least a quarter of class time talking about the problems with technology, and/or troubleshooting.

5.2.4. Technology in everyday life

To answer the fifth research question, *How does the use of technology in higher education reflect real life experiences outside the classroom*?, the research team analyzed 96 responses to the question, "*Do you find technology in your coursework to be different than in everyday life*?" Twenty-four (N=24) students felt that the technologies used in the classroom reflect those same technologies used in everyday life. Student comments in

support of this idea: “I also use similar technologies at work”; “I work as a systems analyst”; “Technology might even be used more in everyday life than in [the classroom]” and, “All that we are learning in class, we will need to know when we have jobs”.

A large number of students (N=61) reported that they did not feel that technology in the classroom reflected real life as illustrated by these student comments: “I use considerably less technology in my everyday life. I prefer writing to typing, speaking to texting, etc.”. Also, other comments included, “I am very rarely on a computer in my everyday life”; and, “there are more formal requirements on school related items”.

5.2.5. The future of technology

The sixth research question concerned the perception of the future of technology in the higher education classroom was addressed by the question: *What do you think technology in education will look like in the future?* The 104 responses yielded six themes as reflected in Table 4. Identified within this section are technologies currently in place, but the student responses showed they feel that this will continue to become more prominent in higher education.

The first theme that emerged from the data was *Increase in Technology Usage* as supported by student perceptions. One student stated, “I think there will be an even bigger increase in technology in the future. Technology is not at its highest point yet. It still has a long way to go.” This theme is buttressed in the literature by a recent poll about the future of higher education which predicted that technology will increase to include “cloud-based computing, digital textbooks, mobile connectivity, and high-quality streaming video” [43:2].

The second theme, *Hybrid Formats* was evident in the student comments. For instance, a student remarked that they expect higher education will be “more web based interactive…Skyping with professors for class”. The literature also predicts these technology-enabled formats will increase in a myriad of ways. In the *Horizon Report: 2014 Higher Education Edition*, “education paradigms are shifting to include more online learning, blended and hybrid learning, and collaborative models…[and] Institutions that embrace face-to-face, online, and hybrid learning models” [44, 10] have the opportunity to engage the higher education learner.

The third theme was *Technology Utilized to Prepare Students for Workplace* was found in several student comments. For instance, a student wrote, “The availability of technology will be more evident throughout the university that will enable students to gain technological skills that will help them once they become part of the workplace” and is also supported in the literature. For instance, virtual teams are often used in the workplace [45] and are used “as a teaching tool in online college courses to enhance students’ engagement with course material, self-awareness, teamwork, self-discovery, or empathy…and organizations are also utilizing virtual teams for learning and for the completion of work tasks” [46:1].

Online Learning was the fourth theme. The perspectives on this theme from students reflected predictions by students that technology for higher education will be available only through online platforms. One student remarked, “I believe all books and materials will be online and eventually schools will be virtual, including conferencing class times”. According to an Educause report, online learning is expected to continue to increase

due to its flexibility and opportunity for improving time for students to earn a degree and noted that "online courses often help by increasing the number of sections of a course offered, the number of students who can take a course, or the frequency with which a course is offered" [47:10].

The fifth theme was *Mobile Learning* was found in a number of student comments. For example, one students remarked that "All students will use tablets" while another said, "I think it will be more mobile than it is today and a lot more user friendly". In the literature, it was noted that mobile technology use is increasing globally and that there is a "growing interest in its use in education and training" [48:1] and many students are "acquiring mobile technology rather than computers, bypassing the desktop and notebook computer" [48:1].

The sixth theme was *Fearful and anxious about the future of education* as exemplified by one student comment, "Unfortunately, I think it will get out of hand to where it is the only thing used rather than teachers teaching!" and faculty members have also had concerns that "asynchronous learning, or teaching and learning that occurs when the interaction between the instructor and students …can cause feelings of isolation, resulting in disappointment and low retention rates in online classes" [40:1] which underscores the need for faculty to develop ways to engage students in online learning experiences.

Table 4: Student perceptions of the future of technology in higher education

Theme	Explanation/Rule for Inclusion	Student Extracts
Increase in Technology Usage	Students predicted that future of education will see increased use of technology in higher education	• The availability of technology will become more evident throughout the university. • It will be a big factor in the future, we will stop using books and use computers to learn.
Hybrid Formats	Students speculated that the future of education will be a varied formats with synchronous and asynchronous interaction	• Every class will incorporate technology some way. More web based interactive, example: Skyping with professors for class. • 3D classroom setup, or as one of my friends put it, "an holographic image setup that will give the feel of an in class professor to the students."
Technology Utilized to Prepare Students for Workplace	Students predicted that technology will be used to facilitate student preparation for career development.	• The availability of technology will be more evident throughout the university that will enable students to gain technological skills that will help them once they become part of the workplace. • Technology is required for future training to remain effective and to be leading edge or competitive.

Online Learning	Students predicted that technology for education will only be available through online platforms	• I believe all books and materials will be online and eventually schools will be virtual including conferencing class times. • I think there will be more and more online degrees available. And employers will legitimize those degrees even more. I think the idea that face-to-face education is more "normal" will be a thing of the past.
Mobile Learning	Students predicted an increase in the use of mobile devices for learning	• I think textbooks will all be digital and everything will be done on tablet pc's and smartboards, instead of paper and chalkboards. • I think it will be more mobile than it is today and a lot more user friendly.
Fearful and Anxious about the Future of Education	Students express worry over the future of education with technology	• Unfortunately, I think it will get out of hand to where it is the only thing used rather than teachers teaching! • I think we will continue to attempt to utilize technology ill-suited for learning for the foreseeable future. • I think the computer companies and the publishing companies are going to merge and there won't be a decent paper book to be had in 15 years or less. • I think there will be a lot more use, but hopefully not end to having to go to class.

6. Discussion

Our goal for this study was to explore students' perceptions regarding the use of technology in the college classroom. We began with a number of research questions to guide our mixed methods exploration. The fundamental research question was to determine the students' use of and experience with technology. Students most frequently reported using word processing, course management systems, text messaging, the university website, mobile apps, social networking sites, music downloads and presentation software. A number of other technologies were used by less than half of the respondents. When asked about their usage of technology specifically related to course work, more than half reported they used word processing, the university website, presentation software, the library website and spreadsheets. The students' usage can be generally described as the *construction of assignments*, using the aforementioned software, *storing information*, which includes submitting assignments in a CMS system and *assessing information*, both internal and external to the class. To a lesser degree, students use technology for research, communications and studying. When asked to rate their skill level with various technologies, higher skill levels were indicated for word processing, presentation software,

and use of the Internet, and somewhat lower skill with use of the library and university websites, spreadsheets, computer maintenance, and evaluating the credibility of online information.

We were also interested in whether there would be differences in experience across age groups and across majors (grouped by college in order to have sufficient numbers for comparison). Age differences were found for the use of connected devices, with older students being more likely to use the desktop computer, and with reported skill levels for word processing, Internet surfing, and using the course management system, with younger students reported greater skill. Younger students (< 22) were more likely than older students to perceive technology as adding interest and encouraging engagement in classes, while students 22-29 saw greater relevance of technology to job skills. Across colleges, we found that graphics software was used significantly more by students in computer science and engineering, followed by those in the business school, and that presentation software was used significantly more by business students compared to all other majors. There were no significant differences in the overall usage of all combined technologies across age categories or majors.

We asked students to report what they felt to be the most effective technologies in their classes. The most frequently mentioned technology was PowerPoint accompanying lectures, which they felt to be helpful to learning. The second most mentioned technology was Blackboard, though many of the statements concerned their wish that more instructors made greater use of the Blackboard CMS in their courses. In order of frequency of comments, the following categories of technology were also deemed useful by somewhat smaller proportions of students: audio-visual sharing, emerging technologies such as games and simulations, hardware such as iPads and Smartboards, and synchronous forums such as Skype and Elluminate.

We further asked students to describe the barriers they perceived to the effective use of technology in their courses. Students mentioned that unauthorized connections to social networks and other Internet sites proved a distraction in many classrooms. On the other hand, connectivity failures, especially during exams, or lack of access to the Internet were mentioned as barriers. Lack of sufficient knowledge of technology both among some instructors and among students were cited as problems that consumed unnecessary time. They mentioned having instructors who had problems using, or even failed to use technology available within a course. Students also stated their concerns that the general move towards online formats would not provide fully adequate substitutes to activities possible in the face-to-face classroom. Some students questioned whether online instruction allowed instructors to do little or no teaching (“easy money”).

Students were then ask to compare how the use of technology in higher education reflects real life experiences outside the classroom. The students in this study seemed to interpret this question in two different ways: (a) technology used in the classroom as compared to technology used in their jobs; and, (b) technology used in the classroom as compared to technology used in their personal lives. Technology in their educational and work lives often involved a “computer” with all the struggles of being confined to a space and trying to gain access. The technology used in their personal lives is more casual and much more mobile. Twenty-five percent of the students felt those technologies were largely the same, while over half did not feel the technology reflected their real lives. Based upon the comments, it can be concluded that many of those who did not perceive the

technology reflected real life, stated that as a result of comparing computer-based higher education use to their mobile personal life style. Qualitative data indicated students felt that the technologies used in their classes were effective overall; and, specifically, helpful in preparing them for jobs "in the real world."

In the final research question of this study, we asked students their perceptions of the future use of technology in higher education. All student respondents agreed that the use of technology will increase, including the application of many currently undeveloped technologies. Students also expressed concern over this technological advancement fearing that it is growing unchecked and often without sound educational reasons. It is important as institutions of higher education move towards more online instruction that both faculty and students be provided training and support to use and implement technology effectively. Also, campuses must have reliable and up to date hardware, software, and Internet accessibility. A significant number of students noted concerns that technology might go too far—rather than just enhancing instruction, it might replace the instructor all together. According to the researchers, using technology for online learning may bring forth "a fear of a loss of control, the fear of technology, and the fear of the unknown" [49:16). Finally, students predicted a much less confined, mobile educational environment.

7.1. Limitations

The findings of this study have limited generalizability due to the fact that the students were from one regional university with varying degrees of technological infusion. Also, the use of survey data may not be representative of all students and is subject to interpretation by the research team.

7. Conclusions and Implications

Universities are rushing to offer their curricula in a variety of technologically supported formats, including online, blended or hybrid classes. This online movement is based on the assumption that students today prefer courses offering the flexibility and mobility associated with such formats, when, in fact, many students indicate a continuing preference for traditional face-to-face classrooms and lecture-style presentations. Also, a portion of students indicated they are not always sufficiently skilled with technologies routinely required by many instructors. It is important, then, for universities and faculties to adapt to the wide variety of students today in terms of their skill and comfort levels with technology by offering courses in multiple formats and/or providing additional supports separate from required coursework to raise skill levels for the less skilled students.

A second issue related to technological skill levels was the perception by a large proportion of students that only some of their instructors seemed to have the skills needed to make effective use of technology in the classroom. While we believe that the majority of instructors who choose to incorporate technologies in the classroom are reasonably prepared to use them appropriately, they may lack the expertise to trouble-shoot problems, particularly with hardware and software in the classrooms, which consumes instructional time as students wait for the issues to be resolved. It is important for universities to provide sufficient training and support of implemented technologies.

The issue of whether technology in the classroom interferes with learning because it is a distraction needs to be

better explored in terms of distinguishing between that technology incorporated by the instructor vs. personal use of technology to access messaging, the Internet, and social media. In our study, those who mentioned technology as a distraction seemed to be referring to the latter. Thus, we conclude that for the most part, students view the technology used in building skills and/or course delivery to be an appropriate addition to the course. However, we are mindful that sometimes emergent shiny new technology is added for its own sake rather than for pedagogically sound reasons. More research should consider developing new models of online learning. Care needs to be taken to ensure that the use of technology supports the learning environment.

We found that when the effectiveness of course management systems are questioned by students, the major complaint seems to be with the instructors who make little use of it, or who do not specifically teach the content included in it. The latter concern (instructors not teaching) may reflect a period of transition, in which students whose previous experience has been primarily with traditional instruction delivery are not yet comfortable with the increased need for taking a more active role in their own learning by making appropriate use of content and resources included but not specifically taught—at least in traditional methods--in the hybrid and online environments. This may be a self-correcting problem, as students gain experience and learn to better appreciate the potential benefits with online instructional methods and resources.

Overall students' perceptions are generally favorable towards the use of technology in courses. However, more work is still required in the training and preparation of both students and instructors in the use of technology in higher education. Universities must also ensure that a current and reliable infrastructure is in place to support the technology for student learning.

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