The Role of Technology: A Path Analysis of Factors Contributing to Undergraduates' Satisfaction with their Overall University Experience

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Dedication

This dissertation is dedicated to the community of educators, innovators, leaders, and professionals who inspire, enlighten, and share their knowledge with others. Thanks for making the world a better place.

Abstract

This study explored the factors that impact students' perception of technology benefits and their impact on overall university student satisfaction of 522 undergraduate students at a large Midwestern research university. The purpose of the study was to identify personal (input) and environmental measures that impact student's overall university satisfaction (output), using Astin's Input – Environment – Output (I-E-O) theory as the theoretical framework (Astin, 1993).

The study followed a quantitative, non-experimental design, and used a series of constructed scales to measure perceived technology benefits and overall student satisfaction. The Student Experience in the Research University (SERU) survey was administered in 2013 at the campus studied. Results from the Technology module, along with core data provided by the institution, measured the personal and environmental predictor variables. Multiple variable regression and path analysis were used to construct the resulting path diagram.

The results of the regression to predict Perceived Technology Benefits indicated a combination of variables explained 25.5% of the variance, depicting a statistically significant model with a small to medium effect size. Results show the Perceived Technology Benefits variable was significantly correlated with seven predictor variables: Instructor Technology Ability, Social Networking, Online Course Preference, Instructor Technology Usage, Engagement with Faculty, Course Specific Behaviors, and Proficiency Social Dimensions. Out of these, the first four entered into the path analysis

model. The two strongest predictors were related to the environment, while the other two were input variables.

The results of the regression to predict Overall Student Satisfaction indicated a combination of variables explained 32.9% of the variance, depicting a statistically significant model with a medium effect size. Overall Student Satisfaction was significantly correlated with all 13 predictors, with nine entering into the path analysis model: Instructor Technology Ability, Technology Obstacles, Course Specific Behaviors, Instructor Technology Usage, Engagement with Faculty, Socioeconomic Status, Proficiency Social Dimensions, and Online Course Preference. Year-in-school bordered on significance ($p = .058$) and was also included in the final model. This resulted in five input variables and four environmental variables impacting Overall Student Satisfaction.

The second research question asked, "Does college of enrollment affect Perceived Technology Benefits and moderate the effects of the technology experience on Overall Student Satisfaction?" College was found to have a significant impact on Perceived Technology Benefits at the $p < .05$ level, but was not found to be significant for Overall Student Satisfaction.

Increased emphasis and ongoing research related to technology usage, student and faculty technology satisfaction, implementation, oversight, and administration are recommended in order to properly guide U.S. postsecondary campus instructional technology investments.

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Chapter One Introduction

Background

Technology's omnipresence and an increase in learners' technological expectations are forcing colleges and universities to shift their traditional environments and develop digital strategies (Stokes, 2015). Colleges are harnessing educational technology's potential and reimagining their curriculum through active learning and other classroom approaches, such as the flipped classroom (Arbaugh, Desai, Rau, & Sridhar, 2010; Garrison & Kanuka, 2008; Bates, 2015). They are also utilizing the power of big data to improve student learning, retention, and educational outcomes (Brooks, 2015; Daniel, 2015). What is missing is a body of empirical evidence to demonstrate how technology affects students' satisfaction with their educational experiences.

Besides this technological shift, a myriad of factors are impacting U.S. postsecondary education. These include changes in economic conditions, increased competition, and a need to educate higher percentages of increasingly diverse students. These changing conditions have caused colleges and universities to rethink their campus missions, increase support for technology environments, adapt campus cultures, and harness technology to optimize its seemingly endless potential.

Changing economic conditions. United States' higher education colleges and universities are under threat, facing decreased funding from state and federal sources (Blumenstyk, 2014; PEW Charitable Trusts [PEW], 2014b), while simultaneously experiencing increased competition from nontraditional forms of higher learning institutions (Christensen, Horn, & Johnson, 2011). Political pressures are indicative of what has occurred nationwide, with reductions to higher education in both state and federal funding. Lawmakers are forcing budget cuts and pressuring colleges and universities to find creative ways to improve access, accountability, and affordability.

Many states have experienced difficulty recovering from the 2008 recession: employment rates were lower in more than fifty percent of states in 2014 than in 2007 (PEW, 2014a). State lawmakers struggle to divide tax dollars between education, health care, infrastructure, and long-term obligations such as state employee pensions and retirement benefits (PEW, 2014c). Some states, such as California and Michigan, are spending more on prisons than on higher education (Roelofs, 2014; Sankin, 2014). Furthermore, demand for college is unequal across the United States, with growing demand in the South and West (Western Interstate Commission for Higher Education [WICHE], 2013). Increased demand for college-educated adults, coupled with declining higher education budgets from both the federal and state level, have spurred debate on how to best meet these demands (Dickeson, 2004; Weisbrod & Asch, 2010). The increasing costs of educational technology and how it contributes to students' learning has yet to be demonstrated.

Over the past two decades, online learning has become an established field (Allen & Seaman, 2015). This has given rise to a shift in terminology, with education leaders now referring to their "digital strategy" as a broader, panoptic term. Digital strategy incorporates learning design and digital experimentation into all courses, not just online learning. According to Stokes (2015), this signals a change in how learning technologies are utilized, viewed, and communicated, with the goal to make education better, regardless of medium. The focus is no longer to make technology-enhanced or online courses as good as classroom courses. Examples of this shift include the use of educational technologies to enhance teaching and learning, and the use of digital strategies to help strengthen college and university's core missions.

In response to these changing economic conditions for higher education (Barr, 2004), online learning has experienced considerable growth with 63% of institutions reporting that online education remains critical to their long-term strategy (Allen, Seaman, Poulin, & Straut, 2016). Chief academic officers consider the learning outcomes for online courses to be "as good or better" than traditional face-to-face courses (71%) (Allen et al., 2016), which is consistent with earlier research (Bernard et al., 2004; Shachar & Neumann, 2010). The research basis to support the above perspective is growing.

Increased competition. Traditional higher education has new forms of competition from for-profit colleges, massive open online courses (MOOCs), and other online education providers. Nontraditional forms of higher learning entering the market include for-profit colleges, such as the Apollo Education Group's University of Phoenix and Capella Education Company's Capella University. For-profit colleges offer fully online degree programs, which are appealing to students due to their flexibility and convenience. MOOCs are another threat to brick-and-mortar institutions, as they offer courses at little or no cost and are backed by several prestigious, private universities such as Harvard, Stanford, and MIT (Ripley, 2012), and more recently, public universities such as the University of Minnesota, are exploring these offerings. MIT has plans to "modularize" education by breaking courses into smaller modules, in effect blurring the traditional educational boundaries and providing extreme flexibility for their students (Straumsheim, 2014b).

For-profits and MOOCs have contributed to an "innovative disruption" in higher education, which some researchers predict will transform higher education in the same manner as the personal computer (PC) transformed the computer industry in the 1970s (Christensen et al., 2011). In fall 2010, 10 percent of the 18 million undergraduate students at United States' degree-granting institutions were enrolled in for-profit colleges (U.S. Department of Education, National Center for Education Statistics [USDoE-NCES], 2012). In 2013, enrollment at private for-profit institutions was 21% lower than in 2010 (USDoE-NCES, 2015), indicating fluctuating demand.

Another form of competition for brick-and-mortar institutions which are "unbundling" the traditional college experience are alternative online education providers, such as 2U, which create online versions of graduate degree programs for a fee, in conjunction with the partnering institution (Blumenstyk, 2014). Professors from 2U teach courses live, via Webcam, to no more than 20 students for $4,200 per student per course (Kolowich, 2013). StraighterLine is another alternative education company which offers hundreds of online courses for a $99 per month membership fee plus $49 per course. Technology spending in the education and training sector, including companies like 2U and StraighterLine, has shown a steep investment in education technology since 2006, with more than $1 billion in payments to educational-technology companies in 2013 (Koenig, 2013).

Growth of online and hybrid models. One means of achieving increased participation in higher education is through increased utilization of online learning.

Several additional factors have combined to increase colleges and universities' adoption of online education. Technological improvements, broadband penetration and adoption, and credible online content have made online learning more feasible for higher education, allowing a previously untapped market to surface (Musyoka, 2005). The need for more accessible content for students of all abilities has also driven the growth of online education (Green, 2014; Stratford, 2014; University of Minnesota [UMN], 2014d).

This increase in online learning is not confined to the United States, with the increased popularity and success of global distance learning programs, both at profit and non-profit institutions. The University of Phoenix in the U.S., Athabasca University in Canada, the Open University in the United Kingdom, Tech De Monterrey in Mexico, and the Open University in Hong Kong (Wilen-Daugenti, 2009c) are all examples of online institutions that have been successful in delivering online instruction in other countries. Increased competition dictates that colleges and universities will need to adopt a strong technology leadership role.

Trends from higher education research groups in the United States indicate increases in online and hybrid course offerings (Center for Studies in Higher Education [CSHE], 2014; Educause Center for Analysis & Research [ECAR], 2014; New Media Consortium [NMC], 2015). Despite growth in online education, quality in online courses remains one of the top concerns of faculty, administration, and the general public (Hopewell, 2012; Massy, Sullivan & Mackie, 2013; Verene, 2013; Windes & Lesht, 2014). Online and hybrid course offerings rely heavily on technology and information technology support personnel to ensure quality (Estelami, 2012). Rovai and Downey (2010) examined the success and failure of online programs and found that issues of quality assurance, online course design and pedagogy, faculty development, and student support services were important factors of success.

An example indicating a slight twist in higher education's traditional approach is the University of Akron's pilot initiative offering a series of general education courses for $50 tuition per credit hour. Diverse course offerings from five areas will include "blended learning," combining online, classroom, and experiential learning elements. This is another example of changing times and one polytechnic institution's change in mission to better accommodate its students and attempt to make college more affordable (University of Akron, 2016).

Changing higher education landscape. While ECAR research indicates that online education is growing, results also show that the majority of students learn best and prefer hybrid courses, which blend the fully online environment with face-to-face components (Arbaugh et al., 2010; Garrison & Kanuka, 2008; Bates, 2015). These blended or hybrid courses are a derivative of the fully online course and allow students to access and exchange ideas in a setting outside the normal face-to-face classroom through the use of learning management systems (LMS) and other technologies. Students in hybrid courses meet in person periodically, but the majority of coursework is often spent online through activities such as discussion forums, group collaboration exercises, tutorials, online games, simulations, self-tests, pre-recorded lectures, and case studies (Littlejohn & Pegler, 2007). Missing from the above discussions are data from students regarding their preferences for various course delivery systems.

Blended or hybrid courses have been shown to increase course effectiveness, communication, and teamwork, as well as to yield better retention rates than purely online courses (Aycock, Garnham, & Kaleta, 2002). The overarching benefits of blended or hybrid learning have yielded new forms of pedagogy: the flipped classroom and Massive Open Online Courses (MOOCs). Both of these relatively new course formats are now possible due to advancements in technology, with progressive audio and video capabilities. The flipped classroom takes blended learning a step further by having students watch video lectures from home, while in-class time is spent on exercises, group discussions, and projects. Flipped classroom instructors function as facilitators or advisors rather than lecturers (Educause, 2012).

The MOOC movement began in 2012 when a small number of providers, such as Coursera and edX, collaborated with top institutions such as Harvard, Massachusetts Institute of Technology and Stanford, to provide online courses at little or no cost as a means of expanding access and potentially reducing the cost of education (Ripley, 2012). The concept of open educational resources (OER) has great potential, but there are also major drawbacks which must be overcome. It is estimated that over 90% of the millions of students who enroll in MOOCs do not finish (Holmes, 2013). Coursera has implemented a special program where students pay a small fee for a resulting certificate and have found that these users are substantially more likely to finish the course. Issues associated with the withdrawal or "drop rate" of MOOCs parlays into collegiate online course environments as well. In the ECAR 2014 survey, 76% of faculty knew what a MOOC was, but only 24% of undergraduates did. It seems the popularity of MOOCS has waned, as they are no longer increasing in market share as they were two years ago (Ripley, 2012).

In January, 2014, *The Chronicle of Higher Education* surveyed over 1,700 college presidents from four- year public and four-year private, not for profit colleges and universities. Out of the 349 presidents who responded, more than three fourths thought hybrid courses (81%) would have the most positive impact on higher education in the future. The second innovative, high-impact concept was adaptive learning, which is a personalized form of education where technology is used to adjust lessons based on a student's response and subsequent learning needs. Over half of the college presidents were also concerned that faculty need additional support in order to convert their classes to hybrid formats. The college presidents identified two key areas of focus as "changes to the model of teaching and learning" (46%) and "technology and online tools" (31%) (Selingo, 2014).

The presidents were also asked about the future of higher education. Thirty-eight percent were concerned that (in the future) only wealthy students could afford an immersive, in-person experience at an elite college. This is a theme reminiscent of Clay Christensen's disruptive innovation theory, where Christensen hypothesizes that MOOCs are considered a key factor in the disruption of higher education (Christensen et al., 2011). Fifty-two percent of the presidents listed MOOCs as having a negative impact on higher education's future.

Increased focus on educational technology. Educational technology, broadly defined as digital technology used for educational purposes, is a rapidly growing area within higher education. Technology has undergone radical change in the past 30 years, with declining cost of personal computing, miniaturization, increased computing capabilities, and Internet connectivity increases (Norris, 2001). We live in a time when students can look up or “Google” information on their phones or other mobile devices (Lemke & Coughlin, 2009). These technological shifts help advance the goals of higher education, especially for those in disadvantaged rural areas. There is evidence that the digital divide is shrinking due to the availability of mobile devices and Internet access via cellular smartphones (National Telecommunications and Information Administration, 2013), but the digital divide also includes a gap in technological skills and technological literacy (DeGennaro & Brown, 2009).

Colleges and universities are investing heavily in educational technology to maintain a competitive edge and meet demands for technology-enabled learning experiences (Bates, 2000). According to Bates (2000), rather than focus on pedagogical issues, planning for online learning tends to focus on personnel and budget planning. Bates’ foresight was that the educational and academic requirement needs to be considered before technology infrastructure is built. Bates advocates that new ways of teaching and learning need to be considered as courses move online (Bates, 2012).

Ongoing higher education investment in technology expenditures attempts to keep pace with advances in personal computing, such as equipping computer labs with touch-screens or issuing fleets of tablet-based computers to aid mobility and engagement in the classroom. Software expenditures help automate and simplify audio recording, collaboration, computing, design, e-portfolios, e-textbooks, evaluations, online training, presentations, reporting, spreadsheets, surveys, voting, and word processing. Supporting educational technology includes staffing for instructional designers, technical trainers, security personnel, and technology support, thereby increasing overall spending on educational technology (Swanson Kazley et al., 2013).

Growth of Online Learning

Early philosophers such as Plato and Socrates believed that the written text would reduce memory skills and lead to an inability to engage in active oral discourse. Handwritten manuscripts prevailed until Gutenberg's 1439 invention of the printing press, which allowed the mass-production of printed books. This revolutionized book-making, and the printing technology quickly spread throughout the world. Since books were now economically profitable for printing businesses and affordable for readers, new knowledge became available to a larger number of people, improving mass literacy, which led to significant social transformations that ultimately led to the scientific revolution (Wagner & Kozma, 2005).

Radical change in methods for conveying knowledge is a slow process, and it has taken decades since the scientific revolution to integrate technology into education. The birth of online education can be traced from the 1920s, as distance education advanced with the utilization of film and correspondence courses. The 1930s and 1940s utilized radio, and the 1950s and 1960s used television as its primary vehicle. The 1970s brought video, and the 1980s brought computers (Cuban, 1986). The early 1990s was when the personal computer began to have high adoption rates in homes, with users accessing the Internet via dialup modem. Colleges and universities adopted course management systems to allow for syllabi, the uploading and downloading of course materials, and a mechanism for online testing. Since then, Internet transmission speeds have improved vastly, allowing students across the world to participate in MOOCs and other online courses.

Mainframes to mobile. Early use of computers in education and research, such as those pioneered by Control Data Corporation (CDC), began in the 1950s. They were cumbersome mainframes, which contained vacuum tubes and utilized punch cards for data entry. The size of computers has become more miniaturized, evolving from room-sized apparatuses to compact devices. In the 1980s, transistors and integrated circuits allowed for personal computers (PCs) to be readily available to the general public. PCs decentralized online learning and allowed individual learning programs to develop. The Internet became widely available in the 1990s, and since then, the Internet has revolutionized online learning (Friedman, 2006).

The price-to-power ratio continues to drop sharply, with the power of 2003 computers being 1,000 times greater than one produced in 1980. Computers have become easier to use with improved software development (Wagner & Kozma, 2005). Examples of mobile computing devices, which take advantage of improved software development, include the introduction of the Apple iPhone, a multimedia-enabled smartphone in 2007, and the Apple iPad, a tablet computer in 2010, which utilize Apple's iOS operating system. The consumer electronics race has continued to morph with additional mobile products such as Android smartphones, Kindle e-readers, Amazon Fire tablets, Google Nexus, and the Microsoft Surface. The iOS and Android platforms each have more than 800,000 third party apps (McCracken, 2013). These apps are designed to improve usability, productivity, and for entertainment purposes. Colleges and universities also develop apps to serve their students, and even host campus codefests or hackathons (Fabris, 2014) to inspire new application development for their campus populations.

Gartner Consulting is a top authority for IT fact-based research. Gartner's (2014) research indicates that worldwide, personal computers have begun a long-term decline with unit sales of 276 million units in 2014, down 20 million from 2013. Tablet unit sales have been steadily increasing, from 207 million in 2013 to 229 million in 2014. Overall tablet sales will represent less than 10% of all devices in 2014, yet tablets will outsell traditional personal computers in 2015 (273 million vs. 261 million). Mobile phone sales are increasing with over 1.8 billion sold in 2014. Devices built on Google's Android mobile operating system, are estimated to equate to 51% of all devices sold in 2015 (Lunden, 2014). According to a recent survey of over 75 thousand students at 213 institutions, there is growth in student's use of devices for academic work: 95% of students utilize a laptop; 68% utilize a smartphone; 47% utilize a tablet, and 18% utilize an e-reader (Chen & Denoyelles, 2013). How their use of such devices affects their perspectives and overall satisfaction with their undergraduate experience is yet to be demonstrated.

Since the 1990s, the number of Internet users has increased from 5 million in 1995 to more than 3.3 billion users in 2015 worldwide, over 46% of the world's population (Internet World Stats, 2015). The number of websites has increased from 200 in 1993 to over 1 billion in 2014 (Internet Live Stats, 2014). All of these technological advances contribute to the growth and availability of online education with a plethora of course offerings throughout the world, and the number is increasing daily.

Sources of higher education technology trends. Several sources help to identify technological higher education trends. One source for information technology (IT) leaders is the NMC Horizon Project, a comprehensive research venture that identifies emerging technologies expected to have a large global impact. The *Horizon Report* is a collaborative venture that began in 2002 between the Educause Learning Initiative (ELI) and the NMC to identify emerging technology trends that will affect higher education. The 2016 *Horizon Report* outlines trends in time-related categories to aid administrators in policy-making, leadership, and practice.

The *Horizon Report 2016 Higher Education Edition* lists the two fastest-moving short-term trends driving change in the next one to two years as "growing focus on measuring learning" and "increasing use of blended learning designs." Their expert panel identified two mid-term trends (next three to five years) as "redesigning learning spaces" and "shift to deeper learning approaches." The two top long-term trends driving Ed Tech adoption in higher education for five or more years are "advancing cultures of innovation" and "rethinking how institutions work" (NMC, 2016, p. 2).

The *Horizon Report 2016 Higher Education Edition* also lists six significant challenges for higher education technology adoption. Solvable challenges include, "blending formal and informal learning" and "improving digital literacy," which are the same as the 2015 *Horizon Report*. Difficult challenges include, "competing models of education" and "personalizing learning." The top wicked or most difficult challenges are, "balancing our connected and unconnected lives" and "keeping education relevant."

The *Horizon Report 2016 Higher Education Edition* also lists important developments in technology for higher education. The near term adoption of one year or less includes "bring your own device (BYOD)" and "learning analytics and adaptive learning." The time-to-adoption of two to three years includes "augmented and virtual reality" and "makerspaces." The longer term four to five-year adoption includes, "affective computing" and "robotics" (NMC, 2016)

A second source of technology trends is an annual online and distance education report sponsored by the Online Learning Consortium (OLC), formerly known as Sloan Foundation, managed by the Babson Survey Research Group (BSRG) and the College Board. In 2015, the report utilized the US Department of Education's Integrated Postsecondary Education Data System's (IPEDS) 2012-2013 data as its new data source, based on 4,891 colleges and universities. The report was also combined with survey responses from decision makers at more than 2,800 colleges and universities (Allen & Seaman, 2015).

Online Report Card – Tracking Online Education in the United States represents the thirteenth (and final) online learning report by the BSRG. In 2015, 71% of academic leaders rated learning outcomes in online education as being comparable to face-to-face (F2F) instruction. The evidence on which they base their appraisals is unclear however. The academic leaders are more positive about learning outcomes for blended or hybrid instruction than online instruction. The BSRG report shows that online education enrollments are continuing to grow, with more than one in four students (28%) having taken at least one online education course. This will be the final BSRG report due to the similarity of findings amongst various online learning reports, allowing the Sloan Foundation to invest in other areas.

Even though overall enrollment in higher education is down (Allen et al., 2016), online education allows institutions an optional means of increasing their enrollments. Public institutions enrolled the majority (73%) of undergraduate online education students. The percentage of chief academic leaders that say online learning is critical to their long-term strategy fell to 63% in 2016, from an all-time high of 70.8% in 2014. Online education allows students flexible learning opportunities.

A third key information source for IT leaders is the Educause Center for Analysis and Research (ECAR), which conducts an annual survey of undergraduate students. In 2014, 75,306 students from 185 U.S. and 28 international institutions were randomly surveyed about their technology experience at their perspective colleges and universities. Results inducted that nearly half (47%) of all higher education students have taken at least one online course during the past year (ECAR, 2014), showing a gradual increase in the past few years (approximately 31% in 2012 and 41% in 2013) (ECAR, 2013). Although the aforementioned report is replete with statistics on usage of various technologies, far less attention has been given to how technology usage affects students' experiences.

A fourth source of information about technology usage for higher education leaders is the Higher Education Research Institute (HERI) and their undergraduate teaching faculty survey (Eagan, Stolzenberg, Lozano, Aragon, Suchard, & Hurtado, 2014). The 2013-2014 HERI Faculty Survey included responses from 16,112 full-time undergraduate teaching faculty members at 269 four-year colleges and universities. The HERI Faculty Survey also asks faculty about their use of technology in the classroom. Results from 2013-2014 indicate a noticeable increase in the proportion of full-time undergraduate faculty who reported teaching a fully online course. This included public and private universities from all sectors. Faculty are also moving away from lecturing and adopting student-centered pedagogical teaching practices, including opportunities for reflection, collaborative learning environments, self-evaluation, and selection of coursework by students (Eagan et al., 2014).

A fifth source of information for technology leaders is found with consortia, such as Unizin (Unizin, 2016) and the Committee on Institutional Cooperation (CIC) (CIC, 2016). These consortia serve as membership-based groups that collaborate on topics surrounding digital education. Unizin was formed in 2014 and allows member institutions to participate in their ecosystem, which consists of an LMS (Canvas), an eText platform, and a host mechanism for design tools. The CIC technology collaboration group focuses on collaborative research and IT support, shared storage services, technology purchasing, identity management, OmniPop (a fiber optic network collaboration), and professional development. The consortia meet regularly and allow for sharing of information and networking for IT professionals.

A sixth source of information on students' technology usage for higher education leaders is the Student Experience in the Research University (SERU) Consortium, based at the Center for Studies in Higher Education (CSHE) at the University of California, Berkeley. The SERU Consortium collaborates to develop policy-specific analysis, share best practices, and engage in collective research aimed at promoting a culture of institutional self-improvement. The SERU survey provided the data for this research.

Problem Statement

Colleges and universities are placing high emphasis on the academic uses of technology, expanding hybrid and online courses, and increasing educational technology budgets in order to better meet student demands, attract top students, and remain competitive in the marketplace. Courses are being offered in a wider variety of formats including active learning approaches, flipped classrooms, hybrid courses, and MOOCs. There is little research literature on the factors which contribute to undergraduates' perspectives on the benefits of technology and whether perceived technology benefits contribute to overall student satisfaction.

Educational technology investments require close examination of many issues, including students' use of educational technology, accessibility of resources, and perceived value. Building a profile of today's undergraduate students, including their expectations of technology, especially for hybrid and online courses, their technological abilities, and their perceptions of how technology should be utilized in the classroom will allow administrators and practitioners to better support the students and faculty at their respective colleges and universities.

Higher education information technology leaders should delicately balance student technology needs and expectations with available resources in order to maximize the impact and potential outcome of technology expenditures. It is imperative to understand student's technology needs, technology ownership and usage, attitudes toward educational technology, and preferences for digital learning environments in order to shape campus mission and institutional priorities.

Rationale for the Study

Hybrid and online classrooms and MOOCs have evolved into everyday terms and indicate that the higher education landscape is changing, yet it is difficult to quantify the impact that increases in educational technology spending are having on student perspectives on the benefits of technology, which may affect their overall satisfaction with their college experience. The need to improve student engagement and increase graduation rates stems from public and political accountability pressures. In an effort to meet these pressures, many colleges and universities are increasing the number of hybrid and online course offerings and expanding budgets in educational technology in an effort to increase capacity to meet growing demand.

Colleges and universities have set ambitious four-to-six year graduation rates, implemented numerous student services efforts, and are investing in online education and educational technology – all with declining budgets from state and federal sources. In 2012, revenue stemming from student tuition and fees exceeded the share coming from the state in 24 states, which in 2000 occurred in only three states (Blumenstyk, 2014).

The purpose of this study is to assess which factors contribute to perceived technology satisfaction and overall satisfaction of undergraduate students at a public Midwestern University. By examining students' technology experiences and their classroom technology expectations, a more holistic view of the teaching and learning environment can be gained, which is vital for colleges and universities to raise their technology-enabled productivity. As suggested by the 2014 ECAR study, "Institutions that harness technology in the service of their educational missions—and that cannily adapt their cultures to achieve optimal potential from technology—will stand the greatest chance of thriving in the decades to come" (ECAR, 2014, p. 3). The increased value of education, institutional concerns, the changing higher education landscape, and the growth of online learning all contribute to the need for this study.

Research Questions

This dissertation poses the following research questions: "How do various technology experiences contribute to perceived technology benefits and in turn do technology experiences and perceived benefits affect overall student satisfaction?"

1) What are the relationships between the technology experience variables from the 2013 SERU[a] survey with regard to perceived technology benefits and, in turn, overall student satisfaction?"
2) Does college of enrollment affect perceived technology benefits and moderate the effects of the technology experience on overall student satisfaction?

Definition of Terms

Definitions of online learning are based on definitions reported by Frank Mayadas and Gary E. Miller with input from Online Learning Consortium (OLC) members (Coswatte, 2014). The OLC was formerly known as the Sloan Consortium.

Distance education. Distance education is the broadest term which includes any courses delivered to students who are not present in the same room, including online courses, interactive television, or courses using videotapes or correspondence strategies (Wilen-Daugenti, 2009c). Distance education and online learning are often terms used interchangeably, as they both reference delivery of content between instructors and students which are separated by time, geography, or both (Rovai, Ponton, & Baker, 2008).

[a] The survey, Student Experience in the Research University (SERU), which is the basis for this study is fully described in Chapter 3, pp. 60-61.

E-learning. E-learning involves "electronically mediated learning in a digital format that is interactive but not necessarily remote" (Zemsky & Massy, 2004, p. 6). E-learning has three broad domains: 1) synonymous with distance education or education delivered on the Web, 2) facilitated transactions software such as CMS where courses are presented or delivered online, and 3) electronically mediated learning including a host of products, services, and applications such as test-prep software (e.g., SAT, GRE) or integrated learning packages (Zemsky & Massy, 2004).

Online courses. Online courses are those "in which all course activity is done online; there are no required face-to-face sessions within the course and no requirements for on-campus activity" (Coswatte, 2014, Course-Level Definitions section, para. 6).

Hybrid or blended courses. Hybrid or blended courses are those where "online activity is mixed with classroom meetings, replacing at least 20%, but not all required face-to-face meetings" (Coswatte, 2014, Course-Level Definitions section, para. 5). Modestly better outcomes are produced using blended or hybrid course formats than all online or all face-to-face formats (Means, Toyama, Murphy, Bakia, & Jones, 2010).

Web-enhanced courses. Web-enhanced courses offer "online course activity complements class session without reducing the number of required class meetings" (Coswatte, 2014, Course-Level Definitions section, para. 4). These courses are similar to traditional courses except they differ in the amount of technology support for faculty and students.

Traditional classroom courses. Traditional classroom courses are also known as face-to-face (F2F). These are courses where the "course activity is organized around scheduled class meetings" (Coswatte, 2014, Course-Level Definitions section, para. 1).

Active learning. Active learning "engages students in the process of learning through activities and/or discussion in class, as opposed to passively listening to an expert. It emphasizes higher order thinking and often involves group work" (Freeman et al., 2014, p. 8413).

Flipped classroom. Flipped classroom or flipped learning is one increasingly popular measure of distributing lecture style classroom instruction. It is a pedagogy where students "flip" roles with teachers, teaching each other. Information transfer, considered lower level cognitive work, i.e. video lectures, may be viewed outside of the classroom. Information assimilation, the application of learning or synthesized analysis, occurs in the classroom (Crouch & Mazur, 2001; Mazur, 2009).

Interaction treatments. Interaction treatments are the instruction and/or media conditions designed into online courses, which are intended to facilitate student-student (SS), student-teacher (ST), or student-content (SC) interactions (Bernard, Abrami, Borokhovski, Wade, Tamim, Surkes, & Bethel, 2009; Moore, 1989).

Transactions software. Transactions software refers to the use of online course management system (CMS) or learning management software (LMS) such as Blackboard, Canvas, Moodle, or Sakai. CMS software is used principally in higher education, linking students to faculty and other students. CMS sites provide a class management system that may include assignments, resources, discussion or chat capability, schedules, reading materials, and computerized assessments (Zemsky & Massy, 2004).

Web-based instruction (WBI). Web-based instruction is a "hypermedia-based instructional program, which utilizes the attributes and resources of the World Wide Web to create a meaningful learning environment where learning is fostered and supported" (Khan, 1997, p. 6).

Quality. Quality refers to a grade of excellence; a level of high distinction or fineness of online education. "Quality is a measure of customer satisfaction with a product or a service" (American Society for Quality, 2014, Methodology section, para. 1).

In the following chapter, the relevant literature is presented and theoretical frameworks for student engagement are described.

Chapter Two Review of the Literature

Introduction

Technology is ubiquitous and learners' expectations now demand anytime, anywhere connectivity and access to courses. In institutions of U.S. higher education, digital strategy has become a top information technology (IT) priority (Stokes, 2015). Growth in hybrid or blended approaches, as well as online courses has also been a priority due to rapidly rising enrollments, especially in the South and West (WICHE, 2013). Teaching approaches have also evolved with the growth and increased dependence on technology, from "sage on the stage" to active learning and flipped classrooms (Allen & Seaman, 2015; Bates, 2015).

This chapter reviews the literature regarding the increased value of education, the cost of education, discussion of IT budget cuts, studies of online education, and the connection between today's college students and online education. The review continues with discussions of the importance of student satisfaction, organizational barriers to offering online education, and learning theories relating to technology use by students.

The Increased Value of Education

Two-thirds of America's economic growth in the 1990s was due to technological innovation, resulting in an increase in jobs that demand higher skill levels. The U.S. Department of Labor, Bureau of Labor Statistics (BLS) projects that between 2014 and 2024, 11 of the 15 (over 73%) fastest growing occupations will require postsecondary education, with the fastest growing fields related to healthcare occupations. Almost 95% of the new jobs will be in service-providing sectors (USDoL-BLS, 2015). As in prior years, median earnings are higher for those with higher levels of education and unemployment rates are lower for those with higher levels of education (USDoE-NCES, 2015).

The value of a college degree continues to increase (Pascarella & Terenzini, 2005; Dickeson, 2004). Earning a baccalaureate degree has been shown to be a major factor in earning power, since individuals with a college degree will earn a million dollars more than those with a high school degree over the course of a lifetime (Pennington, 2004). In 2013, the U.S. Census Bureau listed median earnings for those with a bachelor degree between the ages of 25 and 34 as 71% greater than those with only a high school diploma (as cited in Baum & Ma, 2014, p.7). The latest data from the College Board indicates, "the $103,256 median family income for families headed by a four-year college graduate was more than twice the median income for families headed by a high school graduate" (Baum & Ma, 2014, p. 33). College graduates vote at higher rates, pay more in taxes, volunteer at higher rates, are healthier, more likely to wear seat belts, and are more likely to read literature (Blumenstyk, 2014). The unemployment rate is about half for those with a college degree versus those with only a high-school diploma. Poverty rates for those with only a high school diploma are three times higher in 2014 than they were in 1979 (PEW, 2014).

Yet, if current trends continue, a shortfall of 14 million college-educated working adults is predicted by the year 2020 (Carnevale & Desrochers, 2003). In response, in part, to these demographic trends, President Obama has proposed a national goal for the U.S. to lead the world in college degrees by 2020 (Obama, 2009). The Association of Public and Land-grant Universities (APLU) endorsed this goal and has initiated discussions on how to increase tertiary degree attainment to 55% of 25-34 year olds by 2025 (McPherson & Shulenburger, 2009).

Cost of Education

While rising tuition continues to be in the forefront in higher education news, tuition costs have risen less since the recent recession (Baum & Ma, 2013). Net prices, the amount paid after scholarships, grants, and tax credits are subtracted, have increased since 2010. One reason for this is that financial aid has not kept pace with the increases in tuition (Bidwell, 2013).

A recent study, using IPEDS data, examined whether online learning technologies led to decreased prices in higher education. The authors found that colleges with a higher share of online students, such as large for-profits and less-selective public institutions, were found to have lower tuition prices, but the impact of online learning on education quality was uncertain (Deming, Goldin, Katz, & Yuchtman, 2015).

Higher education price index. Economists and education leaders examine overall costs using the annual Commonfund Institute Higher Education Price Index (HEPI), which is a calculation utilizing eight cost factors that measures inflation for college and university goods and services. HEPI is designed exclusively for higher education, has been in place for over 50 continuous years, and is a more accurate indicator than the Consumer Price Index (CPI). Inflation for colleges and universities was 3% for fiscal year (FY) 2014, which ended June 30, 2014. This amount is substantially higher than the 1.6% rate for FY2013 and was caused by a surge in the inflation rates for two of the cost factors, supplies and materials as well as utilities, combined with smaller increases in the inflation rates of faculty salaries and fringe benefits (Commonfund

Institute, 2014).

Information technology departmental budget cuts. Since 1990, the Campus Computing Project is the largest continuing U.S. higher education information technology (IT) study, founded by Kenneth C. Green. The 2009 Campus Computing Project survey indicated that IT departments play a key role in the operational infrastructure of online programs. Budget cuts have forced IT departments to reorganize their academic computing units, reduce costs, strive for efficiencies, and seek alternative funding. Federal stimulus money temporarily helped some colleges during the recession, but was not a long-term solution (Green, 2009).

IT budgets have experienced significant cuts since 2008, yet IT departments are facing rising demands for services and resources. Public institutions have been hit the hardest, with roughly two-thirds reporting cuts in 2009. Private institutions and community colleges have also been affected by budget cuts, but not as severely as four-year public institutions. Fewer institutions reported IT budget cuts in the fall 2011 Campus Computing Survey, but the budget cuts continued for many institutions, especially public institutions. According to Green (2011), community colleges were particularly hard hit due to exploding enrollment and eroding financial resources for IT services to support online and on-campus courses.

The 2014 Campus Computing Survey (Green, 2014) contained data collected from 470 two and four year public and private colleges and universities across the United States. In aggregate, 29% of the campuses reported outsourcing their online programs, up from 23% in fall 2013. Forty-five percent of respondents listed the campus investment in online courses as very effective. The demand for MOOCs appears to be subsiding, as less than 38% of the survey participants agreed that "MOOCs offer a viable model for the effective delivery of online instruction," down from 53% in fall 2013 (Green, 2014, MOOCs and Online Education section, para. 1). Expectations for making money on MOOCs also declined, with 19% agreeing that MOOCs "offer a viable model for campuses to realize new revenues," down from 29% fall 2013 (Green, 2014, MOOCs and Online Education section, para. 1).

Difficulty of estimating cost of online education. Much debate has ensued related to the cost of online education versus face-to-face instruction. In 2009, the Vice President and Provost at the UMN estimated $23,000 as the average cost of launching an online nursing class (Schmickle, 2009). At that time, the University system had nearly 21,000 students enrolled in over 1,600 courses that were all or partially online. According to Sullivan, "In the short term, the costs will increase. There will not be savings…We can't tell you what the net cost saving will be down the road. It's too new, too evolving." (Schmickle, 2009, Neither Cheap nor Easy section).

A 2009 MinnPost article indicated that the Minnesota State College and University System (MnSCU) offered more than 8,000 course sections online. The article cites a 2007 cost study indicating "half of the online sections were more expensive to run than traditional class meetings" (Schmickle, 2009, Neither Cheap nor Easy section). However, regardless of cost, online education has become a critical long-term strategy for colleges and universities to increase outreach, hopefully reduce cost, and attract new students (Allen & Seaman, 2015). Since 2009, MnSCU's online course offerings have doubled, with over 470 programs and 16,400 blended and online course sections being offered during the 2011-12 academic year, serving over 107,000 students. MnSCU's e-education program experienced a ten-fold increase in enrollments over the past decade, although three-fourths of MnSCU's online students also take classes face-to-face (Rosenstone, 2012).

Administrators and decision-makers must address several factors before adopting online programs: desirability, feasibility, affordability, and sustainability. Haddad and Jurich (2002) found that the total cost should equal fixed costs plus variable costs multiplied by the number of learners: TC = (FC + VC) * N. Fixed costs include the infrastructure. Variable costs include recurring costs, such as training for faculty and students, and the technical help to support them. Finally, cost effectiveness can be positively influenced by increasing the participation rate, but this does not adequately assess learning effectiveness or course quality (Haddad & Jurich, 2002).

Technological advancements, such as more engaging software applications, foster active student participation (Nelson Laird & Kuh, 2005), but must also be factored into overall costs of online education. Other examples of educational technology include learning management systems such as Blackboard, Canvas, Moodle or Desire2Learn, digital tools and materials such as animations, simulations, and educational games, and active learning classrooms with enhanced audio and video capabilities.

Network security and instructional support expenses must also be factored into the rising costs of online education. The ability to prevent phishing, hacking, viruses/malware, and other malicious network-related issues is crucial. Instructional designers must also be trained, hired, and available when needed. Technical support costs, perhaps 24x7 depending on the size of the campus, and overhead expenses must be included. The initial campus investment typically does not include individual faculty costs such as their time commitment, including course development time. The learning curve for faculty can vary depending on experience, aptitude, and willingness (Rogers, 1995). All of these underlying expenses contribute to the growing costs of online education.

Online learning is considered by some to be the best hope for cost savings through larger class sizes and less face-to-face interaction (Christensen, Horn, & Johnson, 2011). Bates (2013) warns that attempts at scaling or increasing economies of scale need to be balanced to ensure quality does not suffer. Bates (2012) advocates for nine steps to quality online learning. These steps include 1) Decide how you want to teach online; 2) Decide on what kind of online course; 3) Work in a team; 4) Build on existing resources; 5) Master the technology; 6) Set appropriate learning goals; 7) Design course structure and learning activities; 8) Communicate, communicate, communicate; and 9) Evaluate and innovate. Bates has written 11 books related to technology, online learning, and distance education and is considered a leader in the field.

There is debate on whether online courses are less expensive than face-to-face courses, especially for high quality online courses (Haddad & Jurich, 2002). Online learning is seen as a way to improve college access at lower cost, especially with rising costs of physical assets such as buildings and roads, maintenance, and other infrastructure needs (Commission on the Regulation of Postsecondary Distance Education, 2013; McPherson & Shulenburger, 2009; Trombley, 2003). Administrators and policy makers must realize that there are many hidden costs with technology, such as security, support costs, and network infrastructure which must also be included when comparing costs to face-to-face courses.

Improving educational quality has become a major concern for colleges and universities who must strive to meet rising student expectations at minimal cost in an era of increased competition (Twigg, 2003). The PEW Charitable Trusts developed strategies to reduce instructional costs as part of their $8.8 million grant to the National Center for Academic Transformation (NCAT) in 1999. NCAT examined how colleges and universities could redesign courses by using technology to save money and enhance quality. They followed a three-stage proposal process which included 1) assessing readiness to participate, 2) developing an improvement plan, and 3) examining traditional instruction cost along with new methods of technology-based instruction. The 30 participating institutions reduced costs by an average of 40%, affecting 50,000 students and reducing $3.6 million in operating expenses (Twigg, 2003, p. 24).

Large-enrollment introductory courses were the focus of the NCAT grant, including mathematics, statistics, computer programming, English composition, Spanish, fine arts, world literature, biology, chemistry, astronomy, psychology, sociology, and American government (Twigg, 2003). The significant cost savings occurred through implementation of online course-management systems, automation of class exercises and assessments, incorporation of online tutorials, and shared resources. Colleges also implemented alternative staffing, such as employing course assistants or preceptors, rather than traditional instructors. Results included improved student retention, improved student-learning outcomes, and better space allocation

Studies of Online Education

This section will highlight selected studies, which show how and why the evolution of online education has matured. Several studies indicate improved student performance and effectiveness with online education (Freeman et al., 2014; Means et al., 2010; Sitzmann, Kraiger, Stewart, & Wisher, 2006). Online learning has become popular for allowing flexible access to course content, increasing accessibility, measuring student satisfaction, lowering costs, and creating efficiencies.

Most recent results. Research on online learning shows online learning can produce quality results. Active learning was found to increase student performance in a meta-analysis of 225 science, technology, engineering, and math (STEM) studies comparing active learning with traditional lecturing. Under active learning (n = 158 studies), the effect size of 0.47, ($Z = 9.781$, $P \ll 0.001$), indicated that on average, student performance on exams and concept inventories increased by just under half a standard deviation with active learning. The odds ratio for failing was 1.95 under traditional lecturing (n = 67 studies). "Average examination scores improved by about 6% in active learning sections, and that students in classes with traditional lecturing were 1.5 times more likely to fail than were students in classes with active learning" (Freeman, et al., 2014, p. 8410).

In September, 2010 the U.S. Department of Education released the revised results of a meta-analysis of more than 1,000 empirical studies comparing online and face-to-face instruction (Means et al., 2010). From these studies, 99 of the best studies employing experimental or quasi-experimental designs were analyzed, with just nine of these studies involving K-12 learners. Out of these 99 studies, 50 independent effect sizes from 46 studies were obtained with 27 from Category 1 (at least one contrast between online learning and face-to-face/offline learning), and 23 from Category 2 (at least one contrast between blended learning and face-to-face/offline learning).

Results from Means et al. (2010), show that online instruction is as effective as classroom instruction and that stronger learning outcomes were achieved using blends of face-to-face courses, which lends support to the hybrid course model. The overall mean effect size for all 50 contrasts was .20, $p < .001$ favoring online conditions (Means et al., 2010). The study results indicated that online students perform significantly better than their classroom counterparts on several outcomes of learning; however, further research is warranted to discover which factors affect these results and whether these results can be replicated over a wide range of disciplines (Shea, 2009). For example, are online classes better at delivering one type of content than another? What is also missing is how the use of various instructional technologies affect student learning.

Sitzmann et al. (2006) conducted a meta-analysis of 96 studies from 1996-2005. Results based on 10,910 learners and 71 effect sizes indicated web-based instruction to be 6% more effective than classroom instruction for teaching declarative knowledge with an effect size of .15. Kraiger, Ford, and Salas (1993) defined declarative knowledge as the learners' fact memorization, principles, and the relationship among knowledge elements (as cited in Sitzmann et al., 2006). Both delivery methods were equally effective for teaching procedural knowledge and trainees were equally satisfied with both methods. Additionally, web-based instruction was 19% more effective (effect size .49) than classroom instruction in long courses where training materials could be practiced and learners received feedback during training.

Comparison with differing studies. A 2004 meta-analysis of 232 studies between 1985 and 2002 compared regular classroom learning and online learning on three separate outcome measures, but did not show significant difference in learning outcomes or effectiveness, effect size of .0128 (Bernard et al., 2004). Several members of this research team followed up with a 2009 meta-analysis examining interaction effects and concluded that learning outcomes improve when online instruction focuses on increasing or enhancing participant interactions. Their meta-analysis included 74 studies comparing interaction treatments (ITs), which are instructional and/or media conditions designed to facilitate student-student (SS), student-teacher (ST), or student-content (SC) interactions (Moore, 1989). The overall weighted average effect size of 0.38 supports the importance of the three types of ITs (Bernard et al., 2009).

Zhao, Lei, Yan, Lai, and Tan (2005) found advantages for blended learning in their meta-analysis of 51 studies, and they also found that instructor involvement was a strong mediating variable. As cited in Zhao et al. (2005), prior research, such as Cavanaugh's (2001) meta-analysis of 19 studies related to the academic achievement of K-12 students had an effect size .015. Allen, Bourhis, Burrell, and Mabry's (2002) meta-analysis (25 studies) of adult learners' student satisfaction had an effect size of .031. Shachar and Neumann's (2003) meta-analysis of 86 studies on student achievement had an effect size of .37. Machtmes and Asher's (2000) meta-analysis of 30 studies on adult telecourses had an effect size of -0.0093, but had considerable heterogeneity. As these examples indicated significant difference in the outcomes of distance education and face-to-face education, Zhao et al. (2005) suggested that it was necessary to examine characteristics of individual studies to determine the individual characteristics (e.g., learner characteristics, instructor characteristics, and/or delivery method) to identify specific contributions to positive outcomes.

Contributions to Student Success

This section places the discussion of student success in the context of current pressing educational technology issues. Student success in college has received considerable attention in recent years (Kuh, Kinzie, Schuh, & Whitt, 2005; Pascarella and Terenzini, 2005). A substantial body of research indicates that once students start college, a key factor to whether they will survive and thrive in college is the extent to which students take part in educationally effective activities (Astin, 1993; Chickering & Gamson, 1987; Kuh et al., 2005; Pascarella & Terenzini, 2005).

National survey of student engagement. *The College Student Report* is an annual survey administered to first-year and senior students in hundreds of four-year colleges and universities across the U.S and Canada. The survey focuses on student engagement, including "the amount of time and effort students put into their studies and other educationally purposeful activities" and "how the institution deploys its resources and organizes the curriculum and other learning opportunities to get students to participate in activities that decades of research studies show are linked to student learning" (National Survey of Student Engagement [NSSE], 2014). Participating institutions receive snapshots of their campus results along with their Institutional Report. These results aid each institution in documenting their undergraduate experience and effective practices. NSSE has experienced considerable growth since 2003. The following progression highlights results from the past ten years.

2003 National survey of student engagement. Based on the 2003 sample from the NSSE, which surveyed 60,000 freshmen and seniors from 420 participating colleges and universities, there is a positive relationship between the use of technology for educational purposes and student engagement (Nelson Laird & Kuh, 2005). Information technology and classroom engagement were most strongly associated with active and collaborative learning, academic challenge, and student-faculty interaction. The authors suggested that learning more about how students are using technology can help increase the reliability of measures of engagement in other effective educational practices.

These NSSE survey results indicate that educational technology is one means of following the Seven Principles for Good Practice in Undergraduate Education (Chickering & Gamson, 1987; Chickering & Ehrmann, 1996), encouraging active learning, giving prompt feedback, and encouraging contact between students and faculty. Instructional technology strategies also strive to promote higher order thinking which contribute to engaged students and increased student learning.

2008 National survey of student engagement. The 2008 NSSE was modified to include additional demographic items which allowed a comparison of face-to-face classroom and online students in terms of student engagement (Indiana University, 2008). Results from 22,000 students from 47 institutions indicated that online students reported significantly better results for several of the indicators of engagement; classroom students did not show better results on any of the indicators. Online students were significantly more likely to report they very often participate in course activities that challenged them intellectually, participate in discussions that enhanced their understanding of different cultures, and participated in major topics related to their field of discipline (Indiana University, 2008; Shea, 2009). Questions remain, such as what triggers greater participation in course activities and discussions for online students compared with classroom students?

2013 National survey of student engagement. The 2013 NSSE results from 100,500 students from 568 institutions found that regarding academic challenge, "online students spent slightly more time studying and reading, and they were assigned more writing on average" (p. 9). Of those students taking all their courses online, three quarters experienced high levels of challenge, compared to 55-59% of students with no online courses (NSSE, 2013). Online students and older students used more study strategies than their counterparts and these were positively related to self-reported grades. Vermetten, Lodewijks, and Vermunt (1999) have shown that students benefit from using a wide variety of study approaches, such as summarizing and organizing new information, taking notes when reading, and creating a study-friendly, conducive environment. The 2013 NSSE also showed that "seniors majoring in health and social service professions reported the greatest use while those majoring in engineering and physical sciences, mathematics, and computer sciences reported the least use of learning strategies" (NSSE, 2013, p. 12).

Today's College Students

It is vital to understand the nature of today's college students with respect to educational technology. Today's college students are known as the Millennials. Born between 1982 and 2004 (Howe & Strauss, 2000), they are rapid adopters of new technologies. Millennials are also known as Generation Y, the Millennial Generation, Net Generation, or Generation Next. Millennials' buying decisions are driven by smartphone apps and convenience (Schultz, 2012). There are over 50 million millennials, which are projected to make up approximately 19% of Americans by 2020.

According to a PEW Research Center 2010 report, more than eight-in-ten

Millennials say they sleep with a cell phone by the bed (Taylor & Keeter, 2010). Millennials are more ethnically and racially diverse and are history's "always connected" generation. They embrace technology and outpace older Americans in Internet and cell phone use. Three-fourths (75%) of Millennials have created a social networking profile, 20% have posted video of themselves online, and 88% of Millennials use their cell phones to text (Taylor & Keeter, 2010).

Smith, Rainie, and Zickuhr (2011) examined several PEW Internet Project surveys to create a statistically meaningful view of today's college students attending community college, four-year schools, and graduate schools. They found that "young adults of all stripes" were much more likely than the general population to go online. In addition, they found that 96% of undergraduates reported owning cell phones, 88% owned laptop computers, and 84% owned iPod or mp3 players. Fifty-nine percent of undergraduates reported owning desktop computers and 58% owned game consoles. Nine percent reported owning e-book readers and 5% reported owning tablet computers (Smith et al., 2011).

Generation Z is the name given to the cohort of people born after the Millennial Generation, born mid or late 1990s to mid-2000s. Wilen-Daugenti (2009b) has further defined children born in 1996 and later as Generation V for the 3 Vs: Visual, Virtual and Versatile. This group is growing up with visual technologies such as handycams, digital cameras, and social media such as YouTube. They experience virtual worlds through Wii, Xbox, PlayStation, and multiplayer virtual reality games such as Second Life. These students are versatile and are accustomed to a variety of devices such as iPods and smartphones. Generation V has been exposed to technology since infancy, with videos and software designed for children as young as six months old. Some have hypothesized that the brain development of these children may be different from earlier generations due to the exposure to technology (Prensky, 2001).

Today's college students have grown up with information and communication technologies (Cotten, McCullough, & Adams, 2011), including social networking websites such as Facebook and Myspace. Junco (2012) studied the relationship between multitasking during class and GPA with a sample of 1,839 students and found that Facebook use and text messaging during class negatively impacted GPA, but that instant messaging, emailing, searching, and phone calls during class did not. Facebook averages 864 million daily active users with over a billion monthly users (Facebook, 2014) and myspace, with a strong music emphasis, has over a million users daily.

Online education helps to reduce the digital divide through convenience and efficiency, and it can reach a broader spectrum of students, including those with disabilities (Wilen, 2009). Online education has the potential to better accommodate students with varying work and family schedules and also allows flexibility in scheduling classes for students to meet graduation requirements.

Importance of Student Satisfaction

It is apparent that today's students have high expectations for technology and the ability to readily access, or "Google" information 24x7. Colleges and universities are placing more emphasis on educational technology and the growth of online and hybrid courses. Higher education trends indicate these patterns will continue, so it is vital to meet student technology expectations and strive to utilize technology in the best means possible. This will allow colleges and universities to excel in training tomorrow's workforce.

Technology adoption and self-efficacy. Researchers have been interested in the factors that influence individuals' use of information technology (IT) since the mid-1970s. Some of the earliest individual or behavioral factors that influenced IT adoption were identified by Lucas (1975) in the usage of a sales information system to see if a relationship existed between computer usage and sales performance. The factors included items such as an individual's decision style, the ability to analyze information and take action, an individual's attitudes and perceptions about systems, and situational and personal factors. Lucas (1978) adds that the extent that management uses an information system is a suggested measure of success. The early use of information systems could be assimilated to instructors' use of the LMS in higher education.

Fishbein and Ajzen's (1975) theory of reasoned action was the first theoretical perspective to gain widespread acceptance in the area of behavioral intention and attitudes toward computers, which maintains that individuals would use computers if they could envision positive benefits or outcomes with usage. Computer self-efficacy is defined as individuals' belief or confidence in their ability to competently use computers (Compeau & Higgins, 1995). Extending this definition further, technology self-efficacy would imply that "Self-efficacy beliefs are rooted in the core belief that one has the power to produce desired effects" (Bandura & Locke, 2003, p. 87). An extension of the theory of reasoned action (Fishbein & Ajzen, 1975), is the technology acceptance model (TAM), which suggests that users' acceptance of technology is determined by their beliefs of perceived use and consequences (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989). The two most important factors that can influence users' technology acceptance behaviors are perceived ease of use and perceived usefulness.

Learner characteristics. Studies related to learners' characteristics include understanding what motivates students to choose online courses, how to match learning styles with instructional design, best delivery methods, and demographics of online learners. Convenience is an important factor (Allen et al., 2002), but studies have found that the quality of instructional design is crucial for a successful learning experience, even with a motivated and highly-focused student. Developers must match expectations of the learners and their cognitive styles, as there isn't a one-size-fits-all format when it comes to delivery environments and that "instructional designers must carefully weigh the user characteristics, the available faculty, the institutional concerns, and the delivery tool in order to create an effective instructional experience online" (Tallent-Runnels, Thomas, Lan, Cooper, Ahern, Shaw, & Liu, 2006, p. 113). A large number of different learning styles are present even within a highly motivated audience (Graff, 2003).

Allen et al., (2002) conducted a meta-analysis of 24 studies comparing student satisfaction with online education to traditional face-to-face classrooms and found a positive impact for online education due to convenience and flexibility of online courses. Sun, Tsai, Finger, Chen, and Yeh (2008) studied 13 factors to determine which were critical for learners' satisfaction in online learning and found seven factors to be significant, including learners' computer anxiety, instructor's attitude, course flexibility, course quality, perceived usefulness, perceived ease of use, and diversity in assessments.

Lin, Lin, and Laffey (2008) studied 110 online students and found that students' perceived task value, social ability, and self-efficacy to be key factors for satisfaction in online learning, with their model accounting for approximately 63% of the variance of the model. Perceived task value is associated with students' perception of the importance, utility, and interest of the learning content or tasks. Perceived social ability is students' ability to associate with others and utilize meaningful resources. Self-efficacy is a measure of students' belief that they are capable of learning.

Learners' outcomes. Studies of the learners' outcomes include the cognitive domain. Does online instruction provide as much learning as traditional learning? The debate continues. Whether or not a significant difference can be identified depends, in part, on which studies are included in the statistical analysis.

Motivation, high interactivity, integration, reinforcement, and a seamless infrastructure have all been shown to contribute to persistence in both the academic and corporate online learning environments (Frankola, 2001). McLaren (2004) compared persistence and performance measures of five semesters of online and traditional sections of a required undergraduate business statistics course. Significantly fewer students persisted in online courses, but those who persisted had course grades comparable to their traditional counterparts. Dropout rates as high as 80% have been reported for online student persistence; course completion rates are generally 10-20% higher in traditional courses than in online courses (Carr, 2000).

Estelami (2012), in an exploratory study of the drivers of student satisfaction and learning experience in marketing courses, found that student satisfaction was most affected by the level of satisfaction with the instructor ($t = 5.08$, $p < .01$), course assignments ($t = 3.063$, $p < .01$), communications ($t = 2.68$, $p < .01$), and effective learning resources ($t = 2.20$, $p < .05$). This study explored the drivers of student satisfaction in hybrid and online courses.

Organizational Barriers to Offering Online Instruction

There are several organizational barriers that can impact student satisfaction for online instruction. Faculty motivation may be impacted by organizational barriers such as changing faculty composition, intellectual property rights, training and physical support, infrastructure, departmental policies, and the department's encouragement to teach online. The Campus Computing Survey (2014), a study of college and university CIOs and senior IT officers, identified a gap in training as well as accessibility-related issues with course design. Individual faculty resistance to teaching online, and institutional and administrative aspects can also impede online instruction's implementation.

Factors impacting faculty motivation. The composition of faculty across U.S. higher education is changing, with a drop in tenured and tenure-track faculty and a rise in part-time or adjunct faculty. Seventy percent of the faculty are employed in part-time or full-time, non-tenure-track appointments (Kezar, 2013). Many lecture and non-tenure-track appointments are on short-term contracts and are not tenure eligible. Many instructors hired to teach one or two courses do not receive benefits such as healthcare. Half of the non-tenure-track faculty are employed part-time.

The U.S. House of Representatives' Committee on Education and the Workforce Democratic Staff launched an eForum in November, 2013 to collect information from contingent faculty and instructors. Contingent faculty are "non-tenure-track teachers, such as part-time adjuncts or graduate instructors, with no job security from one semester to the next, working at a piece rate with few or no benefits across multiple workplaces, and far too often struggling to make ends meet" (U.S. House of Representatives, 2014, p. 1). One respondent, who earned $2,500 per online course, estimated his salary to be approximately $12.56 per hour. Another respondent, who works for a for-profit online university, estimated his salary to be less than $10 per hour. This quote summarizes their sentiments, "I have worked for several online schools to put together enough money to make ends meet, and I don't feel like this is an effective way to teach my students" (U.S. House of Representatives, 2014, p. 10).

The possible advantages of online teaching and hybrid learning strategies must also be weighed against the inherent capabilities of faculty (Massy & Zemsky, 1995). Some faculty may not feel their time spent incorporating technology justifies the learning productivity gained. Academic freedom allows faculty to design their courses as they wish. Online education has potential to reach a broader group of students and offers economies of scale, but this is after an initial front-end investment for the college or university that extends from the network infrastructure to support staff (Daniel, 1997).

Moser (2007) summarized the faculty e-learning behavior process which begins with time commitment, then moves to competence development, course design, teaching with technology, and ends with the reflection stage. Faculty members must be equipped with computers, software, adequate training, workspace, and a conducive and supportive work environment. The overall teaching/learning experience is affected by having a reliable infrastructure. Student feedback is incorporated into the teaching/learning experience and other peer experiences to form the reflection stage (Moser, 2007). Some of the barriers that faculty face in their educational technology adoption are “inappropriate support, unreliable technology, negative peer experiences, limited time commitment, and minimal course design” (Moser, 2007, p. 68).

The issue of intellectual property rights is one that each college or university must address through campus policy. Campus policies related to course ownership must be clear at the outset of online course development. Faculty who develop online courses may or may not be able to bring their developed courses with them should they decide to move to another institution. Issues of compensation for development of online courses must also be addressed (Ehrenberg, 2000).

“Used well, technology can assist institutions in providing student-centered, assessment-driven courses; but it cannot replace effective teaching by qualified faculty” (Finnegan, 2006, p. 144). Adequate training and physical support are needed in order for faculty to actively embrace instructional technology. Resources and faculty training must be available to ensure educational quality (Peterson, 2007). The use of varying technologies must be thoroughly tested prior to implementation, as technical glitches cause faculty confidence to erode (Cuban, Kirkpatrick, & Peck, 2001). Administrators interested in developing effective on-line instruction must recognize there are “both technical and instructional aspects that are not necessarily intuitive or analogous to the traditional classroom” (Fredericksen, Pickett, Pelz, Swan, & Shea, 2000, p. 10).

Cuban, Fitzpatrick, and Peck (2001) described two primary instructional barriers to technology adoption: institutional resistance to change and an inability to rely on consistent operation of the technical infrastructure. ECAR studies have shown operational barriers have decreased for colleges and university information technology departments (Smith, Salaway, Caruso, & Katz, 2009). Faculty perceptions or job satisfaction may be influenced by technology and its availability.

Faculty's willingness to adopt technology into their courses may be dependent upon four primary factors; ownership, time, access (and equality), and learning patterns incompatible with instructional technology (Cuthell, 2002). Other factors may include policy requirements as part of faculty evaluation, workload, or personal preference. Support must also come from administration (Haas & Senjo, 2004). The availability of technical support, the role of instructional designers, and the usability of software programs may also affect faculty's willingness to adopt technology.

Information technology training gap. The 2014 Campus Computing Survey's top institutional priorities relate to IT services such as helping faculty and students use technology in and outside the classroom, as well as hiring capable IT staffers. These top priorities are consistent across all sectors of higher education from community colleges to private research universities. Eighty-one percent of the Campus Computing Survey respondents reported "assisting faculty with the instructional integration of information technology" as the top priority. Three-fourths (74%) of the survey respondents listed "providing adequate user support" as the second top priority (Green, 2014). Nearly 28% of respondents rated their existing training offerings for faculty as excellent, and only 12.8% of respondents rated their student training offerings as excellent. Green referred to the training gap between top priorities and the current training ratings as "dismal" and suggested "just in time" training over summer session (Straumsheim, 2014a).

Campus Computing Survey (2014) respondents identified students who are not receiving sufficient support. Only 49% of institutions reported having a strategic plan to make educational resources accessible to students with disabilities, which comes at a time when advocacy groups are fighting for new guidelines requiring accessible digital resources (Stratford, 2014). As an example, digital formats for legacy courses may need to be redesigned in order to be in compliance with the Americans with Disabilities Act (ADA) of 1990. While course redesign may contribute to higher overall course costs, reasonable accommodations must be offered to provide accessible content. Instructional designers utilize Web Content Accessibility Guidelines (WCAG) 2.0 AA standards, which define how to make Web content more accessible to people with disabilities, including older individuals with changing ability due to aging (UMN, 2014d).

Individual faculty resistance to online education. The main obstacles identified in the literature on the adoption of instructional technology are time commitments and faculty resistance to change. Despite increased access to technology, resistance to adopting instructional technology remains in the academic environment, both in the U.S. (Moser, 2007) and in European countries (Zemsky & Massy, 2006). Slow faculty technology adoption may result from aversion to change, fear of failure, or disinterest (Friel, Britten, Compton, Peak, Schoch, & Vantyle, 2009). Verene (2013) found faculty fear the essence of teaching can be lost when moving courses totally online.

Post-secondary educational theorists cite motivation as a key pedagogical consideration for instructional designers (Ameigh, 2000). In an educational setting, motivation has been described as a pedagogical structure tied primarily to natural anxieties about social and economic acceptance (Chou, McClintock, Moretti, & Nix, 1993). Faculty's individual status quo may cause reluctance to try new teaching styles. Individual resistance may include fear of change and complacency. Re-engineering courses requires significant planning, and long-term faculty may face an inertia issue and wish to remain in their comfort zone (Miller, Martineau, & Clark, 2000).

"Regardless of the quantity of technology placed in classrooms, the key to how those tools are used is the instructor" (Gülbahar, 2008, p. 32). It is vital for instructional technology to be leveraged in an effective or meaningful way in order to engage or retain students. Adoption of technology alone does not provide benefit to learners. "It is not, however, the machine that motivates: it is curiosity, content, and instructional strategies" (Lookatch, 1995, p. 5). Faculty will be challenged to utilize new mediums (video, podcasts, blogs, and portfolios) to assess student work (Wilen-Daugenti, 2009a).

A case study of instructors' usage patterns by Weston (2005), described two types of barriers which affect an instructor's level of technology engagement. First-order *extrinsic* factors include lack of time, lack of physical infrastructure, or flawed training strategies. Second order *intrinsic* factors include faculty values or entrenched practice. Lack of technology adoption due to intrinsic barriers was found to be generally untrue. Those instructors who infrequently used technology cited a mixture of outside obstacles and internal reasons as to why they avoided using technology. Other findings in the literature show faculty are more motivated to adopt technology through a variety of extrinsic factors such as stipends, release time, tenure and promotion, or course reductions (Haas & Senjo, 2004).

Faculty's top intrinsic factors include autonomy (desire to be self-directed), mastery (desire for self-improvement), and purpose (desire to be part of something larger than ourselves). Cooper (2007) found the number one factor that would motivate faculty to participate in online education was faculty satisfaction or intrinsic motivation. Cooper also found that faculty performance, an intrinsic motivator, was more valuable than extrinsic motivators. Faculty at colleges and universities desire to improve both college access and student success (Kuh et al., 2005). Providing better value to students is the whole purpose of using technology in teaching (Daniel, 1997).

Institutional and administrative aspects. Little formal research exists related to institutional factors correlated with the development of online courses. Research on institutional aspects is divided into three parts: institutional policies, institutional support, and enrollment effects. Phipps and Merisotis (2000) studied six leading online institutions, including Brevard Community College (Florida); Regents College (New York); University of Illinois at Urbana-Champaign; University of Maryland University College; Utah State University; and Weber State University (Utah). They found that found that while most of them had university policies for online classes, some of had not yet established clear policies for course development, evaluation, and support.

Rungtusanatham, Ellram, Siferd, and Salik (2004) designed a typology that serves as a best practice for administrators. This practice is to match education goals with design and delivery methods appropriate for the intended course level. In this typology, higher level courses require greater levels of interaction than introductory, overview courses.

Conclusions from the institutional support literature reveal that faculty members as well as students want and need training in the development of web instruction and technological support. Training and technological support should be ongoing and one-on-one. Faculty require support during development of online courses as well as during delivery (Gibson & Herrera, 1999; Zhang, 1998). Faculty also want compensation and training for course development (Dahl, 2003). Finally, the impact on course enrollments shows that online courses can increase enrollment for universities.

Student success is dependent upon certain institutional practices being applied to all students. Adelman and United States (2006) suggest students complete at least 20 credits by the end of their first year and using the summer term strategically. Permissive academic standards and policies have a negative effect on student success (Adelman & United States, 2006; Kuh et al., 2005; Tinto, 1993).

Learning Theories Relating to Technology Use by Students

Learning theory perspectives. Three perspectives on learning theory relating to technology use include: a) the behavioral perspective, where learning is based on the external environment; b) the information-processing perspective, where learning is defined as an objective representation of experience; and c) the constructivist perspective, where learning is defined as a subjective interpretation of experience (Newby, Stepich, Lehman, & Russell, 2000).

The behavioral perspective, or behaviorism, was founded by John B. Watson and is based on the belief that "behaviors can be measured, trained, and changed" (Cherry, 2015). This learning theory is based on the idea that conditioning, which occurs through interaction with the environment, is how behaviors are formed. Classical conditioning and operant conditioning are the two major types of conditioning (Cherry, 2015).

The information-processing perspective is based on cognitive theory which largely rejects behaviorism as it over-simplifies complex human behavior. Information processing is the commonly used description of the mental process which compares the human mind to a computer with thoughts, emotions, and feelings serving as the actual computations (Fritscher, 2015).

A constructivist approach is an "active process in which learners construct new ideas or concepts based upon their current/past knowledge" (Wilen-Daugenti, 2009, p. 30). Constructivist approaches move away from the traditional, didactic teaching process and allow students to actively construct knowledge by solving realistic problems, usually in collaboration with others. Changes in meaning are then "constructed" from experience. This student-focused method allows students to construct knowledge and explore ideas based on their own experiences and observations.

While principles from all three of the above learning theory perspectives can be applied to any learning situation, a sociocultural constructivist approach is the basis for the majority of research on online instruction. Sociocultural theory suggests that social interaction and culture lead to continuous step-by-step changes in thought and behavior. The main ideas adopted in sociocultural constructivism are: a) that students are active learners, b) experiences with people at a higher learning ability and peers who co-construct learning outcomes will allow higher forms of thinking to develop, c) cultural artifacts and tools are used in learning processes, d) quality of learning is affected by the quality of discourse, and e) modern technology is an important tool which can be used to support learning in both co-constructing relationships as well as scaffolding (De Lisi, 2006).

Cognitive theorists. Piaget and Vygotsky were two foundational and influential cognitive theorists who provided perspectives on how peer collaboration can facilitate learning and promote cognitive development (O'Donnell, 2006). Piaget's work provides insights into children's relationships with peers and adults, clarifying the social aspects of constructivism. Both theorists recognized the use of developmental methodology and a constructivist approach to learning, and instruction that emphasizes both social and individual processes (O'Donnell, 2006).

Based upon Vygotsky's Zone of Proximal Development (ZPD), the term *scaffolding* was coined by Wood, Bruner, and Ross (1976). A "scaffold" or support structure is analogous to allowing a person to stretch and climb to places previously out of their reach with an expert available to assist with this next step in learning (Holmes & Gardner, 2006). This theoretical foundation supports most research on using technology to scaffold learning in colleges and universities (De Lisi, 2006).

Vygotskian theory stresses the use of tools and signs to understand mental processes. Technology is a modern example of a cultural tool that can be used to support learning (Wertsch, 1985). Vygotskian theory suggests that development is dependent upon interaction with people, tools, and culture. There are three ways a cultural tool can be passed from one individual to another: a) imitative learning, where one person tries to imitate or copy another, b) instructed learning, which involves following instructions of the teacher, and c) collaborative learning, which involves a group of peers who strive to understand each other and work together to learn a specific skill (Welk, 2006).

Using technology as a tool in order to achieve or improve student learning is a concept that can be explained by the framework of the ZPD (Vygotsky, 1978). According to Vygotsky, leadership is being able to facilitate intellectual and social development in struggles by individuals to change their circumstances, leading to a subsequent benefit in an all-round development of conceptual ability. Human potential is limitless, but it depends on the quality of social interactions and residential environment. Interpreting the ZPD, any problem can be solved as long as a person has access to a more capable peer (Dahms, Geonnotti, Passalacqua, Schilk, Wetzel, & Zulkowsky, 2007).

In the ZPD, learners have an established base of skills, knowledge, and understanding, but in order to advance to the next level, they may need the assistance of an expert or more knowledgeable other to provide guidance and measured assistance to help them improve. The expert's role is to observe when and where a helping hand is needed and to determine the level of help that is required (Holmes & Gardner, 2006).

Theoretical Frameworks for Student Engagement

Creating a culture of student engagement is one well-documented method to help improve retention and graduation rates. Certain institutional practices are known to lead to high levels of student engagement (Astin, 1993; Chickering & Reisser, 1993; Kuh, et al., 2005; Pascarella & Terenzini, 1991). Among the most popular theoretical frameworks to guide the research in online teaching are Chickering and Gamson's Seven Principles for Good Practice in Undergraduate Education. These seven principles include "encouraging contact between students and faculty; developing reciprocity and cooperation among students; encouraging active learning; giving prompt feedback; emphasizing time on task; communicating high expectations; and respecting diverse talents and ways of learning" (Chickering & Gamson, 1987, p. 3). These seven principles primarily focus on communication and interaction between students and faculty. In 1996, Chickering and Ehrmann added that technologies should also be employed in line in order to achieve their full potential.

Keeping these seven principles in mind, many college and university IT and communication departments are striving to create technology resources that contribute to student engagement. A few of these tools include virtual reference through chat

(Tenopir, 2004) and "podcasting" or streaming video-broadcasts of classes for those unable to attend in person or who wish to review outside of class. These technology examples contribute to all seven of Chickering and Gamson's principles, especially active learning and prompt feedback.

Another popular theoretical framework guiding online education research is the Community of Inquiry (CoI) (Anderson, Rourke, Garrison, & Archer, 2001). The CoI suggests that learning or educational experience occurs at the intersection of three types of presences: social, teaching, and cognitive. Palloff and Pratt (2011) recommend that online courses have a student-centered, constructivist approach to learning, and that the CoI allows any participant, instructor, or student to assist in the creation of any of the three areas of presence. "The perception of faculty presence has been cited by many research studies as one of the most important determinants of student satisfaction with online learning" (Eskey & Schulte, 2012, Discussion Facilitation and Instruction section).

Kuh et al., (2005) have demonstrated how 42 separate survey variables regarding student engagement may be used to assess and improve the effectiveness of institutional retention programs. These variables are part of the NSSE which contains five clusters of effective educational practice: 1) level of academic challenge; 2) active and collaborative learning; 3) student interaction with faculty members; 4) enriching educational experiences; and 5) supportive campus environments.

Research has shown that student success is a function of both the pre-entry effects of students and their experiences in the collegiate environment. How pre-entry attributes affect student outcomes have been studied by many researchers. Tinto (1993) points out "congruence" or importance of students fitting into the environment of an institution, using this to assess student departure patterns, distinguishing between the academic and social integration of the student experience. Tinto also examines how each aspect of integration may influence student decisions to depart from an institution prior to graduation. Academic preparation and motivation are the best predictors of whether a student will graduate or not (Adelman & United States, 2006; Pascarella & Terenzini, 1991, 2005).

Subgroups, such as underprepared and disadvantaged students, have also been studied. Positive effects of programs such as the federal student support services program for academically underprepared students have been cited by Chaney, Muraskin, Cahalan, and Goodwin (1998). Disadvantages faced by racial/ethnic minority students have also been researched, citing a sense of isolation which contributes to their departure (Tinto, 1993). The extensive research on this topic shows that student success rates are influenced by institutions (Carey, 2004). Higher education institutions are challenged to identify strategies that are cost effective yet positively impact their student populations and environments.

Astin's (1993) Input-Environment-Outcome (I-E-O) model has been the foundation for research suggesting that a positive relationship exists between students' involvement activities and student retention rates. The I-E-O model allows researchers to control for student input characteristics, which results in a less biased estimate of how environmental variables affect student outcomes. Inputs include the student's personal characteristics at the outset of the learning experience. Input factors might include computer skills, prior knowledge of course content, citizenship, marital status, parental income and occupation, and the importance given to attending college. Educational environmental measures may include items such as faculty characteristics, financial aid, residence, and peer group. Student outcomes, also referred to as student outputs, exemplify the student characteristics after exposure to the learning experience. Outcomes are both psychological, such as satisfaction, values, beliefs, or basic skills, and behavioral, such as student performance, personal habits or citizenship.

Other studies include those in the affective domain, which is similar to Astin's "outcomes or outputs" portion of the I-E-O theory (Astin, 1993). These include students' attitudes, perceptions, and satisfaction with the online environment, which would be considered outcomes after being exposed to the college environment. The affective domain is an area needed for future research (Tallent-Runnels et al., 2006).

Documenting effective educational practice (DEEP). The manner in which institutions implement programs is as critical as the programs that are selected. Kuh et al., (2005) studied 20 institutions, known as the DEEP higher education institutions, which were selected for their ability to foster engagement, persistence, and high graduation rates. These schools implemented their programs and practices in meaningful ways, touching large numbers of students. A vital component of implementation is program assessment (Astin, 1993; Tinto, 1993; Kuh et al., 2005). Sound program assessments enable institutions to identify whether a program is producing the desired results and make timely changes when warranted.

Kuh et al. (2005) identified six features emphasizing engagement and persistence which were found across the 20 DEEP schools. These include 1) aligning institutional mission with the educational philosophy of an institution; 2) focusing on holistic student learning (e.g., utilizing active and collaborative learning strategies, and timely feedback from faculty to students); 3) adapting the college environment for educational enrichment (e.g., creating gathering places for students to congregate, and focusing on community connections); 4) marking clear pathways to student success (e.g., creating resources for strong support structures such as safety nets and ongoing assessment, and having early warning systems and reward systems in place); 5) adopting an improvement-oriented ethos, a term they call "positive restlessness," where colleges are continually revisiting and reworking policies and practices to improve institutional performance; and 6) highlighting shared responsibility for educational quality and student success (e.g., including the importance of student affairs in promoting student success through programs like first year experience, and fostering student agency through shared campus governance).

Course environment. Tallent-Runnels et al. (2006) performed a meta-analysis of 76 online education studies and classified these studies into four themes related to course environment, learners' outcomes, learners' characteristics, and institutional and administrative aspects. In their summary of research on the course environment, they reiterated the importance of online learning communities through small groups, the importance of instructor presence through scaffolding, timely posting of announcements and feedback, and participation in teacher-student and student-student interactions.

The course environment, similar to the environment within Astin's I-E-O theory, contains studies related to classroom culture, including the importance of creating a community of learners (Winograd, 2000; Knupfer, Gram, & Larson, 1997). Structural assistance studies relate to how instructional scaffolds (Greene & Land, 2000; Vygotsky, 1978) and management systems (Cooper, 1999) might guide or assist student learning.

Greene and Land (2000) performed a qualitative analysis using four different types of scaffolding, which is an example of the second environmental theme of learners' outcomes. The four types of scaffolding included World Wide Web (WWW) resources, instructional activity procedural guidelines, student-student interactions, and instructor-student interactions. Results indicate that face-to-face dialogue with instructors and peers, aka social scaffolding, was critical for learners' success, but that learners needed to fully understand the scaffold or resource in order to help them and that the learners' preconceptions and search strategies were difficult to alter.

A third area in the course environment theme includes success factors. A survey of 70 institutions revealed eight dimensions that affect student success: technology experience, access to tools, learning preferences, study habits, goals, lifestyles, purposes, and personal traits (Schrum & Hong, 2001). Measuring student success by performance in course projects has been studied (Hiltz, Coppola, Rotter, Turoff, & Benbunan-Fich, 2000), but results question the validity of findings since course grade can be subjective and influenced by many factors.

Interaction systems comprise the last of the course environment-related studies. Early studies measured student success in various ways. Swan (2002) administered an online survey to 1,406 students to measure perceived satisfaction and perceived learning. Swan then collected data from 73 courses and conducted an empirical investigation of correlations between 22 course design factors, such as percentage of course grade dedicated to discussions, the above student perceptions, and course level. She found three factors to be significantly related to student perceptions, "clarity and consistency in course design, contact with and feedback from course instructors, and active and valued discussion" (Swan, 2002, p. 23). She stressed the importance of creating opportunities for course interactions in online learning environments. As mentioned earlier, Bernard et al. (2009) also concluded that learning outcomes improve when online instruction focuses on increasing or enhancing participant interactions.

While these early studies helped to establish validity of the online medium, they offered limited insights into pedagogically sound techniques for administering online programs or designing and executing online courses. Further research is needed to define the specific types of interactions that result in significant improvement in learning, especially with CMS/LMS technologies.

Recent interaction studies have measured satisfaction by time on task, specifically time spent. Grandzol and Grandzol (2010) studied aggregate data from 359 business undergraduates at community colleges and found that "increased levels of interaction, as measured by time spent, actually decrease course completion rates" (p. 1). Their study included 153 high school students taking a concurrent enrollment partnership (CEP) program face-to-face and an additional 212 students taking televised CEP courses. Their study results contradict other study results which behooves further analysis, as the student development of high school juniors and seniors are in a transitioning phase and may have differing online education needs.

Overall, course environment studies parallel the Seven Effective Principles (Chickering & Gamson, 1987). Instructors should model effective communication, providing presence through scaffolding during discussions and posting of timely feedback and announcements. Learning communities were found to be important as well as interactions between teacher-student and student-student.

Conclusion

The results in this chapter present the increasing need for further study of the factors that impact student satisfaction with online learning in higher education and how this affects overall university satisfaction. This research is necessary due to the current crisis in higher education (Blumenstyk, 2014), with increased competition coupled with declining state and federal revenue sources. The resulting increased competition for students adds pressure to colleges and universities to look for economies in instruction while controlling costs and rising tuition.

Research shows that the growth and popularity of online learning is dependent on online policies, online course quality, technological stability of the LMS and Internet, adequate training, and effective use of technology. By further examining factors such as students' technological self-efficacy, technology experiences, and their classroom technology expectations, a more holistic view of students' satisfaction with teaching and learning environment can be gained.

The following chapter presents the methodology and the data set used to investigate the research questions.

Chapter Three Research Methods

Introduction

This chapter describes the design used to investigate the contribution of undergraduates' technology experiences and their perceptions of the benefits of technology, as measured by items and scales on the Student Experience in the Research University (SERU) survey, to undergraduate student satisfaction at a large Midwestern university. The chapter provides an overview of the research design for the quantitative study, describes the sample population, gives an overview of the conceptual framework used in the study, and describes the predictor and criterion variables chosen for the study. The chapter ends with a description of the data analysis procedures used to answer the research questions.

Methodology

The purpose of this regression study was to understand the relationship between several predictor variables, focusing on student technology experiences and perceived technology benefits, as well as a set of control variables, in the prediction of overall student satisfaction. Undergraduate students at a large, public research university were surveyed regarding their technology experiences and their perceptions of the benefits of educational technology and the impact of educational technology on the learning environment. The research questions focused on the students' educational experiences in relation to Astin's (1993) conceptual framework of the inputs, environment, and outputs (I-E-O) model of undergraduate education.

This study employed a non-experimental method of research design (Muijs, 2004). The data for the proposed research were collected as part of a larger University initiative on student engagement in the research university, one component of which was the periodic collection of survey data from undergraduates. I did not have input into developing the questions on the survey, as they were developed by a Student Experience in the Research University (SERU) working group responsible for developing the questions on the survey, including 10 sets of questions focused on students' experiences with technology. The SERU data are available for research purposes to University personnel and authorized graduate students via approved access to the data.

In this study, an exploratory design was used to measure the predictors and test a path analysis regression model using student technology experiences to predict perceived technology benefits and overall student satisfaction. In path analysis, independent or predictor variables are defined as exogenous variables and dependent variables are defined as endogenous variables. The study analyzed the explanatory power of 12 exogenous variables relative to two endogenous variables. The exogenous variables included: 1) Course Specific Behaviors scale; 2) Technology Obstacles scale; 3) Social Networking scale; 4) Proficiency Social Dimensions scale; 5) Engagement with Faculty scale; 6) Instructor Technology Ability scale; 7) Instructor Technology Usage scale; 8) Online Course Preference; 9) Year in school; 10) Grade point average (GPA); 11) Socioeconomic status (SES); and 12) Gender. The control variables were year in school, GPA, SES, and gender. The endogenous variables included: 1) the Perceived Technology benefits scale and 2) the Overall Student Satisfaction scale.

Methods

Instrumentation: The existing dataset. The 2013 SERU survey was a census survey of all undergraduates at the study institution, implemented by the Office of

Institutional Research, and contained 84 sets of questions about the undergraduate experience, separated into three parts. All students received Part I: The Core Survey (26 questions), Part II: Background information (20 questions), and one of five randomly assigned modules from Part III (ranging from nine – 11 questions). For many of the questions, there were specific item responses for the question, (e.g., 10 items focused on perceived benefits of technology). Altogether, each student received between 54 and 57 questions. The online survey software used by the SERU Consortium, the group of research universities using the survey in 2013, was Qualtrics, an electronic survey program. Student characteristics in institutional records were matched with survey responses.

Questions in the five modules in Part III were organized around five themes; see Figure 1, which were randomly assigned. Thirty percent of the students received the Academic Engagement and Global Experiences module (nine questions); 20% received the Civic and Community Engagement module (10 questions); 10% received the Student Life and Development module (eight questions); 10% received the Technology module (10 questions), and 30% received the Campus Wild Card module (eight questions). The Wild Card module contained campus-specific questions developed by the institution. At the campus studied, these questions in the Wild Card module related to student development, evaluation of writing, and satisfaction with experiences. Due to the random assignment of SERU modules, the same population of students would not have received both the Wild Card and Technology modules. Otherwise, utilizing questions from the Wild Card module could have benefited this research.

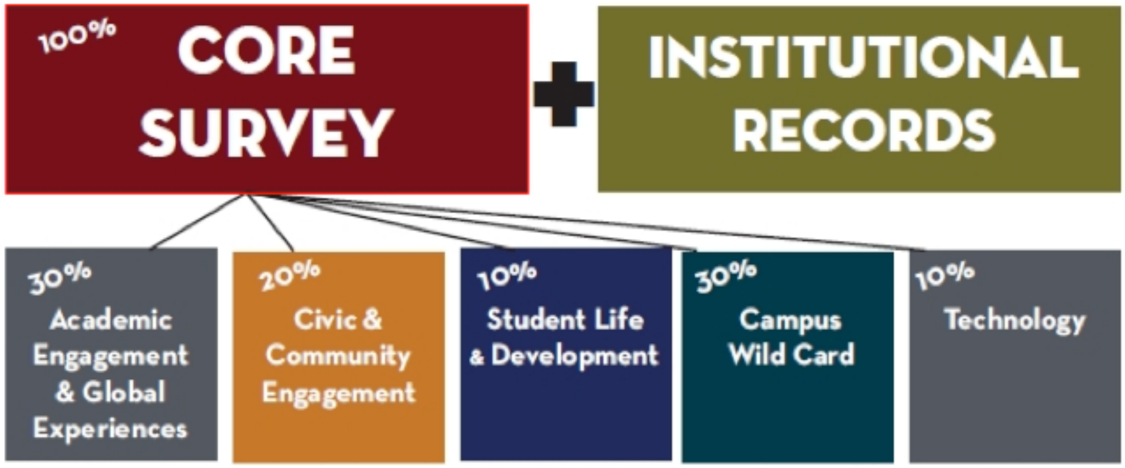

Figure 1. 2013 SERU modules

SERU consortium. The SERU consortium was formed in 2008 by the Center for the Study of Higher Education at the University of California, Berkeley, and included 15 research universities, all of which are members of the Association of American Universities (AAU) as of October 2012. See Appendix A for a list of the universities which administered the 2013 SERU. Institutional researchers and academic scholars developed the SERU Consortium with the goals of promoting a culture of institutional self-improvement, creating new data sources, and providing the basis for relevant policy analysis derived from analysis of SERU data. The consortium is a collaborative effort, which meets annually to review new data based on institutional, comparative, and longitudinal data, and the data are used as a resource for institutional self-improvement as well as for scholarly policy research.

Through the Campus Wild Card, SERU data can be used to gather information on a particular campus that is not available through other surveys, such as immigrant status and religious preference. As such, it is an effective means of benchmarking with peer and aspirational universities, assessing program effectiveness, and gathering student experience data—especially those experiences that have been shown to influence student learning and positive educational outcomes (e.g., high impact practices), both inside and outside of the classroom.

Today, the SERU survey is a comprehensive survey administered to undergraduates at top-ranked U.S. and international major research universities (CSHE, 2014). The SERU survey contains questions that are customized in the Campus Wild Card for each participating campus. Results from the SERU survey help institutions with decision making to improve student services, create new offerings, and improve the student experience. These survey results can be useful when comparing to other national survey trends to help institutions develop campus-specific strategies.

In 2013, the SERU survey included a module focused on educational technology, which included 10 sets of questions, with 89 item responses. Across the Core Survey and the Technology module, students who randomly received the Technology module provided 301 individual item responses. SERU committee members developed the questions with input from SERU member campuses. Only selected questions from the Core Survey were included in the present analysis

Results from this survey module can help determine students' overall technology satisfaction, as questions within this module gathered data regarding technology ownership and usage, preferences for online, hybrid, or supplemental digital course formats, role and preferences for the LMS, and technology obstacles. Sources such as the New Media Consortium (NMC), Educause Center for Applied Research (ECAR), Online Learning Consortium (OLC), and SERU help instructors and leaders understand the importance of studying online education, especially with regard to how technology can improve the student experience. In the 2013 SERU survey, the study institution was one of four universities which administered the Technology module. Whether or not the other three institutions have conducted extensive analyses of date collected on the Technology module is unknown.

Overview of instrument. The 2013 SERU Technology module contained 10 sets of closed-ended questions, with a total of 89 items, developed by a SERU Consortium working group chaired by Ronald Huesman, Jr. from the University of Minnesota, Twin Cities, with representatives from the University of Texas, the University of Florida, and the University of Virginia (J. Douglass, personal communication, January 28, 2015). The Technology module was a new addition to the SERU survey for spring 2013. The Technology module was administered at four universities, one of which was the institution in the present study.

The technology questions related to ownership and student usage of common devices; student usage of social networking and online content creation; student participation and preferences for online course formats; student participation and perception of learning management systems; student perception of faculty use of educational technologies; and perceptions of technology with relation to student engagement and outcomes. Of the 10 sets of items in the Technology module, this research utilized six of those sets of items. Later in this chapter, the reasons for not using the other four sets of items are described.

Population and Data Collection Procedures

At the campus being studied, the SERU survey was launched with a campus goal of a 40% response rate, according to the campus website. Several promotional materials were utilized to reach the campus goal, including reminder emails from campus administration and free bookmarks being offered in libraries, the bookstore, and at campus departments. Colleges, departments, faculty, and support staff were encouraged to use computer screensavers, posters, tweeting, Facebook and blog sites, and the SERU webpage, to encourage student participation. To encourage students to respond, incentives were offered, such as drawings for two Apple iPad minis and 100 $25 bookstore gift cards.

This study took place at a large (enrollment 50,000), public research university in a Midwestern urban city with a population of 675,000 people. The customized online version of the SERU survey was administered at each of the 15 participating campuses during the 2013 spring semester; the survey was launched on March 26, 2013 and ran through June 23, 2013 at the urban campus chosen for this study. Invitations to complete the survey were sent to all currently enrolled undergraduates during spring semester 2013. The SERU was first administered at the university being studied in 2009, with subsequent participation in 2010, and annually from 2012 through 2015. The SERU response rates at the study institution have hovered near a third of the undergraduate student population: 34% in 2010, 32% in 2012, and 34% in 2013 (UMN, 2014a).

For this study, 30% of students were randomly assigned to the Academic Engagement and Globalization Skills and Awareness module, 30% to the Wild Card module, 20% to the Community and Civic Engagement module, 10% to the Student Life and Development module, and 10% to the Technology module. The Office of Institutional Research and members of the SERU steering committee at the campus studied determined the percentages for each module. The survey was sent via email to the entire population of 28,773 undergraduates, with a 36.1% response rate; 51.1% of the respondents were female (UMN, 2014c). Each respondent completed the Core Survey questions, which focused on students' use of time, evaluation of major, and overall satisfaction. Students were randomly assigned one of five survey modules, one of which focused on Technology. Survey administrators randomly assigned each module on pre-determined percentages; the technology survey was administered to 10% of the student population at the institution being examined.

Perspective of the Researcher

The researcher worked in the technology sector for over 25 years, initially for three years in technology sales and promotion, followed by 22 years of service at two campuses at a public university system in the Midwest. The first 14 of 22 years were spent in the unique role of managing a computer help desk where 1,300+ notebook computers were issued to all students, faculty, and staff. The researcher developed and taught business and technology courses, both online and face-to-face, and has taken numerous online courses including a massively open online course (MOOC).

The researcher worked as an admissions recruiter and served on numerous committees focused on student retention, student success, and technology. I have directed an academic technology team responsible for managing and maintaining the University's course management system and other third-party tools, and have guided the implementation of several system-wide software applications. At present, I coordinate academic technology-related efforts for six health-related colleges and schools at the study institution and consult with a national center for inter-professional practice and education. To mitigate any perceived bias, the review of the literature has been used to guide the selection of the research variables rather than the researcher's personal viewpoint and interests.

Human Subjects Review

The researcher received exemption from the UMN Institutional Review Board (IRB) for human subjects' approval March 25, 2015. The University's Office of Institutional Research provided the data file containing the responses to the questions proposed in this analysis.

Theoretical Framework for Selection of Variables

Astin's IEO theory. Astin (1993) formed a conceptual framework based on Inputs (I), Environment (E), and Outputs (O), popularly known as the I-E-O model, for studying student outcomes. While the model has been refined since its inception in 1962, its underlying elements have remained the same (Astin, 1993). This framework helps determine which environmental factors can help develop certain outcomes, in this case undergraduate student satisfaction. Astin's I-E-O model served as the broad foundation for the development of the SERU survey.

Inputs are the characteristics of the student at the time they enter college, such as parental income and occupation, marital status, citizenship, religious preference and the importance given to attending college. The environmental measures include institutional, peer-group interaction, faculty, curriculum, financial aid, place of residence, and student involvement characteristics. Outcomes are the student characteristics after exposure to the college. Outcomes are both psychological, such as values, beliefs or basic skills, and behavioral, such as personal habits or citizenship.

The framework of the I-E-O model has been enhanced over the past 51 years due to the Higher Education Research Institute's (HERI) research in the Cooperative Institutional Research Program (CIRP). Astin was the founding director of HERI, which hosts CIRP as well as other surveys of students and faculty (Higher Education Research Institute, 2014). The CIRP survey is administered to over 12 million students, and another 250,000 faculty and staff respond to faculty surveys, at more than 1,800 higher education institutions, making it one of the largest and most comprehensive ongoing studies of college students and faculty in the United States. The CIRP study utilizes 140 input characteristics, 192 college environmental variables, and 57 student variables and is given to full-time college students at bachelor-degree granting institutions.

Brint (2015) developed an undergraduate education multi-dimensional framework, which further defines the structure of the SERU survey. The SPACES framework consists of five fundamental purposes: Social development (interpersonal skills, appreciation for diversity, and social networks); Personal development (e.g., sense of agency, life purpose, health and well-being, fostering conscientiousness), Academic development (e.g., cognitive skills, research skills, engagement); Civic engagement (e.g., democratic citizenship, community participation, service, global awareness), and Economic opportunity (e.g., career awareness/knowledge, skills development). The sixth element, Settings, represents the physical classroom environment and campus climate. The SPACES model parallels Astin's I-E-O model and helps serve as an additional theoretical framework for this study.

Conceptual Framework for Present Study

Figure 2 aligns the SERU questions with the I-E-O framework on areas related to Course Specific Behaviors, Technology Obstacles, Social Networking, Proficiency Social Dimensions, Engagement with Faculty, Instructor Technology Ability, Instructor Technology Usage, and Online Course Preference. These input and environmental variables contribute to the output variables of Perceived Technology Benefits and Overall Student Satisfaction.

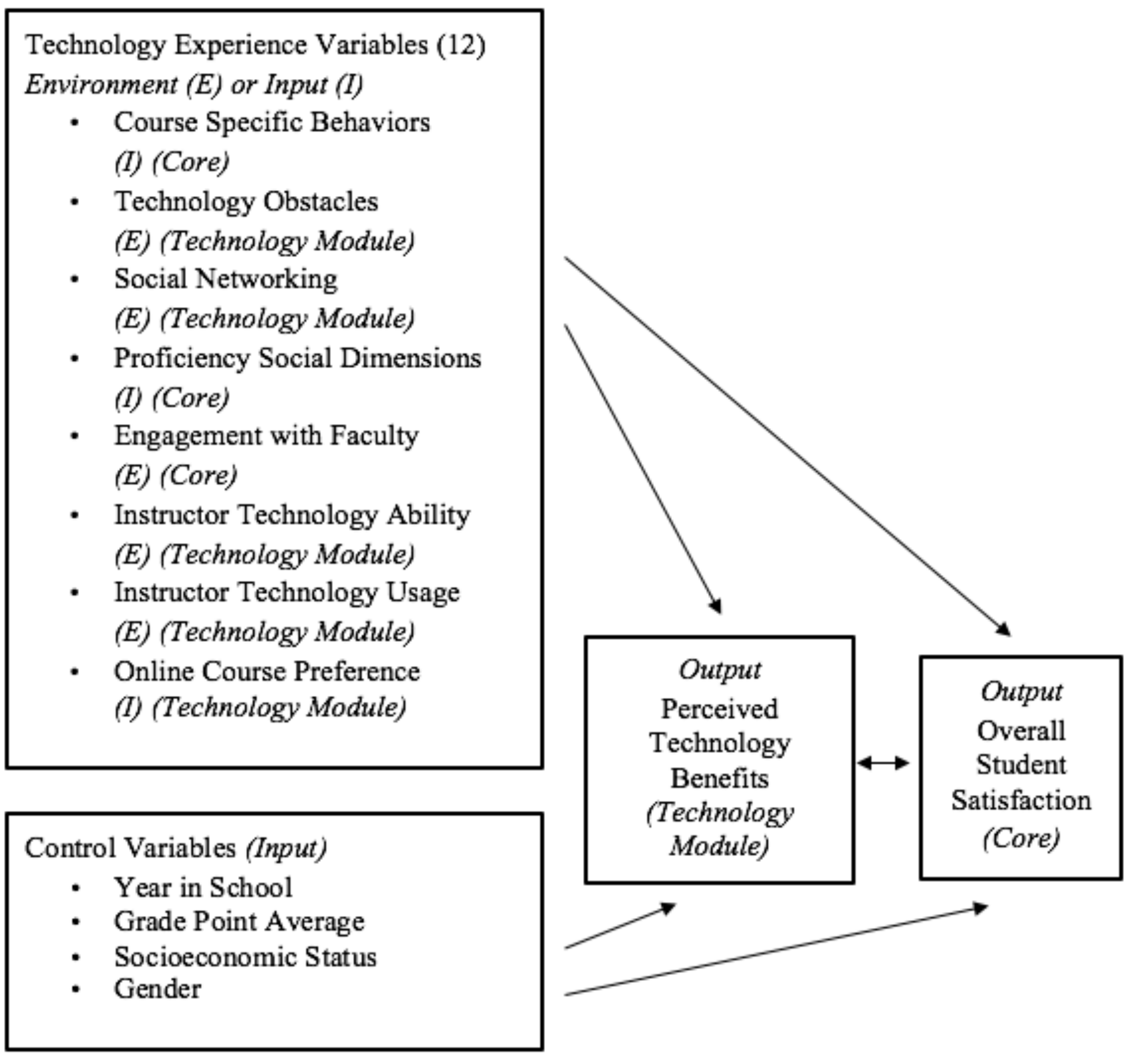

Figure 2. Conceptual framework for first research question

Since no published research on the psychometric characteristics of the 10 sets of questions on the SERU 2013 Technology module has taken place, extensive analyses were undertaken to identify those questions that provided reliable data for the present study. In path analysis, independent variables are termed exogenous variables, also known as predictor variables. Seven independent variables were developed as scales, such as Course Specific Behaviors, Technology Obstacles, Social Networking, Proficiency Social Dimensions, Engagement with Faculty, Instructor Technology Ability, and Instructor Technology Usage.

Development of scales for use in regression analysis. Results of the internal consistency analysis were used to determine the composition of scales used in the analysis. Cronbach's alpha was used to maximize scale reliability/internal consistency. Reliability analysis followed a methodical process of analyzing individual scale items, using the "scale if item deleted" option, then subsequently modifying each scale accordingly. Nunnally (1978) has indicated .7 to be an acceptable reliability coefficient when utilizing Cronbach's alpha for measuring internal consistency.

Exploratory factor analysis was also used to investigate the dimensionality of selected sets of items, including the Proficiency Abilities scale (contrasting when the student started at the institution and at the time of the survey), Student Activities Social scale, and the Learning Management System (LMS) scale. In these scales, the component matrix was selected based on the percentage of variance explained and the highest eigenvalues.

The above three scales were omitted from further analysis for several reasons. The Proficiency Abilities scale included responses related to students' leadership skills, computer skills, and Internet skills. Although this scale had an alpha of .783, it did not contribute to the final model. The format of this question required students to rate themselves when they started and their current ability level, which may have contributed to the higher missing values. The Student Activities Social scale, which consisted of students' reported time on various activities such as attending classes, working, performing community service, and participation in clubs or organizations had a lower alpha (.647). This scale was not found to contribute to the model as a key predictor, so was eliminated. In the LMS scale, there was a high percentage (14.4%) of missing data, in part due to a mistake on the survey, which impacted scale reliability.

Table 1 presents an overview of the summary of the exogenous technology experience variables, control variables, and endogenous dependent variables. For the questions, which served as basis for construction of scales, Cronbach alphas ranged from .697 for Social Networking to .893 for Overall Satisfaction. Each of the following sections briefly describes each of the variables used in the analysis and how they were constructed.

Independent Variables

Course Specific Behaviors (CSB). This is an input measure indicating student ability for initiative and help seeking behavior, which was included in the Core Survey. The nine items relating to Course Specific Behaviors were, "How frequently during this academic year have you done each of the following?" a) Turned in a course assignment late; b) Gone to class without completing assigned reading; c) Gone to class unprepared; d) Skipped class; e) Raised your standard for acceptable effort due to the high standards of a faculty member; f) Extensively revised a paper before submitting it to be graded; g)

Sought academic help from instructor or tutor when needed; h) Worked on class projects or studied as a group with classmates outside of class; and i) Helped a classmate better understand the course material when studying together.

Table 1

Summary of Technology Experience Variables, Perceived Technology Benefits, and Overall Student Satisfaction

Variable name	No of items	Cronbach's alpha	Possible scale range	Actual scale range
Course Specific Behaviors (CSB)	9	.727	9 - 54	15 - 52
Technology Obstacles (TO)	4	.749	4 - 16	4 - 16
Social Networking (SN)	8	.697	8 - 48	8 - 44
Proficiency Social Dimensions (PSD)	5	.792	5 - 30	5 - 29
Engagement with Faculty (ENG)	3	.786	3 – 18	3 - 18
Instructor Technology Ability (ITA)	4	.808	4 - 16	4 - 16
Instructor Technology Usage (ITU)	15	.877	15 - 60	15 - 48
Online Course Preference (OCP)	1	--	1 – 5	1 - 5
Year in School (YR)	1	--	1 – 4	1 - 4
Grade point average (GPA)	1	--	0 – 4	0.4 - 4
Socioeconomic Status (SES)	1	--	1 - 5	1 - 5
Gender (GEN)	1	--	1 – 2	1 - 2
Perceived Technology Benefits (PTB)	7	.871	7 – 28	7 - 35
Overall Student Satisfaction (OSS)	19	.893	19 - 114	28 - 114

Course Specific Behaviors' response options ranged from 1 (never), 2 (rarely), 3, (occasionally), 4 (somewhat often), 5 (often), and 6 (very often). The first four items were recoded so that a response of "very often" would be scored as a 1, and "never" as a 6 so that these were consistent with the other five response items. Higher scores indicate a more positive response related to course specific behaviors, whereas lower scores indicate a negative response. The possible scale range was 9 – 54 with a Cronbach's alpha of .727.

Technology Obstacles (TO). Technology Obstacles is an environmental measure for problems encountered in relation to technology usage that stems from the Technology module. Respondents were asked, "To what degree has each of the following factors been a problem for your use of educational technology in your courses?" a) Instructors not using educational technologies at all; b) Instructors not using educational technologies well; c) Amount of time needed to learn educational technologies; and d) Amount of time needed to use educational technologies.

Students were asked to rate their responses as 1 (not a problem), 2 (small problem), 3 (moderate problem), to 4 (large problem). These are environmental items that could contribute negatively to perceived benefits of technology and overall satisfaction. Given that there are four items in this set, each with a response scale of 1 through 4, the range for this scale variable is 4-16. Higher scores on this scale indicate a higher perception of technology-related obstacles, whereas lower scores indicate lower perceptions of technology-related obstacles. Cronbach's alpha, which serves as a reliability index, was .749 for the four-item Technology Obstacles scale.

Social Networking (SN). Social Networking is an environmental measure summarizing students' frequency of use of various web-based technologies. This question asked, "Many web-based technologies allow users to participate actively in the creation of online content. About how often do you do each of the following?" a) Send a tweet via Twitter; b) Create or contribute to a blog; c) Create or contribute to a wiki; d) Create a podcast; e) Upload a video (e.g., YouTube) to share with others; f) Upload photos (e.g., Instagram, Snapfish, Picasa) to share with others; g) Contribute to a Google document or spreadsheet; and h) Upload content to Facebook.

Students were asked to rate their frequency of usage, which were recoded to 1 (seldom or never), 2 (a few times a semester), 3 (a few times a month), 4 (a few times a week), 5 (about once a day), to 6 (multiple times a day). The Social Networking scale has 8 items with a response scale of 1 through 6, with a possible scale range of 8 to 48 and Cronbach's alpha of .697. High scores indicate a higher frequency of use of social networking, whereas a lower score indicates lower use of social networking. Internal consistency item analysis showed this to be the optimum alpha, and with rounding meets the .70 criterion recommended by Nunnally (1978).

Proficiency Social Dimensions (PSD). PSD is a set of items from the Core Survey. This is an input measure that summarizes the difference in student's response to rating their abilities from the date the survey was taken from when they began at the University. Respondents were asked to rate the following: a) Ability to appreciate, tolerate and understand racial and ethnic diversity; b) Ability to appreciate the fine arts (e.g., painting, music, drama, dance); c) Ability to appreciate cultural and global diversity; d) Understanding the importance of personal social responsibility; and e) Self-awareness and understanding.

The PSD response scale was 1 (very poor), 2 (poor), 3 (fair), 4 (good, 5 (very good), and 6 (excellent). Initially, the difference in scores allowed for negative values, so a value of 12 was added to the overall scale to prevent negative values. Higher scores indicate a higher proficiency for appreciation and understanding of social dimensions, whereas a lower score indicates a lower proficiency for appreciation and understanding of social dimensions. The PSD scale had five items, scale range of 5 – 30, and Cronbach's alpha of .792.

Engagement with Faculty (ENG). This is a set of five items from the Core Survey, which is environmental measure representing the frequency with which students interacted with faculty. Respondents were asked, "How frequently have you engaged in these activities so far this academic year?" a) Communicated with a faculty member by e-mail or in person; b) Talked with the instructor outside of class about issues and concepts derived from a course; and c) Interacted with faculty during lecture class sessions. Responses were 1 (never), 2 (rarely), 3 (occasionally), 4 (somewhat often), 5) (often), and 6 (very often). Higher scores represent a higher level of faculty engagement, whereas lower scores represent a lower level of faculty engagement. The possible range of the engagement with faculty three-item scale is 3 to 18 with a Cronbach's alpha of .786.

Instructor Technology Ability (ITA). This is an environmental measure representing student opinion of their instructor's technology quality level that stems from the Technology module. Respondents were asked, "Thinking about your college experience within the past year, how many of your instructors ____?" a) Effectively use technology to impact your academic success; b) Provide you with adequate training for the technology used in courses; c) Have adequate technical skills for carrying out course instruction; and d) Use the "the right kind(s)" of technology. The ITA responses range from 1 (none), 2 (some), 3 (most), to 4 (all). Instructors' technology ability has four items in the scale with a response scale of 1 through 4. Higher scores represent a higher level of instructor technology ability, whereas lower scores represent a lower level. The possible scale range is 4 to 16, with a Cronbach's alpha of .808, suggesting the scale has relatively high internal consistency.

Instructor Technology Usage (ITU). ITU is an environmental measure with students reporting their instructors' use of technology, based on 15 items included in the Technology module. Part A of the question asked, "Different instructors use different technologies. For each of the following resources/tools please indicate if your instructors are using it." The 15 items included in this scale are a) E-portfolios; b) E-books or e-textbooks; c) Freely available course content beyond your campus (OpenCourseWare, Khan Academy, etc.); d) Wikis (Wikipedia, course wiki, etc.); e) Blogs; f) Recommend an article or information online by tagging/bookmarking/liking (Delicious, Digg, Newsvine, Twine, etc.); g) Online forums or bulletin boards; h) Podcasts and webcasts; i) Web-based music; j) Web-based videos; k) Video-sharing websites (YouTube, etc.); l) Photo-sharing websites (Flickr, Snapfish, Picasa, etc.); m) Online multi-user computer games; n) Simulations or educational games; or o) Facebook. Higher scores represent a higher level of instructor technology usage, whereas lower scores represent a lower level of usage. The possible scale range was 15 – 60 and Cronbach's alpha was .877. Responses ranged from 1 (none), 2 (some), 3 (most), to 4 (all).

The four items that did not contribute to the ITU scale were: a) Course or learning management system (Blackboard, Moodle, Sakai, Desire2Learn, etc.); b) Locally installed word processor and spreadsheet software (Word, Excel, etc.); c) Locally installed presentation software (PowerPoint); and d) Web-based word processor, spreadsheets, presentation software, Google Documents, NumSum, Prezi, etc.). These four items were analyzed separate as the Everyday Instructor Technology Usage scale with alpha of .663, but this variable was not found to be a predictor, possibly due to 9.6% missing values; see p. 81.

Online Course Preference (OCP). This is an input measure from the Technology module indicating students' preference for fully online courses. Respondents were asked, "Many universities are considering increasing the number of courses they offer fully online, i.e. with no face-to-face contact at all. What is your preference about taking courses fully online as opposed to face-to-face courses?" Students were asked to rate their responses which were recoded to 1 (strongly prefer face-to-face courses), 2 (somewhat prefer face-to-face courses), 3 (neutral between fully online and face-to-face courses, 4 (somewhat prefer fully online courses), and 5 (strongly prefer fully online courses). The "don't know" response was added to the neutral category. The mean was 1.8 with a standard deviation of 1.07 (n = 515) with over half of students (53.4%) strongly preferring face-to-face courses. Note: the survey contained other parallel questions that were not used; refer to reasons for exclusion of the Hybrid Course Preference question on p. 81.

Dependent Variables

Two dependent variables were used in this study, in alignment with path analysis.

Perceived Technology Benefits (PTB). This dependent variable was a seven-item forced-choice scale based on the question, "To what extent do you agree or disagree with the following statements?" Responses ranged from 1 (strongly disagree), 2 (disagree), 3 (agree), 4 (strongly agree), to 5 (I don't know). The "I don't know" response was re-coded as a 3 (neutral), 4 (agree) and 5 (strongly agree). The questions in this scale included, a) I get more involved in courses that use technology; b) Technology makes me feel more connected to what's going on at the college/university; c) Technology better prepares me for future educational plans (i.e. transferring to another degree program, getting into graduate school); d) Technology makes me feel connected to other students; e) Technology makes me feel connected to professors; f) Technology elevates the level of teaching; and g) Technology helps me achieve my academic outcomes.

Understanding the factors that contribute to how students perceive the benefits of technology can help colleges implement optimal programs and facilities to improve this critical measure. Higher scores represent a higher level of perceived technology benefits, whereas lower scores represent a less positive level. The perceived technology benefits possible scale range was 7 to 35 with Cronbach's alpha .871, suggesting the scale has relatively high internal consistency.

Overall Student Satisfaction (OSS). This dependent variable is a scale of 19 items based on two questions from the Core Survey. Responses ranged from 1 (very dissatisfied), 2 (dissatisfied), 3 (somewhat dissatisfied), 4 (somewhat satisfied), 5 (satisfied), to 6 (very satisfied). The first question began, "Please rate your level of satisfaction with the following aspects of your university education." Items included: a) grade point average; b) overall social experience; c) overall academic experience; and d) value of your education for the price you're paying.

The second question asked, "How satisfied are you with each of the following aspects of your educational experience overall?" The six response options for this set of items were the same as for the first question. Students responded to the following 15 items: a) Advising by faculty on academic matters; b) Advising by student peer advisers on academic matters; c) Advising by school or college staff on academic matters; d) Advising by departmental staff on academic matters; e) Quality of faculty instruction; f)

Quality of teaching by Graduate Students (TA's, AI's); g) Availability of courses for general education or breadth requirements; h) Availability of courses needed for graduation; i) Access to small classes; j) Access to faculty outside of class; k) Ability to get into a major that you want; l) Opportunities for research experience or to produce creative products; m) Educational enrichment programs (e.g., study abroad, internships); n) Accessibility of library staff; and o) Availability of library research materials.

Research shows that overall student satisfaction is critical for institutions to remain competitive, which is important from the standpoint of student retention, but also for improving student outcomes. Higher scores represent a higher level of overall student satisfaction, whereas lower scores represent a lower level of satisfaction. The overall university satisfaction possible scale range was 28 to 114 with a Cronbach's alpha of .893. Results of factor analysis with nineteen variables supported retaining all items in a single scale.

Control Variables

The following four variables were treated as control variables: year in school, grade point average, familial socioeconomic status, and gender.

Year in school (YR). Year in school represents students' respective class year and was obtained from institutional records as 1 (Freshman), 2 (Sophomore), 3 (Junior), and 4 (Senior). These classifications are based upon 30 credit increments, so that freshmen have between 1-30 credits, sophomores have 31-60 credits, juniors have 61-90 credits, and seniors have 91+ credits. Differences among class levels may show varying levels of technology usage and perceived technology benefits and overall university satisfaction.

Cumulative grade point average (GPA). GPA was obtained from institutional records and is based on a score of 0 to 4.0, where an "A" = 4.0. There were 496 valid responses with a mean of 3.27 and standard deviation of .54. The minimum GPA was 0.43 and the maximum GPA was 4.0. According to Bean and Bradley (1986), an assumption that a reciprocal relationship exists between GPA and student satisfaction stems from organizational theory literature where employees' job satisfaction is reciprocal with performance. Students are analogous to employees in the sense that they are both subject to the official organizational sanctions, they are both members of their respective organizations, and they interact with other organization members. Higher levels of student satisfaction are positively associated with higher cumulative GPAs.

Familial socioeconomic status (SES). SES is self-reported and asked, "Which of the following best describes your social class when you were growing up?" Responses were: 1) Low-income or poor; 2) Working-class; 3) Middle-class; 4) Upper-middle or professional-middle; or 5) Wealthy. The mean was 3.0 with a standard deviation of .88. The largest percentage of respondents were the Middle class at 46%, followed by Upper-middle or professional-middle class at 28%.

Gender (GEN). Gender was transformed into a dummy variable for the regression analysis and based on the institutional-provided records. Females were coded as "0" and males were coded as "1." Students' self-reporting of computer skills has been shown to vary by gender, with males ranking their technology ability higher than females (Oblinger & Oblinger, 2005).

Excluded Variables

Path analysis requires a researcher to determine which causal variables to include in the model, the ordering of the causal chain, and the elimination of paths that do not contribute to the model's significance (Garbin, 2015). As part of this process, multiple SERU variables were examined for significance and subsequently eliminated from the statistical analysis. Streiner (2005) indicates extraneous variables with low path coefficients and non-significance should be eliminated from the model, as they signal that that variable is not related to the dependent variable.

Increased skill level. This scale was an input measure based on students' self-reported level of proficiency when they started at the institution and their current level. The Increased Skill Level scale contained seven items, including: a) Leadership skills; b) Computer skills; c) Internet skills; d) Library research skills; e) Other research skills; f) Ability to prepare and make a presentation; and g) Interpersonal (social) skills. Responses were 1 (very poor), 2 (poor), 3 (fair), 4 (good), 5 (very good), and 6 (excellent). The scale was created by taking the difference between each of the seven variables, then adding a score of 15 to avoid negative numbers. The possible scale range was 7 – 39, with a Cronbach's alpha of .783. This variable did not contribute to the model as a key predictor, so was removed from analysis.

Increased academic proficiency. This scale was based on five response items including a) Analytical and critical thinking skills, b) Ability to be clear and effective when writing, c) Ability to read and comprehend academic material, d) Understanding of a specific field of study, e) Ability to speak clearly and effectively in English, and f) Ability to understand international perspectives (economic, political, social, cultural).

This scale was not found to be a key predictor in the final models, possibly, in part, due to high missing responses of 14.1%.

Learning management system (LMS). LMS was an environmental measure indicating the role played by LMS in students' university experiences. Respondents were asked a two-part question, "Have you participated in a course which used a Learning Management System (e.g., Blackboard, Canvas, Moodle, Desire2Learn?" If yes, "How much do you agree or disagree about the role the Learning Management Systems (LMS) like Blackboard, Canvas, Moodle, or Desire2Learn have played in your learning experiences at this university?" Seven items were included in the scale including: a) LMS have helped me to interact with my instructors; b) LMS have resulted in prompt feedback from my instructors; c) LMS have made it easier to work with other students; d) LMS have helped me to complete assignments on time; e) LMS has helped me be more efficient with my study time; f) In general, LMS have helped me to succeed in my coursework; and g) The advantages gained by using LMS outweigh the disadvantages.

Unfortunately, the LMS question contained an error in the construction and formatting of the survey, where the strongly disagree response was omitted. The original intention was to have five responses including 1 (strongly disagree), 2 (disagree), 3 (agree), 4 (strongly agree), and 5 (I don't know). As a result, the LMS scale responses were recoded as binomial with 1 (disagree) and 2 (agree/strongly agree) to see if the data could be used. The possible scale range of the LMS scale was 7 to 14 with a Cronbach's alpha of .836. The missing value percentage of 14.4% impacted scale validity, so the LMS scale was removed from the analysis.

Instructor everyday technology usage. This variable was based on the same question as the Instructor Technology Usage scale. Part A of the question asked, "Different instructors use different technologies. For each of the following resources/tools please indicate if your instructors are using it." Responses ranged from 1 (none), 2 (some), 3 (most), to 4 (all). This scale included four items: course or learning management system, word processor and spreadsheet software, presentation software, and web-based software. Cronbach's alpha was .663, so met the .7 threshold with rounding, but missing values were 9.6%. These four items were included as a separate scale for analysis but did not result in being a predictor in the final model. This question set also had a Part B that asked students if they felt "faculty should be using these technologies more." The second portion of the question (Part B) was not used due to extreme missing data (33.9%).

Hybrid course preference. The hybrid course preference variable was an input measure indicating students' preference for hybrid courses. Respondents were asked, "What is your preference about taking hybrid (blended, with both online and face-to-face components) as opposed to traditional face-to-face courses?" Students were asked to rate their responses which were recoded to 1 (don't know), 2 (strongly prefer traditional courses), 3 (somewhat prefer traditional courses), 4 (neutral between hybrid and traditional courses, 5 (somewhat prefer hybrid courses), and 6 (strongly prefer hybrid courses). The mean was 3.26 with a standard deviation of 1.3 (n = 513). The neutral response was highest with 27.4%, followed by 24.9% strongly preferring traditional courses. Responses to this question were highly correlated with Online Course

Preference, with Pearson Correlation .563, $p < .01$, so this item was excluded due to problems of multicollinearity.

Student social activities. This was an input variable based on activities that were not directly related to academics. Respondents were asked, “How many hours do you spend in a typical week (7 days) on the following activities?” Questions included in this scale were: a) Attending movies, concerts, sports, or other entertainment events; b) Participating in physical exercise, recreational sports, or physically active hobbies; c) Pursuing a recreational or creative interest (arts/crafts, reading, music, hobbies, etc.); d) Socializing with friends; e) Partying; f) Using the computer or other electronic device for non-academic purposes; or g) Watching TV. Responses were 1 (0), 2 (1-5), 3 (6-10), 4 (11-15), 5 (16-20), 6 (21-25), 7 (26-30); or 8 (More than 30). The possible scale range was 7 – 56 with Cronbach’s alpha of .676. This alpha coefficient approached Nunnally’s (1978) acceptable recommendation of .7, but was the optimum that could be achieved from this group of questions. This scale did not contribute to the final regression models as a predictor, so was eliminated from further analysis.

Student time working. This scale was created from the same question as the Student Social Activities scale, but was an input variable based on student’s time spent working Respondents were asked, “How many hours do you spend in a typical week (7 days) on the following activities?” Questions included in this scale were: a) Paid employment (include paid internships); b) Of your total hours spent working for pay, about how many hours did you work on campus?; c) Of your total hours spent working for pay, about how many hours did you work off campus?; and d) Of your total hours spent working for pay, about how many hours were related to your academic interests? .

Responses were 1 (0), 2 (1-5), 3 (6-10), 4 (11-15), 5 (16-20), 6 (21-25), 7 (26-30); or 8 (More than 30). The possible scale range was 7 – 56 with Cronbach's alpha of .685. This scale did not contribute to the final regression models as a predictor, so was eliminated from further analysis.

College. Student's college was examined, based on their self-reported college code. As some colleges only had one respondent, groups were formed based on affinity groups such as the Health group combining Biological Sciences, Nursing, Medicine, and Allied Health. The education group combined education and human development as well as continuing education. Altogether, seven groups were used for the analysis. These groups including the breakdown of respondents include Business (n = 30), Education (n = 63), Science and Engineering (n = 91), Health (n = 56), Liberal Arts (n = 227), Design (n = 21), and Agriculture (n = 34). College was not found to be a key predictor for the overall path analysis, but this variable was analyzed separately in order to answer the second research question.

ACT composite score. The ACT composite score was obtained from institutional records on a score of 0 to 36. There were 414 valid responses with a mean of 27.16 and a standard deviation of 4.0. The minimum score was 12 and the maximum score was 36. Further analysis revealed that transfer students are not required to supply an ACT score, which explains the high portion of the percentage of missing values (n = 108). As a result, it was determined to use cumulative GPA as a control variable rather than the ACT composite score.

Parental education. This variable was self-reported and asked respondents about the highest level of education for their mother (in U. S. or in foreign country) and highest education for father (in U. S. or in foreign country). Responses ranged from 0 (not applicable) to 9 (doctorate or equivalent). Given this set of research questions and the percentage of missing values, it was determined to exclude parental education from the analysis.

Demographic Information

Results included in this section include year in school, cumulative grade point average, socioeconomic status, gender, and respondents' college; see Table 2.
The variable for gender indicates 59% (n = 307) of the students surveyed in the study were women and 41% (n = 215) were men, based on statistics provided by institutional research (*N* = 522).

Representation of respondents' year in school (*N* = 522) was as follows: 15.3% freshmen, 27.4% sophomores, 23.6% juniors, and 33.7% seniors. The year in school mean was 2.76 on a four-point scale. The majority of respondents (73.6%) reported being middle-class or upper-middle or professional-middle class.

The cumulative grade point average (GPA) mean was 3.3 with a standard deviation of .54 (n = 496). The range was 0.4 to 4.0. In order to view the continuous variable as groups, the values for cumulative GPA were recoded as follows 0 to 1.0 = 1; 1.01 to 2.0 = 2, 2.01 to 3.0 = 3, 3.01 to 4.0 = 4. Note: the recoded GPA variable was used for descriptive data analysis only, not in the regression models. The mean with the recoded variable was 3.7 with standard deviation of .5 (n = 496).

The breakdown of respondents' self-reported socioeconomic status was as follows: 1) 6.8% low-income or poor, 2) 18.8% working-class, 3) 45.7% middle-class, 4)

27.9% upper-middle or professional-middle class, and 5) .8% wealthy. The mean was 3.0 with a standard deviation of .88 ($N = 516$).

Table 2

Demographic Characteristics of Participants

	Gender			
Variable response	Female (N = 307)	Male (N = 215)	Total	%
Year in school				
Freshman	59	21	80	15.3
Sophomore	87	56	143	27.4
Junior	67	56	123	23.6
Senior	94	82	176	33.7
Total	307	215	522	100
GPA				
0 - 1.0	1	0	1	0.2
1.1 – 2.0	2	5	7	1.4
2.1 – 3.0	73	58	131	26.4
3.1 – 4.0	214	143	357	72
Total	290	206	496	100
SES				
Low-income/poor	19	16	35	6.8
Working class	56	41	97	18.8
Middle-class	142	94	236	45.7
Upper-middle/prof. middle	81	63	144	27.9
Wealthy	3	1	4	0.8
Total	301	215	516	100
College				
Business	18	12	30	5.7
Education	45	18	63	12.1
Science & Engineering	19	72	91	17.4
Health	40	16	56	10.7
Liberal Arts	141	86	227	43.5
Design	18	3	21	4.0
Agriculture	26	8	34	6.5
Total	307	215	522	100

The variable for college is comprised of respondents from 11 colleges. The largest grouping was from Liberal Arts (n = 227), followed by Science and Engineering (n = 91), Education and Human Development (n = 48), Biological Sciences (n = 43), Agriculture (n = 34), Business (n = 30), Design (n = 21), Continuing Education (n = 15), Nursing (n = 11), Allied Health (n = 1), and Medicine (n = 1). As mentioned previously, the smaller groups were combined by affinity for analysis of the second research question. The Health group contains Biological Sciences, Nursing, Allied Health, and Medicine (n = 56). The Education group merged Continuing Education with Education and Human Development (n = 63). Altogether, there were seven groups included in the respondents by college variable used to answer the second research question.

Overall survey response demographics indicate a higher percentage of females than males responded to the survey; a higher percentage of seniors than other class levels responded; a higher level of those identifying as middle class responded; a higher percentage of students reporting higher grade point averages responded to the survey, and the majority of respondents were from Liberal Arts (43.5%).

Statistical Methods

A series of quantitative tests were utilized to answer the two research questions. For the purpose of this study, the research set the significance level at $p < .05$. The statistical analysis consisted of three parts: univariate descriptive analyses, correlational statistics, and multiple variable inferential analyses. Data were rounded to reflect more reasonable values (Utts & Heckerd, 2006), e.g., means rounded to the nearest tenth.

The first research question was, “What are the relationships between the technology experience variables from the 2013 SERU survey with regard to Perceived

Technology Benefits and, in turn, Overall Student Satisfaction?" The second research question was, "Does college of enrollment affect Perceived Technology Benefits and moderate the effects of the technology experience on Overall Student Satisfaction?"

Preliminary analyses. Initial data analysis steps included the examination of descriptive statistics and frequencies for the entire sample on relevant demographic variables, predictor variables, outcome variables, and control variables. Missing data were examined and summarized in tables as appropriate, but were excluded in the final analysis.

The demographic profile of the participants was described using measures of central tendency, variance, and standard deviation. Inferential statistics included independent sample t-tests, one-way ANOVA, and MANOVA to measure statistically significant differences among the means of the groups. Bivariate correlations were obtained for all predictor, outcome and control variables. Mean frequencies of the exogenous variables were correlated with the mean scale score for the perceived student technology benefits scale and overall student satisfaction scale. The strength of the relationship between the predictor and outcome variables were explored using multiple variable linear regression, using year in school, cumulative grade point average, familial socioeconomic status, and gender as control variables.

Multivariate linear regression. Multivariate linear regression is used to determine how much variance is accounted for by a linear combination of multiple predictor variables. Multivariate linear regression can also determine the strength of these relationships and control for confounding variables. Multiple linear regression is appropriate for this study as the predictor variables were quantitative and categorical.

Initially, stepwise regression utilizing a bidirectional elimination approach was utilized. This allowed testing at each step for variables to be included or excluded. Once the list of predictor variables was narrowed, the approach was changed to ordinary least squares. Following the "law of parsimony" (Occam's razor, 2015), a regression model was fit to depict how much variance in perceived student technology benefits was accounted for by a linear combination of multiple independent variables. The strength of these relationships was expressed as the beta coefficient for each predictor variable.

Path analysis. This study utilized path analysis to further address the first research question as a method to identify the factors that contribute to perceived technology benefits and overall student satisfaction. A series of multiple regression analyses were computed. Suhr (2013) states, "Path analysis is a flexible and powerful statistical methodology used to examine the relationships between measured variables" (p. 9). Path analysis extends multiple regression, allowing for the examination of more complicated models. Streiner (2005) defines path analysis as "an extension of multiple regression that allows us to examine more complicated relations among the variables than having several independent variables predict one dependent variable and to compare different models against one another to see which one best fits the data" (p. 116). Path analytic techniques are a part of causal modeling, which is appropriate when the variables can consistently be identified in the literature to be correlated (Hackett, 1985). Path analysis is appropriate for investigating phenomena such as self-efficacy, self-concept, and achievement, which is congruent with the purposes of this study.

According to Hackett (1985), path analysis consists of three stages. The first is the development of a path model. Second is the "computation of path coefficients and elimination of non-significant paths in the original model" (p. 50). Third is the "specification of a reduced path model consistent with the data" (p. 50). The path diagram, or causal model, is a series of regressions that provide analysis and help determine "chains" of influence, for example variable A influences variable B, which in turn affects variable C (Streiner, 2005).

Benefits of path analysis include: 1) the ability to study both direct and indirect effects simultaneously; 2) the ability for variables to serve as response and/or predictor variables for later regressions along the path (flexibility); 3) the requirement of a hypothesized model allows the researcher to analyze more complex and realistic models (Streiner, 2005); 4) the ability to estimate magnitude and significance of causal connections; and 5) the ability to explicitly specify error or unexplained variance (Suhr, 2013).

The following chapter presents the results of the study.

Chapter Four Results

Introduction

This chapter presents the results of the study of undergraduates' technology experiences and satisfaction at a large, public Midwestern Research University. Descriptive statistics for scales used in the analysis will be presented first, followed by analytical statistics to answer the research questions.

Descriptive Statistics

This section of the chapter presents the descriptive statistics of the scales derived from the SERU survey.

Univariate analysis. Results included in this section are presented in the following order. First, computed study variables are summarized with their univariate descriptive statistics. Second, bivariate correlations among the independent and dependent variables are presented.

Table 3 presents the descriptive statistics for study variables and scales including number of responses, numbers and percentages of missing data, means, and standard deviations. This study used 12 predictor variables and two dependent variables. Frequencies and percentages by variable and scale are displayed in Table 3. The overall N for this study is 522 respondents with missing data removed from all analyses.

Course Specific Behaviors (CSB) was the nine-item scale with items such as, "Raised your standard for acceptable effort due to the high standards of a faculty member," "Extensively revised a paper before submitting it to be graded," or "Worked on class projects or studied as a group with classmates outside of class," each with a six-point scale. The scale mean of 35.8 divided by 9 (i.e., nine items produced the scale) indicates the students' average response was four. This response corresponds to "somewhat often" out of the six-point scale where 5 indicated "often" and 6 indicated "very often." This suggests students more often than not are striving to excel in their courses.

Table 3

Univariate Descriptive Statistics for Study Variables and Scales

Variable name	N	N Missing Responses	% Missing Responses	Mean	SD
Course Specific Behaviors (CSB)	504	18	3.6	35.8	6.37
Technology Obstacles (TO)	505	17	3.3	7.1	2.46
Social Networking (SN)	508	14	2.7	15.1	5.29
Proficiency Social Dimensions (PSD)	511	11	2.1	12.5	3.11
Engagement with Faculty (ENG)	511	11	2.1	11.0	3.32
Instructor Technology Ability (ITA)	510	12	2.3	11.0	2.17
Instructor Technology Usage (ITU)	454	68	15.0	20.2	4.98
Online Course Preference (OCP)	515	7	1.3	1.8	1.07
Year in School (YR)	522	--	--	2.8	1.1
Grade Point Average (GPA)	496	26	5.0	3.3	.54
Socioeconomic Status (SES)	516	6	1.2	3.0	.88
Gender (GEN)	522	--	--	.4	.5
Perceived Technology Benefits (PTB)	493	29	5.9	20.3	3.83
Overall Student Satisfaction (OSS)	480	42	8.8	86.0	11.5

Technology Obstacles was the four-item scale with items including, "Instructors not using educational technologies at all," "Instructors not using educational technologies well," "Amount of time needed to learn educational technologies," and "Amount of time needed to use educational technologies" each with a four-point scale. The scale mean of 7.1 divided by 4 (i.e., four items that produced the scale) indicates that the average response to the set of items was 1.8 out of 4. With rounding, this corresponds to "small problem," suggesting students reported experiencing a relatively small level of technology obstacles.

Social Networking was the eight-item scale with items such as, "Send a tweet via Twitter," "Create or contribute to a blog/wiki/podcast," "Upload a video or photos," "Contribute to a Google document or spreadsheet," and "Upload content to Facebook," each with a six-point scale. The scale mean of 15.1 divided by 6 (i.e., six items produced the scale) indicates that the average response was 1.9, corresponding to "a few times a semester," suggesting a very low frequency of usage for social networking.

Proficiency Social Dimensions was the five-item scale with items such as, "Ability to appreciate, tolerate, and understand racial and ethnic diversity," "Ability to appreciate the fine arts," and "Ability to appreciate cultural and global diversity," each with a six-point scale. The scale mean of 12.5 divided by 5 (i.e., five items produced the scale) indicates that the average response was 2.5. This falls between the "poor" and "fair" responses, suggesting a relatively low level of appreciation of various social dimensions from diversity to fine arts.

Engagement with Faculty was the three-item scale with three items, "Communicated with a faculty member by e-mail or in person," "Talked with the instructor outside of class," and "Interacted with faculty during lecture class sessions," each with a six-point scale. The scale mean of 11.0 divided by 3 (i.e., three items produced the scale) indicates that the average was 3.7. This falls between the "occasionally" and "somewhat often" responses, suggesting students report having a moderately high level of engagement with their faculty members.

Instructor Technology Ability was the four-item scale with items, “Effective use technology to impact your academic success,” “Provide you with adequate training for the technology used in courses,” “Have adequate technical skills for carrying out course instruction,” and “Use the right kinds(s) of technology,” each with a four-point scale. The scale mean of 11 divided by 4 (i.e., four items produced the scale) indicates the average is 2.75, which falls between “some” and “most.” This suggests students report the majority of their faculty are effectively using technology and have the necessary technology skill sets.

Instructor Technology Usage was the 15-item scale with students reporting their instructor’s use of technology including items such as, “E-portfolios,” “E-books or e-textbooks,” or “Freely available course content,” each with a four-point scale. The scale mean of 20.2 divided by 15 (i.e., 15 items produced the scale) indicates the average of 1.35, which falls between “none” to “some.” This suggests instructors have a very low level of technology usage, with regard to incorporating open source materials or freely available content into their courses.

Online Course Preference asked students their preference about taking courses fully online as opposed to face-to-face, with a five-point scale. The mean of 1.8 (out of 5) indicates the average response falls between “strongly prefers face-to-face courses” to “somewhat prefers face-to-face courses.” It is important to note that more than half (53.4%) of the students strongly preferred face-to-face courses in the 2013 SERU survey.

Perceived Technology Benefits was the seven-item scale with items such as, “I get more involved in courses that use technology,” “Technology makes me feel more connected to what’s going on at the college/university,” and “Technology better prepares me for future educational plans," each with a five-point scale. The scale mean of 20.3 divided by 5 (i.e., five items in the scale) indicates the average of 2.9, which corresponds to students being "neutral" in regards to their perceived benefits of technology.

Overall Student Satisfaction was the 19-item scale with items that asked about students' satisfaction related to items such as advising on academic matters, quality of faculty instruction, availability of courses, and access to small classes, based on a six-point scale. The scale mean of 86 divided 19 (i.e., 19 items in the scale) indicates the average of 4.5, which falls between "somewhat satisfied" to "satisfied."

Bivariate analysis. Table 4 presents the bivariate correlations of the 14 final study variables. Results show the Perceived Technology Benefits variable, which consisted of items such as, "I get more involved in courses that use technology," "Technology makes me feel more connected to what's going on a the college/university," and "Technology better prepares me for future educational plans," was significantly correlated ($p < .05$) with seven predictor variables: Instructor Technology Ability, Social Networking, Online Course Preference, Instructor Technology Usage, Engagement with Faculty, Course Specific Behaviors, and Proficiency Social Dimensions. The predictor variables with the highest correlations with Perceived Technology Benefits were Instructor Technology Ability $r(491) = .33$, $p < .01$, Social Networking $r(491) = .26$, $p < .01$, and Online Course Preference $r(491) = .22$, $p < .01$.

Overall Student Satisfaction was significantly correlated with all 13 predictors: Instructor Technology Ability, Course Specific Behaviors, Technology Obstacles, Social Networking, Proficiency Social Dimensions, Engagement with Faculty, Instructor Technology Usage, Online Course Preference, year in school, GPA, SES, gender, and

Table 4

Bivariate Correlations

Variable name	1. CSB	2. TO	3. SN	4. PSD	5. ENG	6. ITA	7. ITU
1. Course Specific Behaviors (CSB)	--						
2. Technology Obstacles (TO)	.03	--					
3. Social Networking (SN)	.10*	.11*	--				
4. Proficiency Social Dimensions (PSD)	.02	.04	-.04	--			
5. Engagement with Faculty (ENG)	.47**	.04	.17**	.13**	--		
6. Instructor Technology Ability (ITA)	.08	-.08	.04	.08	.11*	--	
7. Instructor Technology Usage (ITU)	.06	.13**	.17**	.05	.14**	.01	--
8. Online Course Preference (OCP)	-.07	.09*	.04	-.06	-.10*	.05	.10*
9. Year in School (YR)	-.11*	.09*	-.16**	.13**	.09	.01	.03
10. Grade Point Average (GPA)	.24**	-.06	.01	.03	.05	.02	.01
11. Socioeconomic Status (SES)	.06	-.07	.09*	-.08	-.05	.00	-.04
12. Gender (GEN)	-.07	-.02	-.21**	.03	.02	-.12**	.04
13. Perceived Technology Benefits (PTB)	.11*	.04	.26**	.10*	.11**	.33**	.12*
14. Overall Student Satisfaction (OSS)	.25**	-.19**	.17**	.12**	.23**	.31**	.14**

Table 4

Bivariate Correlations (Continued)

Variable name	8. OCP	9. YR	10. GPA	11. SES	12. GEN	13. PTB	14. OSS
1. Course Specific Behaviors (CSB)							
2. Technology Obstacles (TO)							
3. Social Networking (SN)							
4. Proficiency Social Dimensions (PSD)							
5. Engagement with Faculty (ENG)							
6. Instructor Technology Ability (ITA)							
7. Instructor Technology Usage (ITU)							
8. Online Course Preference (OCP)	--						
9. Year in School (YR)	.02	--					
10. Grade Point Average (GPA)	-.14**	-.02	--				
11. Socioeconomic Status (SES)	-.16**	-.03	.19**	--			
12. Gender (GEN)	-.05	.13**	-.11*	-.01	--		
13. Perceived Technology Benefits (PTB)	.22**	-.02	-.06	-.03	-.05	--	
14. Overall Student Satisfaction (OSS)	-.10*	-.12*	.18**	.14**	-.14**	.22**	--

Perceived Technology Benefits. The predictor variables with the highest correlations with Overall Student Satisfaction were Instructor Technology Ability $r(478) = .31$, $p < .01$, Course Specific Behaviors $r(478) = .25$, $p < .01$, and Engagement with Faculty $r(478) = .23$, $p < .01$.

Analytic Statistics

Comparison of means for control variables. To understand the differences between/among groups to identify control variables to be used in the path analysis, a combination of independent t-tests and one-way ANOVA tests were conducted between the scale variables and demographic control variables including gender, year in school, and SES. Effect size was calculated as the standardized correlation coefficient in bivariate analysis. Cohen's standard interpretation for effect size is 0 to 0.2 = small; 0.21 to 0.5 = medium; and .51 to 0.8 = large (Cohen, 1988).

Gender. Table 5 summarizes gender differences in the study variables and scales. Means for females and males were compared using independent samples *t* tests. Significant differences were observed for four variables, with females having higher means for Social Networking, Instructor Technology Ability, GPA, and Overall Student Satisfaction. In contrast, males had a significantly higher mean for year in school. The *t* statistics for equal variances not assumed are presented, based on Levene's test for equality of variances.

Results of the independent t-tests for gender and the dependent variables reveal that there is a significant difference for gender for Overall Student Satisfaction ($p < .01$),

Table 5

Gender Differences in Study Variables and Scales

	Gender							
	Female (N = 307)		Male (N = 215)					
Variable/Scale	M	SD	M	SD	*t*	*df*	*p*	Cohen's *d*
Course Specific Behaviors	36.16	6.22	35.22	6.55	1.61	434	.109	.15
Technology Obstacles	7.11	2.41	7.0	2.53	0.53	430	.597	.05
Social Networking	16.06	5.36	13.8	4.9	4.92	473	<.001	.45
Proficiency Social Dimensions	12.42	2.9	12.62	3.4	-0.67	411	.503	-.07
Engagement with Faculty	10.92	3.25	11.07	3.41	-0.5	436	.623	-.05
Instructor Technology Ability	11.17	2.13	10.65	2.19	2.68	442	.008	.26
Instructor Technology Usage	20.09	4.65	20.45	5.43	-0.74	357	.462	-.08
Online Course Preference	1.88	1.11	1.76	1.01	1.21	478	.228	.11
Year in School	2.64	1.11	2.93	1.02	-3.06	485	.002	-.28
Grade Point Average	3.32	.51	3.2	.56	2.4	416	.018	.23
Socioeconomic Status	2.98	.87	2.96	.9	0.18	451	.860	.02
Perceived Technology Benefits	26.18	5.45	25.68	5.42	1.03	443	.318	.1
Overall Student Satisfaction	87.3	11.1	84.09	11.8	3.01	410	.003	.3

N = 522

with females indicating they are more satisfied. Cohen's effect size of (d = .3) indicates a "medium practical significance" of the difference in means. No significant difference for gender was found for Perceived Technology Benefits. Even though there were significant differences for females on four variables and one significant difference for males, the large sample size impacted the final results. A weak correlation can be statistically significant, but may not be practically important, which may explain why gender did not enter into the final path analysis results.

Year in school by gender. Means and standard deviations for Perceived Technology Benefits and Overall Student Satisfaction for year in school by gender are summarized in Table 6. Females had higher means in each class group for both dependent variables, other than freshman males for Perceived Technology Benefits.

Table 6

Mean Scores and Standard Deviations for Perceived Technology Benefits and Overall Student Satisfaction as a Function of Year in School by Gender

	Perceived Technology Benefits		Overall Student Satisfaction	
Group	*M*	*SD*	*M*	*SD*
Female (N = 269)				
Freshman (n = 53)	25.7	5.86	88.7	11.49
Sophomore (n = 80)	26.1	4.13	87.5	11.17
Junior (n = 57)	26.7	4.89	87.9	9.58
Senior (n = 79)	26.3	6.32	85.5	12.15
Male (N = 187)				
Freshman (n = 19)	26.1	6.18	86.6	9.59
Sophomore (n = 48)	26.0	4.95	84.1	11.24
Junior (n = 50)	25.9	6.20	85.0	11.35
Senior (n = 70)	24.9	5.24	82.4	12.96

Notably, the female mean was two to three points higher than the males' means for Overall Student Satisfaction.

Table 7 presents the multivariate and univariate analyses for gender and year in school. The multivariate analysis of variance (MANOVA) was utilized to determine whether different levels of gender and year in school had an effect on the two continuous dependent variables and also to indicate associations among the dependent variables, whereas the univariate analyses identified the effects of gender and year in school separately for each dependent variable. The Box's test of equality was significant (p = .011), but likely due to unequal size groups. Pillai's trace was used for reporting, as it is robust, but not as highly linked to the normality of distribution of the data.

Table 7

Multivariate and Univariate Analyses of Variance F Ratios for Gender x Year in School

				Univariate					
	Multivariate			Perceived Technology Benefits			Overall Student Satisfaction		
Source	F^a	p	η^2	F^b	p	η^2	F^b	p	η^2
Gender (GEN)	3.09	.046	.01	.68	.410	.00	6.01	.014	.01
Year in School (YR)	1.01	.419	.01	.34	.797	.00	1.84	.139	.01
GEN x YR	.26	.954	.00	.48	.697	.00	.04	.990	.00

Note. Multivariate *F* ratios were generated from Pillai's statistic.
[a]Multivariate *df* = 6, 896.
[b]Univariate *df* = 7, 448.

Given that the multivariate analysis indicated a statistically significant difference as a function of gender ($p < .05$), a univariate analysis followed. The univariate results for gender and year in school indicate that there are no significant differences for

Proficiency Technology Benefits, but that there are significant gender differences for Overall Student Satisfaction (p = .014). The above multivariate results also indicated that there is a significant difference (p = .046) for gender, but not for year in school or the association between gender and year in school. Eta-squared effect sizes are small.

A one-way ANOVA was conducted to examine whether there were statistically significant differences for Social Networking amongst year in school in relation to the 13 study variables. As Table 8 indicates, there were three variables that were statistically significant at the $p < .05$ level. Social Networking was statistically significant at the $p < .001$ level, $F(3, 504) = 5.68$, $p = .001$. Levene's F test revealed that the homogeneity of variance assumption was met for Social Networking $F(3,504) = 1.37$, $p = .252$. Post hoc analysis utilizing the Games Howell test found significant mean differences for Social Networking between freshman and juniors (mean difference 2.1, SD = .755, p = .031); freshman and seniors (mean difference 2.07, SD = .748, p = .033); sophomores and juniors (mean difference 1.86, SD = .627, p = .017); and sophomores and seniors (mean difference 1.83, SD = .619, p = .018).

Proficiency Social Dimensions was significant at the $p < .01$ level, $F(3, 507) = 4.68$, $p = .003$. The Levene's F test was not met for Proficiency Social Dimensions, so the Scheffe test was utilized. There were significant differences for Proficiency Social Dimensions between seniors and freshman (mean difference 1.07, SD = .410, p = .048); seniors and sophomores (mean difference 1.06, SD = .369, p = .048); and seniors and juniors (mean difference 1.11, SD = .373, p = .016).

Table 8

One-Way Analysis of Variance for the Effects of Year in School on Thirteen Study Variables

Variable	Source	*SS*	*MS*	F *(df)*	*p*	η^2
Course Specific	Between	277.11	92.37	2.293 (3,500)	.077	.014
Behaviors (CSB)	Within	20140.2	40.28			
Technology Obstacles	Between	38.39	12.8	2.125 (3,501)	.096	.013
(TO)	Within	3016.45	6.02			
Social Networking	Between	463.82	154.61	5.679 (3,504)	.001***	.033
(SN)	Within	13721.37	27.23			
Proficiency Social	Between	133.19	44.40	4.681 (3,507)	.003**	.027
Dimensions (PSD)	Within	4508.56	9.48			
Engagement with	Between	65.98	21.99	2.012 (3,507)	.111	.012
Faculty (ENG)	Within	5541.89	10.93			
Instructor Technology	Between	21.93	7.31	1.562 (3,506)	.198	.009
Ability (ITA)	Within	2368.04	4.68			
Instructor Technology	Between	80.98	26.99	1.088 (3,450)	.354	.007
Usage (ITU)	Within	11164.27	24.81			
Online Course	Between	.36	.12	.103 (3,511)	.958	.001
Preference (OCP)	Within	587.95	1.15			
Grade Point Average	Between	.24	.80	.275 (3,492)	.844	.002
(GPA)	Within	142.91	.29			
Socioeconomic	Between	1.81	.60	.781 (3,512)	.505	.005
Status (SES)	Within	394.76	.77			
Gender	Between	2.59	.86	3.610 (3,518)	.013*	.020
(GEN)	Within	123.86	.24			
Perceived Technology	Between	31.44	10.48	.353 (3,489)	.787	.002
Benefits (PTB)	Within	14510.16	29.67			
Overall Student	Between	943.60	314.53	2.401 (3,476)	.067	.015
Satisfaction (OSS)	Within	62350.94	130.99			

Gender was significant at the $p < .05$ level, $F(3,518) = 3.61$, $p = .013$. The Levene's F test for was not met for gender, so the Scheffe test was utilized. Significant differences for gender were found between juniors and freshman (mean difference .193, SD = .067, *p* = .026); and seniors and freshman (mean difference .203, SD = .062, *p* = .007). Freshman means were higher in both cases.

SES by gender. Means and standard deviations for Perceived Technology Benefits and Overall Student Satisfaction by gender and SES are summarized in Table 9. Females had higher means than males in nine out of 10 groups. Only the middle-class male group (*M* = 25.9) had a higher mean for Perceived Technology Benefits than the female middle-class group. The mean gender difference was greater for Overall Student Satisfaction than for Perceived Technology Benefits.

Table 9

Mean Scores and Standard Deviations for Perceived Technology Benefits and Overall Student Satisfaction as a Function of SES by Gender

	Perceived Technology Benefits		Overall Student Satisfaction	
Group	*M*	*SD*	*M*	*SD*
Female (N = 266)				
Low-income/poor	27.0	5.22	82.7	14.52
Working-class	28.0	3.95	85.8	10.99
Middle-class	25.6	5.67	86.7	11.40
Upper-middle	26.0	5.42	90.2	9.91
Wealthy	28.7	5.13	86.3	7.37
Male (N =187)				
Low-income/poor	24.1	8.53	79.6	15.84
Working-class	26.0	5.40	81.6	12.52
Middle-class	25.9	5.51	85.1	11.71
Upper-middle	25.4	4.72	84.9	10.01
Wealthy	25.6	5.52	83.9	11.79

SES. Table 10 presents the multivariate and univariate analyses for gender and SES. The Box's test of equality was (.071), meeting the homogeneity of variance assumption. Pillai's trace was again used for reporting, due to the unequal sized groups. Multivariate analyses also showed significant differences for gender (*p* = .011) and SES (*p* = .035), but not for gender x SES. Eta-squared effect sizes are small.

Table 10

Multivariate and Univariate Analyses of Variance F *Ratios for Gender x SES*

				Univariate					
	Multivariate			Perceived Technology Benefits			Overall Student Satisfaction		
Source	F^a	p	η^2	F^b	p	η^2	F^b	p	η^2
Gender (GEN)	4.53	.011	.02	4.21	.041	.01	6.81	.009	.02
SES	2.09	.035	.02	1.02	.399	.01	2.65	.033	.02
GEN x SES	1.05	.392	.01	1.51	.211	.01	.72	.541	.01

Note. Multivariate *F* ratios were generated from Pillai's statistic.
[a]Multivariate *df* = 6, 888.
[b]Univariate *df* = 8, 444.

Table 11 lists the ANOVA summary for SES effects on the study variables. There were two variables with statistical significance at the $p < .01$ level. These were Online Course Preference $F(4, 505) = 3.42$, $p = .009$, eta-squared = .026, and GPA $F(4,486) = 4.919$, $p = .001$, eta-squared = .039, both small effects. Overall Student Satisfaction was statistically significant at the $p < .05$ level, $F(4,472) = 2.573$, $p = .037$, eta-squared = .021, also a small effect size (Cohen, 1988).

The assumptions of independence and normality indicated the data were statistically normal. However, the Levene's *F* test revealed that the homogeneity of variance assumption was not met for Online Course Preference $F(4,505) = 4.25$, $p = .002$. Post-hoc comparisons using the Games Howell test indicated that the mean score for

Online Course Preference and SES working-class (level 2) and upper-middle class (level 4) were significantly different (mean difference = .452, standard error = .141, *p* = .014), with the working-class (level 2) mean higher.

Table 11

One-Way Analysis of Variance for the Effects of SES on Thirteen Study Variables

Variable	Source	*SS*	*MS*	F *(df)*	*p*	η^2
Course Specific Behaviors (CSB)	Between	144.28	36.07	.885 (4,494)	.473	.007
	Within	20135.13	40.76			
Technology Obstacles (TO)	Between	15.21	3.81	.627 (4,496)	.643	.005
	Within	3007.91	6.06			
Social Networking (SN)	Between	170.50	42.63	1.528 (4,499)	.193	.012
	Within	13921.43	27.90			
Proficiency Social Dimensions (PSD)	Between	67.70	17.42	1.806 (4,502)	.126	.014
	Within	4843.05	9.65			
Engagement with Faculty (ENG)	Between	16.30	4.07	.367 (4,501)	.832	.003
	Within	5562.65	11.10			
Instructor Technology Ability (ITA)	Between	13.78	3.44	.735 (4,501)	.568	.006
	Within	2347.32	4.69			
Instructor Technology Usage (ITU)	Between	96.14	24.03	.966 (4,446)	.426	.009
	Within	11092.99	24.87			
Online Course Preference (OCP)	Between	15.41	3.85	3.420 (4,505)	.009**	.026
	Within	568.75	1.13			
Year in School (YR)	Between	2.01	.50	.431 (4,511)	.786	.003
	Within	596.19	1.12			
Grade Point Average (GPA)	Between	5.55	1.39	4.919 (4,486)	.001**	.039
	Within	136.95	.28			
Gender (GEN)	Between	.31	.08	.321 (4,511)	.864	.003
	Within	125.10	.25			
Perceived Technology Benefits (PTB)	Between	134.09	33.52	1.142 (4,484)	.336	.009
	Within	14209.77	29.36			
Overall Student Satisfaction (OSS)	Between	1345.20	336.30	2.573 (4,472)	.037*	.021
	Within	61682.27	130.68			

The Scheffe post hoc test was utilized for gender and Overall Student Satisfaction, as Levene's *F* was met, $p > .05$. There were significant differences in mean scores for GPA and SES' low income/poor (level 1) and middle class (level 3): mean difference = .323, standard error = .098, $p = .025$. There were also significant differences in mean scores for GPA and SES' low income/poor (level 1) and upper-middle class (level 4): mean difference = .416, standard error = .102, $p = .002$. Scheffe's post hoc test for Overall Student Satisfaction found no significant differences between SES groups. One final note regarding comparison of means: there were four variables that did not have significant differences for year in school, GPA, SES or gender. These included Technology Obstacles, Engagement with Faculty, Instructor Technology Usage, and Perceived Technology Benefits.

College. The second research question was, "Does college of enrollment affect Perceived Technology Benefits and moderate the effects of the technology experience on Overall Student Satisfaction?" In order to answer this research question, means and standard deviations for Perceived Technology Benefits and Overall Student Satisfaction by college are summarized in Table 12. The college of business had the highest numerical mean for both Perceived Technology Benefits ($M = 27.9$) and Overall Student Satisfaction ($M = 90.2$). Education was tied for Perceived Technology Benefits ($M = 27.9$). The college of Health (consisting of Biological Sciences, Nursing, Medicine and Allied Health respondents) had the second highest numerical mean for Overall Student Satisfaction ($M = 86.7$).

Howell (2009) indicates that the analysis of variance is assumed to valid if the populations are similar in shape with the largest variance being no more than four times the smallest. The groups were recoded to alleviate this issue, but the group sizes are still unequal, so results are interpreted cautiously. The assumption of homogeneity of covariance across the groups using Box's Test of Equality of Covariance Matrices found

Table 12

Mean Scores and Standard Deviations for Perceived Technology Benefits and Overall Student Satisfaction as a Function of College

	Perceived Technology Benefits		Overall Student Satisfaction	
College	*M*	*SD*	*M*	*SD*
Business (N = 26)	27.9	1.08	90.2	2.31
Education (N = 51)	27.9	.83	86.3	1.76
Science & Engineering (N = 77)	26.4	.74	84.4	1.57
Health (N = 53)	26.6	.82	86.7	1.74
Liberal Arts (N = 197)	25.3	.39	85.8	.84
Design (N = 20)	25.2	1.68	77.9	3.58
Agriculture (N = 32)	25.5	1.10	83.4	2.34

N = 456

the Box's *M* value of 84.85 ($p < .001$), which was significant at the $p < .005$ level (Huberty & Petoskey, 2000). Box's test shows that there are significant differences between the covariance matrices. The assumption was violated, so Pillai's Trace test was used for further analysis, as described earlier.

Table 13 summarizes the multivariate and univariate analyses for gender x college. The Assumption of Normality was evaluated and determined to be satisfied with skewness of -.29 and kurtosis of -.55. A Shapiro-Wilk's test ($p > .05$) and a visual inspection of their histograms, box plots, and normal Q-Q plots showed that the major distributions were approximately normally distributed. The homogeneity of variance assumption is considered satisfied for both dependent variables, based on Levene's *F* test, $F(13, 442) = 1.38$, $p = .166$ for Perceived Technology Benefits; and $F(13, 442) = .941$, $p = .510$ for Overall Student Satisfaction.

Table 13

Multivariate and Univariate Analyses of Variance F Ratios for Gender x College

	Multivariate			Univariate					
				Perceived Technology Benefits			Overall Student Satisfaction		
Source	F^a	p	η^2	F^b	p	η^2	F^b	p	η^2
Gender (GEN)	2.62	.074	.01	.685	.408	.00	5.13	.024	.01
College	1.86	.035	.03	2.17	.045	.03	1.8	.098	.02
GEN x College	.981	.465	.01	1.13	.345	.02	.87	.521	.01

Note. Multivariate *F* ratios were generated from Wilk's Lambda.
[a]Multivariate $df = 12, 884$.
[b]Univariate $df = 13, 442$.

Because the MANOVA for college was significant, an ANOVA was performed. Perceived Technology Benefits was significant at the $p < .05$ level, $F(13, 442) = 2.17$, $p = .045$, eta-squared = .029 (small effect); Overall Student Satisfaction $F(13, 442) = 1.8$, $p = .098$, eta-squared = .024 (small effect). Also, gender was significant at the $p < .05$ level for Overall Student Satisfaction, $F(13, 442) = 5.13$, $p = .024$, eta-squared = .011 (small effect). While college had a small effect on Perceived Technology Benefits, it did not significantly impact Overall Student Satisfaction. Given these results, no further analysis included the college variable.

Regression models. Prior to the path analysis, several linear regression models were used to predict the Perceived Technology Benefits, the first dependent variable. Table 14 contains the results of the regression analysis, which indicate that the combination of variables explained 25.5% of the variance, $R^2 = .255$, $p < .001$. In descending order, the four statistically significant predictor variables and their standardized beta (β) weights included Instructor Technology Ability (.310), Social Networking (.257), Online Course Preference (.223), and Proficiency Social Dimensions (.121).

Table 14

Regression Analysis Summary for Variables Predicting Dependent Variable: Perceived Technology Benefits

Variable	*B*	*SE B*	β	*t*	*p*
Course Specific Behaviors (CSB)	.09	.05	.1	1.8	.072
Technology Obstacles (TO)	-.1	.11	-.04	-.9	.370
Social Networking (SN)	.27	.05	.26	5.1	<.001***
Proficiency Social Dimensions (PSD)	.22	.08	.12	2.64	.009**
Engagement with Faculty (ENG)	-.07	.09	-.04	-.81	.420
Instructor Technology Ability (ITA)	.82	.12	.31	6.73	<.001***
Instructor Technology Usage (ITU)	.04	.05	.04	.75	.453
Online Course Preference (OCP)	1.15	.24	.22	4.76	<.001***
Year in School (YR)	.21	.24	.04	.86	.388
Grade Point Average (GPA)	-.51	.52	-.05	-.98	.326
Socioeconomic Status (SES)	.08	.3	.01	.27	.787
Gender (GEN)	.52	.52	.05	.99	.324

*$p < .05$, **$p < .01$, *** $p < .001$

The first dependent variable, Perceived Technology Benefits, was added to the second regression becoming an exogenous or predictor variable. Several linear regression models were fit to predict Overall Student Satisfaction, the second dependent variable. Results in Table 15 show that seven of 13 exogenous or predictor variables were found to influence the second dependent variable, Overall Student Satisfaction, at $p < .05$ or greater. Of the seven statistically significant variables, three were at $p < .05$; one variable at $p < .01$, and two variables at $p < .001$. Two additional variables approached statistical significance at $p < .05$.

Table 15

Regression Analysis Summary for Variables Predicting Dependent Variable: Overall Student Satisfaction

Variable	*B*	*SE B*	β	*t*	*p*
Course Specific Behaviors (CSB)	.24	.10	.13	2.4	.017*
Technology Obstacles (TO)	-1.07	.23	-.22	-4.7	<.001***
Social Networking (SN)	.05	.12	.02	.44	.663
Proficiency Social Dimensions (PSD)	.36	.17	.10	2.07	.039*
Engagement with Faculty (ENG)	.46	.19	.13	2.36	.018*
Instructor Technology Ability (ITA)	1.5	.27	.27	5.53	<.001***
Instructor Technology Usage (ITU)	.32	.12	.13	2.81	.005**
Online Course Preference (OCP)	-1.020	.52	-.09	-1.94	.053
Year in School (YR)	-.96	.51	-.09	-1.9	.058
Grade Point Average (GPA)	2.05	1.11	.09	1.84	.067
Socioeconomic Status (SES)	1.5	.63	.11	2.4	.017*
Gender (GEN)	-1.24	1.10	-.05	-1.12	.262
Perceived Technology Benefits (PTB)	.19	.11	.09	1.74	.082

*$p < .05$, **$p < .01$, *** $p < .001$

These nine variables and their standardized beta (β) weights in descending order include Instructor Technology Ability (.268), Technology Obstacles (-.219), Course Specific Behaviors (.131), Instructor Technology Usage (.129), Engagement with Faculty (.129), Socioeconomic Status (.110), and Proficiency Social Dimensions (.095). The two variables that bordered on statistical significance were Online Course Preference (-.092), p = .053, and year in school (-.090), p = .058. The proportion of variance in the dependent variable accounted for by the equation (R^2) is 0.329 of the variance.

Perceived Technology Benefits was only found to be a statistically significant predictor for Overall Student Satisfaction when four additional variables were included in the regression. These four variables included the Increased Academic Proficiency scale, Student Time Working scale, Increased Skill Level scale, and the Instructor Everyday Technology Usage scale. Inclusion of these four variables produced a slightly higher R^2 of 33.5% for Overall Student Satisfaction, but negatively impacted the R^2 for Perceived Technology Benefits. Following the “law of parsimony” (Occam’s razor, 2015), these four variables were eliminated. See Chapter 3, pp. 81-86 for further details.

Path analysis. Figure 3 represents the results of the path analysis based on the regression results summarized in Tables 14 and 15. Path analysis is commonly used to diagram and describe directed dependencies among a set of variables, when more than one dependent or ‘endogenous’ variable is being analyzed. The independent predictor ‘exogenous’ variables are modeled as being correlated (see Table 4). The statistically significant endogenous variables are each contained in a separate box with their standardized regression coefficient, or beta (β) weight, near the arrow connecting it to the associated exogenous (dependent) variable. The predictors are listed in the same order as the various tables throughout this chapter, rather than in a prioritized order.

In this analysis, four of twelve exogenous (predictor) variables were found to influence the first endogenous (dependent) variable, Perceived Technology Benefits. These four statistically significant predictor variables and their standardized beta (β) weights included Instructor Technology Ability (.310), Social Networking (.257), Online Course Preference (.223), and Proficiency Social Dimensions (.121). The standardized beta weights indicate how much of an increase (or decrease) is predicted if the other variable were to change by one standard deviation from the mean. For example, if Instructor's Technology Ability increases by one standard deviation from its mean, Perceived Technology Benefits would increase by .310.

Nine of 13 exogenous (predictor) variables were found to influence the second endogenous (dependent) variable, Overall Student Satisfaction. These nine variables and their standardized beta (β) weights in descending order include Instructor Technology Ability (.268), Technology Obstacles (-.219), Course Specific Behaviors (.131), Instructor Technology Usage (.129), Engagement with Faculty (.129), Socioeconomic Status (.110), and Proficiency Social Dimensions (.095). The two variables that bordered on statistical significance were Online Course Preference (-.092), $p = .053$, and year in school (-.090), $p = .058$.

Again, Instructor Technology Ability is the strongest predictor, determined by beta weight. As described earlier, a standard deviation increase from the mean of Instructor Technology Ability would increase Overall Student Satisfaction by .268. As expected, Technology Obstacles would negatively impact Overall Student Satisfaction – a one standard deviation change in the mean would cause Overall Student Satisfaction to decrease -.219. Course Specific Behaviors, Instructor Technology Usage, and Engagement with Faculty all have very similar beta weights, .131, .129, and .129, respectively, with a one standard deviation change resulting in an estimated .13 increase in Overall Student Satisfaction. A one standard deviation change in the mean of Proficiency Social Dimensions would result in an estimated .095 increase in Overall Student Satisfaction. Chapter 5 contains further discussion related to the interpretation of these results.

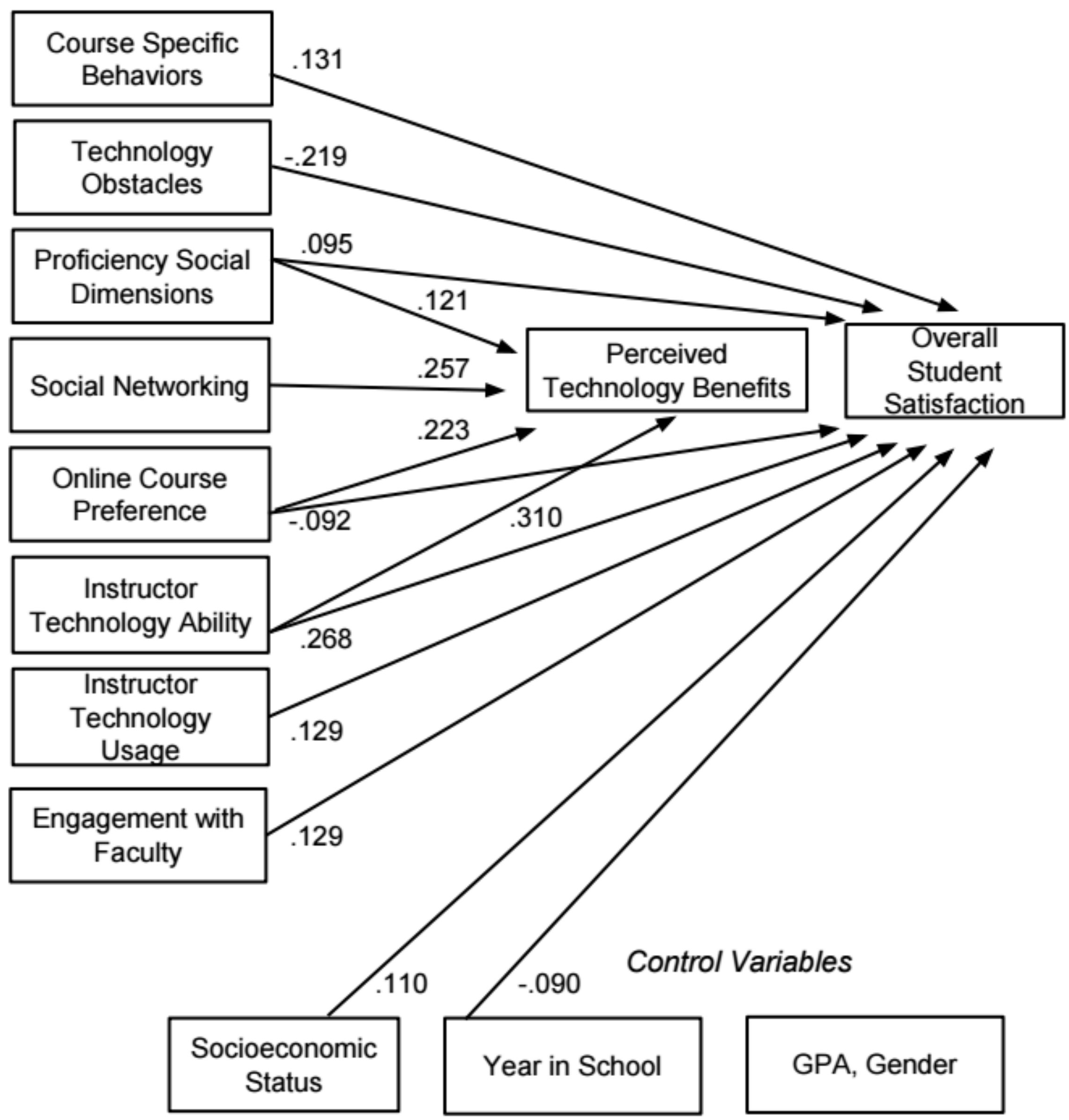

Figure 3. Results of the Path Analysis

Chapter Five Discussion

Introduction

This chapter begins with a summary of the purpose of the study followed by a summary of the research findings, and comparison with relevant previous research. Next, implications for practice are discussed. Finally, suggestions for future research are discussed.

Summary of Research Findings

The purpose of this study was to identify personal (input) and environmental factors influencing Perceived Technology Benefits and Overall Student Satisfaction (output) for undergraduate students at a large Midwestern university. Astin's (1993) I-E-O model served as the theoretical framework for the study. Multiple variable regression analysis was used to determine the factors that most influenced Perceived Technology Benefits and Overall Student Satisfaction. The specific research questions were as follows:

1) What are the relationships between the technology experience variables from the 2013 SERU survey with regard to Perceived Technology Benefits and, in turn, Overall Student Satisfaction?
2) Does college of enrollment affect Perceived Technology Benefits and moderate the effects of the technology experience on Overall Student Satisfaction?

This study used the dataset from the 2013 Student Experience in the Research University (SERU) survey, which was administered at the campus studied. The primary focus of the study was based on the questions in the Technology module, which was randomly administered to 10 percent of the survey responders at the campus being studied. This resulted in a final sample of 522 participants for this study. The exogenous or predictor variables used in this study were: 1) Course Specific Behaviors; 2) Technology Obstacles; 3) Social Networking; 4) Proficiency Social Dimensions; 5) Engagement with Faculty; 6) Instructor Technology Ability; 7) Instructor Technology Usage; 8) Online Course Preference; 9) year in school; 10) GPA; 11) SES; and 12) gender. The two endogenous or dependent variables were the Perceived Technology Benefits and Overall Student Satisfaction.

Seven of the predictor variables were categorized as inputs, according to Astin's (1993) framework. These included Course Specific Behaviors, Proficiency Social Dimensions, Online Course Preference, year in school, GPA, SES, and gender. Five of the predictor variables were categorized as environmental: Technology Obstacles, Social Networking, Engagement with Faculty, Instructor Technology Ability and Instructor Technology Usage. The two dependent variables were categorized as outputs (Astin, 1993).

Correlation analysis was conducted to determine if there was a relationship between each of the independent (exogenous or predictor) variables and the dependent variables. Next, hierarchical regression analysis was used to determine the amount of influence the predictor variables exerted on the endogenous (dependent variable) outcomes of Perceived Technology Benefits and Overall Student Satisfaction.

Discussion of the Findings

Overall, two regression analyses were conducted in order to answer the first research question. The R^2 for the first dependent variable, Perceived Technology Benefits, is 25.5%, indicating that the model explains 26% of the total variance, depicting a statistically significant model with a small to medium effect size. The four primary determinants (or factors) which entered into the path analysis model were: a) Instructor's Technology Ability; (.310); b) Social Networking (.257); c) Online Course Preference, a strong preference for face-to-face classes (.223); and d) Proficiency Social Dimensions (.121). The two strongest predictors were related to the environment, while the other two predictors were inputs (Astin, 1993). The remaining factors significantly correlated with Perceived Technology Benefits included Instructor Technology Usage, Engagement with Faculty, and Course Specific Behaviors.

The results of the regression to predict Overall Student Satisfaction indicated a combination of variables which explained 32.9% of the variance, depicting a statistically significant model with a medium effect size. Overall Student Satisfaction was significantly correlated with all 13 predictors with nine entering into the path analysis model: a) Instructor's Technology Ability (.268); b) Technology Obstacles (-.219); c) Course Specific Behaviors (.131); d) Instructor Technology Usage (.129); e) Engagement with Faculty (.129); f) Socioeconomic Status (.110); g) Proficiency Social Dimensions (.095); and h) Online Course Preference (-.092). Year in School bordered on significance (p = .058) and was also included in the final model (-.090). This resulted in five input variables and four environmental impacting Overall Student Satisfaction (Astin, 1993).

Table 16 summarizes the standardized coefficients of the predictor variables from the regression analyses. Variables will be discussed in their order of perceived impact on the overall path analysis, beginning with three predictors, i.e., Instructor Technology Ability, Proficiency Social Dimensions, and Online Course Preference, that impacted both endogenous or dependent variables. Other variables will follow based on their standardized beta (β) weights and their contribution to the overall path model.

Table 16

Summary of Standardized Coefficients of Predictor Variables

Predictors	PTB	OSS
Course Specific Behaviors (CSB)	.098	.131*
Technology Obstacles (TO)	-.042	-.219***
Social Networking (SN)	.257***	.022
Proficiency Social Dimensions (PSD)	.121**	.095*
Engagement with Faculty (ENG)	-.044	.129*
Instructor Technology Ability (ITA)	.310***	.268***
Instructor Technology Usage (ITU)	.035	.129**
Online Course Preference (OCP)	.223***	-.092*
Year in School (YR)	.041	-.090
Grade Point Average (GPA)	-.048	.088
Socioeconomic Status (SES)	.013	.110*
Gender (GEN)	.047	-.052

*$p < .05$, **$p < .01$, *** $p < .001$

Predictor variables impacting both endogenous (dependent) variables.

Instructor Technology Ability. Results of the path analysis found that Instructor's Technology Ability was the strongest predictor for both dependent variables. The standardized beta (β) weights were .310 ($p < .001$) for PTB and .268 ($p < .001$) for OSS. The standardized beta weights indicate how much of an increase (or decrease) is predicted if the other variable were to change by one standard deviation from the mean. For example, if Instructor's Technology Ability increases by one standard deviation from its mean, PTB would increase by .310 and OSS would increase by .268.

Additionally, Instructor's Technology Ability was the mostly highly correlated with the two dependent variables, (r = .33** for PTB; r =.31** for OSS), indicating medium effect sizes (Cohen, 1988). The Instructor's Technology Ability scale included items related to instructors' ability to effectively use technology, provide students with adequate technology training, have adequate technical skills for carrying out course instruction, and using "the right kind(s)" of technology. Note: Instructor's Technology Ability does not include elements of instructors' technology usage, e.g., blogs, e-portfolios, or simulations, which form the separate Instructor Technology Usage (ITU) variable.

Recent educational technology survey results align with these findings. The 2015 ECAR findings (based on students and faculty technology surveys) found that faculty's top motivation for integrating technology is to have, "Clear indication/evidence that students would benefit from the integration of the technology into courses or curricula" (Brooks, 2015, p. 16). The ECAR study also found that faculty are motivated by having release time to design or redesign their courses, especially at public institutions. Another top motivator included having confidence that technology would work the way they planned. The ECAR study had 13,276 faculty respondents from 139 institutions, with 12,070 from 39 U.S. states, while the student survey consisted of 50,274 student respondents from 161 institutions in 43 states and 11 countries. The faculty survey found that faculty have considerable experience teaching in digital learning environments and that they own a variety of technologies.

The 2015 Campus Computing Survey (CCS) results also point to the importance of digital technologies in higher education. The CCS survey participants included CIOs and senior IT officials from 417 two- and four-year public and private colleges and universities. The 2015 number one priority was assisting faculty to integrate technology into instruction (Green, 2015), which was also the top priority from the 2014 national survey. Survey respondents overwhelmingly agreed that digital curricular resources helped make learning more efficient and effective (94%); created a richer, more personalized learning experience (87%); and had potential to improve students' learning outcomes (94%). Granted, the respondents in the CCS survey are technology advocates, but this group works closely with faculty, staff, and students to support and integrate technology into the classroom. The remaining top four campus IT priorities were hiring and retaining qualified staff, providing adequate user support, enhancing or upgrading data and network security, and leveraging resources to support student success.

The CCS survey also found that while instructional integration was the top priority, only 17% of the campuses surveyed recognize instructional IT efforts as part of the promotion and review process. This result is related to the ECAR study which found faculty were motivated by having release time to focus on the design/redesign of their courses. Creating an online course, flipping the classroom, or modifying course structure to include active learning elements can take considerable time. Opportunities to improve courses that meet student's technology expectations need to take this time element into consideration.

Proficiency Social Dimensions. The second highest predictor in the path analysis model that impacted both dependent variables is Proficiency Social Dimensions (PSD). The standardized beta (β) weights were .121 ($p < .01$) for PTB and .095 ($p < .05$) for OSS. If Proficiency Social Dimensions were to increase by one standard deviation from its mean, PTB would increase by .121 and OSS would increase by .095. Proficiency Social Dimensions is the difference in students' rating of their abilities from the date the survey was taken from when they began at the University. This scale contained five responses: a) ability to appreciate, tolerate and understand racial and ethnic diversity; b) ability to appreciate the fine arts; c) ability to appreciate cultural and global diversity; d) understanding the importance of personal social responsibility; and e) self-awareness and understanding. Proficiency Social Dimensions' correlations were small ($r = .10^*$ for PTB; $r = .12^{**}$ for OSS) (Cohen, 1988). This set of items was included in the regression model to determine the relative importance of this aspect of a students' undergraduate experience compared to the effects of variables more closely connected with instructional technology experiences.

Proficiency Social Dimension's response items align with higher education's increased focus on diversity, inclusivity, and accessibility (UMN, 2014d). Valuing diversity, considering how people and places are represented, avoiding stereotyping, and choosing the most appropriate curriculum for the student body are key elements of a democratic, inclusive, and civilized society. This is important for improving all students' success and will help create equity, promote complex thinking skills, and create the ability to work across difference (Nelson Laird, 2014). These elements help contribute to student's overall satisfaction. PSD may also benefit from social media's ability to break down barriers and link individuals from diverse populations on common subject areas, whether they be politics, creative interests, or cultural events.

Online Course Preference. The third predictor in the path analysis model that significantly impacted both dependent variables is Online Course Preference (OCP). This question asked students their preference about taking courses fully online as opposed to face-to-face. The standardized beta (β) weights were .223 ($p < .001$) for PTB and -.092 ($p < .05$) for OSS. If Online Course Preference increases by one standard deviation from its mean, PTB would increase by .223 and OSS would decrease by -.092. Online Course Preference correlations were small ($r = .22$** for PTB; $r = -.10$* for OSS) (Cohen, 1988). Respondents' breakdown was as follows: strongly prefer face-to-face (n = 279); somewhat prefer face-to-face (n = 100); neutral/don't know (n = 90); somewhat prefer fully online (n = 36); and strongly prefer fully online (n = 10). It is interesting to see how students' strong preference for face-to-face courses in 2013 had a strong impact on both their Perceived Technology Benefits and how it negatively impacted Overall Student Satisfaction. Since 2013, sentiment toward online education has been changing, favoring hybrid or blended approaches (Allen & Seaman, 2015; Bates, 2015).

Predictor variables impacting only Perceived Technology Benefits.

Social Networking. The Social Networking scale had a strong significant impact, ($\beta = .257$, $p < .001$), on PTB, but did not have a significant impact on OSS ($\beta = .022$). If

Social Networking increases by one standard deviation from its mean, PTB would increase by .257 and OSS would increase by .022. It is noteworthy to point out that Social Networking was shown to be statistically significant for students' Perceived Technology Benefits, but did not have a significant impact on Overall Student Satisfaction, possibly due to the disconnect between using Social Networking for personal versus educational purposes.

Social Networking correlations were small to medium (r = .26** for PTB; r = .17** for OSS) (Cohen, 1988). This scale indicated the frequency which students actively create online content, e.g., Tweeting, uploading video or photos, contributing to Google documents, and uploading content to Facebook. The rise of social media and Web 2.0 services in recent years has clearly impacted students' desire to be connected and utilize technology to their advantage. Web 2.0 services, growth in the smartphone and mobile device market, and vast improvements in wireless connectivity have helped improve collaboration and communication for students, faculty, and staff. These key Social Networking attributes can be utilized to enhance educational goals, besides personal ones, especially with their inclusion into newer course management systems since 2013.

As mentioned earlier, three-fourths (75%) of Millennials have created a social networking profile and 20% have posted video of themselves online (Taylor & Keeter, 2010). Social networking sites can vary from those connecting with like or shared interests (i.e., Friendster or Snapchat) to career-related interests, such as LinkedIn. Facebook, with over a billion daily active users, has been shown to help form and maintain social capital and was shown to interact with measures of psychological well-being (Ellison, Steinfield, & Lampe, 2007). The authors found that Facebook and social networking systems may benefit students with low satisfaction and low self-esteem. Another finding was that students' satisfaction with their campus was strongly correlated with bridging social capital ($\beta = .66$, $p < .0001$). Social networking can aid with connections between college communities, such as alumni and career services, besides opportunity for improving students' perceived technology benefits.

Predictor variables impacting only Overall Student Satisfaction.

Technology Obstacles. The Technology Obstacles scale was significant and negatively correlated with Overall Student Satisfaction, -.219 ($p < .05$), but was not found to be a significant predictor for Perceived Technology Benefits. If Technology Obstacles increases by one standard deviation from its mean, OSS would decrease by -.219. Conversely, reducing Technology Obstacles will improve OSS. Technology Obstacles' correlations were small ($r = .04$ for PTB; $r = -.19$** for OSS) (Cohen, 1988). The small to medium negative correlation with Overall Student Satisfaction and the fact that it was the second strongest predictor indicates problems using technology has an impact on student satisfaction.

This question asked, "To what degree has each of the following factors been a problem for your use of educational technology in your courses?" a) Instructors not using educational technologies at all; b) Instructors not using educational technologies well; c) Amount of time needed to learn educational technologies; and d) Amount of time needed to use educational technologies.

A myriad of technology-related issues can occur during class. Two items in this question focused on instructors: not using technology at all, or not using it well. The other two were related to time needed to learn and time needed to use educational technologies. More research is needed in these areas, as well as other technology obstacles that can occur in a classroom setting, such as disruption caused by other students who may be multitasking or performing activities unrelated to class (Gillard & Bailey, 2007). It is important to strive for seamless integration of technology into the classroom.

The ECAR studies of students and faculty highlight that there is a gap between what faculty perceive students to be doing on their mobile devices in class, as compared to what students claim to be doing. Policies guiding appropriate use of technology in the classroom and bring-your-own-device (BYOD) can help alleviate confusion in this area (Brooks, 2015). The ECAR study also discusses a key faculty motivation as having confidence that the technology one plans to use works the way they planned or intended. Faculty expect technology to be reliable and consistent across classrooms (Brooks, 2015). Reducing technology obstacles is key to improving student (and faculty) satisfaction.

Course Specific Behaviors. The Course Specific Behaviors scale had a significant impact on Overall Student Satisfaction, .131 ($p < .05$), but did not have a significant impact on Perceived Technology Benefits (β =.098). If Course Specific Behaviors increases by one standard deviation from its mean, PTB would increase by .098 and OSS would increase by .131. Course Specific Behaviors' correlations were small to medium (r = .11* for PTB; r = .25** for OSS) (Cohen, 1988).

The CSB scale was based on the following question: "How frequently during this academic year have you done each of the following?" The means, standard deviations, and revised means are listed after each question, based on a six-point scale: a) Turned in a course assignment late, $M = 5.25$ (was 1.75), $SD = .95$; b) Gone to class without completing assigned reading, $M = 3.78$ (was 3.22), $SD = 1.37$; c) Gone to class unprepared, $M = 4.27$ (was 2.73), $SD = 1.14$; d) Skipped class, $M = 4.58$ (was 2.42), $SD = 1.13$; e) Raised your standard for acceptable effort due to the high standards of a faculty member, $M = 3.43$, $SD = 1.18$; f) Extensively revised a paper before submitting it to be graded, $M = 3.84$, $SD = 1.35$; g) Sought academic help from instructor or tutor when needed, $M = 3.21$, $SD = 1.4$; h) Worked on class projects or studied as a group with classmates outside of class, $M = 3.77$, $SD = 1.43$; and i) Helped a classmate better understand the course material when studying together, $M = 3.65$, $SD = 1.34$.

As mentioned earlier, academic preparation and motivation are the best predictors of whether a student will graduate (Adelman & United States, 2006; Pascarella & Terenzini, 1991, 2005). Twenty-first century learners who wish to persist will need to adopt behaviors congruent with academic achievement and integration (Tinto, 1993). Those students who strive for academic excellence, have perceived social ability (to associate with others and utilize meaningful resources), and have high self-efficacy (belief they are capable of learning) will be more satisfied (Lin, Lin, & Laffey (2008).

Instructor Technology Usage. The Instructor Technology Usage scale had a strong significant impact on Overall Student Satisfaction, $\beta = .129$ ($p < .01$), but did not have a significant impact for Perceived Technology Benefits, $\beta = .035$. Instructor

Technology Usage correlations were small (*r* = .12* for PTB; *r* = .14** for OSS) (Cohen, 1988). Instructor Technology Usage included items such as e-portfolios, e-books or e-textbooks, or freely available course content. This scale identified instructors' use of free or low-cost educational technology, and is not based on instructors' ability to *use* technology, as depicted by the Instructor Technology Ability scale.

A key factor for college students is the extent to which they take part in educationally effective activities (Astin, 1993; Chickering & Gamson, 1987; Kuh et al., 2005; Pascarella & Terenzini, 2005). Students may feel more connected and engaged in environments where faculty have like-minded interests. Cost-saving measures incorporating electronic and open-source (free) resources should increase student satisfaction.

Engagement with Faculty. The Engagement with Faculty scale was significantly correlated with Overall Student Satisfaction, $\beta = .129$ ($p < .05$). While it was not statistically significant, Engagement with Faculty negatively impacted PTB ($\beta = -.044$). If Engagement with Faculty increases by one standard deviation from its mean, PTB would decrease -.044 and OSS would increase by .129. Engagement with Faculty correlations were small to medium (*r* = .11** for PTB; *r* = .23** for OSS) (Cohen, 1988). The Engagement with Faculty scale was based on a question which asked "How frequently have you engaged in these activities so far this academic year?" a) Communicated with a faculty member by e-mail or in person; b) Talked with the instructor outside of class about issues and concepts derived from a course; and c) Interacted with faculty during lecture class sessions.

Faculty whose courses are thoughtfully designed using principles such as Bates' (2012) nine steps to quality online learning or Chickering and Ehrmann's (1996) seven principles will have built-in communication features, and opportunities for dialogue both synchronously and asynchronously. Faculty who respect diverse talents and ways of learning (Chickering & Gamson, 1987; Chickering & Ehrmann, 1996) will be perceived as being more engaged with students. While it is easy to understand how higher faculty engagement contributes to Overall Student Satisfaction, it is disconcerting to find that this variable negatively impacted Perceived Technology Benefits.

Perhaps students prefer faculty to use technology for communicating, or they are not satisfied with the level of promptness in faculty responses to their inquiries. More information is needed to fully understand the rationale for the negative impact on PTB, such as student's expectations for course contact whether this be through the LMS, or through mobile means, such as text messaging or SMS. It seems this scale should include additional items, so that it may better reflect recent literature related to this subject.

Socioeconomic Status. The standardized beta (β) weights were .013 for PTB and .110 ($p < .05$) for OSS. If SES were to increase by one standard deviation from its mean, PTB would increase by .013 and OSS would increase by .110. SES correlations were small ($r = -.03$ for PTB; $r = .14^{**}$ for OSS) (Cohen, 1988). Socioeconomic Status is self-reported and asked, "Which of the following best describes your social class when you were growing up?" Responses were: 1) Low-income or poor; 2) Working-class; 3) Middle-class; 4) Upper-middle or professional-middle; or 5) Wealthy.

Cost of college is a key factor for students. Trends based on three decades of data from national samples of entering college freshman show a steady increase in the representation of high-income students, a steady decrease in middle-income students, and little change in the representation of low-income students. Unfortunately, this has contributed to a further stratification of higher education in the U.S. over the past 30 years, especially at the most selective institutions (Astin & Oseguera, 2004).

Year in school. Year in school bordered on statistical significance ($p = .058$) and was also included in the final model. The standardized beta (β) weights were .041 for PTB and -.090 for OSS. If year in school increases by one standard deviation from its mean, PTB would increase by .041 and OSS would decrease by -.090. This more clearly shows the connection how satisfaction declines as year in school increases. Year in school correlations were small ($r = .02$ for PTB; $r = -.12$* for OSS) (Cohen, 1988).

The undergraduate experience entails students investing time, energy, and money in their college education (Astin, 1993). Satisfaction can be related to factors such as on/off-campus life, faculty, students' major, value of education, transportation, university services, experiential learning opportunities, safety, advising, career services, sense of community, and food. Upperclassmen may be less satisfied as they are realizing the requirement to pay back student loans, the upcoming job hunt, or uncertainty of their future.

Limitations

There are several limitations of the present research.

Implications for SERU. In general, the nature of the SERU survey is that several questions are part of the core survey and students are randomly assigned additional modules, based on institutional preferences for the areas they wish to focus on. The limitation of this, with regard to the 2013 technology module was that only 10% of students received the technology module, so that the population size was significantly reduced. It would be beneficial to have a higher percentage of students receive the technology module for future research purposes.

How the SERU modules' nature of the set of Technology questions affected students' mindsets in responding to questions is not known. Most of the commonly used undergraduate surveys, such as the Cooperative Institutional Research Program (CIRP) or NSSE, are designed so that all students are expected to answer all questions. The combination of the length of the SERU survey coupled with the inclusion of several multipart questions may have negatively impacted survey response rates.

The SERU survey focused exclusively on undergraduate education through 2013. In 2014, the first graduate surveys were launched. Unfortunately, the Technology module was not included as part of the 2014, 2015, or 2016 SERU surveys. Technology is an important aspect of higher education that would benefit future educational research. It would also be beneficial to include students' responses from the other four system campuses in order to get a better perspective of these subcultures. University life at smaller system campuses can be drastically different than that of the larger "central" campus and resources may be more limited. SERU results could be useful for tailoring support offerings for the smaller campus environments, especially in situations where technological support program offerings can be linked or extended.

Survey content. Additionally, in hindsight, the researcher may have benefited from additional items in the original dataset request, including race/ethnicity and transfer student information. The large percentage of missing data with regard to ACT was an indication that there was a high percentage of transfer students who received the SERU Technology module in this sample. However, based on the research institution's official enrollment statistics for 2013, students of color comprised 15.5 % of the total population (UMN, 2014b). Based on the random nature of the SERU survey and the chance that students of color would have responded to the technology questions would potentially have resulted in subgroups too small to do the preferred analysis.

External validity of the findings could be improved by replicating such an analysis across multiple universities and over time. It would be interesting to see if students' preference for hybrid and online courses has increased, as is indicative of recent survey results. Sampling larger populations would also allow a better comparison between colleges, especially those that are technologically focused, such as Nursing. This study focused on undergraduate students from a large Midwest public university. The results may not be generalizable to other types of institutions, such as private institutions.

Another limitation of this study is statistically significant findings, but with low effect sizes. This may be in part due to the population of students being relatively homogenous in terms of technology opinions, education, and life experiences. As a result, there is little variance that can be detected by the regression and path analysis. Another possibility is that the variables are not as predictive as they might be had other questions involving particular skills, experiences, or abilities were asked. It is also possible that because the variables are being examined at a micro level, with the randomized sample at the institution studied, no one variable can have great impact.

Implications for Educational Technology Policy and Research

There are numerous areas in which this study informs educational technology policy and research. With the cost of many technologies decreasing (Allen et al., 2016), colleges and universities are able to acquire and launch effective IT programs and better serve their populations. This requires collaboration and communication between faculty, staff, and students to determine which methods may be the best for individual circumstances. Care must be given to those with accessibility needs and to provide standardized service whenever possible.

It is critical for higher education institutions to provide multiple avenues of academic technological support for students and faculty (Gillard & Bailey, 2007). This is evident by the number one predictor, Instructor Technology Ability, impacting the results of this study. Assisting faculty to effectively use technology involves training and support, instructional design, and an environment conducive to trial and error. Overall, it takes significant effort to increase an average by a standard deviation, so investment should be placed in areas where it would have the biggest impact. Thoughtfully designed programs targeted to impact faculty and student technology training can reap large rewards.

It is critical for faculty to have adequate technical skills in the classroom and to be confident in using the right kinds of technology to best exemplify their preferred teaching practices (Brooks, 2015). Reducing technological obstacles or barriers will also contribute to overall satisfaction. Fortunately, many technology obstacles can be overcome with training, practice, and development, but these require thoughtful planning, implementation, and oversight (Gillard & Bailey, 2007).

Creating engaging and personalized user experiences (NMC, 2016) are key elements for student success. Flipped classrooms and other active learning techniques can benefit from the use of technology. Offering hybrid/blended or online courses offers students and faculty greater flexibility and availability, besides convenience and cost savings. It is imperative for higher education institutions to weigh these considerations in their strategic planning, especially for digital strategies (Stokes, 2015).

Future Research

Future educational technology research would benefit from several areas stemming from this study. These research opportunities include 1) impressions and opinions of the learning management system (LMS), 2) student preferences for online courses, MOOCs, and hybrid or blended learning courses 3) graduate students' perceptions of technology, and 4) student preferences related to technology ownership and usage, including mobile technology aspects.

The importance of studying students' feelings and behavior surrounding their campus learning management system is a critical technology element that had to be disregarded in this particular study due to unforeseen consequences. It would have been especially interesting to compare seniors with freshmen, as the senior participants in this study would have experienced a conversion between Blackboard's WebVista LMS and Moodle, while the freshman would only have been exposed to Moodle. Student input is key to decisions surrounding core instructional tools. At the campus studied, it is estimated that nearly 75% of University courses utilize a Moodle site (C. Campbell, personal communication, April, 2, 2014).

As there has been tremendous growth in MOOCs, this is another important consideration for future research. MOOCs have become a form of outreach for many prominent universities, with 11.3% of institutions now offering them (Allen et al., 2016). According to Allen and Seaman (2015), the primary objectives for offering MOOCs are, "to increase institution visibility, drive student recruitment, innovate pedagogy, and offer flexible learning opportunities" (p. 34). MOOCs have global impact, allowing institutions to reach new students. While critics site low overall completion rates, an Educause study found that certification rates typically range from 2-10% (Reich, 2014). Additional research is needed for this growing and unique approach to further higher education, but monetizing these is an issue.

It is also important to capture the perceptions of graduate students with regard to educational technology. At the campus being studied, a SERU graduate student edition was launched in 2014. These results did not include a separate technology component, but this would be recommended for future research. It would be interesting to survey undergraduates, as well as graduate students, about their preference for online v. hybrid

v. face-to-face courses, especially with the rise in the number of students taking online courses (Allen et al., 2016).

Another area of research for understanding today's college students' technology portfolio is better information on their technology ownership and usage. The 2014 ECAR study stated 57% of students wish to access the LMS from a mobile device (ECAR, 2014). This is one type of information that was asked in the 2013 survey, but the formatting of the question may have negatively impacted the response rate. Reforming this question using a mobile-friendly question format should improve results. While this question initially explored students' use and ownership of computer devices, these areas were not found to significantly impact Perceived Technology Benefits or Overall Student Satisfaction. A 2015 Pearson survey examined current ownership and usage of mobile devices, which devices students felt they learned best from, and their attitudes toward mobile devices for learning. Follow up studies by ECAR show faculty and students own three or more devices: laptops, tablets, and smartphones (ECAR, 2015).

Conclusion

This study shows the potential variables that can have a clear impact on Perceived Technology Benefits and Overall Student Satisfaction. The first research question asked, "What are the relationships between the technology experience variables from the 2013 SERU survey with regard to Perceived Technology Benefits and, in turn, Overall Student Satisfaction?"

Overall path analysis results indicate the R^2 for the first endogenous (dependent) variable, Perceived Technology Benefits, is 25.5%, indicating the model explains 26% of the total variability. This depicts a statistically significant model with a small to medium effect size. The four primary factors which entered into the path analysis model were: a) Instructor's Technology Ability; b) Social Networking; c) Online Course Preference, a strong preference for face-to-face classes; and d) Proficiency Social Dimensions. The two strongest predictors were related to the environment while the other two were input variables (Astin, 1993). The remaining factors significantly correlated with Perceived Technology Benefits included Instructor Technology Usage, Engagement with Faculty, and Course Specific Behaviors.

The results of the regression to predict the second endogenous (dependent) variable, Overall Student Satisfaction, indicated a combination of variables explained 32.9% of the variance, depicting a statistically significant model with a medium effect size. Overall Student Satisfaction was significantly correlated with all 13 predictors with nine entering into the path analysis model: a) Instructor's Technology Ability; b) Technology Obstacles; c) Course Specific Behaviors; d) Instructor Technology Usage; e) Engagement with Faculty; f) Socioeconomic Status; g) Proficiency Social Dimensions; and h) Online Course Preference. Year in School bordered on significance and was also included in the final model. This resulted in five input variables and four environmental impacting Overall Student Satisfaction (Astin, 1993).

In both regression models, Instructor's Technology Ability was the predominant variable in predicting Perceived Technology Benefits and in Overall Student Satisfaction. This helps justify the need for effective IT user support and training for faculty, as indicated by the 2014 Campus Computing survey (Green, 2015). This is also key to implementing successful blended learning designs and shifting to deeper learner approaches, as indicated by the publications such as the 2016 *Horizon Report* and ECAR studies (Brooks, 2015).

The second research question asked, "Does college of enrollment affect Perceived Technology Benefits and moderate the effects of the technology experience on Overall Student Satisfaction?" The college of business had the highest numerical mean for both Perceived Technology Benefits ($M = 27.9$) and Overall Student Satisfaction ($M = 90.2$). Education was tied for Perceived Technology Benefits ($M = 27.9$). The college of Health (consisting of Biological Sciences, Nursing, Medicine and Allied Health respondents) had the second highest numerical mean for Overall Student Satisfaction ($M = 86.7$). College was found to have a significant impact on Perceived Technology Benefits at the $p < .05$ level, but was not found to be significant for Overall Student Satisfaction.

College administrators and IT leaders can assume a leadership role by collaborating with fellow institutions through groups such as Educause, the Online Learning Consortium, Unizin Consortium, and the Committee on Institutional Cooperation. These groups share expertise, create opportunities for students and faculty, collaborate on innovative programs, provide networking opportunities, and leverage campus resources. Collaboration with member institutions allows colleges and universities to work together to overcome challenges and enhance the greater good.

Increased emphasis and ongoing research related to technology usage, student and faculty technology satisfaction, implementation, oversight, and administration are needed in order to properly guide U.S. postsecondary campus IT investment. It is vital that college administrators and IT leaders develop digital strategies (Stokes, 2015) to help shape campus mission and institutional priorities. These policies should ensure accessibility of resources, reduction of technology obstacles, and educational technology support for students and faculty. Further research into educational technology and alignment with expert industry publications, such as the *Horizon Report*, will help colleges and universities continue to make effective funding decisions and help them remain competitive in the marketplace.

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Appendix A

Participating SERU Universities, 2013

Rutgers University
University of California
University of Florida
University of Michigan at Ann Arbor
University of Minnesota
University of Oregon
University of Pittsburgh
University of Texas at Austin
University of Southern California
University of North Carolina
University of Virginia
Texas A&M University
University of Iowa
Purdue University
University of Washington