An Investigation of University Students' Ownership, Usage, and Skill with Technology: Key Factors for Course Design

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Abstract

Students at a regional campus of a Midwestern university were surveyed using an online questionnaire to determine their ownership, skill, and use of technological devices. Four hundred ninety-three students responded to the survey. It was found that the survey sample mirrored the student population at the university. Students owned and used a wide variety of electronic devices. Eighty five percent of the students owned laptop computers, 62% digital phones, 60% desktop computers, and 52% gaming systems. Students used electronic devices an average of 6.03 hours per week on classroom activities and 3.93 hours per week surfing the Internet for pleasure. They perceived themselves as being very skilled at using email, surfing the web, and word processing. It was also found that there was a significant correlation between students' ownership of and skill with educational technology and their experience with Blackboard. Technological barriers were found to have a negative impact on students' experience with Blackboard. Those barriers also negatively impacted their technological use and skill. A simple linear regression model explains that students' experience with Blackboard is enhanced by having greater skill with technology, but is diminished when confronted with technological barriers. Implications for course design are discussed.

Keywords: *Educational Technology; Post-Secondary Education; Student Experience with Technology; Barriers to Use Technology; Course Design*

Introduction

Technology is changing the way we live and work, and it cuts across industries, helps establish competitive advantage, and facilitates efficient personal and organizational action. In this article, instructional technology or innovation is defined as the new tools adopted by faculty for teaching to foster learning in or outside the classroom (Baia, 2008). This definition builds on Sahin's (2005) research that focused on faculty adoption and Luppicini's (2005) study involving a systems view of educational technology in society. According to that view, technology is defined as "the organization of knowledge for the achievement of practical purposes, as well as any tool or technique of doing or making" (Luppicini, 2005, p. 104).

Universities are being challenged to change as technological innovation alters the way students and faculty members think about information and knowledge. These challenges are becoming increasingly evident as new generations of students enter universities with different needs and

expectations, and as the demand for online and hybrid course offerings increases. While new technologies and innovation continue to develop, faculty readiness and expertise become increasingly important to an institution maintaining its competitive edge.

In 2006, Mishra and Koehler developed an innovative way of viewing instructional technology and its use in the learning process. Known as the Technological Pedagogical Content Knowledge (TPCK) theory, it highlights instructors' need to know about teaching in the information age to achieve excellence in the quality of educational delivery and a competitive advantage. Although it was developed with a focus on the K-12 educational environment, the theory can also inform practices in higher education.

According to TPCK, technology, content, and pedagogy should be viewed not in isolation, but rather, as a unity. Doing so compromises good teaching and the successful implementation of technological innovation. Further, it suggests that faculty development experiences should be redesigned so that technology, pedagogy, and content are seen as interconnected (Mishra and Koehler, 2006). If any component in this triumvirate of knowledge is changed, the others should move along with it. Mishra and Koehler clearly state that "viewing any of these components in isolation from the others represents a real disservice to good teaching" (2006, p. 1030).

This study examines students' views about technology and its impact on education. It focuses on ownership, usage, skill, and barriers to technological innovations in higher education. The findings will help inform faculty members about how technology, pedagogy, and content can be addressed to more effectively reach learners in the university environment. The findings will also assist offices of instructional technology to create development programs that enable faculty to enhance the quality of their teaching.

Organizationally, this article is divided into four sections. The first includes a review of the literature and a statement of the seven hypotheses. The second presents the methodology used to conduct the survey of students. The third presents the results of the data analyses. The fourth discusses the findings and implications of the study.

Review of the Literature and Statement of Hypotheses

The use of educational technology has both its supporters as well as critics. Studies conducted by the Alberta Initiative for School Improvement indicate that project-based approaches and inquiry, coupled with a focus on curricular issues, support the incorporation of educational technology into the process of teaching and learning (Clifford, Friesen, & Lock, 2004). A number of technologies are presently used in university classrooms. They include classroom computers, wikis and blogs, class websites, online media such as YouTube, digital games, and mobile devices such as clickers or smart phones. In addition, there are other tools that could be used, depending on funds available for educational technology, including digital cameras, video cameras, interactive whiteboards, document cameras, or LCD projectors (Biocchi, 2011; Levine, 2002; Tremblay, 2010).

While educational technology has benefits when effectively deployed in the classroom, there are drawbacks. Some of them include limited access, lack of faculty training, and lack of having the

extra time needed for the effective implementation of technology. To effectively use the available and newly developing technologies, faculty members must also have some grounding in the theories of human behavior because technology affects student behavior.

According to Namahoe (2011), students believe that technology is critical to success in learning. However, students do not simply want more technology, they want the proper technology used appropriately. Because of their ownership and usage of technological devices, many students are more confident and more fluent with the dominant current technologies than the adults charged to teach them. This is in part due to the fact that today's young adults never knew anything other than the digital world. As cited in Clifford, Friesen, and Lock (2004), Prensky (2003) notes that "there are important, never-before seen differences between the generation that grew up with digital technologies (Digital Natives) and the generation that grew up before these technologies….The new abilities, skills, and preferences of the Digital Natives are to a large extent misunderstood and ignored by the previous generation of educators" (p. 9).

Based on these ideas about the ownership and use of technology by students, the following hypotheses were proposed:

H1: Increased *ownership* of educational technology is positively related to students' experience with a course management system.

H2: Increased *use* of educational technology is positively related to their experience with a course management system.

H3: Increased students' *skill* with educational technology is positively related to their experience with a course management system.

While universities are investing considerable sums of money into computer-related technologies to support and enhance instruction (Massy & Zemsky, 1996), faculty members simply are not using this technology in their courses (Rice & Miller, 2001). A more recent study shows that "students and faculty of all disciplines used their institution's CMS much more frequently than any other specific technology or tool," but academic technologies such "blogs, collaborative editing tools, and games and simulations — are uniformly unused by faculty in all disciplines (Guidry & BrckaLorenz, 2011)." One reason for this disconnect between faculty and student use relates to the obstacles or barriers inhibiting the integration of technology into instruction.

From a faculty perspective, there are five categories of barriers to technology integration: time, expertise, access, resources, and support (Leggett & Persichitte, 1998). Likewise, a recent review of the empirical research related to technology integration identified five core barriers to technology integration: (a) resources, (b) knowledge and skills, (c) institution, (d) attitudes and beliefs, and (e) subject culture[1] (Hew & Brush, 2007). Similar barriers are identified by Rogers (2000), who developed a model for visualizing the relationships among the barriers. According to

[1] Subject culture is defined as the "general set of institutionalized practices and expectations which have grown up around a particular school subject" (Goodson & Mangan, 1995, as cited in Hew & Brush, 2007, p. 231).

Rogers (2000), stakeholder perceptions and attitudes toward technology, institutional support, and its use in education determine what is considered. Once the technological possibilities are determined, three external barriers affect implementation: availability and access, stakeholder development, and technical support. Funding and time impact these three external barriers.

Because of the importance of technology in society and to the future of education, identifying the barriers and obstacles to its integration in universities is an important step in improving the quality of teaching and learning. According to Bingimlas (2009), studying technological barriers is crucial because this knowledge could provide "guidance for ways to enhance technology integration" (as cited in Schoepp, 2005, p. 2). It would also encourage greater use of technology in the classroom. Al-Alwani (2005) argues that by identifying fundamental obstacles to technology implementation, educators can overcome the barriers and become successful technology adopters. Most of the research dealing with barriers to classroom technology has focused on instructors. Little has been published that examines the barriers to technology use by students. The current study aims to investigate the barriers perceived by students to using computers or educational technology in their class work. As such, we propose the following hypotheses:

H4: Students' perceptions of the presence of technological barriers are negatively related to students' experience with a course management system.

H5: Students' perceptions of the presence of technological barriers are negatively related to students' *usage* of electronic devices.

H6: Students' perceptions of the presence of technological barriers are negatively related to students' *skill* in using electronic devices.

Combining the ideas related to technological barriers with ownership, usage, and skill with technology, we propose the following hypothesis:

H7: Students' experience with a course management system is associated with the technological barriers they face and with their ownership of technology, its usage, and their skill in using it.

In brief, the purpose of this article is to summarize the results and discuss potential implications associated with an online survey of university students related to their personal ownership of technological devices. The survey also examined the extent to which students used various forms of technology and their level of skill in using it.

The impetus for conducting this study was to assist the university's Office of Instructional Technology in planning instructional design programs for faculty. It was meant to supplement the knowledge about students' technology preferences and skills so that faculty across the campus could more effectively train for, use, and implement technologies to supplement Blackboard, the university's course management system. To some extent, the study established a baseline to benchmark students' use of technology and to examine the relationship between such usage and demographic as well as attitudinal variables.

Methodology

Respondents

Students enrolled during the fall 2010 semester at a regional campus of a Midwestern land grant university constituted the survey sample. The respondents were contacted by means of an email message sent to all students enrolled at the university. They were also contacted by means of an announcement, posted to the university's course management system, asking them to complete a survey questionnaire. Respondents were also contacted and asked to participate in a survey by representatives of the Office of Instructional Technology who staffed an exhibit at a campus-wide university event. A total of 493 participants attended the study; characteristics of the participants are presented in Table 1.

Questionnaire

The questionnaire contained 22 closed-ended items related to the respondents' ownership, usage, and skill associated with various educational technologies. It also contained demographic and attitudinal items. Lastly, the questionnaire contained items related to technological benefits and barriers. Two of the 22 items were open-ended, which allowed the respondents to fill in their responses. Many items on the questionnaire were based on items included on the Study of Undergraduate Students and Information Technology conducted by the Educause Center for Applied Research (ECAR) (ECAR, 2004).

Procedure

The questionnaire was administered electronically, though some respondents completed a paper-based printout of the survey when their participation was solicited at a campus-wide student event.

Students who were recruited to complete the online questionnaire were contacted by one or more of the methods described below. An email message was sent to the respondents asking them to voluntarily complete an online questionnaire related to their use of educational technology. Two follow-up email messages were sent at weekly intervals to increase the response rate. Respondents were also alerted to the ongoing research study by means of an announcement posted in Blackboard, the university's course management system. The announcement contained a link to the online questionnaire, which students were asked to voluntarily complete. Students attending a campus-wide student event were also given a flyer with a link to the online questionnaire and were asked to complete it at their convenience.

Students attending the campus-wide student event were also invited to complete a paper-based version of the questionnaire at that time. Responses recorded on paper were later entered into the online questionnaire tool.

In all cases, respondents completed the questionnaire anonymously, which took approximately 5-10 minutes of time.

Findings

Characteristics of the Respondents

There were a total of 491 respondents, of which 470 designated their gender. This represented a 5% response rate of the 9,807 undergraduate and graduate students invited to participate in this study. One hundred seventy three males (37%) and 297 females (63%) participated in the study. Their ages are described in Table 1.

Table 1. Distribution of Respondents by Age

Age Category	*n*	*%*	*Cumulative %*
18 – 22 years old	201	42	41
23 – 30 years old	112	24	66
31 – 40 years old	67	14	80
40 – 49 years old	57	12	92
50 – 59 years old	28	6	98
60 – 69 years old	5	1	99
Declined to answer	2	1	100
Missing Data	21		

Note: Total number of respondents to this question was 472.

In response to the question on student status, 350 respondents (75%) indicated that they were full time and 118 (25%) indicated that they were part time students. With respect to classification, the data are summarized in Table 2.

Table 2. Distribution of Respondents by Student Classification

Student Classification	*n*	*%*	*Cumulative %*
Freshman	68	14	14
Sophomore	85	18	32
Junior	98	21	53
Senior	141	30	83
Graduate student	67	14	97
Other	10	2	99

Note: Total number of respondents to this question was 469.

Educational Technology Ownership, Usage, and Skill

Ownership

The survey respondents indicated that they owned a variety of electronic devices. The data in Table 3 are organized in descending order of ownership.

Table 3. Distribution of Respondents' Ownership of Electronic Devices

Electronic Device Owned	*n*	*%*
Personal laptop computer	410	85
Cell or digital phone	300	62
Personal desktop computer	289	60
Gaming system	249	52
MP3 player	204	42
Smart phone	192	40
MP4 player	138	29
Handheld gaming system	127	26
E-book reader	36	7
iPad	21	4

Note: There were 481 respondents to this question which allowed multiple responses. As such, the column total exceeds 481.

In response to the question on type of service for mobile (cell) telephones, there were 466 responses. Of these, there were 416 respondents (89.5%) who had either limited or unlimited text plans with 337 respondents (72.3%) having plans that included limited or unlimited data capabilities.

Usage

Table 4 summarizes the results associated with the mean number of hours per week the respondents spent on various activities using any of their electronic devices. The data are organized with the number of hours shown in descending order.

Table 4. Hours Spent on Various Activities Using Electronic Devices

Type of Activities	*M*	*n*	*SD*
Studying and classroom activities	6.03	484	3.50
Surfing the Internet for pleasure	3.93	482	3.41
Social networking media	3.24	480	3.22
Texting	3.15	476	3.39
Downloading or listening to music or videos	2.75	477	3.00
Playing games	1.79	473	2.40
Online shopping	1.30	469	1.64

The data indicate that students used their electronic devices most (6.03 hours per week) for studying and classroom activities. Students' second and third highest usage of electronic devices was for Internet surfing (3.93 hours per week) and for engaging in social networking media (3.24 hours per week).

In response to the question on the number of hours spent weekly on activities using their computers or hand-held devices, it was found that students spent most of their time (3.7 hours) engaged in word processing. They spent 3.6 hours per week engaged in activities on the university's course management system (Blackboard) and 3.3 hours per week engaged in social networking media. Students spent 3.0 hours per week reading and sending email or text messages.

Skill

Table 5 summarizes the data associated with students' skill in using various computer applications. The respondents indicated their level of skill using a four-point Likert scale, where 1 corresponded to very unskilled, 2 corresponded to unskilled, 3 corresponded to skilled, and 4 corresponded to very skilled. The data are organized with the mean skill level scores shown in descending order.

Table 5. Students' Skill with Various Computer Applications

Type of Computer Applications	*M*	*n*	*SD*
Email	3.58	487	0.63
Web surfing	3.52	486	0.68
Word processing	3.43	481	0.71
Instant messenger and chat	3.35	485	0.81
Viewing videos (YouTube)	3.23	475	0.86
Course management systems (Blackboard)	3.11	477	0.85
Social networking media (Facebook, MySpace)	3.09	475	0.98
Presentation software	3.07	482	0.80
Spreadsheets	2.92	483	0.88
Graphics	2.21	477	0.91
Creating and editing video or audio	1.93	474	0.86
Creating web pages	1.92	473	0.94

The data indicate that students perceive that they are skilled or very skilled in a number of computer applications, including email, web surfing, word processing, instant messaging, video viewing, use of Blackboard, social networking, and use of presentation software. There is a precipitous drop in students' perceived skill level to the unskilled and very unskilled categories for graphics, creation of video or audio, and creation of web pages.

Barriers to Technology Use

Table 6 summarizes the students' responses in relation to barriers preventing them from using a computer or information technology in their class work. The data are organized in descending order of frequency reported.

Table 6. Barriers to Using Computers or Information Technology in Class Work

Barrier	*n*	*%*
No barriers	217	47
Feels like extra work with little connection to the course	103	23
Applications don't run on computer	53	12
Lack access to a printer	51	11
Too many browser variations to troubleshoot	40	9
Lack of technical support	38	8
Too expensive	34	7
Lack reliable Internet access	25	5
Lack sufficient access to computer	21	5
Lack necessary skills	21	5

Note: There were 457 respondents to this question which allowed multiple responses. As such, the column total exceeds 481.

The data indicate that nearly half of the respondents did not feel that there were any barriers preventing them from using a computer or information technology in their coursework. Of those who did identify at least one barrier, the most frequently reported barrier (reported by 23% of respondents) was that the use of technology felt like extra work and had little connection to the course. Sixty-four students (14% of the respondents) also identified additional barriers beyond those that were listed. Among the additional barriers reported were a lack of faculty skill in using technology, inappropriate use of technology by faculty, unreliable applications, threat of exposure to viruses, and a belief that subject/course need human interaction.

Tests of Hypotheses

Hypotheses 1-3

Table 7 summarizes the data associated with the test of hypotheses 1-3. These hypotheses tested the relationship between students' experience with a course management system and their ownership, usage, and skill with educational technology. Experience with a course management system was measured on a five-point Likert scale where 1 corresponded to very negative, 2

corresponded to negative, 3 corresponded to neutral, 4 corresponded to positive, and 5 corresponded to a very positive experience. The table shows the Pearson correlation coefficients and two-tailed tests of significance associated with these variables.

Table 7. Correlation between Experience with Course Management System and Technology Ownership, Usage, and Skill

Variables	Pearson r Coefficients and Significance			
	Exper. CMS	Tech owner	Tech usage	Tech skill
Experience with CMS	1			
Technology ownership	.100*	1		
Technology usage	.066	.340**	1	
Technological skill	.206**	.257**	.355**	1

** p < .01 (two-tailed test)
* p < .05 (two-tailed test)

The data indicate that there is a small, but significant correlation (r = .100, p < .05) between students' ownership of educational technology and their experience with a course management system. These data support Hypothesis 1.

The data also indicate that there is a non-significant correlation (r = .066) between students' usage of educational technology and their experience with a course management system. As such, the data fail to support Hypothesis 2.

Lastly, the data indicate that there is a significant correlation (r = .206, p < .01) between students' skill with educational technology and their experience with a course management system. These data support Hypothesis 3.

Interestingly, there are statistically significant correlations between technology ownership and technology usage (r = .340, p < .01) as well as technological skill (r = .257, p < .01). There is also a significant correlation between technology usage and technological skill (r = .355, p < .01).

Hypothesis 4

The data indicate that there is a statistically significant correlation (r = -.420, p < .01) between the number of technological barriers and students' experience with a course management system. Experience with a course management system was measured using a five-point Likert scale as described above. The technological barriers variable was measured by counting the number of barriers students reported as impeding their use of computers or information technology in their class work. The fairly strong negative correlation indicates that as the number of technological barriers increases, students' experience with a course management system such as Blackboard becomes negative. In other words, technological barriers impede performance in Blackboard.

Hypotheses 5-6

Table 8 summarizes the data associated with the test of hypotheses 5-6. These hypotheses tested the relationship between the presence of technological barriers and students' skill in using technological devices and their usage of such devices. The table shows the Pearson correlation coefficients and two-tailed tests of significance associated with these variables.

Table 8. Correlation between Technological Barriers and Students' Ownership, Usage, and Skill with Technology

Variables	Pearson r Coefficients and Significance			
	Tech Barriers	Tech owner	Tech usage	Tech skill
Technological barriers	1			
Technology ownership	-.054	1		
Technology usage	-.104*	.340**	1	
Technological skill	-.157**	.257**	.355**	1

** $p < .01$ (two-tailed test)

* $p < .05$ (two-tailed test)

The data indicate that there is a statistically significant correlation ($r = -.104$, $p < .05$) between the number of technological barriers and students' usage of technological devices. The negative sign preceding the correlation coefficient indicates that as the number of barriers increases, students' usage of technological devices decreases. These data support Hypothesis 5.

The data also indicate that there is a statistically significant correlation ($r = -.157$, $p < .01$) between the number of technological barriers and students' skill in using technological devices. The negative sign indicates that as the number of barriers increases, students' perceived skill in using technological devices decreases. These data support Hypothesis 6.

Hypothesis 7

Hypothesis 7 stated that students' experience with a course management system is associated with the technological barriers they face and their ownership, usage, and skill with educational technology. Students' perceived overall experience in using a course management system such as Blackboard served as the dependent variable in a simple linear regression analysis. Four independent variables – technological barriers, technology ownership, technology usage, and skill with using educational technology – were included in the regression model. The hypothesis was partially supported. The findings of the regression model are summarized in Table 9.

Table 9. Simple Linear Regression Model of the Effect of Technological Barriers and Skill on Students' Experience with a Course Management System

Predictor Variables	*B*	*t*	*p*
Constant	3.414	13.4	.000
Technological barriers	-.289	-9.2	.000
Technology skills	.018	2.6	.009

Note. R^2 = .20 for overall model; F = 27.59 at $p < .001$

The results of the regression analysis indicate that 20% of the variance in students' overall experience with Blackboard is explained by two factors: technological barriers associated with using computers or information technology in class work and the perception of their technology skills. The regression model explains that students' experience with a course management system such as Blackboard is attributable to the technological barriers that confront them and their skill in using technology. Their experience is enhanced by having greater skill with technology; but it is diminished when confronted with technological barriers which includes factors such as not seeing a connection to the course, not having access to a computer, or not having the necessary technical support, to name a few.

Results

This study examined the technologies owned and used by students for educational purposes. It also examined how technological skills and barriers affect students' overall experience in a course management system. The data summarized in Tables 1 and 2 indicate that the survey respondents were a representative sample of the university on the basis of age, classification, gender, and part-time versus full-time status.

It was found that more than half of the respondents owned a number of electronic devices including laptop computers, cell/digital phones, desktop computers, and gaming systems such as an X-Box or Wii. They used their electronic devices extensively for classroom activities (6.03 hours per week), surfing the Internet for pleasure (3.93 hours per week), communicating with social networking media (3.24 hours per week), and texting (3.15 hours per week). These figures are the average number of hours reported by the students participating in the study. The students perceived that they were skilled or very skilled in six areas including the use of email, web surfing, word processing, using instant messenger, viewing videos on YouTube, and navigating in their course management system, i.e., Blackboard.

A number of hypotheses were tested. The data showed that there was a statistically significant correlation between students' ownership of and skill with educational technology and their experience with Blackboard. As might be expected, the data indicated that students' ownership of electronic devices also correlated significantly with their technological usage and skill. In other words, students actually used and developed their skill with the devices they owned.

Another hypothesis tested the relationship between technological barriers and students' experience with Blackboard. There was a fairly strong ($r = -.421$, $p < .01$) negative correlation found. When students see obstacles to their use of technology, it impedes their performance. This is consistent with a student who commented that when technology is effectively used, it strongly impacts his (or her) ability to learn, but when it does not work properly, it is a distraction (Namahoe, 2011).

In two other hypothesis tests it was found that technological barriers negatively impacted students' usage of technology devices ($r = -.103$, $p < .05$). It also negatively impacted their skill in using technology devices ($r = -.154$, p ¸.01). The benefit of understanding the barriers to technology as perceived by students is that steps can be taken to minimize their effects. While many students (47%) perceived that there were no barriers to using a computer or information technology in their class work, 23% of the students in the survey felt like the technology created extra work and had no connection to the course. This is significant because it raises a faculty development issue. In other words, if students perceive that there is a disconnect between the technology used and the course content, the use of technology may actually become a distraction to the learning process. However, training programs can be developed to rectify this situation. This reinforces the idea that technology, content, and pedagogy are interconnected, as suggested by Mishra and Koehler's (2006) TPCK model of knowledge.

Lastly, a model was developed to explain students' overall experience with Blackboard. The model explained 18% of the variance in students' experience with two independent variables: technological barriers and skill in using technology. According to the simple linear regression model, students' experience with Blackboard is enhanced by having greater skill with technology, but it is diminished when they are faced with technological barriers. As previously noted, students' most frequently cited barrier to technology in the classroom was its lack of connection to the course content. Clearly, this is a barrier than can be addressed through better course design, and supported by faculty development in cooperation with the office of instructional technology.

Conclusions

The findings of this study generally suggest that faculty need to realize that their students are technologically savvy. They own electronic devices, use them, and have developed considerable skill in their usage. Faculty need to approach their classroom work with an appreciation for the skills their students possess. They need to use the technologies with which students are familiar and adept at using and ones that enhance student learning. It could be that some faculty members lag behind their students in terms of understanding how electronic and educational technology operates. As such, these faculty members should seek university assistance to develop their skills and bolster their confidence. Two instructor-level barriers to the successful integration of technology into the university environment are a lack of instructor confidence and a lack of instructor competence. When faculty members seek development and overcome their technological competence issues, they may develop confidence in using technologies that are helpful in their teaching and personal work. Further, it may minimize the resistance to change that implementation of technological innovation requires.

Enhancing faculty members' technological competence may require a joint effort between their academic department and the office of instructional technology. Programs can be developed to assist faculty with course design, which would have a positive effect on the quality of their teaching and directly impact student learning.

One innovative approach to helping faculty members successfully integrate technology into their courses is to "learn with your students" (Boss, 2008). Boss suggests that instructors can learn about technology in the context of their own classroom, next to their students. Further, she suggests that professional development that is embedded in class work has more efficacy than one-shot workshops. A number of academic institutions have tried a program which includes training for students and on-site professional development for instructors. This shares the vision of the twenty-first century learning with students. It is a way of saying "here are the things we imagine could happen with this technology; what do you think?" (Boss, 2008).

Limitations

Because this study was conducted at a single Midwestern-based university, readers should be cautious about generalizing these findings to other universities or to more global populations. Additional research at other higher education institutions would add to the external generalizability of these findings.

A second limitation of this study stems from the fact that it used a single survey instrument, which can result in a common method bias. Using a survey questionnaire was the only feasible means of efficiently collecting data from a large number of students. Future studies should investigate the use of alternative data collection methods. By using mixed methods,
a study's findings are strengthened and the threats of mono-method bias found in organizational behavior research can be minimized (Donaldson and Grant-Vallone, 2002).

A third limitation of this study is that it relied on self-report measures. Even though the student-respondents completed their questionnaires anonymously, self-report has the potential of creating a social-desirability bias. This manifests itself when subjects in a study respond in a way that makes them look as good as possible. They may attempt to answer in a socially desirable way and occasionally under-report behaviors deemed inappropriate by researchers and over-report behaviors viewed as appropriate. While the possibility for this effect exists, the probability that it affected the study's findings is extremely low given that the respondents did not know the research hypotheses or desired responses.

Implications

This study reports findings that may be of value to other institutions in a similar situation – that is, in the process of increasing the integration of appropriate technologies by faculty as identified by their students. Even though the number of participants in this study may be small, it has been logically argued that the sample is fairly representative of the student population at the university

included in this study. Thus, an institution with a similar population may find the information and conclusions gleaned here beneficial. At the very least, because few studies on student perceptions and barriers exist, such research should serve as a catalyst for other investigators to explore this topic more broadly.

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