EDUCAUSE
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**Developing a Context-Specific Measure
of Technological Expertise:
The University of Washington**

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Seeking Evidence of Impact

Snapshot

Institution:	University of Washington, Seattle, a public, doctoral-granting R1 institution serving some 41,500 students
Timetable:	September 2010 to April 2012
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URL:	http://www.washington.edu/lst/research/research_projects/2011techsurveys

At the University of Washington (UW), improving the student experience and helping faculty and teaching assistants (TAs) advance their teaching practices are major goals. In UW Information Technology (UW-IT), the university's central technology unit, we support these goals by identifying and encouraging technology practices that make faculty, teaching assistants, and students more effective educators and scholars. The first step in making informed technology-related decisions to help UW meet these goals is to understand the current levels of technological expertise and patterns of technology used at the UW Seattle campus and to identify the unmet needs of the university community. Campus-wide technology surveys can provide informative insights into these qualities, patterns, and needs.

1. Project Overview

1.1. Project Goals, Context, and Design

To systematically gather data to help inform technology-related decisions, UW conducts campus-wide surveys of instructors and students every three years. The surveys are specific to UW's main campus in Seattle, since our two branch campuses have different technology and support infrastructures. These surveys are a collaborative undertaking. While UW-IT leads this effort, the survey development process incorporates feedback from numerous faculty, staff, and student units/groups across the institution that support teaching and learning with technology. These surveys have been developed to help all units on campus that focus on teaching and learning through technology gather data to help them optimize the technology initiatives and support they offer. One of the main goals in the survey approach is to increase the level of context around data so that efforts can be better tailored to existing needs.

A unique and useful component of UW's technology surveys is our technological proficiency measures. These measures allow users to place themselves on defined scales for *computer skills* (e.g., using macros to speed computing tasks), *digital and media literacy* (e.g., maintaining a wiki), and *technology adoption* relative to peers. The goal of these measures is to better understand the skill levels of the UW population and to enable comparisons between faculty, TAs, and students. The measures also provide a useful lens for looking at other data from the survey—for instance, they enable comparisons of how

beginning and expert populations seek technical support or where they encounter obstacles to using technology. Ultimately, these measures help UW tailor technology and support projects to target the needs of specific populations.

This case study focuses on the 2011 version of the surveys, which represent a culmination of several years of survey development effort. Earlier versions of the surveys, in 2005 and 2008, contain models of some of the measures discussed. The surveys are an evolving effort, updated with new questions to gather more specific data around technology skills and needs, as well as the supports and technologies currently available.

1.2. Data-Collection Methods

The principal instruments were online surveys created in WebQ, a survey tool developed by UW-IT. Samples of surveys for faculty, TAs, and students can be found online at the URL listed in the Snapshot above. The surveys were distributed to faculty and a sampling of undergraduate and graduate students. Prospective participants were recruited via an e-mail that contained a link to the online survey instrument. Three reminder e-mails were sent during the course of recruitment. Given the costs associated with mailing paper surveys and in keeping with UW's focus on environmental awareness, e-mail was the only distribution method. All instructors of record (winter through summer 2010) were recruited; research faculty were also recruited. E-mails were sent to 7,500 undergraduate and graduate students (the sample reflected the proportion of undergraduate and graduate students in the general population). A total of 689 faculty responded to the survey (response rate of 15%) and a total of 800 students (response rate of 11%). The number of respondents and response rates differed slightly from our 2008 survey: faculty, $N =$ 547, response rate of 16%; students $N =$ 656, response rate of 14%.

All participants were asked the same questions about their technological proficiency and technology adoption behavior. The computer skills measure was designed to assess expertise using a computer, such as the ability to use spreadsheets for calculations. The digital and media literacy measure was designed to assess online abilities and activities, such as creating and maintaining a blog. For both measures participants were asked to respond on a five-point scale. We included indicators on three of the five points on the scale that listed specific tasks or activities associated with each level in order to reduce the possibility of self-reporting biases (see Appendix 1, sections a and b).

To assess the helpfulness of different types of technical support, we asked participants to think of times when they needed to learn to do something new with technology to support their teaching or learning. Participants rated a short list of supports, including self (trial and error), colleagues, and family. To assess the severity of different obstacles people commonly encounter with technology, we asked participants the extent to which certain barriers got in the way when using technology to support their teaching or learning. A few items were included in the student survey and not the instructor survey (and vice versa) because of differences in available support (e.g., the faculty survey included "your students" as a possible type of support).

1.3. Data-Analysis Methods

In this case study, we discuss data from two sections of the survey: technological proficiency, and technology supports and obstacles. These items provide a useful example of how the surveys were developed to contextualize the data, in this case by enabling a comparison of how supports and obstacles vary for individuals with different levels of technological proficiency.

Technological Proficiency

Technological proficiency was measured using two survey items. Participants were asked to rate their computer skills and digital and media literacy. Participants were also asked to indicate their level of technological adoption relative to their peers (see Appendix 1, section c).

As mentioned, for the computer skill and the digital and media literacy items, participants were asked to select one of five points on a scale. For both proficiency measures, participants were grouped into three categories in the following manner: Those who selected either 1 or 2, for instance, were classified as "low," those who selected position 3 on the scale were considered "intermediate," and those who selected 4 or 5 were classified as "experts" or "high." We categorized participants in these three groups to facilitate data analysis.

These categories formed the basis for comparison regarding which technical supports were found the most helpful and which obstacles related to technology were the greatest. Specifically, we compared the mean (average) scores for each obstacle and support item across the different levels of proficiency (low, intermediate, high). Looking at three different aspects of proficiency provides a fine-grained view of how proficiency impacts supports and obstacles.[1]

Additionally, we measured the willingness of our participants to adopt a new technology relative to their peers. Using a standard technology-adoption scale, we asked subjects to identify how quickly they typically adopt new technologies. Using the common nomenclature for the "technological adoption lifestyle," participants were classified as a laggard if they selected "I never adopt it," late majority if they selected "after most of my colleagues," early majority if they selected "before most of my colleagues," early adopter if they selected "before most of my colleagues," and innovator if they selected "I'm one of the first to try it." For the adoption scale, we retained the five categories—that is, we did not place subjects into groups in the same manner as the other proficiency measures (e.g., low, intermediate, high).

Technology Supports and Obstacles

In terms of technology supports, that section included 13 items reflecting a wide range of supports that people utilize when trying to learn a new technology or when they encounter a problem with technology, from trial-and-error learning to classroom support services. Participants were asked to rank the helpfulness of each support (if they had used it) on a three-point scale: (1) not helpful, (2) moderately helpful, and (3) very helpful.

The obstacles section included 12 items for faculty and 10 items for students that represented possible barriers to technology use, such as a lack of time to learn a new technology or experiencing poorly functioning classroom technology. Participants were also asked to rank the severity of each potential obstacle on a three-point scale: (1) not an obstacle, (2) minor obstacle, and (3) major obstacle.

1.4. Findings

Generally, those who self-rated a lower proficiency score experienced significantly greater difficulty from obstacles when trying to learn something new with technology compared with those of intermediate or high proficiency (see Appendix 2, tables 2 and 3). Interestingly, we found that the differences between high, intermediate, and low groups were more substantial for the computer skills scale than for the digital and media literacy scale. Furthermore, the different adoption levels did not yield as many statistically significant differences compared with the computer skills scale for obstacles and supports. Not surprisingly, the proficiency measures were highly correlated (see Appendix 2, table 1).

Looking specifically at the computer skills scale, faculty with low expertise were considerably more affected by technical obstacles than expert users; in fact, beginners considered all of the obstacles included in the survey as greater compared with expert users. Whether it was the time needed to learn the technology, incentives to use technology, or knowledge about how to use technology to achieve goals, experts experienced significantly fewer barriers when learning a new technology. For students, seven of the 10 obstacle items were considered to be greater by beginners compared to those of intermediate and advanced expertise, and these differences were statistically significant. Similar to faculty, students of low expertise cited a lack of time to learn technology as the greatest obstacle. Students of lower expertise also experienced greater barriers associated with training on technology required for coursework and a lack of knowledge about where to go to learn a new technology for their education.

The results from 2011 were very similar to those of 2008 in comparing expertise groups for support items. Beginners found different kinds of support more or less helpful compared with those of intermediate or high proficiency (see Appendix 2, table 4). For example, faculty and students with higher expertise found online resources more helpful. Higher-expertise faculty and students also found trial-and-error learning to be more helpful. In contrast, those faculty with lower expertise tended to gravitate more toward local support, such as departmental technical support. For students, those with lower expertise found supports such as friends and family to be helpful forms of support.

1.5. Communication of Results

The survey instruments, data tables, and a comprehensive report of findings can be found online at http://www.washington.edu/lst/research/research_projects/2011techsurveys. We communicated the results in a number of ways. First, we included a link to the survey report in a campus-wide technology newsletter. We also shared the survey findings on campus—in formal presentations, discussion of findings at meetings of stakeholder groups, and participation in a teaching and learning poster session. At these sessions, we discussed how the findings could be used to help individual groups tailor the support they offered, for instance by enhancing support at the point of need, especially for individuals with low expertise. We hosted brown-bag lunches for staff in UW-IT and other technology units to discuss findings, ensuring engagement beyond campus leaders.

1.6. Influence on Campus Practices

The use of proficiency measures to better understand the needs of individuals with different levels of technological expertise has influenced how we approach support for technology projects. Recently, for example, UW-IT embarked on an initiative to improve the student experience by introducing new teaching and learning technologies, including Canvas Learning Management System and Tegrity Lecture Capture. These projects were envisioned from the outset with multiple forms of support to target different user needs—online resources, graduate students hired to offer one-on-one support, and a "train-the-trainer" model that reaches out to departmental technology support staff so that they can offer enhanced local support to faculty, TAs, and students. In addition, the resources aimed at faculty focus on how to meet various teaching goals using technology, rather than focusing only on what tools are available. We have also partnered with the Center for Teaching and Learning to build faculty learning communities around the use of these new technologies to help faculty learn from each other. We are extending this idea to build up systems of support in departments to help a larger number of faculty try something new.

2. Reflection on Design, Methodology, and Effectiveness

2.1. Project Design, Data Collection, and Analysis

Past research indicates the importance of technological expertise when it comes to which technology supports are considered the most helpful and the severity of obstacles encountered.[2] Technological expertise is likely an important hurdle in many other domains of technology as well. But in order to understand the role expertise plays, a researcher must have an accurate, context-specific measure of proficiency. Over the past seven years (which included three campus-wide surveys) we have been developing items that effectively measure technological proficiency in two domains in particular: computer skills and digital and media literacy.

The proficiency measures utilized in the 2011 surveys were developed from an original proficiency measure used in our 2005 surveys. In 2005, we simply asked subjects (as is common in many technology surveys) to rate their expertise on a scale of 1 (novice) to 5 (expert). During survey development and piloting of our triennial surveys in 2008, we discovered that a person's viewpoint on what is considered an "expert" on the proficiency scale (used in 2005) may differ based on several factors. There are numerous methodological concerns with such a method. From the subject's standpoint he or she may ask: What kind of expertise? Are they referring to conducting tasks on my computer? Surfing the web? Programming my DVR? Recognizing these potential problems, on three of the five points on the scale we included a list of tasks that a person should be able to complete. For instance, position 3 on the five-point scale ("intermediate") was defined as "able to format documents using styles or templates, use spreadsheets for custom calculations or charts, and/or use graphics/Web publishing." Providing tasks for each level of the scale eliminates the ambiguity that underlies any general scaling method that lacks indicators for each level.

In the process of developing our 2011 surveys, we noticed that the tasks used to define points on the proficiency scale focused on a particular type of expertise—computer skills, such as formatting documents. While defining points on the scale was clearly advantageous, helping to eliminate reporting biases, we felt we were missing out on other types of skills that might influence the technology obstacles encountered in an educational context. So, in our 2011 surveys we included an additional scale that focused on digital and media literacy, with a list of tasks and behaviors for three of the five points on the scale. We also included a commonly used technology adoption scale.

We have learned through our survey development process that proficiency as it relates to technology is multidimensional. This is particularly interesting when it comes to supports and obstacles. We found that a certain type of expertise—computer skills—impacts what kinds of support are found to be helpful and what kinds of obstacles are encountered compared with other measures of expertise. This finding points to a very important aspect of technology research: that if a researcher wants to truly understand how expertise influences the study population with regard to a research question, it is important that the correct domain of expertise is measured.

We suspect that differences in technological expertise influence a plethora of technology-related issues beyond obstacles and supports. For instance, technology proficiency may impact the types of technology that a professor chooses to utilize in the classroom or the disciplines that students gravitate toward. Better understanding how technology proficiency impacts a researcher's question may require devising a novel scale that better evaluates the issue at hand. One thing we have learned is that technological proficiency is a multifaceted and dynamic trait, and thus may require a scale that is tailored to the specific question a researcher is investigating.

2.2. Effectiveness and Influence on Campus Practices

The main lessons we have learned in working on this survey project over the years is that it takes time to build a culture that incorporates data into technology and support decisions. Bringing in stakeholders from the beginning is also important for influencing how results are used. The 2011 survey built on those that came before—the changes we are seeing on campus are the effect of similar findings emerging over the years and starting to influence practice. Educational technology is an area where it is challenging to know how to target initiatives to reach beyond traditional early adopters to the rest of the community, and so gathering data that show the support needs and areas of challenge for non-early adopters is important. These data allow evidence, rather than anecdote, to influence how technology and support decisions are made.

One of our goals for the future is to streamline the survey process, perhaps by breaking the survey into sections that take less time to develop and analyze. Minimizing the gap between collection and release of data would help us have greater influence on campus practices. We are also continuing to work to tie the survey into the ongoing strategic goals of the IT organization and the university, so that data are directly tied to current needs.

3.   Supporting Materials

Appendix 1: Excerpts from the Student Survey

(a) **Technological expertise**

On a scale of 1 to 5, how would you rate your current technological expertise?

For the purposes of this survey, we're primarily concerned with your computer and web-based skills. We've defined three points on the scale as follows. These tasks represent some of the things a person at each level might do.

Beginner *(characterized as 1 and 2 on scale):* Able to use a mouse and keyboard, create a simple document, send and receive e-mail, and/or access web pages

Intermediate *(characterized as 3 on scale):* Able to format documents using styles or templates, use spreadsheets for custom calculations and charts, and/or use graphics/web publishing

Expert *(characterized as 4 and 5 on scale):* Able to use macros in programs to speed tasks, configure operating system features, create a program using a programming language, and/or develop a database.

Beginner		Intermediate		Expert
(1)	(2)	(3)	(4)	(5)
O	O	O	O	O

(b) **Digital and media literacy**

On a scale of 1 to 5, how would you rate your current digital and media literacy?

For the purposes of this survey, we're primarily concerned with the types of activities you engage in online. We've defined three points on the scale as follows. These activities represent some of the things a person at each level might do.

Consumer *(characterized as 1 and 2 on scale):* Find and read articles and/or blogs online; purchase items online and/or view quality ratings of products or services; find and view videos or photos.

Producer *(characterized as 3 on scale):* Contribute to a blog or forum conversation; search and contribute reviews for products or services; upload and tag photos or video for sharing online.

Activist *(characterized as 4 and 5 on scale):* Create or maintain a website, wiki, blog, or discussion forum for people with shared interests or concerns; produce and edit videos and audio for presentation online; use digital or online means to mobilize efforts in the public interest.

Consumer		Producer		Activist
(1)	(2)	(3)	(4)	(5)
O	O	O	O	O

(c) **Adoption**

When a new technology (hardware, software, or web application) becomes available, how quickly do you tend to adopt it?

- I never adopt it

- After most of my colleagues

- When it becomes mainstream

- Before most of my colleagues

- I'm one of the first to try it

Appendix 2: Findings

All proficiency measures were highly correlated (p<.001). Computer expertise and technological adoption had the highest bivariate correlation coefficient (Pearson's r = .423; N = 1,787; p<.001) followed by computer expertise and digital and media literacy (Pearson's r = .400; N = 1,793; p<.001).

Table 1. Correlation of Proficiency Measures

Measure		Correlation		
		Computer Skills	**Digital and Media Literacy**	**Technological Adoption**
Technological Expertise	Pearson Sig. N	1 1801		
Digital and Media Literacy	Pearson Sig. N	.400* <.001 1793	1 1799	
Technological Adoption	Pearson Sig. N	.423* <.001 1787	.384* <.001 1786	1 1793

Table 2. Obstacles by Computer Skills, Faculty

Obstacle, Faculty	Computer Skills						
	Beginner		Intermediate		Advanced		p-value
	Mean	SD	Mean	SD	Mean	SD	
Lack of knowledge about teaching technologies available for use at the UW	2.10	.64	1.94	.68	1.66	.64	.000
Lack of knowledge about where to go to learn the technology	2.04	.67	1.83	.70	1.55	.64	.000
Lack of time to learn how to use the technology	2.67	.60	2.51	.64	2.30	.77	.000
Lack of knowledge about how to use the technology to achieve my goals	2.44	.67	2.12	.69	1.68	.68	.000
Lack of time to maintain or monitor technology once implemented	2.37	.77	2.16	.74	1.99	.75	.000
Lack of timely technical support	2.00	.78	1.83	.74	1.70	.73	.004
Lack of personal motivation	1.85	.74	1.48	.60	1.44	.61	.000
Concern about a technical problem affecting my teaching	1.91	.80	1.58	.70	1.44	.68	.000
Poorly functioning or inadequate technology in my teaching environment	2.08	.85	1.91	.81	1.79	.81	.014
Lack of incentives to use technology in teaching	1.77	.71	1.56	.71	1.53	.72	.010

Table 3. Obstacles by Technological Expertise, Students

Obstacle, Students	Computer Skills						
	Beginner		Intermediate		Advanced		p-value
	Mean	SD	Mean	SD	Mean	SD	
Lack of adequate training on technology required for coursework	1.84	.72	1.63	.63	1.49	.60	.000
Lack of knowledge about where to go to learn the technology	1.82	.69	1.56	.64	1.43	.62	.000
Lack of time to learn how to use the technology	1.88	.76	1.86	.77	1.71	.76	.024
Lack of personal motivation	1.69	.72	1.59	.65	1.47	.64	.004
Concern about a technical problem affecting my grade	1.70	.76	1.57	.68	1.48	.67	.015
Lack of ability to access software or equipment when I need it	1.54	.69	1.53	.66	1.42	.66	.033
Lack of ability to access online tools for class from my home or dorm	1.56	.72	1.50	.67	1.35	.58	.005

Table 4: Support by Computer Skills, Faculty, and Students

Role	Support	Computer Skills						p-value
		Beginner		Intermediate		Advanced		
		Mean	SD	Mean	SD	Mean	SD	
Faculty	Self (trial and error)	1.87	.58	2.20	.53	2.65	.50	.000
	UW online help or tutorial	1.75	.58	1.96	.59	1.90	.54	.041
	Non-UW online help or tutorial	1.73	.56	1.93	.57	2.07	.48	.001
Student	Self (trial and error)	2.20	.66	2.31	.57	2.62	.50	.000
	Non-UW online help or tutorial	2.15	.66	2.03	.58	2.20	.57	.005
	Friends	2.47	.58	2.33	.56	2.30	.64	.046
	Family	2.00	.76	1.92	.72	1.70	.72	.004

Notes

1. Relationships between proficiency level and supports score and (separately) obstacle score were analyzed using the Kruskal-Wallis non-parametric statistical test. All statistical tests were conducted using SPSS 19.0 with the p-value set at 0.05. Correlations between the three proficiency measures were analyzed using Pearson's *r*.

2. C. A. Lane and H. F. Lyle III, "Barriers and Supports Related to the Use of Educational Technologies: The Role of Technological Expertise, Gender, and Age," *Journal of Computing in Higher Education* 23, no. 1 (2011):38–59.