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One to One Computing in Higher Education: A Survey of Technology Practices and Needs

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The purpose of this article is to examine the computing needs and practices of students at Arizona State University as a means of assisting the university in the decision to implement a one to one (l:1) computing model, in which every student is equipped with a laptop. A web-based survey was solicited to students by way of targeted e-mail messages. Results indicated that 81% of students consider a laptop to be very important to their success in college. However, only 60% of students reported that they would be willing to purchase a laptop if their program required it, with financial aid as the most preferred purchasing option. Students desired more technology in the classroom as well as on campus to enhance their educational experience.

The objective of this survey study is to collect information relevant to the readiness of implementing 1:1 computing to provide decision-making support while Arizona State University (ASU) is redesigning the physical infrastructure of the downtown campus and the strategy of use of instructional technology. The 1:1 computing model is an instructional technology application in which all users have their own mobile multimedia digital devices that possess the capability of connecting to the Internet, such as a laptop, as opposed to the one to many computing model, in which one desktop computer is stationed in a lab and shared by many students. Although the survey results are by no means generalizable to all other institutions, ASU is a large research intensive institution (60,000 enrollments in 2005-2006) located in a metropolitan area (Phoenix is the sixth largest city in the US), and thus findings in ASU could be taken as a reference by other similar institutions.

OWNERSHIP AND EDUCATIONAL USE

Information technology and its many hardware components are no longer limited to the purview of highly trained professional specialists with niche responsibilities. It is now a seemingly ubiquitous commodity whose use and ownership is becoming the norm rather than the exception. This is exemplified in a study by the EDUCAUSE Center for Applied Research (ECAR) on students and information technology (Kvavik & Caruso, 2005). Data collected from 63 higher education institutions across 24 states showed that nearly 62% of students own desktops and 56% own laptops. In sum, 96% of students own computers and a clear preference for laptops is exhibited among younger students. Beyond computers, 13% of students own PDAs, 90% own cell phones, 39% own music devices (such as MP3 players), and 25% own wireless adaptors. High-speed internet seems the expectation with 90% of students having access to broadband.

Such numbers are impressive; however, the EDUCAUSE Fiscal Year 2004 Summary Report warns that looking at overall computing ownership among students may be misleading (Hawkins, Rudy, & Nicolich, 2005). Though this number is clearly on the rise, when looked at across institution type, we see that students at private institutions are 21% more likely to own their computers than those at public institutions. In light of concerns over the existing digital divide, a research intensive public university such as ASU must be sensitive to not only the current status of computer ownership of its constituents, but also to the specialized and esoteric characteristics of students within specific programs.

Although there may be some variation by institution type, students clearly own and use many types of technology. Such trends make it natural and necessary to examine the question of whether high levels of technology ownership, combined with the ways in which tools and approaches have become not only commonplace, but expected, are a significant factor in student choice of school and program, in retention and completion rates, satisfaction with their program, and ultimate quality of experience. Likewise, the ways in which learning technologies are utilized by the faculty, the degree to which the university infrastructure—both physical and intellectual—fosters and facilitates a technologically responsible and responsive campus. To the degree to which these are factors, higher education institutions must be proactive in addressing student expectations of technological competence as well as instructional integration with the curriculum. However, these notions must be tempered considering student use of technology is actually divided among communication, entertainment, and education purposes (Kvavik & Caruso, 2005).

Kvavik and Caruso (2005) found that students actually only support a moderate amount of technology in their courses. They also reported students have lower skill levels in course-related technologies, such as using specialized software, or a course management system, such as Blackboard™. Therefore, assessing the level of Information and Communication Technology (ICT) literacy on a given campus is important in making decisions regarding technology incorporation into curriculum and other future campus-wide investments in technology resources (Tyler, 2005; Educational Testing Service [ETS], 2005).

The consideration of technology being further incorporated into classroom curriculum, particularly through the addition of internet connectivity, has sparked expression of concern in the literature, as well as among practitioners. Specifically, there is the question of what effect internet access will have on student behavior during classes. With a mobile computer, and continuous access to the Internet, there is concern that student attention will be directed away from the lecture content to nonacademic pursuits such as instant-messaging, playing games, and watching videos. There are debates over students' ability to effectively multitask and whether multitasking is an advanced way of functioning in today's society. Additionally, there are queries about how much training and support is necessary to succeed with these resources in the classroom environment. All of these are new and potentially critical questions that need to be assessed when designing and delivering instruction in today's courses, on today's campus.

GOING WIRELESS?

Increased interest in other technology initiatives such as wireless technologies find some of their basis in cost cutting concerns as higher education institutions are faced with budget tightening. The 2003 Campus Computing Survey results highlighted a 30% increase in the number of higher education institutions with computing budget cuts from the year 2000 (Green, 2003). Although some reversal of this trend was evident in the 2005 survey results, it was heavily clustered among the private four-year colleges (Campus Computing Project, 2005). Additionally, increasingly large portions of these budgets are being diverted into security and ERP/infrastructural concerns. Consequently, installing the often less expensive wireless technology is attractive under looming budget cuts (Carlson, 2000). Of particular relevance are older buildings where wireless technology may cost only 1/5 of what a school would spend on retrofitting with traditional wired technology. This was evident at the University of Southern Mississippi; computing officials decided that instead of rewiring old buildings ($75,000 for a single building), they would install wireless coverage for the same building ($9,000).

In addition to the bottom line and cost savings, there are efficiency issues: how many students may we teach with the number of dollars we have? A single access point may serve many users making it easier to enroll more students. Especially beneficial in a time of tightening budgets and increasing student enrollment, wireless implementation is a swiftly growing trend in higher education. Intel's 2005 *Most Unwired College Campuses* survey noted that 98% of the top 50 campuses are covered by a wireless network, a 34% increase over the previous year. Another 14% increase is observed in complete wireless network coverage on campuses (Intel Corp., 2005). These findings are echoed in the Campus Computing Survey administered to IT officials across the nation by the Campus Computing Project (2005). This survey found that 64% of higher education institutions have implemented strategic plans for wireless networks, an increase from 24.3% in 2001.

TECHNOLOGY AND QUALITY OF EDUCATION

As the interest in collaborative and open learning environments spreads and the ownership of mobile computing among students and faculty increases, university campuses have the potential of being fertile ground for marrying the two. This push towards more and more inclusion of technology on higher education campuses requires the backing of research-based evidence that illustrates its effectiveness. Although many schools have implemented 1:1 computing initiatives of varying scale and depth, the Apple Computer 2005 report indicated there is no conclusive evidence to show that the quality of education has increased as a result (Apple Computer Inc., 2005). Similarly, Albion (1999) and Muir et al. (2006) argued that laptops were presented as the answer without actual scrutiny about their effectiveness and appeared to be more of a trend among K-12 and higher education. Furthermore, advantages of laptops over desktops are not conclusively demonstrated and there are a number of issues to be resolved (e.g., connectivity, weight carried in a backpack, etc.). Strategies and evaluation procedures need to be outlined for these initiatives. These will allow for collecting baseline data and providing rigorous assessment that will test effectiveness after implementation and inform suggested improvements.

Those initiatives that have been implemented tend to derive from four goals: (a) improving academic achievement, (b) increasing equity of access to reduce the digital divide, (c) increasing economic competitiveness by preparing students for a highly technological workplace, and (d) transforming teaching practice. Technology by itself is never the answer. Rather, it is the way in which technology is deployed in the learning environment and the pedagogy that drives the initiative (Schacter, 1995). Following this principle, Maine Learning Technology Initiative (MLTI) kept technology as secondary to educational objectives, and instead focused on teaching and learning using technology as a tool (Muir, Knezek, & Christensen, 2004).

Mobile computing programs are among the computing initiatives implemented by many campuses. Some have included hard mandates where a particular computer system must be purchased, or given to incoming freshmen, and maintained according to administrative guidelines. Others have been characterized by soft mandates where students are required to have a computer with specific software. Schools with hard mandates constitute only about 5% of the BA colleges (Hawkins et al., 2005). Anecdotal evidence from the implementing institutions indicates these mandates have leveled the playing field for students, eased technology support as a result of the standardization imposed, and provided a competitive edge in student recruitment (Campus Technology, 2005). A review of the literature on mobile computing initiatives suggests that students are generally supportive. Views toward a deliberate and strategic implementation of mobile computing are predominantly favorable.

The adaptation to using online learning environments in an effort to maximize the opportunity of 1:1 computing and ubiquitous computing is not often addressed. Mobile computing and wireless connectivity provide instant and continuous access to a vast array of resources such as searches of library catalogs while taking notes, recording audio, and interacting simultaneously with peers in-class and around the world in real-time. However, instructors and instructional designers are not necessarily incorporating higher levels of technology skills into their teaching and student assignments. In many cases, static "presentation graphics" remain the norm. Online instructional environments typically consist of PowerPoint presentations and static text files. It is evident that assessment in 1:1 computing must also include instructional effectiveness, along with the other considerations of technical connectivity challenge, financial barriers, skill-level, and comfort-level.

STUDENT REACTIONS AND EFFECTIVENESS OF INITIATIVES

Student satisfaction with and attitude towards a 1:1 computing mandate has been a concern for many higher education institutions. In the fall of 1998, Seton Hall University (SHU) implemented a Mobile Computing Project where all full-time freshmen at the university were given a laptop computer, which resulted in a tuition increase of $700 per semester (Fountain, 2004; Landry, Fountain, & Mirliss, 2005). Overall, students responded positively with 89% reporting that they were satisfied or very satisfied with the use of technology in their courses, and 93% of students found technology was used effectively or very effectively in their course. Additionally, Colorado Technical University, after giving tablet PCs to all students, conducted a survey and found that 90% of the students believed that the tablet PCs enhanced their learning environment (Robinett, Leight, Malinowski, & Butter, 2005). Similar results were obtained from students enrolled in the computer science courses at DePauw University, who reported satisfaction with the use of the tablet PC in their classroom (Berque, Bonebright, &Whitesell, 2004), which enabled both the students and the instructor to share information during classroom discussions by sketching on the surface of the tablet. The interactive nature of the Tablet PC proved to be a desirable tool for most students.

However, not all institutions have reported high degrees of student satisfaction as a result of a 1:1 computing mandate. Moderate student satisfaction ratings were reported at Winona State University (WSU) after the university implemented a pilot laptop program in 1997 (McVay, Snyder, & Graetz, 2005), which eventually led to all students and faculty using tablet PCs. Only 34% of students reported that the tablet PC improved their classroom environment, and 27% found the tablet to have improved their study habits (Robinett et al., 2005). Results also indicated a need to assist faculty in integrating technology into their courses. In addition, students in the Department of Computer Science at Virginia Tech were given tablet PCs during lab sessions for the purpose of writing, compiling, and testing programs (Edwards & Barnette, 2004). A survey indicated that 86% of students believed that the tablet PC was more difficult to use than a desktop for computer programming tasks.

The infusion of technology into higher education curriculum, however, has not been limited to laptops and tablet PCs. In 2004, Duke University distributed 20 GB Apple iPods with Belkin Voice Recorders to all entering freshman, thereby giving several faculty the opportunity to incorporate the iPods into their curriculum (Belanger & Menzies, 2005). Within an academic context, 60% of students reported using the iPod as a recording device, and 28% reported using it for the music database and hard drive storage. Faculty reported using the iPod as a course dissemination tool, a classroom recording tool, a field recording tool, a study support tool, and a file storage and transfer tool.

A small number of universities have attempted to assess various outcomes related to 1:1 computing through experimental design. A study conducted by North Carolina State University (Spurlin, 2002) assessed student problem-solving ability in several courses where one section was taught with the wireless computer in the classroom and one section was taught with no expectation of student laptop use during class. Although students in the laptop sections demonstrated better problem-solving ability, it was not certain whether the improvement in performance was due to use of technology or the fact that the instructor modified their teaching pedagogy because of the technology or because the lecture and lab experience was more closely aligned. Similarly, the United States Military Academy at West Point developed a quasi-experimental study to examine the effects of laptop computers on student attitudes and learning in a general psychology course (Efaw, Hampton, Marinez, & Smith, 2004). Six instructors were assigned to a control group that did not incorporate laptops into the curriculum, and four instructors were assigned to an experimental group that used laptops in the curriculum. Results indicated that students in the experimental group scored significantly higher on all six exams than students in the control group. Of the students in the laptop classrooms, 73% commented on the ease of note-taking and organization due to the laptop computers, and 50% complained that it was heavy and a pain to carry to class. Though these studies suggest improvements and satisfaction resulting from the implementation of 1:1 computing, they do not exhibit the experimental rigor necessary to draw conclusions about the effectiveness of the use of technology.

Some other schools who have implemented mobile computing programs include UCLA, Carnegie Mellon, Georgetown, University of Miami, and University of Virginia. A review of mobile computing initiatives reveals over 400 implementations (Brown, 2005). Indiana State University recently approved a new laptop initiative to start in the Fall 2007 amid strong objections from students (due to tuition hike) and faculty (due to concerns over technology as distraction). Overall 1:1 computing is indisputably the current trend in higher education.

One caveat about assessing the effectiveness of such initiatives is allowing enough time for the programs to take shape and make their marks. Owen, Farsail, Knezek, and Christensen (2005-06) suggested that adjustment by teachers and students to such a program usually takes about three years and even longer to institutionalize those changes. Setting aside funds and implementing the 1:1 initiative takes a lot of planning and reorganization, yet it can only succeed with successful leadership and the quality of instructors' application of the new tools and technology in the classroom (Muir, 2005).

In assessing the need for ASU to implement its own computing initiatives, it was recommended that initially, a survey concentrating on factual data regarding the state of practice at ASU and a contextual understanding of specific colleges and departments to be affected by such an initiative is conducted.

METHOD

Participants

The target population was students who plan to take classes on the Arizona State University (ASU) downtown campus, which includes all students from the College of Nursing (NU) and Public Programs (PP). The sample included 3,083 students and the composition by college is shown in Table 1.

Table 1
Sample Pool, Number of Respondents and Response Rate

College	Total students	Percent	Responded	Response Rate
NU (Nursing)	1561	50.63	184	12%
PP (Public Programs)	1522	49.37	279	18%
Total	3083	100	463	15%

The overall response rate of this survey was 15%, with 463 participants. A lottery was used to offer incentives (iPod and iRiver MP3 players) to students in return for participation in the survey. The participants are self-selected and thus nonresponses might lead to a biased result. As a remedy, after the initial invitation the survey team sent two follow-up letters to improve the response rate. Although the response rate is moderate, it is not a hindrance to drawing valid inferences. It is a common misconception that sample size determination is viewed as being based upon the ratio between the sample and the population. The central limit theorem demonstrates the sample size does not depend on the population size being sampled, unless the population is so small that the sample size is a considerable fraction. Results from the same sample could be used to make inferences about a population of 8 million or that of 125,000. The precision of the result is a function of the quality of information one collects, not the quantity of information (Burrill, 1999; Yu, 1999; Warwick & Lininger, 1975).

After the data were collected, the survey team identified subject demographic information by matching their e-mail addresses from the survey to that in the ASU Data Warehouse. Contaminated data, such as test entries by the survey team and responses submitted by a student whose age is under 18, were removed.

Materials

A web-based survey was developed to assess students current use and opinions of technology and computing with regard to their education. The survey orients toward fact-finding (what students have, what they use, and what they need) and no latent psychological constructs were measured. Hence, no construct validation was needed in the survey development process. The survey engine used was Survey Monkey (2006), in which collected data were readily exportable to any statistical packages.

Design and Procedure

Student participation was solicited by way of targeted e-mail messages sent to students contact e-mail addresses that were gathered from the ASU data warehouse. Resulting data were imported into the SAS Statistical package for detailed analysis and reporting.

RESULTS

The results of the survey were summarized through three distinct types of questions: (a) What technology do students own, (b) what technology do students regularly use, and (c) what are students' technology related needs and desires and their views on technology with regard to their education?

What Do Students Own?

The reported general status of technology ownership by ASU students from Public Programs and College of Nursing provides useful insight into both the reported technology utilized and owned, as well as user preferences and previous experience. Overall, a higher percentage of Public Program students in our sample are equipped with a wider variety of technological devices and software than are students enrolled in Nursing program. A similar trend is seen in the comparison between lower division, upper division, and postgraduate students. Higher percentages of postgraduate students own a larger selection of technology and software than their undergraduate counterparts. However, a frequency difference between these groups could be misleading in interpretation if the difference is not statistically significant. Therefore, Chi-square and Fisher's Exact Test results are reported in each section.

A significant majority of students report owning a computer (97%); however, Public Program students constitute about 59% of these respondents while Nursing students account for about 39%. Similarly, among the computer owners, a much lower percentage of lower division students (about 16%) is observed than their upper division (about 30%) and postgraduate counterparts (about 50%). Less than one third of the students own a laptop while about 41% own a desktop. Ownership of both desktop and laptop constitutes less than a third of the students. Public Program students reflect higher percentages of ownership than Nursing students in our sample.

At the academic level, the familiar pattern of postgraduate students with higher percentages of ownership in desktop and laptop is observed. When laptop ownership by college affiliation is examined through the Chi-square Test of Goodness of Fit, and the Fisher's Exact Test, we see that the p value yielded from Chi-square Test is .53 whereas the two-sided exact p value is also .57. Thus, the surface observation that ownership of laptop computers among Public Programs students is significantly higher than that of Nursing students is not substantiated. The Chi-square test and the Fisher's Exact Test do not show a significant difference between academic levels in terms of laptop ownership with both p values equal to .16.

Among desktop owners, the majority of students use Windows based PCs (about 84%) while Apple users are around 4%. It was found that students in the 18-27 age group tend to own a PC laptop (Figure 1). Again, the majority of laptop owners have PC laptops. PC laptop owners mostly use Windows XP operating system (about 78%).

The types of software students use range from word processing (95%), presentation and spreadsheet (87%), followed by multimedia, graphic, and database applications (just above 50%) (Figure 2). Trailing behind are more specific use software such as desktop publishing (16%), statistical analysis and math packages (15%), web development (8%), and GIS applications (about 3.5%). Postgraduate students and Public Program students again constitute higher percentages within each division.

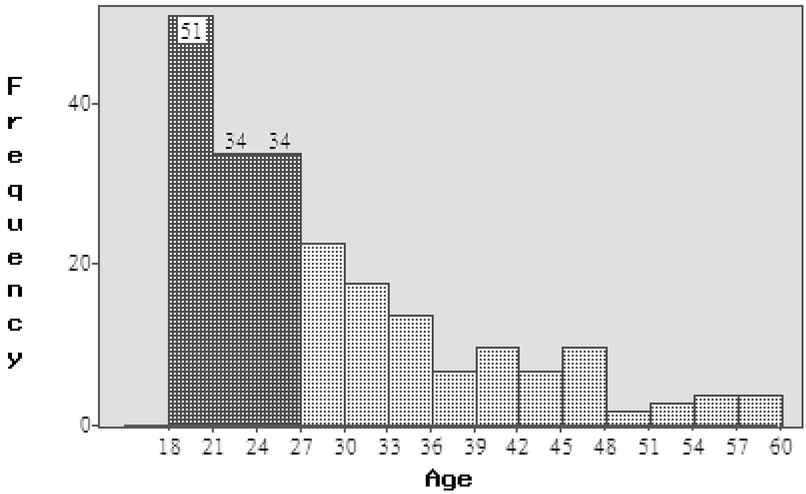

Figure1. Laptop ownership by age

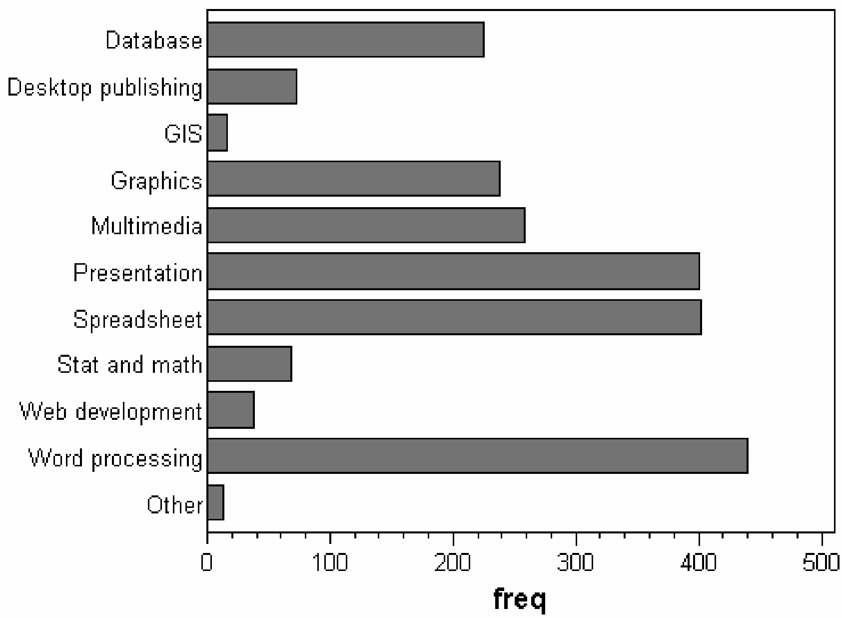

Figure 2. What type of software do you presently own?

Ownership of mobile devices among students reflects the pattern identified when examined by college and by academic level. While the highest reported owned device was, as expected, mobile phones, postgraduate students and Public Program students constituted a larger percentage among all categories (Figure 3). iPod ownership followed in second with 28% of students reporting owning one. In the 18-22 age category, ownership of iPod increases as age increases (Figure 4). After age 22 the number gradually decreases. However, resurgence of ownership trends is observed in the late 20s. Thereafter ownership declines as age increases. As the sample size is small, this pattern suggests only a worthwhile phenomenon for future inquiry, not a firm conclusion about the relationship between age and use of mini mobile devices. Lastly, 18% of students reported owning an MP3 player and 16% reported owning PDAs. PDAs and Blackberry's are devices more commonly owned by postgraduate than the undergraduate students. A small percentage of students own Blackberrys or Sony PSP (about 2%).

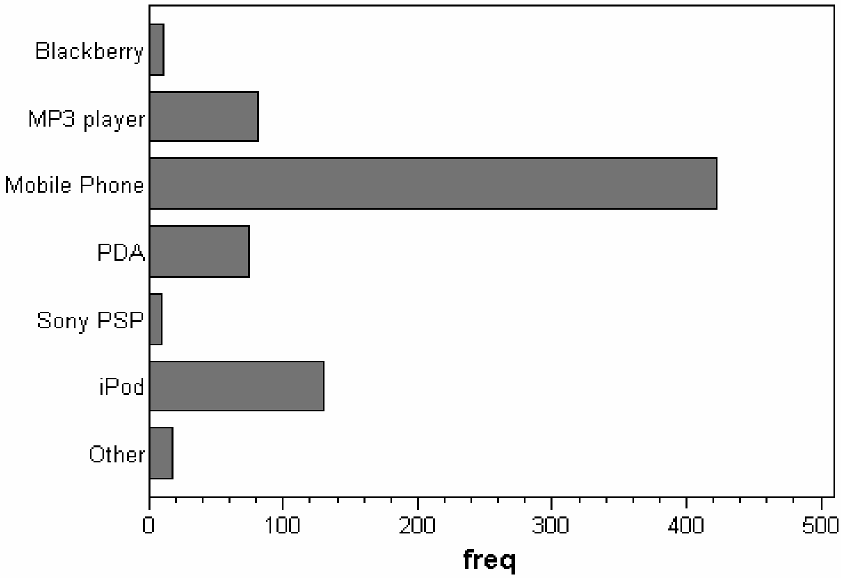

Figure 3. Which of the following mobile devices do you own?

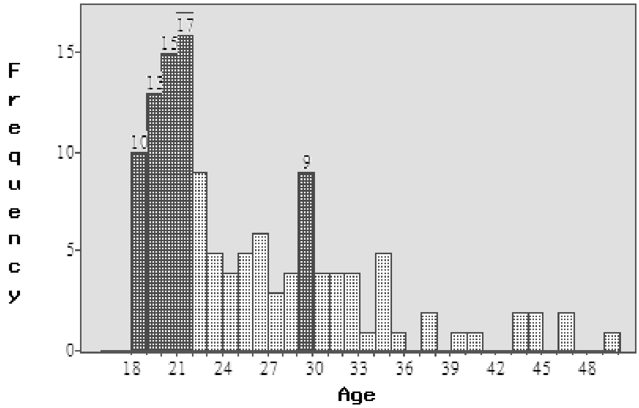

Figure 4. iPod ownership by age

Because various types of mini mobile devices differ from one another in their functions, the Chi-square Test and the Fisher's Exact Test were conducted on ownership of type of device. No significant difference was found between colleges in their ownership of iPod for the *p* value yielded from the Chi-Square Test is .12 while the exact *p* value is .14. Both the Chi-square Test and the Fisher's Exact Test indicate that there is a significant difference between academic levels in terms of ownership of iPod. The *p* value yielded from the Chi-Square Test is .004 whereas the exact *p* value is .005, which implies that upper division and graduate students are more likely to own an iPod than lower division students.

What Do Students Use?

Students commonly reported using a hand-held mobile device for listening to music (47.95%), storing/viewing digital photos (26.35%), and listening to the radio (18.14%) (Figure 5). Only 5.83% of students reported using a hand-held mobile device for course seminars or lectures, with higher reports among postgraduates and upper-division students (Figure 5). Caution is encouraged in the interpretation of this particular finding, as the number of ASU courses presently recorded and distributed through an internet-based subscription (e.g., podcast) is presently minimal. Likewise a central, integrated mechanism for capture and syndication is not currently established.

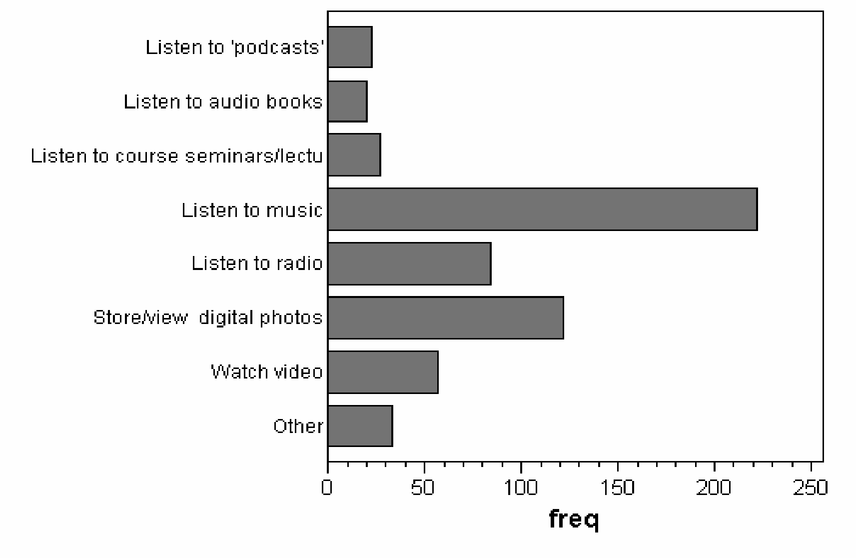

Figure 5. Do you use a hand- held mobile device for any of the following, at least once a week?

A total of 29.5 % of students reported bringing their laptop to class at least once a week. This finding was greatest among postgraduates (17.24 %), compared to 7.28 % of upper division students and 4.98 % of lower division students. Public programs students were approximately twice as likely to report bringing their laptop to class at least once a week (19.54 %) compared to nursing students (9.96 %).

What Do Students Think?

Student views of the importance of technology to a successful college experience tend to mirror their technology ownership. Mobile phones were noted as being important to a successful college experience with 71% of students noting some level of importance; however, their use as a primary means of communication likely accounts for this more than college success. Computers in general are considered essential to a successful college experience. Laptops garnered a high degree of importance, with 81% of students considering them of value at some level. Overall, desktop computers were rated as the most important type of computer, with 90% of students reporting them important at some level and 63% considering them very important. However, the degree of emphasis placed upon desktop computers decreases significantly as students are further in their educational career. PDAs and iPods were not considered important to the college experience.

The importance of laptops to a successful college experience does not translate to a willingness to purchase one. Students are fairly split on this notion with 60% responding that they would be willing to purchase laptop, and 40% saying they would not be willing to purchase one. A slightly higher margin of students from the Nursing Program and graduate students are willing to purchase a laptop.

Among the purchasing options for securing a laptop, 37% of students indicated financial aid as their first choice, and 54% ranked it as their second or third option. The option of "inclusion in tuition" was also indicated, although in these instances, the approach of "financial aid" was selected as the second preference. This observation suggests that means toward containing costs and making available financial aid, are most sought after. Following this designation, 77% ranked an up-front purchase as desired. Students were not supportive of the leasing option with 90% choosing this approach as their least preferred.

An open ended question asking for additional comments was analyzed into three categories: existing technology and tech support on campus, technology in the classroom educational value of technology, and laptop mandate. Overall, these responses showed that students want more and better supported technology. For example, wish for a campus that is completely wireless is expressed strongly. Technology support and training for students is another topic brought up. Students also ask that instructors continue to train in new technological developments and bring it into the classroom. Regarding the laptop mandate, students who were against it did so with strong language while students who agreed with it did so more at a theoretical level (it would be good if all students had laptops), but they also expressed concern over financial burden. Open ended responses also showed a need for more computers and computer labs on campus in addition to updated hardware and software. Overall students want more technology in the classroom as well as on campus to enhance their educational experience, but they also want more training and support.

DISCUSSION

This student survey represents an initial phase in the ongoing, multi-method assessment of means and needs toward a 1:1 model of learning and instruction. The process and results are intended to provide us with a forum and foundation for insight into the current usage and attitudes towards technology of students enrolled at ASU. Students from the ASU downtown campus (College of Public Programs and the College of Nursing) were surveyed. Almost all of the students completing the survey reported that they presently own a computer, with a significant number owning both a laptop and desktop. Computers were considered to be the most important technological devices contributing to a student's college experience. Of those who do not presently own a laptop, a majority indicated that they would be willing to purchase a laptop if their academic program required it. Those students who were willing to purchase a laptop indicated a preference for the cost to be addressed through financial aid qualified and/or included in tuition.

With regard to hand-held mobile devices, a phone is carried by virtually all students, followed by iPod/MP3 player as next most commonly owned. Ownership of audio devices as well as perceived educational value of the device and course audio were distinguished to some extent by year in the program/experience at the University. Students in their early undergraduate careers and those in graduate programs report higher incidence of ownership. Students reported using their iPod or MP3 device for listening to music and storing/viewing digital photos. Although a relatively small percentage of students reported that they presently use their handheld audio devices for academic purposes such as listening to course seminars and lectures, a finding consistent with the small number of courses presently available in this format at ASU, students indicate that they would access and utilize such resources if available.

CONCLUSION

Technology—equipment, applications, as well as use and integration, is clearly a priority expressed by the respondents. Across the colleges surveyed, as well as within levels of academic career, the role of technology as a learning tool is consistently recognized. A continuous, multi-method approach to evaluation and assessment of student and faculty status and needs, will provide the framework for enabling and supporting learning through technology. It is very important not to lose the centrality of educational objectives in technology initiatives. After a thorough assessment of student and faculty needs, instructional pedagogy suitable for an engaging and empowering learning/teaching style must be introduced, and necessary support and professional development must be provided. Hence, this survey generates actionable items that may substantively transform the use of instructional technology. Based on the findings of the survey, ASU launched a pilot program at ASU's Downtown Phoenix campus that enables and supports 1:1 computing specific to the needs of downtown students. The campus was designed with 1:1 computing in mind—with wireless Internet access throughout most parts of the campus and experienced support staff onsite to provide troubleshooting and just-in-time solutions. For those students who choose not to own a laptop, common computing resources are also provided at the campus. ASU would like all students to have the opportunity to benefit from 1:1 computing. To that end, ASU has partnered with Apple and Dell to provide reduced-cost laptop computer packages with extensive technical support. Financial aid options are available for qualified students. In brief, survey findings previously discussed helped ASU set reasonable goals and actionable items to ensure a successful 1:1 initiative, which will be continually assessed, evaluated, and adapted in the years coming.

Throughout the current academic year, the 1:1 model is being extended to the entire ASU campus, as well as forming the basis of ASU's extended education programs, ASU at the Global Campus. Central to ASU's conceptualization of one-to-one computing, is a strategic emphasis on the learning "platform." Through the use of flexible, dynamic, open source learning, and communication tools, ASU's 1:1 environment is positioned to maximize learning and community.

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