An Overview of Student Technology Usage over Time and Implications for Community College Planners and Policy Makers
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Introduction

Community colleges (CCs) face a mixture of challenges as their leaders seek to understand and expand innovative and effective uses of computer technology for students. Leaders who plan for and implement successful information technology (IT) plans, however, can monitor changes and adjust budgets and curriculum more effectively when their decisions are supported by broad computer technology usage data. Because there is increasing student demand for and usage of computer technology both at the basic and advanced levels, it is incumbent for CC planners and policy makers to be proactive and regularly update curriculum and educational technologies that are closely aligned with the critical needs of America's high-tech, digital, and global economy.

The purpose of this article is to help CC leaders, planners, and policy makers identify trends in student computer usage over a recent seven-year period to better understand and plan for ever-changing technology needs. The potential for a college instructor in today's classroom to utilize the Internet, course management systems, podcasts, wikis, and smartboards (among other technologies *yet* to be introduced) that impact student learning is overwhelming.

Although CCs have invested heavily over the years in educational technology, many technical infrastructures are very much at risk today because colleges must grapple with tight budgets and increasing numbers of students with diverse educational needs. While most colleges recognize their informal identity of being *all things to all people*, it becomes increasingly difficult to do so, even with the most exemplary planning, while working on a shoestring budget. This conundrum is exacerbated by the demographic variety of students and their mottled sophistication with computer technology. What is more, today's college students are part of a new generation that grew up with technology (Ketzle, 2007). They, for example, have never known a world without the Internet, e-mail, micro blogging, Flicker, Google Apps, instant messaging, Bluetooth, iPod, or the BlackBerry (Johnson, Levine, & Smith, 2009).

According to Picciano (2006), one of the major issues impeding the establishment of successful technology programs in schools is the lack of careful planning. Increasingly, policy makers must ask: How will or should technology be used in our college? Who will need access and for what purpose(s)? What are our short- and long-term goals relative to staying up to date on the advancing use of educational technology? More specifically, according to the 2009 International Society for Technology in Education Performance Indicators for Administrators, educational administrators should create, promote, and sustain a dynamic, digital-age learning culture that provides a rigorous, relevant, and engaging education for all students (ITSE, 2009).

An IT plan should be driven by the college's mission and based on a clear understanding of defensible data recounting current usage and trends. Perhaps the most important post-implementation aspect of the technology plan process is evaluating its results, usage, and impact on students.

The findings contained in this paper are based on seven years of data (2000 to 2007) provided by the Community College Student Experiences Questionnaire (CCSEQ), an instrument that is administered to CC student populations in over 30 states. As a parallel to this model of a more current technology skills framework, the 21st Century Student Outcomes for Technology Skills, similarly is concerned with technology changes over time. Specifically, it states that people of the 21st century live in a technology and media-driven environment, marked by access to an abundance of information, rapid changes in technology tools, and the ability to collaborate and make individual contributions on an unprecented scale (21st Century Skills, 2009).

The following questions guided this research investigation: (1) Are there changes over time in the usage of computers in CCs? (2) Based on the data survey findings, what are those changes relative to the two subscales of basic computer technology usage and advanced computer technology usage? and (3) What are some explanations as to why those changes, if any, occurred? Ultimately, the actionable research goal is to determine how these findings can assist CC leaders and policy makers to better craft and then administer forward-looking IT plans.

Methodology

Participants

The national CCSEQ (Pace, Friedlander, Murrell, & Lehman, 1999) data set, housed at the University of Memphis, contains data from 64 participating community colleges across the United States that administered and reported CCSEQ data from Fall 2000 to Spring 2007 (with the exception of Fall 2004). This study's sample of 53 community colleges was a subset of the national CCSEQ that had complete responses for the eight computer technology scale items for Fall and Spring semesters between 2000 and 2007, for a final sample of 33,524.

The sample consisted of 58.60% females and 68% white students. Five ethnic groups; Native American (3.60%), Asian-Pacific Islander (8.80%), African-American (8.00%), and Hispanic (11.60%) were represented. Approximately 57% of the sample was between 18-22 years of age. Approximately 35% would be considered part-time, and nearly 40% had taken a total of 46 or more units at their institution. Most grades reported by the students were A's or B's (68.10%). Nearly 55% of the students reported that they were attending to prepare for transfer to a four-year college or university.

Measure

Pace (1979) delineated a theoretical model for studying student development and college impress. That model was the basis for his development of the College Student Experience Questionnaire (CSEQ) and the CCSEQ. The CCSEQ is a self-reported instrument that in part assesses the quality of student effort. Pace operationalized the conception of quality of effort in the CCSEQ to reflect the domains of academic and intellectual experiences, personal and interpersonal experiences, and group experiences. The revised CCSEQ (Pace et al., 1999) accounts for current trends such as technology and focuses on various activities that are most available and pertinent to CCs and two-year students (Ethington, 2000).

The CCSEQ contains 12 College Activities topics, including the Computer Technology (CT) scale that was used for this study. Using Cronbach's alpha as a measure of internal consistency, the coefficients for the activity scales ranged from .82 to .93, with .86 for the CT scale. The CT scale consists of eight items

representing specific activities with which students are asked to report how often they have engaged in the activity during the current school year. Items are rated on a 4-point scale; (1) *never*, (2) *occasionally*, (3) *often*, and (4) *very often*. The eight items in the Computer Technology scale are; (1) Used e-mail to communicate with an instructor or other students about a course, (2) Used the World Wide Web or Internet (or other computer network) to get information for a class project or paper, (3) Used a computer tutorial to learn material for a course or remedial program, (4) Used computers in a group (cooperative) learning situation in class, (5) Used a computer for some type of database management, (6) Used a computer to analyze data for a class project, (7) Used a computer to create graphs or charts for a class paper or project, and (8) Wrote an application using existing software or programming languages. The CT scale is commonly used as an 8-item scale showing the average use of computer technology by students. However, for this study, the CT Scale was split into a Basic Computer Technology Usage sub-scale (Items 1-4, Cronbach α = .76) and an Advanced Computer Technology Usage sub-scale (Items 5-8, Cronbach α = .85). The two sub-scales were created by averaging the applicable items to obtain an average usage of computer technology reported by the student. Scores were only created from students who responded to all items within the sub-scale to avoid potential confounding of the sub-scale's construct (i.e., basic or advanced usage).

Results

Means and standard deviations for students' basic and advanced computer technology usage by the 14 academic terms are shown in Table 1. As can be seen in the table, students' basic computer technology usage was consistently above 2.00, ranging from 2.03 (Fall 2000) to 2.54 (Spring 2007), with an overall average of 2.28. With the exception of one academic term, students' advanced computer technology usage was consistently below 2.00, ranging from 1.71 (Fall 2000) to 2.03 (Spring 2007), with an overall average of 1.88.

Table 1
Means[a] and Standard Deviations[b] for Basic and Advanced Computer Technology Usage by Semester and Year[c]

Semester/Year	*N*	Basic	Advanced
Spring 2000	1695	2.13 (.76)	1.84 (.81)
Fall 2000	2050	2.03 (.75)	1.71 (.76)
Spring 2001	1704	2.24 (.80)	1.87 (.83)
Fall 2001	439	2.16 (.79)	1.81 (.82)
Spring 2002	4019	2.19 (.82)	1.87 (.84)
Fall 2002	3120	2.20 (.80)	1.85 (.83)
Spring 2003	3428	2.25 (.77)	1.86 (.81)
Fall 2003	1530	2.30 (.81)	1.91 (.85)
Spring 2004	2549	2.38 (.78)	1.96 (.83)
Spring 2005	4427	2.33 (.80)	1.90 (.83)
Fall 2005	2933	2.28 (.81)	1.86 (.84)
Spring 2006	3168	2.39 (.79)	1.93 (.84)
Fall 2006	486	2.43 (.85)	1.91 (.88)

Spring 2007	1976	2.54 (.78)	2.03 (.86)
Total	33524	2.28 (.80)	1.88 (.83)

[a]Means based on 4-point (1-4) scale; [b]Standard Deviations in parentheses; [c]No data for Fall 2004

Significant Kruskal-Wallis tests showed differences among the 14 academic terms (Fall 2000 ¿ Spring 2007) on median change in students' basic computer technology usage as well as students' advanced computer technology usage. Follow-up tests were conducted to evaluate pairwise differences among the 14 groups, controlling for Type I error across the tests by using the Bonferroni approach. Figure 1 provides a visual representation of the average basic and advanced computer technology usage across the 14 academic terms.

Figure 1. *Average basic and advanced computer technology usage across academic terms.*

Results of the pairwise comparisons indicated that students' basic computer technology usage, on average, continued to increase over time. Notable drops in usage occurred in Fall 2000 and then again in Fall 2005. Both drops were either preceded or followed by significant peaks in usage. Results of the pairwise comparisons for the advanced computer usage, while consistently lower than the basic usage, showed similar peaks and drops in usage, as well as the continual average increase in usage over time.

Discussion and Implications

While the authors are fully aware of the evolution of technology over the past decade (1999-2009), it is strongly felt that these findings serve as a good measurement of the increasing trends in student usage of educational technology over time. Findings from this study should prove useful for CC planners and

policy makers. Several significant upward patterns of usage were found in the study results. Though not consistent, the results suggest a continual increase of all categories of computer usage by students over time. Though the advanced computer technology usage skills never caught up to the basic computer technology skills, the advanced skills did make its greatest leap in Spring 2007. These results suggest that policy makers need to not only prepare for the basic usage of computer technology, but they similarly need to prepare for advanced usage. Further, while efforts may be different in how to handle basic and advanced usage, those efforts must be expended to ensure the continued advancement of both levels.

To the question, are there changes over time in the usage of computers in CCs, the study found that there were. In fact, the usage trend progressively increased in both areas; basic and advanced. Based on the 14 time points across academic terms, the trajectory, as shown in Figure 1, would suggest a continual increase in both levels of technology usage.

It further appears that the dichotomizing of the computer technology scale into basic and advanced usage was successful. This is supported by the ordinal relationship of the mean trajectory of both usage levels as seen in Figure 1. In other words, basic usage was consistently above 2.0, ranging from 2.03 to 2.54, with an average of 2.28. Advanced usage, on the other hand, with the exception of one academic term, was consistently below 2.0, ranging from 1.71 to 2.03, with an average of 1.88.

There was an unusual dip in Fall 2000 for both basic and advanced, followed by a relatively high spike in Spring 2001. In a review of computer software history during that period of time, this finding appears to be consistent with the roll out of Microsoft Windows 2000 in February 2000 (Computershop, 2009). As a possible explanation, perhaps the initial fear of change and the lack of acceptance, training, and knowledge occurred. This, then, was followed by a greater comfort level of the new version.

For both basic and advanced skills, usage appeared to be on an upward trend beginning with Fall 2001 continuing up through Spring 2004, followed by a downward usage trend over Spring 2004 and appearing to bottom out in Fall 2005, at which point it appears to have an upward trajectory. Similar to the announcement of Microsoft Windows 2000, a new operating system called Microsoft Windows XP was released in October 2004, causing a similar disruption due to change and new learning curves required for countless computer operations (Computershop, 2009).

How can these findings assist CC planners and policy makers to better craft and then administer a forward-looking IT plan? An analogy using video technology might explain better. For example, society's need for video technology has evolved over the years from Beta to VHS to CD to DVD to Blu-Ray Disc. This shows the continual evaluation and improvement of a particular technology device and begs the question for CCs of, *what's next*?

What is evidenced through the questions posed to CC students in the CCSEQ survey is that their usage relative to computer technology has continually increased over the last seven years, only dipping when upgrades to operating systems were announced. An awareness of this information is critical for planners to not only meet and accommodate future needs of technology in CCs, but for an eagerness and continual commitment to stay current and be forward-looking as they fully support *next generation* educational technology.

The bottom line is as new IT plans are written and adjusted, a review of actual IT events inside and outside the institution need to be carefully studied and used as a basis for the next steps to stay on the cutting edge of technology. Moreover, policy makers who do not act on the knowledge at hand, based on the apparent demand of technology usage of this sample, must realize that other institutions will. Competition will determine who keeps and best serves the technology-savvy customer¿the CC student.

In summary, the underlying message this article wants to convey is a clear awareness that technology usage in CCs continues to be on the rise. While the CCSEQ was limited on the types of technology posed in the questions of the subscales, future iterations should capture more current educational technology trends (e.g., twitters, podcasting, social networking). In addition, future research should account for potential differences in, for example, age, gender, ethnicity as it equates to technology usage.

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