Key Findings

Students and Information Technology, 2005: Convenience, Connection, Control, and Learning

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Providing undergraduate students with the information technology (IT) services, skills, tools, and training they need to be successful presents a significant challenge for higher education institutions. Key to these efforts is an understanding of what students need and how they incorporate IT into their academic and social lives. Last year's *ECAR Study of Students and Information Technology 2004: Convenience, Connection, and Control* was the first EDUCAUSE Center for Applied Research (ECAR) effort to describe and evaluate the undergraduate student IT experience (Kvavik, Caruso, and Morgan, 2004). This year's study, *ECAR Study of Students and Information Technology, 2005: Convenience, Connection, Control, and Learning*, expands and continues this effort (Kvavik and Caruso, 2005).

Many of the students participating in the 2005 student study are members of the so-called Net Generation. These students are often characterized as digitally literate, always connected, desiring an immediate response, experiential, social, visual, and craving interactivity (Oblinger and Oblinger, 2005). They are expected to be very deft and comfortable with IT. These characteristics encouraged ECAR investigators to focus on, question, and test several assumptions:

- Students will demand greater use of technology in teaching and learning.
- College and university faculty must increasingly use technology in their instruction to appeal to the attention, learning styles, and preferences of this generation of students.
- Students already possess good IT skills.
- Students gain these skills largely outside their courses.
- Collegiate students will require little further training or education in the use of IT.

Through the use of survey and interview data, these assumptions are scrutinized in this study.

Methodology and Study Participants

The study consists of these data collection and analytical initiatives:

- A review of the literature and other surveys, both in the United States and internationally.
- A review and comparison of the results of the 2004 study, *ECAR Study of Students and Information Technology, 2004: Convenience, Connection, and Control* and the 2003 ECAR study *Faculty Use of Course Management Systems* (Morgan, 2003).
- A Web-based survey of undergraduate freshmen and seniors, which supplies student quantitative data based upon their experiences with IT in higher education. A sample of 143,730 students at 63 higher education institutions in 24 states received an e-mail invitation to participate in the study. Fully 18,039 students responded.[1]
- Interviews of 82 undergraduate students at seven institutions and 20 instructional support staff.
- Analysis of the more than 8,000 students' comments on IT in the open-ended questions of the survey.

Significant Findings

The findings of the 2005 (and 2004) ECAR studies of undergraduate student use and skill with IT are somewhat surprising. They represent a snapshot in time, providing a factual description of the undergraduate IT experience of the students who responded to the survey.

- ***Like teenagers, undergraduates live with abundant technology and networks.***

The vast majority of the student respondents own at least one computer and a cell phone (see Table 1). These technologies are used on a daily basis for studying, social interaction, and entertainment. Students are increasingly mobile, using a combination of cell phones, laptops, and PDAs, and about 25 percent have wireless adapters. Virtually all have access to the Internet, and the majority have broadband access.

[1] Students in this sample attend 30 doctoral institutions, 18 MA institutions, 12 BA institutions, 2 AA institutions, and 1 specialized institution. Two-thirds of the respondents are female. Thirty-nine percent of respondents are between 18 and 19 years old, 48 percent are between 20 and 24 years old, and 13 percent are over 25 years old. Only 1.1 percent of the students are over the age of 50. Ninety-two percent of the students are full-time students. In the absence of our weighting of institutional responses, this means that we can generalize to the sampled students but not to the 63 institutions. These findings are instructive and not necessarily conclusive of student experiences at different types of institutions. We can say with 99 percent confidence that the error attributable to sampling and other random effects is +/- 2 percent.

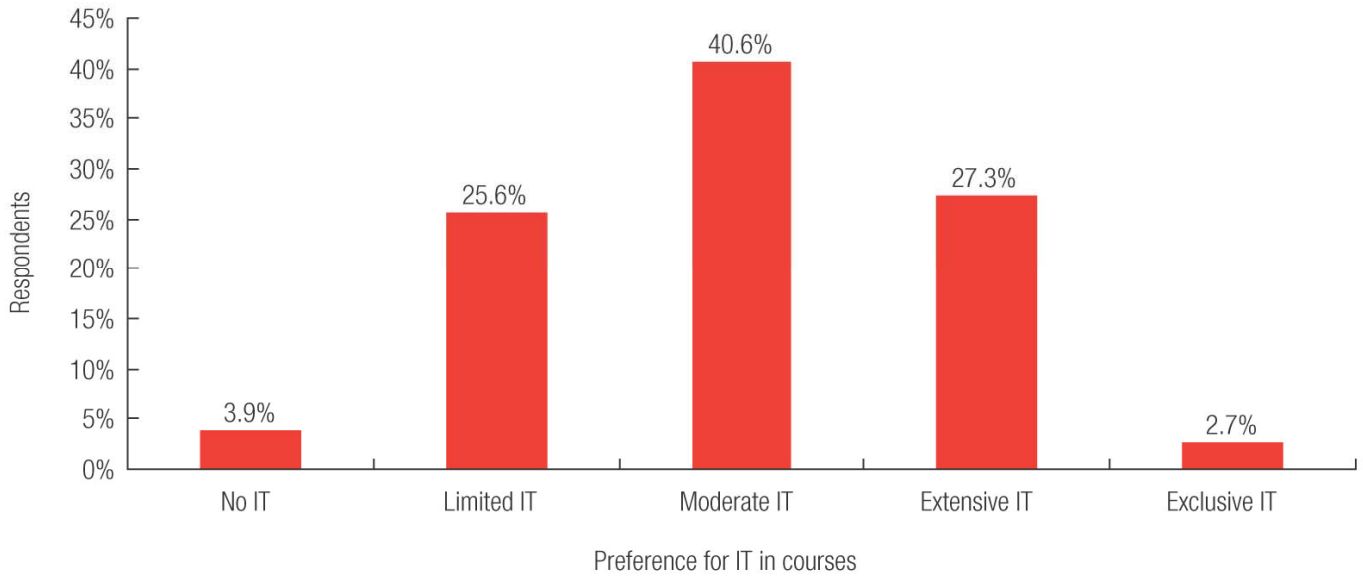
Table 1. Ownership of Selected Technologies

Technology Owned	Males (N = 6,123)	Females (N = 11,835)	Seniors (N = 10,042)	Freshmen (N = 7,997)	Overall (N = 18,039)
Personal desktop	68.7%	58.0%	70.1%	50.9%	61.6%
Laptop	55.0%	55.9%	49.3%	63.5%	55.6%
PDA	17.0%	10.4%	15.5%	9.0%	12.6%
Smart phone	2.2%	0.8%	1.4%	1.2%	1.3%
Cell phone	86.5%	92.1%	90.5%	89.7%	90.1%
Music device	46.3%	34.2%	34.3%	43.5%	38.4%
Wireless adapter	32.3%	20.9%	26.4%	22.8%	24.8%

- ***Students look to IT for convenience and to make it easy to connect with others. They prefer IT in their courses but typically to a moderate degree.***

Students prefer a moderate use of IT in their courses (see Figure 1), and they expect faculty to use technology well. They give good grades for their instructors' skills in using IT in courses. The primary benefit of technology in courses is convenience, followed by connectedness.

Figure 1. Student Preference for Use of IT in Courses (N = 17,856)



- ***Male and female students are comfortable with a core set of technologies and less comfortable with more specialized technology applications.***

Students are comfortable using core information technologies and rate themselves as skilled in their use (see Table 2). The majority of students perceive that they need no additional training to use these technologies. Students differentiate their skills with different technologies—word processing is highest and specialized applications are lowest.

Table 2. Student Self-Reported Skill Level

Activity	N	Mean	Std. Deviation
Word processing (Word)	17,951	3.52	0.548
Computer operating systems (Windows, OS X)	17,371	3.04	0.773
Presentation software (PowerPoint)	17,191	2.98	0.745
Spreadsheets (Excel)	17,264	2.88	0.760
Online library resources	17,144	2.85	0.687
Course management systems	14,416	2.67	0.822
Computer maintenance	16,853	2.47	0.927
Securing your electronic device (firewalls, antivirus software)	17,102	2.47	0.922
Graphics (Photoshop, Flash)	14,686	2.40	0.850
Creating Web pages (Dreamweaver, FrontPage)	11,210	2.14	0.913
Creating and editing video/audio (Director, iMovie)	10,656	2.01	0.867

Scale: 1 = very unskilled, 2 = unskilled, 3 = skilled, 4 = very skilled

- ***Students view technology in the classroom as supplemental to their course experience, not as transformational.***

IT in courses is not viewed as transformational but rather as supplemental. Most students prefer face-to-face interaction with their instructors and with other students, though this preference is not universal. Students who report having positive or very positive experiences with IT in the course context are more likely to seek or even expect IT in future courses. Students in disciplines that incorporate a great deal of IT, like engineering, business, computer science, and so forth, also demonstrate higher preference levels for IT in the course experience.

- ***Students employ "core" technologies widely and specialized technologies narrowly.***

All students in this survey population use IT for recreation, and this is especially true for younger students. Nearly all use their computers for writing documents and e-mail, followed by surfing the Internet for coursework (98.4 percent) and for classroom activities (96.2 percent).

Technologies or IT-enabled activities that fall outside the core are less widely used (see Table 3). The least common activities are creating Web pages (24.9 percent) and editing video/audio (24.1 percent). While the penetration of these specialized skills lags those in the core, student employment of graphics, audio and video production, and Web page development rose significantly from 2004 to 2005. This rise may be an artifact of survey techniques, but it is a possible trend that ECAR will monitor and report on.

Table 3. Technologies Used by Students

Activity	N	Senior	Freshman	Total
Creating, reading, sending e-mail	17,865	99.7%	99.7%	99.7%
Writing documents for your coursework	17,902	99.1%	98.7%	98.9%
Surfing the Internet for information to support your coursework	17,936	98.7%	98.1%	98.4%
Class activities and studying using an electronic device	17,961	96.4%	96.0%	96.2%
Surfing the Internet for pleasure	17,925	94.7%	95.0%	94.8%
Using a library resource to complete a course assignment	17,960	88.8%	86.9%	88.0%
Creating, reading, sending instant messages	17,782	74.2%	89.7%	81.1%
Downloading or listening to music or videos/DVDs	17,891	68.2%	83.8%	75.1%
Online shopping	17,905	77.2%	65.3%	71.9%
Creating presentations (PowerPoint)	17,909	73.2%	54.6%	65.0%
Completing a learning activity or accessing information for a course using a CMS	17,910	64.6%	61.9%	63.4%
Creating spreadsheets or charts (Excel)	17,943	71.2%	51.7%	62.5%
Playing computer games	17,865	57.3%	64.9%	60.7%
Writing documents for pleasure	17,825	59.3%	61.9%	60.4%
Creating graphics (Photoshop, Flash)	17,837	49.3%	47.2%	48.7%
Creating Web pages (Dreamweaver, FrontPage)	17,821	26.1%	23.4%	24.9%
Creating and editing video/audio (Director, iMovie)	17,854	23.4%	25.0%	24.1%

- ***Curriculum and technology use are intertwined.***

The importance of a student's academic major and the underlying curriculum of the discipline are evident in the use of more specialized applications such as spreadsheets, presentation software, graphics, video/audio, and tools to create Web pages. Engineering and business students, not surprisingly, report the highest levels of use of spreadsheets and presentation software.

Spreadsheets are used by engineering students (79.3 percent) and business students (78.5 percent) much more than by fine arts students (47.6 percent).

- ***Students spend a lot of time online.***

Students indicate that on average they spend 11–15 hours/week using electronic devices (see Table 4). The most common tasks are course activities (3–5 hours/week), writing documents for coursework (3–5 hours/week), instant messenger activities (3–5 hours/week), e-mail activities (1–2 hours/week), and surfing the Internet for pleasure (1–2 hours/week). Least common activities are creating graphics, creating Web pages, and creating and editing video/audio (all less than 1 hour/week).

Table 4. Hours Spent per Week on Technology-Related Activities

Activity	N	Average Number of Hours Used
Excluding cell phones, hours each week using an electronic device	17,964	11–15 hours
Course activities and studying using electronic device	17,281	3–5 hours
Writing documents for your coursework	17,701	3–5 hours
Creating, reading, sending instant messages	14,421	3–5 hours
Creating, reading, sending e-mail	17,811	1–2 hours
Surfing the Internet for pleasure	16,996	1–2 hours
Surfing the Internet for information to support your coursework	17,652	1–2 hours
Downloading or listening to music or videos/DVDs	13,437	1–2 hours
Playing computer games	10,836	1–2 hours
Completing an activity using a CMS	11,356	1–2 hours
Using a library resource to complete a course assignment	15,798	Less than 1
Online shopping	12,876	Less than 1
Creating spreadsheets or charts (Excel)	11,214	Less than 1
Creating presentations (PowerPoint)	11,636	Less than 1
Writing documents for pleasure	10,773	Less than 1
Creating graphics (Photoshop, Flash)	8,680	Less than 1
Creating Web pages (Dreamweaver, FrontPage)	4,438	Less than 1
Creating and editing video/audio (Director, iMovie)	4,303	Less than 1

- ***Technology permeates all aspects of student life, but its use as a tool has become paramount.***

A pattern emerges from the data that students use technology first for educational purposes, second for connectedness, and third for entertainment. This varies, however, by gender. On the whole, men

spend more time each week on their computers for entertainment than do women. For example, men report that they spend, on average, 3–5 hours/week surfing the Internet for pleasure, while women report on average less than 3 hours/week.

The attributes of today's students are more readily observable in nonacademic contexts than in the academic setting, despite having enabling technologies readily accessible in both spheres. Technology use in classes is controlled and very much depends on instructor preferences, pedagogy, and skills. Course management systems, for example, which support new patterns of interaction, are faculty-centric. The instructor determines the features that will be used.

Outside courses, students can use the Internet and electronic devices to create social networks and do all kinds of things that they dream up. Social networking, blogging, and instant messaging are often not understood or used by the faculty. Transferring these activities into the academic setting does not happen readily. New patterns of social interaction, which converged and mobile devices enable, occur mostly outside the academic setting.

- ***IT facilitates student communications and academic feedback.***

When asked about the impact of IT in courses, students respond that IT in courses has a positive impact, especially in communications. The highest scores are given to improved communications—communication with instructors (mean of 3.89), feedback from instructors on coursework (3.77), and communication with classmates (3.70), where the scale is 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree.

- ***According to responding students, IT is improving their learning. Students report that our institutions and our faculty are integrating IT inconsistently into courses.***

While learning may not be seen as the primary benefit of IT use in courses, 64.1 percent of the students perceive that IT used in courses improves learning. The remaining students are largely neutral (28.8 percent), while only 7.0 percent disagree or strongly disagree. For those students who indicate that IT in courses improves learning, the most important factor indicated from regression analysis is the skill of the instructor, regardless of the student's age, gender, or major.

The instructor's skill in using IT in courses makes a significant difference in the student's perception of the impact of IT in courses. When comparing the differences in the means between students who rate the instructor's IT skills highest versus those who rate them lowest, the results indicate that the instructor's skills with IT has the greatest positive impact on student engagement in the course, interest in the subject matter, and understanding of complex concepts. Where the instructor's skill is less relevant to the activity (such as communication), the mean differences are significantly lower.

- ***The technology in courses is helping.***

The students surveyed report that the most valuable benefit of using technology in courses is convenience (50.3 percent), followed by connection/communication (19.7 percent). Management of course activities (13.5 percent) and learning (12.7 percent) are next. Only 2.8 percent of the students perceive no benefit whatsoever from using technology in courses. Note, however, that convenience, connectedness, and communications can support learning.

- ***Most students have used a course management system (CMS), and most have had positive experiences.***

Course management systems are being used differently among the institutions in the study. Some institutions are just beginning to adopt course management systems and have limited use, while other institutions have used them for many years. The student respondents report an overall use rate of 72.0 percent. Students at doctoral institutions (75.1 percent) are more likely to have taken a course that used a CMS, and students at AA institutions (23.8 percent) are least likely to have done so.[2]

Of students who have used a CMS, more than 75 percent report a positive or very positive experience using the system. Only 5.0 percent are negative or very negative, and 19.8 percent are neutral.

When assessing what factors contribute to a positive experience with a CMS, students who agree or strongly agree that courses using IT allow them to take greater control of their course activities (planning, apportioning time) report the most positive experience with a CMS. The next greatest factor is the perceived skill of the instructor, followed by instructor's use of IT to provide prompt feedback.

- ***Students use a variety of CMS features.***

Students report the highest use of the syllabus feature (95.2 percent) of a CMS, followed by the use of online reading (94.0 percent). Other features used extensively are keeping track of grades (90.5 percent), access to sample exams and quizzes (83.7 percent), and turning in assignments online (80.1 percent). The features used least are getting assignments back from instructors with comments and grades (67.2 percent) and sharing materials among students (67.5 percent).

The student feedback on CMS use is fairly consistent—students seem to like many of the features but wish instructors used them more extensively and consistently.

- ***A good experience with a CMS translates into positive feelings about IT and learning.***

Students who report a positive experience with a CMS are more likely than students with a neutral or negative experience to agree that the use of IT in courses has a significant positive impact on student engagement in the course and interest in the subject matter; that it improves presentation of their coursework; and that it increases their understanding of complex concepts.

Nearly two-thirds of students who have a very positive experience with a CMS also agree or strongly agree that the use of IT in courses improves their learning. Conversely, if the student's experience with a CMS is negative, the student is more likely to indicate that the use of IT in courses does not improve learning.

[2] Only two AA institutions are reflected in these data; therefore, generalizations about AA students cannot be made with any confidence.

Implications of the Study

The analysis of quantitative and qualitative data can be used to help develop a profile of a world-class undergraduate IT experience. A world-class experience is responsive to student expectations. Listening to the students and paying attention to this study's findings, the analysis identifies six areas to which institutions must pay particular attention:

- Integration of IT into the curriculum
- Definition of IT skills
- Training for students and faculty
- Common learning environments and consistent instructional approaches
- Accessible and effective IT service and support
- Monitoring and benchmarking

Importance of the Curriculum

A major finding of the 2005 ECAR study on student use of technology is that students with the highest level of IT skills acquired many of these skills as a result of course (or program) requirements. Curricula are becoming increasingly IT-intensive, as professional societies and government redefine competencies required of some professions. Such mandates will likely lead to a requirement to develop clear and explicit policies on the role of IT in courses and in the curriculum.

Defining IT Skills Needed for Learning

Once a more global understanding emerges of which information technologies are wanted in courses and in the curriculum, at what level of sophistication, and for what purpose(s), it will become possible to establish a set of required skill sets.

Comprehensive Training

Once skills have been agreed upon, training programs for faculty and students can be designed. Students expect faculty to be skilled in the use of PowerPoint and course management systems. Students also seem to be looking for more innovative use of information technologies that provide students with real-time data in experiential learning exercises; more visual materials; and simulation.

Consistent Use of IT

Students are looking for more consistency in how information technologies are used. This is especially an issue with course management systems, which are used inconsistently by faculty. Students clearly want most of their classes to use course management systems and for faculty to use them in a standardized manner—to have a common appearance.

IT Services and Support

In their responses to the survey and in the interviews, students directly state that they need IT services that are fast, easy-to-use, and reliable. Without basic reliability, students feel they can't count

on the technologies when they need them the most—for submitting papers to their instructors, taking online exams, and communicating with instructors and classmates.

Monitoring

We need to measure student and faculty competencies, attitudes toward the use of IT in courses, and how students and faculty actually use IT. Such measures are needed to assess the effectiveness of the curriculum, the use of technologies, and the performance of training programs.

Conclusion

ECAR plans to repeat this study in 2006, providing a third snapshot in time and making possible an assessment of trends and rates of change in the use of IT, satisfaction with IT, and the impact of IT, especially on learning. It will be interesting to see whether students of institutions that have adopted policies and practices in these areas show increases in their use and skill with information technologies in courses and whether they learn more as a result.

References

- Kvavik, R. B., and Caruso, J. B. (2005). *ECAR study of students and information technology, 2005: Convenience, connection, control, and learning.* Boulder, CO: EDUCAUSE Center for Applied Research. Retrieved October 13, 2005, from http://www.educause.edu/LibraryDetailPage/666?ID=ERS0506
- Kvavik, R. B., Caruso, J. B., & Morgan, G. (2004). *ECAR study of students and information technology, 2004: Convenience, connection and control*. Boulder, CO: EDUCAUSE Center for Applied Research. Retrieved October 1, 2005, from http://www.educause.edu/LibraryDetailPage/666?ID=ERS0405
- Morgan, G. (2003). *Faculty use of course management systems*. Boulder, CO: EDUCAUSE Center for Applied Research. Retrieved October 1, 2005, from http://www.educause.edu/LibraryDetailPage/666?ID=ERS0302
- Oblinger, D. G., & Oblinger, J. L. (Eds.). (2005). *Educating the net generation*. Boulder, CO: EDUCAUSE. Retrieved October 1, 2005, from http://www.educause.edu/LibraryDetailPage/666?ID=PUB7101

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A copy of the full study referenced above is available through the EDUCAUSE Center for Applied Research (www.educause.edu/ecar/).