ECAR Study of Undergraduate Students and Information Technology, 2012

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Contents

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Citation

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FOREWORD

The annual ECAR study of undergraduate students and information technology is an invaluable resource for monitoring the ongoing evolution of undergraduate students' relationship with the digital technology that is increasingly integrated into their academic lives. Understanding this relationship is important because student preferences are crucial to their motivation and attention to their academic work. Furthermore, although their preferences can be driven by technology trends, under the right circumstances students are quite capable of reflective choices about the technology that helps them learn.

The annual student technology study provides baseline measures that make it possible to test and reevaluate assumptions about the technologies students prefer for learning, their capabilities with those resources, and their view of technology's impact on instructors' effectiveness. Past studies have taught us that although some patterns have persisted, many have not, demonstrating the difficulty of predicting how an intervention will develop in this complex system. For instance, students continue to express a preference for learning environments that blend technology with face-to-face instruction. Students also prefer resources that contribute to the achievement of their learning goals rather than technology that is merely trendy. By contrast, student device ownership has shown rapid evolution away from desktop computers, feature cellphones, and PDAs toward laptops, smartphones, and possibly tablets and e-readers. In addition, the ECAR student technology studies help readers dispel common misconceptions about students and technology, such as the view that all traditional-age students have a high level of technical expertise or the idea that because so many students use social networking applications in their personal lives, those technologies should be leveraged for academic purposes as well.

This year's study demonstrates just how important the student voice is in shaping the learning environment of higher education. The voice that emerges here is nuanced and reflective; it is curious about the new but brings a healthy skepticism to the incorporation of *au courant* technologies into teaching and learning. Surely this voice has contributed to the dramatic increase in the use of instructional technologies; heeding it closely now and in the future will enable instructors, administrators, and IT professionals to shape the technological learning environment in constructive ways.

Charles Dziuban, University of Central Florida

J.D. Walker, University of Minnesota

EXECUTIVE SUMMARY

Technology is a critical part of students' learning environments—this is true for traditional brick-and-mortar classrooms as well as e-learning settings. The report *ECAR Study of Undergraduate Students and Information Technology, 2012* explores technology ownership, use patterns, and perceptions of technology among undergraduate students. This year, ECAR collaborated with 195 institutions to collect responses from more than 100,000 students from around the world. Information was gathered about students' perceptions of technology, how various technologies contribute to their overall academic experience, and, more specifically, how technology contributes to their academic achievement.

This year's findings are distilled into the broad thematic message that institutions and educators need to balance strategic innovation with solid delivery of basic institutional services and pedagogical practices and to know students well enough to understand which innovations they value the most. Findings and recommendations reflect four general themes:

- Blending modalities and using technology to engage learners is a winning combination.
- Students continue to bring their own devices to college, and the technology is both prolific and diverse.
- Students have strong and positive perceptions about how technology is being used and how it benefits them in the academic environment.
- Students are selective about the communication modes they use to connect with instructors, institutions, and other students.

The basic premise behind the annual student technology study is that undergraduate student behaviors and opinions of today can inform the technology needs of undergraduate students of tomorrow. Though it is not designed as a formal predictive modeling study, short-term and long-term trends provide insight about how undergraduate student technology experiences and expectations are changing. Undergraduates' behaviors and opinions are also leading indicators of mainstream technology use and drive the adoption of technology used by faculty and staff. Looking at this year's results, comparing them to previous student technology study results, and considering them in the big picture of the cultural relevance of technology helps flesh out explanatory material that goes beyond what students do or say, revealing why they do it or say it and how institutions and instructors can better serve students' technology needs and expectations.

"This year's findings are distilled into the broad thematic message that institutions and educators need to balance strategic innovation with solid delivery of basic institutional services and pedagogical practices and to know students well enough to understand which innovations they value the most."

Key Findings

Blending modalities and engaging learners is a winning combination.

- Blended-learning environments are the norm; students say that these environments best support how they learn.
- Students expect their instructors to use technology to engage them in the learning process, and instructors are responding.
- Understanding which technologies are more or less effective for students can translate into strategic pedagogical investments.

The time has come to move beyond thinking about individual platforms and devices.

- No surprises this year for device ownership—portable devices are the academic champions, and they are diverse in terms of brands and platforms.
- Students continue to bring their own devices, favoring small, portable ones.
- Students want to access academic progress information and course material via their mobile devices, and institutions deliver.

Students believe that technology is critical to academic success and that it plays an important part in their future accomplishments.

- Students believe technology benefits them, especially with regard to achieving their academic outcomes and preparing for future plans.
- Students report that basic technologies have the greatest impact on their success.
- Technology training and skill development for students is more important than new, more, or "better" technology.
- When it comes to device preferences, the usability afforded by the larger screens and keyboards of laptops trumps the portability offered by tablets, but the line between the two is beginning to blur.

Students want multiple communication options, and they prefer different modes for different purposes and audiences.

- Students use social networks for interacting with friends more than for academic communication.
- Academic success is underpinned by e-mail, face-to-face interaction, and using the course/learning management system.

INTRODUCTION

Survey research about students' technology-related opinions and behaviors is important for a couple of reasons. First and foremost, it gives students a voice to express their experiences and expectations about technology in an educational context. Listening to this collective voice of undergraduates can inform the general nature and status of technology in higher education. This voice should be considered in conjunction with a broader decision-making plan about technology investments and use, however, and ECAR recognizes the annual student technology study results as one of many factors that can support decision making and investments in technology. Second, ECAR acknowledges the relationship between students' preferences for technology and their motivation to use technology. Knowing what devices and technology resources students prefer and find useful helps focus attention and concentration on the technologies that matter most.

ECAR Study of Undergraduate Students and Information Technology, 2012, marks the ninth year of data collection about undergraduate students' reported uses of, ownership of, and attitudes toward technology in conjunction with their academic experiences. The study is designed to gather both trending data, to provide insight about how undergraduate student behaviors and perceptions have changed over time, and topical data, to address new or emerging issues that are relevant for the year in which data are collected. The primary objectives of this year's study are to create a profile of undergraduate students' ownership and use of technology for academics, to identify ways that technology helps them achieve their academic outcomes, and to assess their perceptions of how well institutions and instructors use technology to enhance the academic experience. Secondary objectives include identifying longitudinal technology trends among students and providing higher education institutions with actionable recommendations about how to meet or exceed students' expectations for technology in academics.

The findings in this report were developed using a representative sample of students from 184 U.S.-based institutions. A stratified random sample of 10,000 respondents was drawn from the overall response pool to proportionately match a profile of current U.S. undergraduates (based on IPEDS demographics and institutional data). In some cases, comparison data from the additional 11 institutions from around the world were included to highlight differences and similarities between U.S. and non-U.S. results[1] (see participant list in Appendix A). Findings from past ECAR studies were included, where applicable, to characterize longitudinal trends. In exchange for distributing the ECAR-developed survey to their undergraduate student population, participating colleges and universities received files containing anonymous, unitary-level (raw) data of their students' responses and summary tables that compared their students' aggregated responses to student responses at similar types of institutions.

FINDINGS

Blending Modalities and Engaging Learners Is a Winning Combination

Technology is important to students in terms of how they access course materials and how instructors use technology to engage them in the learning process. Students prefer courses with some online components, and they expect their instructors to seamlessly integrate technology in their pedagogical practices. It is important to students that their instructors know how to use technology to facilitate and support learning, and the majority of students said that their instructors use technology effectively. Students shared the types of technology they want instructors to use more of, such as open educational resources and game-based learning. Given the resources needed for instructors to change their curriculum and pedagogy, listening to what students say about new or different technologies to integrate into the learning environment could be a wise investment.

Blended-learning environments are the norm; students say that these environments best support how they learn. About three out of four students reported that they have taken at least one course that includes online components (see Figure 1). The use of blended-learning techniques creates a "postmodality era" where instruction is no longer either online or face-to-face but rather a blending of traditional and nontraditional learning environments.[2] Some institutions, such as the University of Central Florida, the University of Southern California, Rio Salado College, and Umeå University (Sweden), have formal initiatives that provide deconstructed learning spaces for students—pushing out "the classroom" to an anytime, anywhere environment—while other institutions might be experimenting with hybridizing limited components of face-to-face courses. Even with varying levels of sophistication among blended-learning experiences, the vast majority of students in our research (70%) said that these are the environments in which they learn most. Undergraduates at public doctoral institutions have the most opportunities for blended-learning options, with one out of every four students (25%) indicating that all or nearly all of their courses have some online components ($p < 0.0001$). More students age 25 or greater (older students) than younger students preferred classes with online components ($p < 0.0001$). Part-time students did not take courses with online components at significantly higher rates than did full-time students ($p = 0.0575$).

Figure 1. Blended Learning Environments
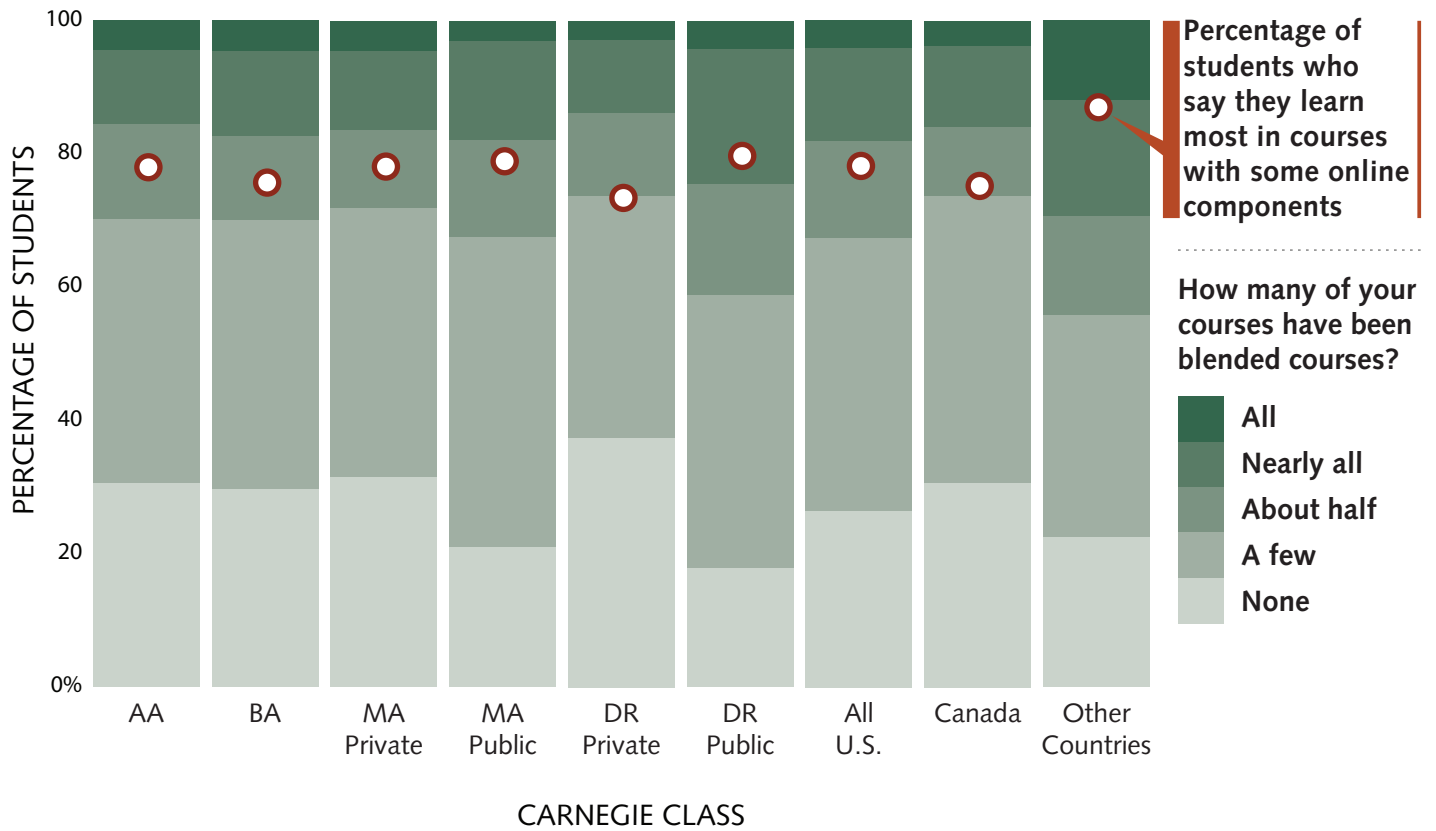
A substantial number of students have also taken a course completely online in the past year. In fact, twice as many students are taking online courses in 2012 (31%) than in 2008 (15%). Associate degree–granting institutions are leaders in online learning. Students taking courses that are completely online are more likely to be enrolled in a community college, older (age 25 or greater), female, not a freshman/first-year student, and attending an institution in the United States ($p < 0.0001$ for all characteristics listed). Part-time students did not take courses offered completely online more than full-time students ($p = 0.1871$). Online course opportunities have expanded access to course offerings beyond a student's primary institution of attendance. Students are opportunistic consumers, and some are taking courses at more than one institution either concurrently or serially. For concurrent enrollment, this "swirling" behavior is highest among students attending associate's institutions in the United States (22%), but 15% of students worldwide are concurrently enrolled in more than one institution.

Students expect their instructors to use technology to engage them in the learning process, and instructors are responding. More students than ever gave positive marks for their instructors' use of technology. Two years ago, less than half (47%) of students reported that most or almost all of their instructors effectively use technology to advance students' academic success, whereas this year more than two-thirds (68%) said that this is the case (Figure 2). Students attending AA institutions reported effective use of technology at significantly higher rates than other types of institutions ($p < 0.0001$). More students in 2012 also reported that instructors have used technology to aid their understanding of course materials and ideas (70%) than they did two years ago (49%).

Figure 2. Instructors' Effective Use of Technology, 2010–2012
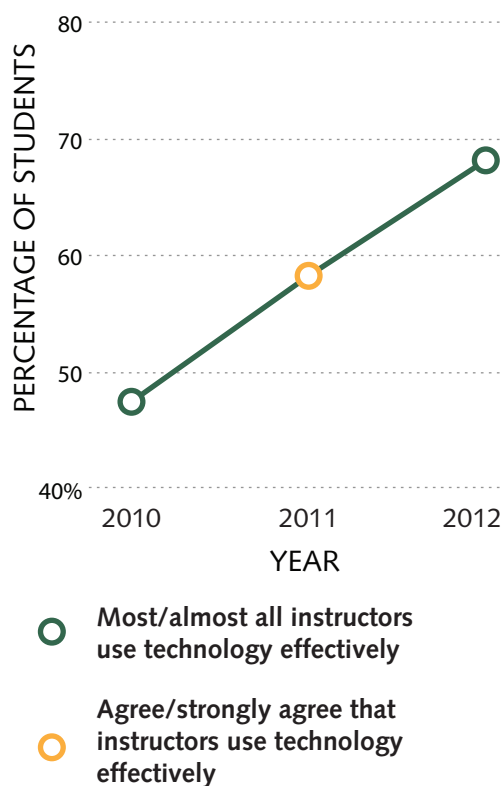
To further demonstrate students' positive attitudes about their instructors' use of technology, about two out of three students agreed that most or all of their instructors:

- Have adequate technology skills
- Have used technology to aid understanding of course materials
- Use the "right kind(s)" of technology
- Use technology effectively

Percentage of students taking courses offered entirely online:

31% at U.S.-based institutions

22% at Canadian institutions
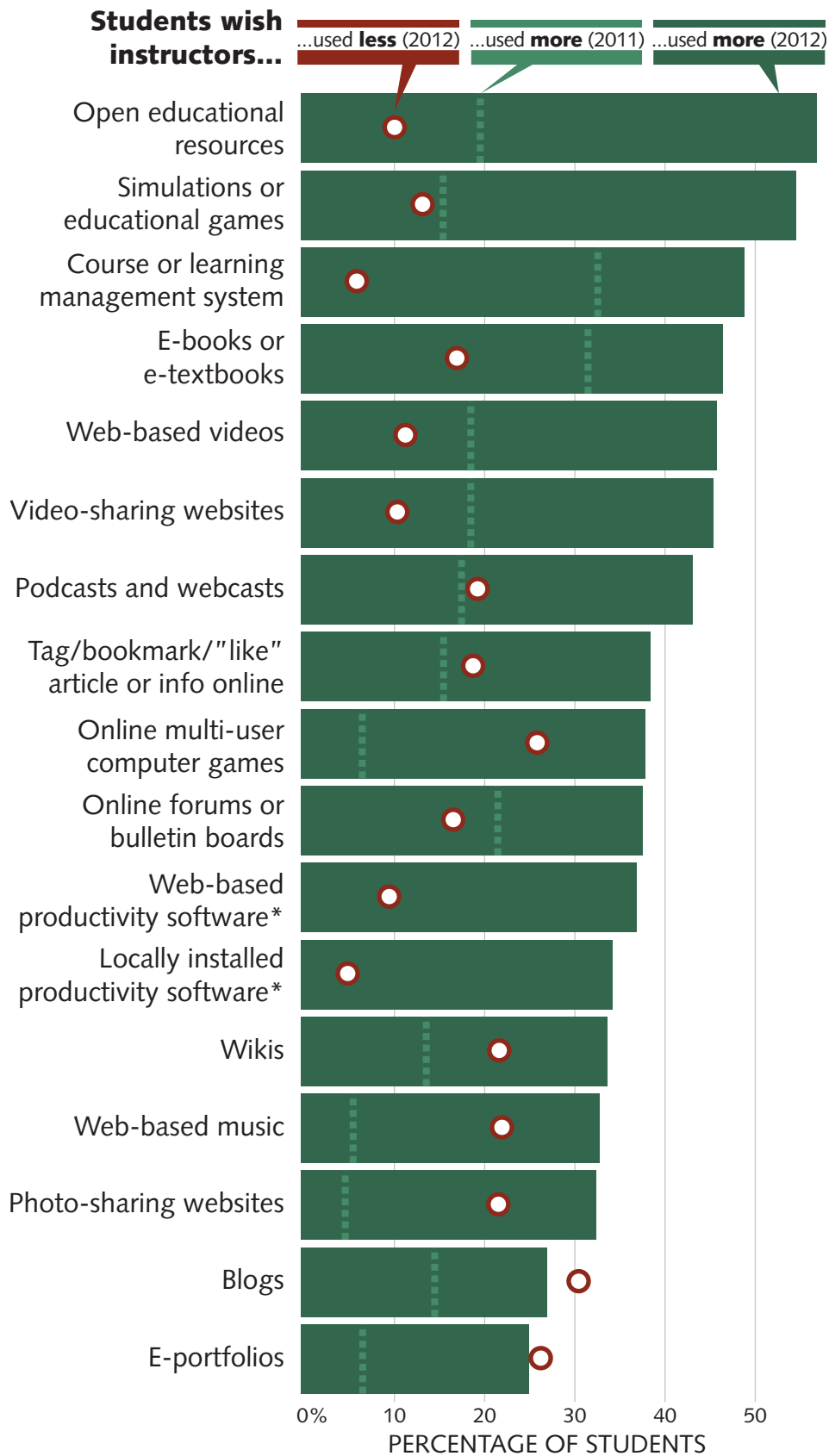
12% at institutions in other countries

64% of students agree/strongly agree that technology elevates the level of teaching

Both faculty and student familiarity with and access to technology helps explain improved student attitudes about technology in academia. Instructors' familiarity with and use of technology in other contexts (e.g., personal, research, or administrative tasks) is transferable to their teaching activities. For students, the line between using the devices they own for both personal and academic purposes is also blurred, and this suggests a comfort level with technology for academic use.

Why are students more actively involved in courses that use technology? There are elements of both connectedness and engagement that speak to this, but there are also utilitarian aspects of technology that relate to students' attitudes about technology. Students said that technology helps them feel connected to what's going on at the institution (67%). Whether this is through passive channels, such as the institution's public website, or active channels, such as a personalized online tutoring session, technology is a tool by which to connect to students regardless of time or space. Similarly, technology makes majorities of students feel connected to their instructors (59%) and to other students (58%). Electronic communication media (e.g., e-mail, text messaging, instant messaging, and social networking) and the proliferation of personal, handheld mobile devices are the obvious explanations for how technology connects students with others. However, although mobile device ownership has grown over the past year, about the same percentage of students in 2012 as in 2011 (about 60%) reported that technology makes them feel connected to others. In this case, more technology does not translate into more connectedness; technology has its limits in facilitating connectivity among individuals.

Understanding which technologies are more or less effective for students can translate into strategic pedagogical investments. Time, resources, and energy are all limited, so instructors must be strategic about whether and how they change their curriculum, pedagogy, or modes of delivery. Students shared suggestions about which technology tools and resources they wish their instructors used less or more often (see Figure 3). To maximize the return on investment for change, this list can be used to inform decisions about making strategic adjustments in pedagogical practices. Newly topping the list this year are students' interest in their instructors using more open educational resources (OERs) and simulations or educational game-based learning (GBL), while more use of course or learning management systems and e-books carry over from the wish list from 2011. Students are on the fence about the use of e-portfolios and blogs, with nearly equal numbers saying these should be used less and used more.

Figure 3. Wish List for Instructors' Technology Usage

Students wish instructors...

- ...used **less** (2012)
- ...used **more** (2011)
- ...used **more** (2012)

Categories (top to bottom):
- Open educational resources
- Simulations or educational games
- Course or learning management system
- E-books or e-textbooks
- Web-based videos
- Video-sharing websites
- Podcasts and webcasts
- Tag/bookmark/"like" article or info online
- Online multi-user computer games
- Online forums or bulletin boards
- Web-based productivity software*
- Locally installed productivity software*
- Wikis
- Web-based music
- Photo-sharing websites
- Blogs
- E-portfolios

X-axis: PERCENTAGE OF STUDENTS (0%, 10, 20, 30, 40, 50)

* No data for 2011

Open Educational Resources: In 2012, 57% of students said they wish their instructors used freely available course content *more,* and this figure is up substantially from the previous year, when only 19% had this on their wish list. The emergence of freely available content is part of the way open solutions are transforming higher education.[3] Examples of open educational resources include the OpenCourseWare Consortium and the Khan Academy. "Education is, first and foremost, an enterprise of sharing,"[4] and OER capitalizes on this idea. There were no significant differences by age or gender, but students who are not first-year students, and white students as opposed to non-white students, reported wishing their instructors would use OERs more than their counterparts ($p < 0.0001$).

Game-Based Learning: The 2012 *NMC Horizon Report* pegs game-based learning as a midterm horizon—two to three years out—before seeing widespread adoption. "Game-based learning reflects a number of important skills higher education institutions strive for their students to acquire: collaboration, problem solving, communication, critical thinking, and digital literacy."[5] According to Epper et al., six trends drive the adoption of game-based learning, the first of which is student expectations.[6]

Simulations and educational games gained popularity on students' wish lists in 2012, with 55% saying they wish their instructors used these more (only 15% of students said so in 2011). Game-based learning and simulations are avenues for IT to change the educational experience, making it more immersive and integrative and capitalizing on students' "digital native" experiences since technology has always been a part of their lives. Educational games can require technical skills of instructors and students beyond those typically expected for general preparation for a course, however, and so implementation plans for game-based learning strategies should consider skill assessment and development needs for both populations. There were no significant differences by age, gender, ethnicity, or class standing (at the $p < 0.0001$ level) for more GBL—this seems to be a unilateral request among students.

The Time Has Come to Move Beyond Thinking about Individual Platforms and Devices

The ownership rates of technological devices among students continue to increase. Nearly all students own a laptop, and more students in 2012 than in previous years own handheld mobile devices such as tablets, smartphones, and e-readers. There is diversity in brands and operating systems among these devices, and consequently there is growing need for device neutrality of apps designed for these mobile technologies. Striking a balance between device-neutral apps and apps that are optimized for specific mobile platforms is tricky but critical in the bring-your-own-device era.

Redefining the "4 R's" in education with the advancement of open educational resources:*

✓ Revise

✓ Remix

✓ Reuse

✓ Redistribute

✱ David Wiley and Cable Green, "Why Openness in Education," in *Game Changers: Education and Information Technologies,* ed. Diana Oblinger (Washington, DC: EDUCAUSE, 2012), 81.

No surprises this year for device ownership—portable devices are the academic champions, and they are diverse in terms of brands and platforms.

Desktops and Laptops: Laptops dominate the quiver of student-owned devices, with almost 9 out of 10 students owning one (86%) (see Figure 4). Laptop ownership is most prominent among younger students ($p < 0.0001$) and students attending a four-year college or university ($p < 0.0001$) versus an AA institution. Fewer community college students own laptops, but they don't lack access to computers. Significantly more community college students own desktop computers ($p < 0.0001$), and 2011 EDUCAUSE Core Data Service (CDS) data demonstrate that AA institutions are more likely to provide on-campus computer access than their four-year institutional counterparts.[7] Laptop ownership among undergraduate students around the globe doesn't vary much—nearly all students said they own one (83%). In terms of operating systems for laptops, the majority of students use the Windows platform, but younger students ($p < 0.0001$) and those attending four-year institutions ($p < 0.0001$), especially private doctoral institutions, favor Macs. Students attending Canadian institutions also reported higher Mac use compared to U.S. students and those in

Figure 4. Device Ownership and Usage
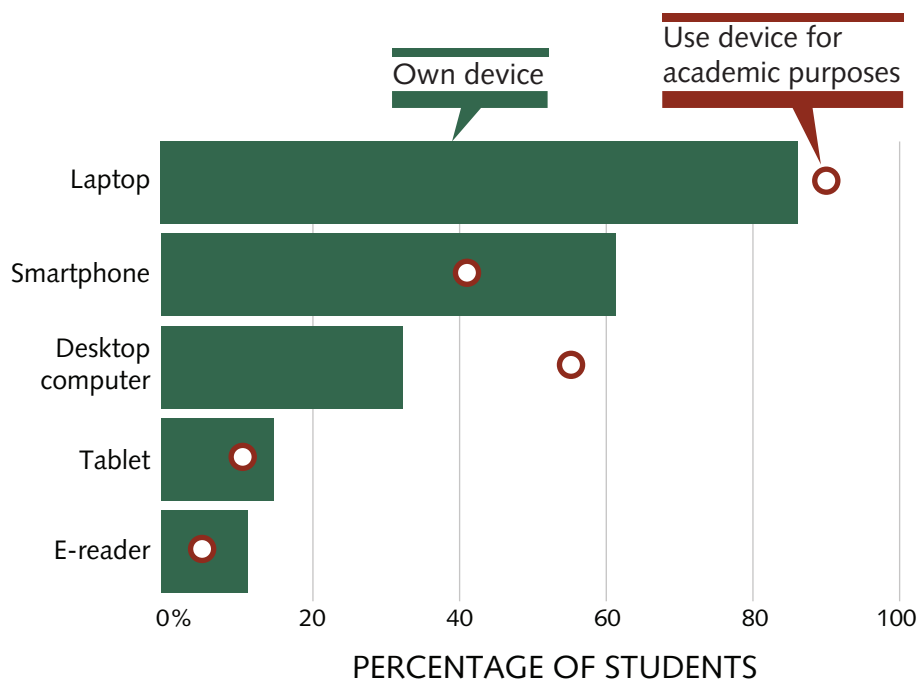
other countries ($p < 0.0001$), but the difference disappears for the U.S. sample when community college students are eliminated from the analysis. Across the board, at most institutions enough students use both platforms to warrant supporting the use of both for academics. CDS data from 2011 demonstrate that the majority of institutions offer full help desk support for Windows (ranging from a low of 72% at

Among students who use a laptop for academics,

76% use Windows/PC

21% use OS X/Mac

Students at four-year institutions and younger students favor the use of Macs.

non–liberal arts BA institutions to a high of 86% at BA liberal arts institutions). Mac support is somewhat less widespread, with a low of 48% at AA institutions and a high of 78% at DR institutions.[8]

Tablets and E-Readers: Many students who own a tablet (15%) or an e-reader (12%) (see Figure 5) use the device for academic purposes (67% and 47%, respectively). There are no statistically significant differences in tablet or e-reader ownership by age, gender, class standing, or Carnegie class. The tablet and e-reader ownership rates for students in the United States don't quite match those of the general adult population. According to the Pew Research Center's Internet & American Life Project, about one in five U.S. adults owns an e-reader and/or a tablet (19% for each).[9]

More students use iPads than Android tablet devices, and more students use Kindles than Nook devices, but there is enough diversity in type of tablet and e-reader device ownership to warrant keeping options open for students to use the devices they already own or prefer to use. According to the 2011 CDS data, most institutions offer best-effort (rather than full) help desk support for e-readers (ranging from a low of 51% for AA institutions to a high of 68% for BA liberal arts institutions). Support for tablets, especially iPads, is greater than for e-readers, with the majority of institutions offering best-effort help desk support to tablet users (ranging from 61% at AA institutions to 75% at BA institutions for iPads, and somewhat higher across Carnegie classes for other tablets).[10]

Tablet ownership is basically identical in the United States and Canada (~15%) but is greater in other countries (18%) ($p < 0.0001$). Looking to other countries' ownership rates of tablets can inform U.S. and Canadian institutions about adoption and integration experiences. For example, among lessons learned from Qatar about student mobile IT practices are that mobile devices have not yet replaced standard tools—such as laptops—that students use for academic work and that mobile devices are most frequently used to keep connected with peers, faculty, and the institution, rather than to generate content for coursework.[11]

Smartphones: A greater percentage of students in 2012 (62%) than in 2011 (55%) said they own a smartphone, and nearly twice as many in 2012 (67%) than in 2011 (37%) reported using their smartphone for academic purposes. Data from the Pew Research Center's Internet & American Life Project also show an increase in smartphone ownership from 2011 to 2012, growing from 35% to 46% of adults in the United States.[12] Undergraduate students own smartphones at higher rates than

Why Provide Desktop Computer Workstations When Nearly All Students Own a Laptop?

The chasm between usage (56%) and ownership (33%) of desktop computers is notable, suggesting that students rely on institution-provided shared computer stations (labs or kiosks) or borrowed equipment for their desktop computing needs. What do they use these desktop computers for that their laptops can't provide? Do they have faster/more stable Internet connectivity? Do they allow access to special hardware or software that is not standard on their laptops? Are they used to access free (or cheap) printing services? Do they provide a convenient designated workplace on the physical grounds of the institution? Since these questions cannot be answered using 2012 student study data, investigating this matter locally is the best way to provide insight about the phenomenon. This type of investigation is imperative before changing policies or practices around reducing or increasing institution-provided and -supported computer stations.

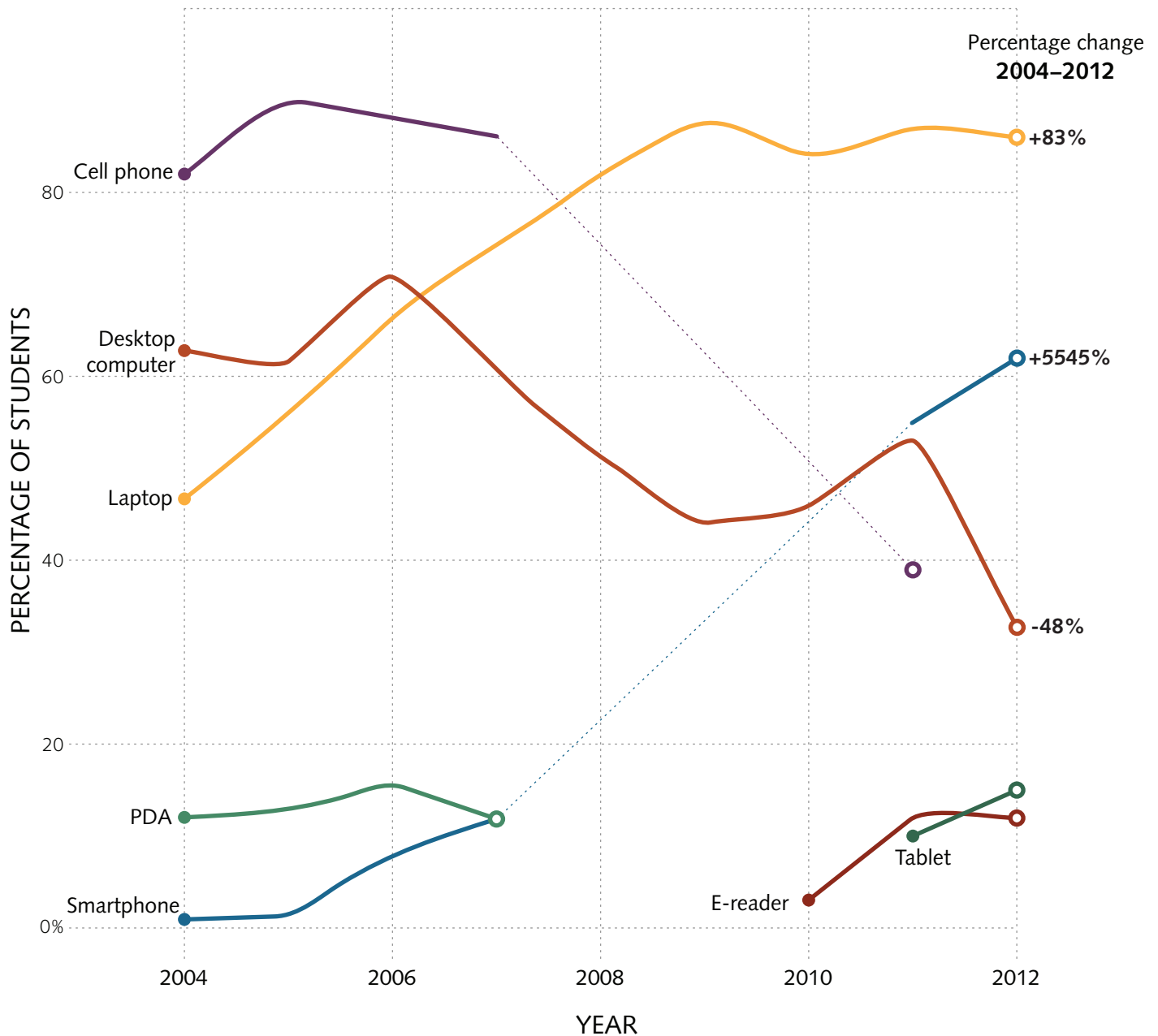Among students who use a tablet for academics,

57% use an iPad
25% use an Android device

For e-readers,
59% use a Kindle
24% use a Nook

Figure 5. Longitudinal Trends in Undergraduate Technology Ownership, 2004–2012

the general public, but there likely are compounding factors that explain this (e.g., socioeconomic status, students on the leading edge of technology use, etc.). There are some significant differences in the demographics or institution type of undergraduate students who own smartphones, but the field is equal for age and gender. Students who said they use their smartphone for academics, however, tended to be non-white[13] ($p < 0.0001$), were not freshman/first-year or sophomore/second-year students

(*p* < 0.0001), and were presently attending a four-year institution as opposed to an AA institution (*p* < 0.0001). Android devices and iPhones share essentially equal helpings of the smartphone market for undergraduate students.

Students continue to bring their own devices, favoring small, portable ones.
Looking at 2004 through 2012 ECAR student technology study data reveals a clear and distinct decline in desktop computer and feature cellular phone ownership in favor of laptops, tablets, and smartphones. This is a statement of the obvious, but Figure 5 shows the extent to which small, portable devices have propagated over the past nine years. Laptops replaced desktops around 2006 and smartphones replaced feature cellular phones around 2010. Only a few years of data on e-reader and tablet ownership have been collected, but the trend over the past few years clearly indicates that these devices have become more and more common among undergraduate students. Pew data support this, with both types of devices growing from about 6% ownership among adults in September 2010 to 19% in January 2012.[14]

Time will tell whether these devices are additive or will replace another technology, but as it presently stands, tablets are generally noted as good tools for consumption (e.g., sourcing info, communicating) but awkward tools for production (e.g., producing academic work). Unless and until tablets become easier to use for producing required coursework, they will remain somewhat marginal in the academic world.

Students want to access academic progress information and course material via their mobile devices, and institutions deliver. Nearly all students reported that basic institutional services and resources are available online or via mobile device applications, and the majority of students who have a handheld mobile device have used it to access a service or resource (see Figure 6). Institutional service offerings are most widespread for grade checking (85%), course websites/online syllabi (85%), and course/learning management systems (82%). These data track with the findings of the mobile IT study[15] conducted by ECAR in 2011, in which the most frequent types of mobile-friendly services, applications, or websites institutions deployed were student- and public-facing (e.g., institutional website, LMS/CMS, library catalog and services).
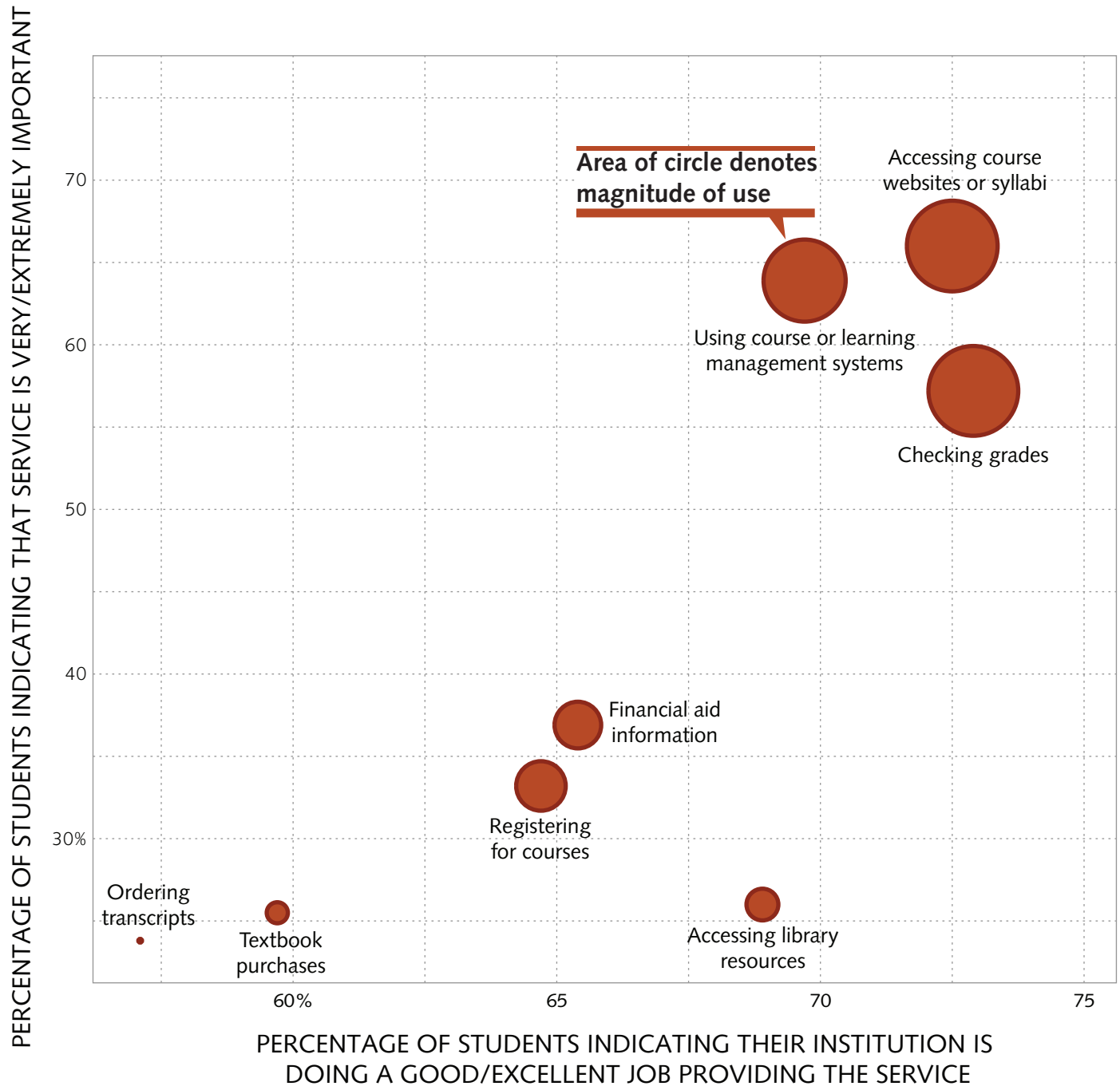
Among students who use a smartphone for academics,

44% use an iPhone

46% use an Android device

Younger students favor the use of iPhones over Android devices.

Figure 6. Students' Access of Services, Apps, and Websites from Mobile Devices

In terms of "on-the-go" access, students were most satisfied (greatest percentage of good or excellent responses) with their institutions' mobile delivery of academic progress information (such as grades) (73%), course materials (such as course websites or syllabi) (73%), and course/learning management systems (70%). These same three services are also what students said are most important to them.[16]

A greater percentage of students at community colleges than students at public universities reported that their institution does a good or excellent job of providing access to services, applications, and websites from a handheld mobile device ($p < 0.05$) There were exceptions for the AA vs. private university comparisons, with no significant differences found between AA institutions and MA private institutions for providing access to library resources ($p = 0.2927$) or accessing course websites or syllabi ($p = 0.3992$), nor were there differences between AA institutions and DR private institutions for ordering transcripts ($p = 0.0782$).

In 2011, AA institutions excelled in some online service delivery areas (i.e., online textbook sales, online course registration, and providing access to grades), but in 2012 they excelled in all areas. A 2012 ECAR report, *Information Technology Services in Community Colleges: Strengths, Opportunities, and Challenges,* explores in more detail how AA institutions compare to other types of higher education institutions in various IT areas.[17]

Mobile technology (or "apps") for academic or institutional purposes clearly needs to support multiple platforms. Findings from the ECAR mobile IT study of 2011 suggest that this is the general direction institutions are headed toward with mobile strategies. While most institutions have no discernible mobile deployment strategy, about a quarter (24%) are adopting mobile web–only strategies (i.e., device-neutral apps that are delivered over a smartphone's browser), 8% are adopting native apps–only strategies (i.e., apps developed for a specific mobile platform), and 13% are adopting a hybrid of mobile web and native apps.[18] Smartphone device and platform diversity would suggest that device-neutral mobile web browser apps are a wise mobile deployment strategy choice; however, a recent Purdue University study on mobile app preferences for general tasks and course-related tasks found their students preferred native mobile apps. Native mobile apps are faster and easier to use, students say.[19] For institutions, the challenge will be to strike a balance between delivering more mobile services and making sure their services are sufficiently mobile-friendly.

Students Believe That Technology Is Critical to Academic Success and That It Plays an Important Part in Their Future Accomplishments

Students value technology in the academic environment, and the vast majority say that technology helps them achieve their academic outcomes and prepares them for the future. Common technologies such as laptops, printers, and USB thumb drives top the list for the most important devices, and technology infrastructure such as the library website and course or learning management systems are among the institutional technology resources that students use the most. In terms of student use, the three types of resources that grew the most over the last year were e-portfolios, web-based citation tools, and e-books.

Despite the availability of new technology and integration of existing technology into "the classroom," students' interest in having more technology skills or training by far exceeds their interest in having new, more, or "better" technology. Using technology for academics for most undergraduates is more about using existing technologies *better* and less about adopting innovative technologies.

Students believe technology benefits them, especially with regard to achieving their academic outcomes and preparing for future plans. Students generally agree that technology helps them achieve their academic outcomes (75%), prepares them for future educational plans (74%), and prepares them for the workforce (63%). The devices students own are tools for both productivity and discovery. And speaking to the latter, technology has a democratizing effect on education by providing access to information on demand, inside and outside the formal learning environment.[20] Postsecondary education has always been an environment for exploration and discovery of ideas and knowledge, and today's technology facilitates this process and literally delivers information to the palm of your hand within seconds. If the "access to information" component of education is streamlined, students should have more time to "use the information" (i.e., build knowledge through exploration, experimentation, and critically thinking about what the information means). Students recognize the value of technology and acknowledge that it helps prepare them for their future endeavors in academia and in the workplace.

Students report that basic technologies have the greatest impact on their success. The utility of technology as a resource to students continues to rise, with technologies such as the institution's library website and the course or learning management system being among the resources that students use most.[21] (The use of the word "basic" here refers not to rudimentary or uncomplicated technology but rather to typical or standard technology that one would expect an institution of higher education to offer.) Like the textbooks and chalkboards/whiteboards, the institution's library and the learning management system are resources that students expect and encounter in most of their courses, and the data show that these resources are both

Percentage change from 2011 to 2012 in general agreement that technology prepares students for future educational plans: +18%

used and considered important for academic success. Looking at the three most recent years of data, there is an obvious increase in technology use among students for all the resources and activities asked about (Figure 7).

Figure 7. Institution-Supported IT Resources and Tools
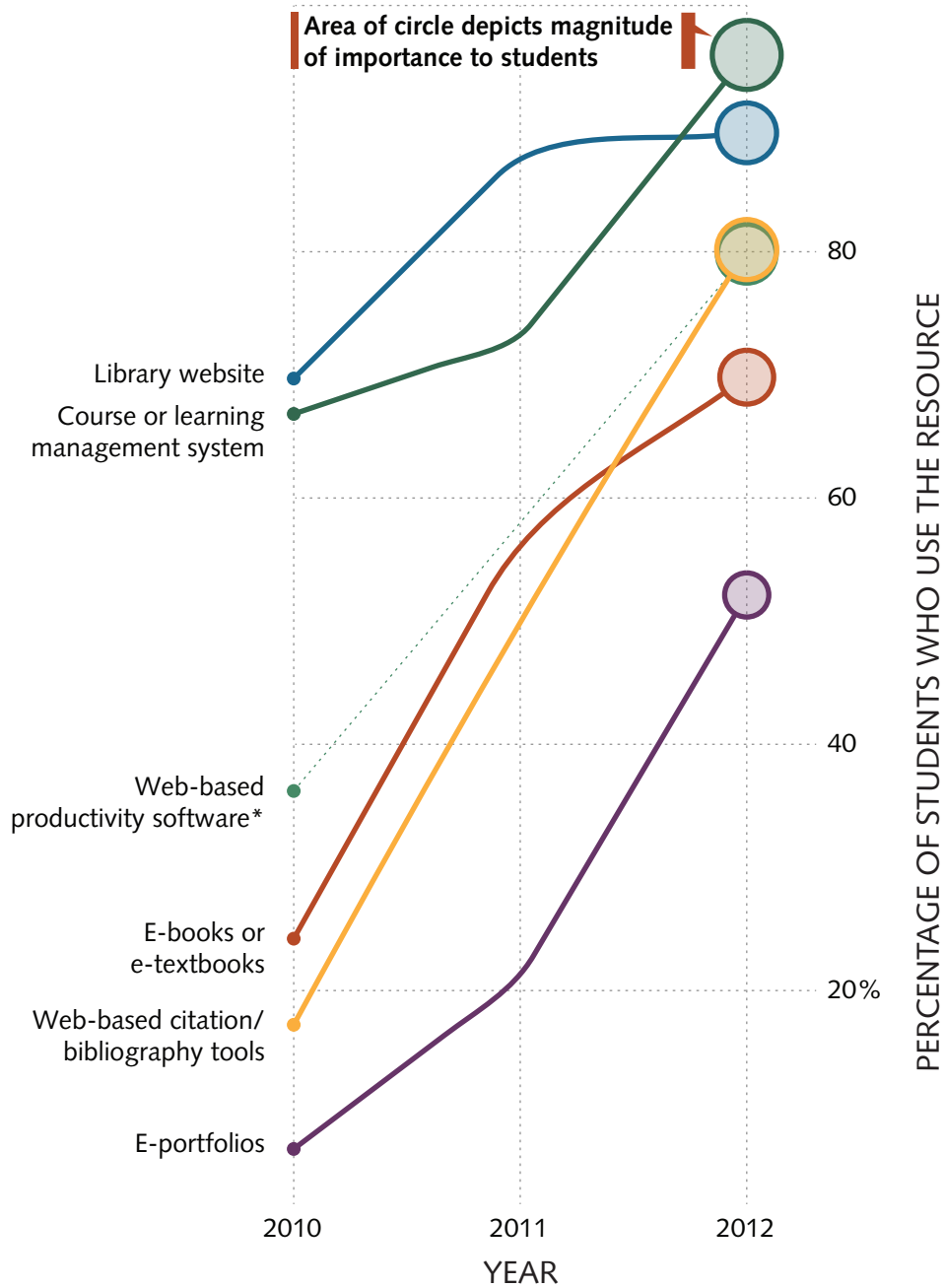
* No data for 2011

With regard to resources students use to facilitate their academic success, the greatest increases from 2010 to 2012 were for e-portfolios, web-based citation/bibliography tools, and e-books or e-textbooks. For e-books and e-texts, the 2011 NMC *Horizon Report* predicted that time to adoption for electronic books was one year or less,[22] and the data gathered about e-books and e-textbooks in the past three ECAR student technology studies support this prediction. In 2010, only 24% of students reported using e-books or e-texts; this figure was 54% in 2011 and 70% in 2012. In 2012, 47% of students said they wish their instructors used e-books or e-textbooks more, suggesting that there is still room to grow here.

However, these same three emerging resource items (e-portfolios, web-based citation tools, and e-books) are at the bottom of the importance list as resources or tools that help students succeed. Perhaps asking about value instead of importance (or lack thereof) would have yielded different results, but as it appears now, a growing number of students use these technologies and acknowledge their usefulness for academic success. Students' perception of importance could also be driven by the rate of use by instructors, in which case their importance to academics could best be judged latently (after more experience with the resource has been gained, and the use of and importance of these resources is tracked in relationship to rate of instructor use). E-portfolio and e-book usage is reported more often by male students ($p < 0.0001$) and students attending institutions outside North America ($p < 0.0001$); there were no differences in specific Carnegie classes in terms of e-portfolio or e-book usage.

More students used the resource in 2012…

7× as many students used e-portfolios (52% vs. 7%)

5× as many students used web-based citation/bibliography tools (80% vs. 17%)

3× as many students used e-books or e-textbooks (70% vs. 24%)

… than in 2010.

Technology training and skill development for students is more important than new, more, or "better" technology. While students reported that most or all of their instructors effectively use technology to impact academic success (68%), there is room to grow in terms of providing students with the training and skills they need to confidently use the technology that is expected of them. Technological proficiency is vital to students' success in the digital age, and the majority said that it is very or extremely important to be better trained or skilled at using technologies to learn, study, or complete coursework (64% U.S., 61% Canada, 58% other countries). The majority of students also said that when they entered the college/university, they were adequately prepared to use the technology needed in their courses (66% U.S., 65% Canada, 57% other countries), but this leaves about a third of students inadequately prepared to use technology. Regarding students' experiences with instructors providing training, just over half of the U.S. students and fewer students in other countries (U.S. 54%, Canada 39%, other countries 48%) said that most or all of their instructors provide them with adequate training for technology used in courses. In the United States, AA and MA private institutions are the leaders in this area ($p < 0.0004$).
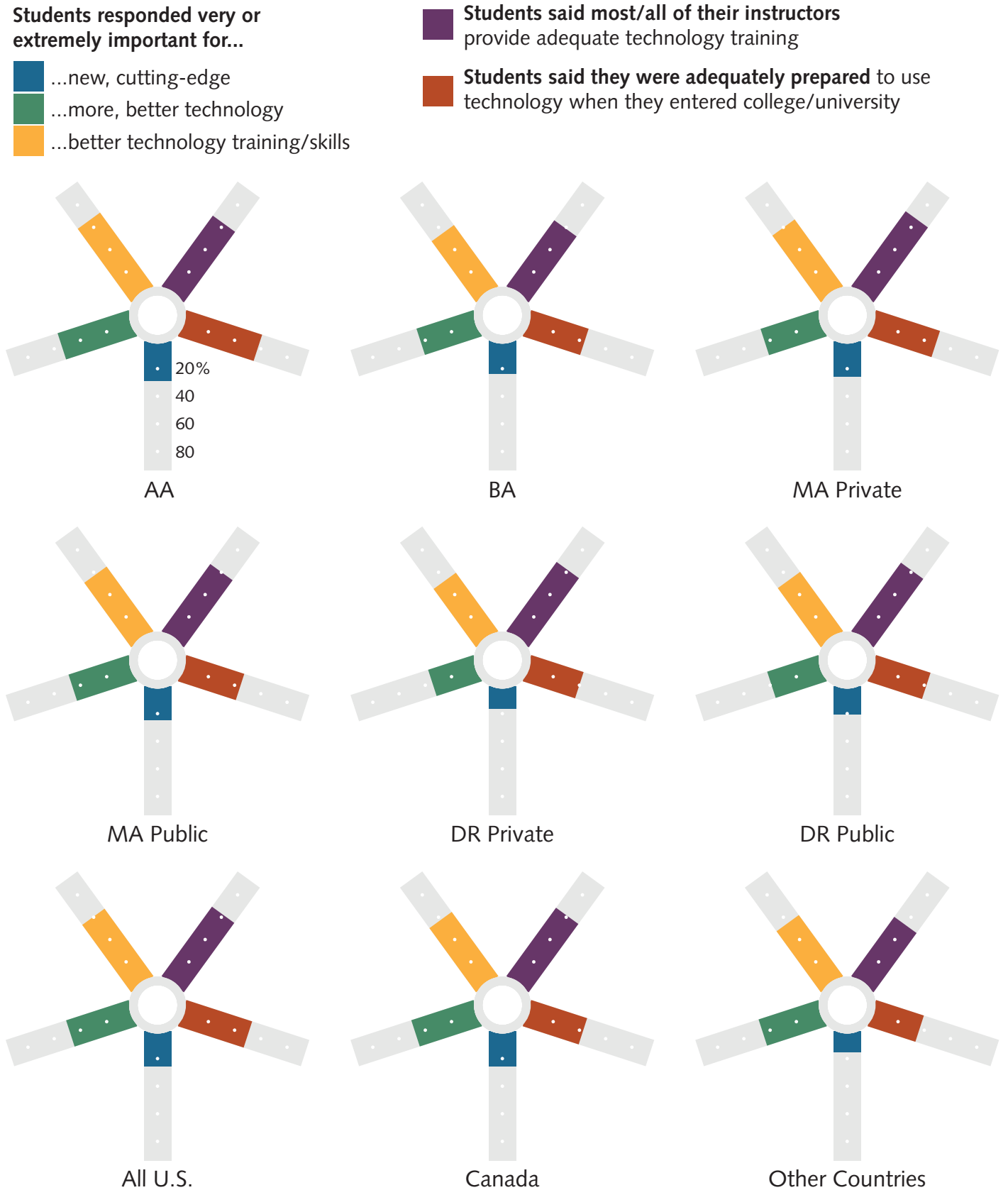
The message from students is clear: Even though most students felt prepared to use technology upon entry, most also said they need or want more technology training or skills. And many indicated a training void that instructors could fill by providing, or making arrangements for, technology training that pertains directly to coursework. Since these are self-reported claims, it is imperative to investigate what these mean for students at an individual institution before taking action to provide more training or access to skills-based resources. The type of training (i.e., topics/content) and how students receive training (i.e., modality/process) can occupy a broad spectrum. The answer to addressing this training issue may be in a help desk format rather than in a course or course-like format. For example, research on this topic from the University of Minnesota found that students favor on-demand problem resolution with technology rather than formal organized training such as in a course or seminar.[23]

Students were ambivalent about their instructors' use of "new, cutting-edge" technologies (25% worldwide said this was very or extremely important, and 28% said it was not at all or not very important), whereas half (50% worldwide) said that having "more" or "better" technology is very or extremely important (Figure 8). Together with the importance students placed on better training in using the technology available to them, this suggests that innovative uses of technology are valuable only if students are prepared to use them.

"Even though most students felt prepared to use technology upon entry, most also said they need or want more technology training or skills."

In 2012, 54% of students in the United States said that instructors provide adequate technology training for IT used in their courses; this is up from 38% in 2010.

Figure 8. Innovation Interests Versus Training Needs

Students responded very or extremely important for...

■ ...new, cutting-edge
■ ...more, better technology
■ ...better technology training/skills

■ **Students said most/all of their instructors** provide adequate technology training

■ **Students said they were adequately prepared** to use technology when they entered college/university

AA

BA

MA Private

MA Public

DR Private
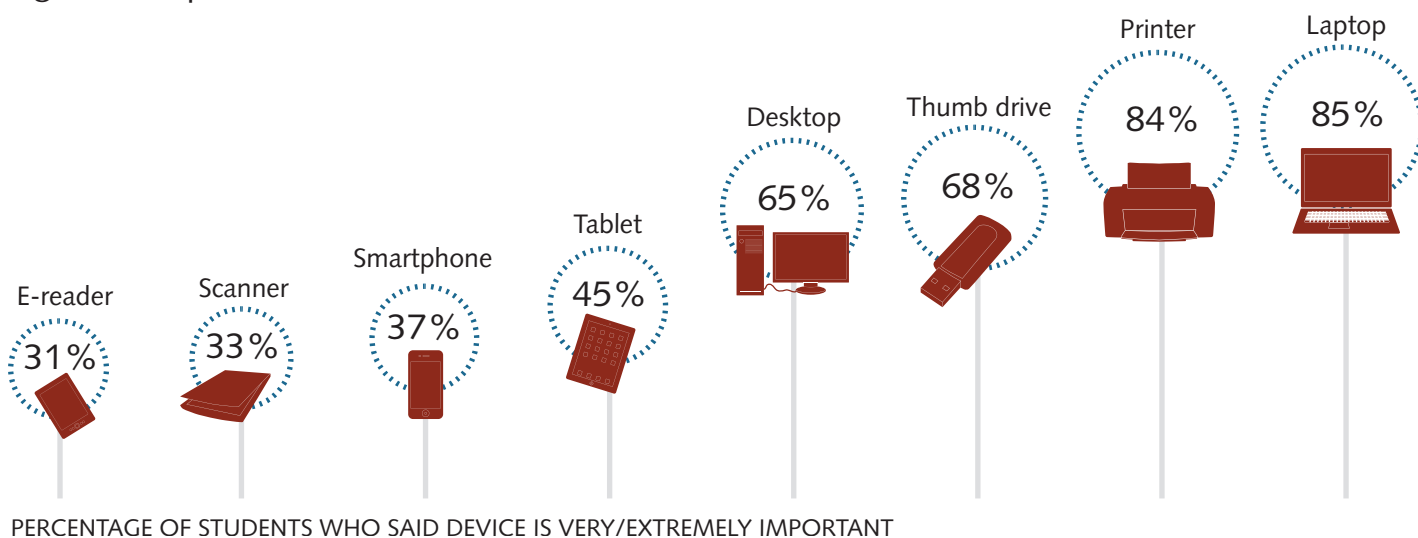
DR Public

All U.S.

Canada

Other Countries

Students who said that it was very or extremely important for their instructors to use "new, cutting-edge" technologies were asked to provide examples of what they meant. In most cases, the technologies students reported were neither new nor cutting edge by industry standards, but in the context of classroom application and utility, things such as smartboards, recorded lectures, and digital course materials are what they want their instructors to use. "New, cutting-edge" technology for undergraduate students is really less about innovation and more about more or better use of existing technologies (e.g., having more and up-to-date software, hardware, and other equipment; encouraging faculty adoption; and using technology to extend learning and communication both inside and outside "the classroom").

When it comes to device preferences, the usability afforded by the larger screens and keyboards of laptops trumps the portability offered by tablets, but the line between the two is beginning to blur. The winning trifecta for the technologies most important to students is laptops, printers, and portable USB devices (i.e., thumb drives). These three devices cover students' basic technology needs to create content for course assignments (laptop), to produce a physical copy of their work for preview or submission (printer), and to transport their work between devices (USB thumb drive)[24] (see Figure 9). These three devices are the icons of productivity for students even though handheld mobile devices, which are presumably more convenient to carry, are gaining in popularity.

More students rated laptop and desktop computers as very or extremely important to their academic success than any handheld mobile device. Presumably, the larger screens and keyboards make it easier to use these devices for research and writing. Ninety-six percent of students who own a tablet also own a laptop, indicating that tablets don't supplant laptop ownership and instead have an additive value to the

Figure 9. Importance of Devices to Academic Success

E-reader 31% Scanner 33% Smartphone 37% Tablet 45% Desktop 65% Thumb drive 68% Printer 84% Laptop 85%

PERCENTAGE OF STUDENTS WHO SAID DEVICE IS VERY/EXTREMELY IMPORTANT

repertoire of devices undergraduates own. But users of tablets rate these devices higher in terms of importance to academics than any other handheld mobile device, suggesting they are a possible intermediary between productivity and portability. Students who own tablets but not laptops rated their tablets as very or extremely important at a substantially higher rate (67%) than students who own both devices (46%). This suggests that the line between mobile convenience and productivity is beginning to blur, but laptops are still the quintessential academic tool of choice for undergraduates. In terms of demographic profiling, a surprising finding is that older students tended to favor tablets ($p = 0.0004$), smartphones ($p < 0.0001$), and e-readers ($p = 0.0082$) over younger students. Cost could be a factor here, with younger students not having the purchasing power to acquire these devices. But regardless of the reason, these data suggest that students transitioning directly from secondary to postsecondary education are not prepared to use these devices as academic tools, or at least haven't found them to be very or extremely important yet. Based on undergraduate student opinions today, one can postulate that these skills are developed during their postsecondary experience. There were no significant differences by age for the importance of laptops.

Students Want Multiple Communication Options, and They Prefer Different Modes for Different Purposes and Audiences
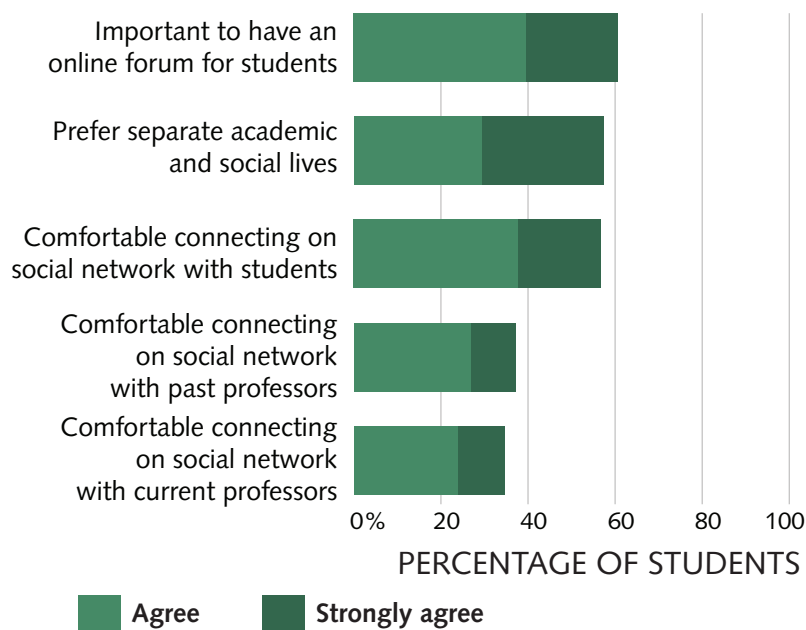
Most students prefer to keep their academic and social lives separate, and they see social networks as more about connecting with friends and less about doing academic activities. E-mail is the preferred method of communication with instructors, while on-demand interactive communication methods (i.e., texting, instant messaging, online chatting) are commonly used among students to interact with one another. These on-demand communication methods increased the most from 2011 to 2012 in terms of what students wished their instructors used more often.

Students use social networks for interacting with friends more than for academic communication. The majority of students continue to want to keep their academic and social lives separate, with nearly three in five stating so in 2011 (58%) and 2012 (57%). Most are comfortable, however, connecting with other students on social network sites and through online forums. The separation of academics and social lives appears to be specific to their disinterest in connecting with instructors on social networks (see Figure 10). Students "friending" current and former instructors is still taboo for most students (only about one in three agreed that it is appropriate), and this finding is consistent with last year's finding. The big picture takeaway here is to note that even though students use a technology regularly as part of their everyday lives, it does not necessarily mean they want that same technology integrated into their academic lives.

Tablets, Smartphones, and E-Readers Persist as Significant Academic Tools

In 2011, students were asked how valuable tablet, smartphone, and e-reader devices are to their academic success, and the findings are relatively consistent with the 2012 importance ratings. The two exceptions are that tablets outranked smartphones and e-readers in 2012 (the reverse was true in 2011) and that smartphones outranked e-readers (which were tied in 2011).

Figure 10. Social Networks and Academics

Important to have an online forum for students

Prefer separate academic and social lives

Comfortable connecting on social network with students

Comfortable connecting on social network with past professors

Comfortable connecting on social network with current professors

0% 20 40 60 80 100

PERCENTAGE OF STUDENTS

■ Agree ■ Strongly agree

Academic success is underpinned by e-mail, face-to-face interaction, and using the course/learning management system. Students care about their privacy when it comes to communicating with instructors via social networks, but outside social networks, students want to interact with instructors using direct forms of interaction. Students also want options for communicating as part of their academic experiences. The three communication modalities that stand out as most important to students are e-mail, face-to-face interaction, and using the course or learning management system to connect with others (see Figure 11). E-mail provides a passive interaction channel that is highly documentable and may be particularly useful when communicating with faculty, TAs, or institutional offices. Face-to-face interaction is not passé; almost 9 out of 10 students found it very or extremely important (87%). This is true even as the trend continues for students to take online courses; for students who have taken a course completely online, face-to-face interaction is very or extremely important to 8 out of 10 of them (81%). Course and learning management systems are becoming more and more sophisticated with regard to a variety of communication options and real-time interaction. Students recognize these systems as more than a tool to send or receive assignments; they are course communication hubs.

The use of "other" social network sites and Twitter moved from minority status in 2011 to majority status in 2012, and social studying sites (e.g., Cramster, CourseHero, GradeGuru, etc.) grew more than any other form of communication by undergraduate students, with 26% more students using social studying sites in 2012 than in 2011.

Greatest changes in forms of communication students use for academic purposes…
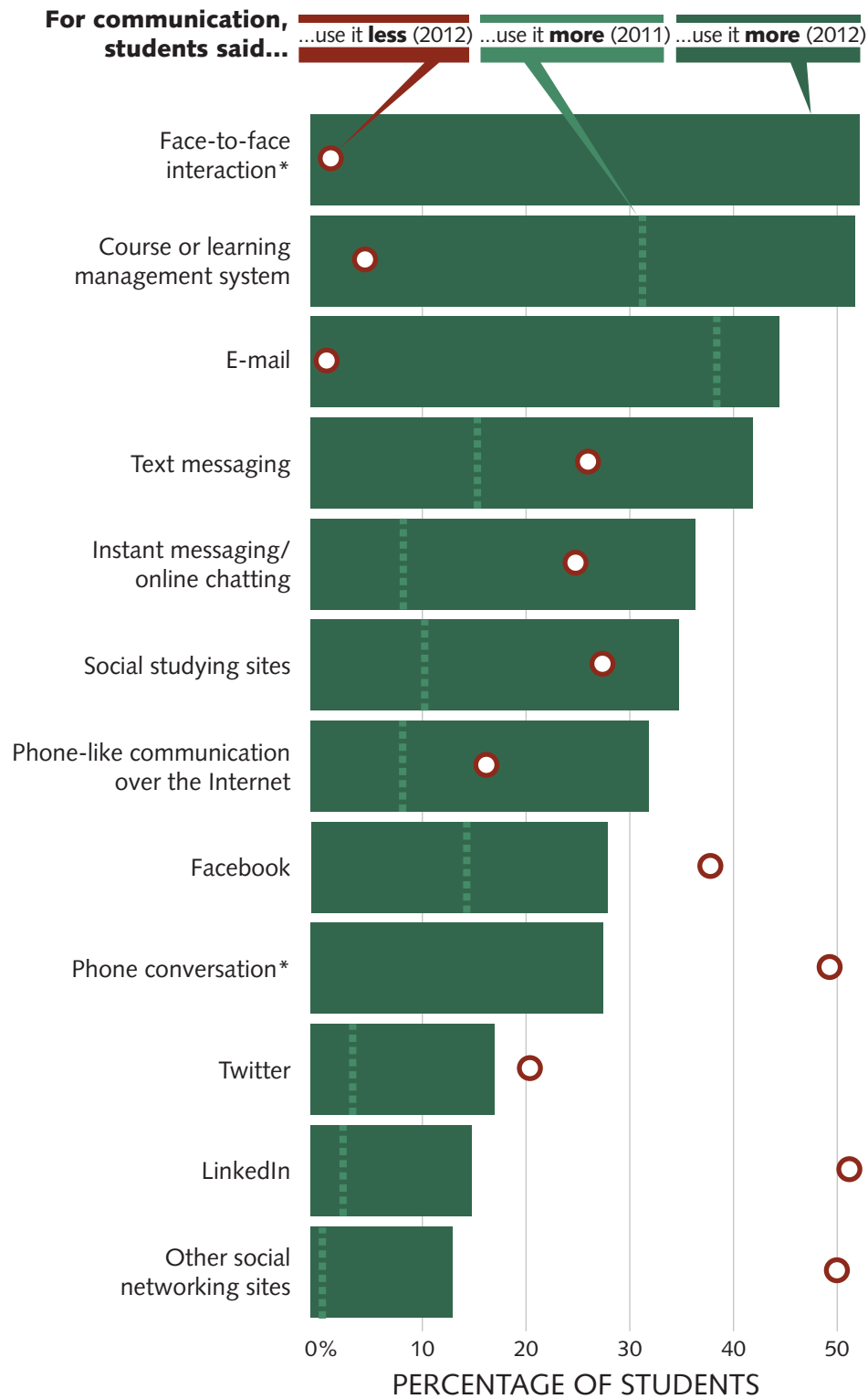
+26% social studying sites

+21% LinkedIn

+20% other social networking sites

+18% Twitter

- 7% Facebook

… in 2012 than in 2011.

Figure 11. Students' Preferences for Communication

For communication, students said... ...use it **less** (2012) ...use it **more** (2011) ...use it **more** (2012)

Face-to-face interaction*

Course or learning management system

E-mail

Text messaging

Instant messaging/ online chatting

Social studying sites

Phone-like communication over the Internet

Facebook

Phone conversation*

Twitter

LinkedIn

Other social networking sites

0%   10   20   30   40   50

PERCENTAGE OF STUDENTS

No data for 2011

The three forms of communication that students find most important align with what they say they want their instructors to use more. Students indicated they want to interact with their instructors more face-to-face, via their course and learning management system, and through e-mail. E-mail topped this same list in 2011. On-demand interaction via text messaging and instant messaging/online chatting also were of notable interest for instructors to use more—these hold the top two positions for the greatest growth from 2011 to 2012. On the other hand, students do not favor social networking sites and telephone conversations as ways to interact with their instructors.

Greatest changes to students' wish list for how instructors should communicate…

+28% IM/online chatting

+27% text messaging

+24% Internet-based phone-like conversation

+21% CMS/LMS

+20% social studying sites

… in 2012 than in 2011.

CONCLUSION

The findings from *ECAR Study of Undergraduate Students and Information Technology, 2012*, tell us what technologies students use and how they perceive technology at their institutions.

Some findings have not changed since last investigated:

- Technology continues to be a means of engagement, with two in three students agreeing that it makes them feel connected to their institutions, their teachers, and other students (2011–2012).
- About two in three students agreed that technology elevates the level of teaching (2011–2012).
- Google and Blackboard topped students' lists for websites they can't live without (2011–2012).
- Few students (~16%) agreed that they skip class when course materials are available online (2010, 2012).
- Students still prefer courses with some online components (blended learning) to other learning environments (2011–2012).

Some findings were predictable changes based on historic trending patterns:

- Continued growth in students' ownership of portable devices; continued decline of desktop computers (2004–2012)
- Substantial, but not surprising, growth (nearly doubled) in the use of smartphones for academic purposes, from 37% to 67% (2011–2012)
- Substantial, but not surprising, growth (nearly tripled) in the use of e-books and e-textbooks, from 24% to 70% (2010–2012)

And a few findings were surprising:

- Substantial growth (nearly sevenfold) in the use of e-portfolios, from 7% to 52% (2010–2012)
- Marked increase in the number of students agreeing that their instructors use technology effectively; this shifted from minority to majority status (2010–2012)
- The appearance of open educational resources and game-based learning at the top of the list of what students wish their instructors used more (2011–2012)
- Students' ambivalence toward their instructors using "cutting-edge" technology while making a strong statement about wanting more technology training and skills for themselves (2012)

RECOMMENDATIONS

Blending modalities and engaging learners is a winning combination.

1. **Continue to support blended-learning environments and reward innovation** of scalable (successful) blended-learning practices. Students say they learn most in courses that have online components, and this practice supports their interest in anytime, anywhere learning opportunities.

2. **Don't underestimate the importance of technology to students,** and consider their ratings of the effective use of technology by their instructors as a key indicator for their general experience with technology at the institution. Instructors have the most frequent direct contact with students, and as the institution's de facto technology ambassadors to students, faculty should have professional development opportunities and support for their use of technology "in the classroom."

3. **Look to emerging or established leaders (other institutions, other countries, other industries) for strategies** to deliver institutional and curricular content to tablets and smartphones. Learn from their exemplary strategies for IT support and security with student devices as well as planning, funding, deploying, and managing instructional technologies, services, and support.

4. **Develop a plan to learn about your students' technology profile,** experiences, and interests. Use the information you learn from students to take action to improve their experiences with technology at the institution.

5. **Work with faculty to experiment with open educational resources and game-based learning** opportunities; these are among the technologies that students wish their instructors used more.

The time has come to move beyond thinking about individual platforms and devices.

1. Diversity of technology among students is as high as it has ever been, and it is impossible to support all brands, products, and platforms. **Develop mobile IT strategies that allow for cross-platform compatibility,** such as generic mobile apps and hybrid apps.

2. **Prioritize the development or improvement of mobile–friendly resources** and activities that students say are important: course websites and syllabi, course and learning management systems, and academic progress reports (i.e., grades).

3. For institutions that provide desktop computer stations on a physical campus, investigate how these are being used by students. **Identify what additional value or resource desktops provide beyond the user-owned laptop,** and consider alternative and perhaps more affordable options to meet this need.

Students believe that technology is critical to academic success and that it plays an important part in their future accomplishments.

1. Even though technology helps students feel more connected, don't discount the importance of face-to-face interaction. **Consider multiple communication channels between the institution and students and between instructors and students**; students say they want options.

2. **Bridge the gap between the technologies that have seen the greatest growth** (e-portfolios, e-books/e-textbooks, and web-based citation/bibliographic tools) **and students' attitudes about their importance.** Focus training/skill-building opportunities for students, professional development opportunities for faculty, and support service opportunities on these "emerging technologies."

3. **Don't assume all students know how to use the technology they own and use as academic tools.**
   - Instructors should reconcile the technical literacy of their students and the technology they use/ask students to use. Providing on-demand opportunities or resources to gain requisite technical skills will contribute to student performance assessments being true to their knowledge of the subject matter rather than to their technical skills in completing assignments.
   - Institutions should consider assessing the technical literacy of their students upon entry and offer opportunities for technical training or on-demand skills building. Training is more important to students than more or "better" technology and is essential for their success in a world where these skills are expected.

Students want multiple communication options, and they prefer different modes for different purposes and audiences.

1. Students want to connect with one another through social networks but are cautious of mixing academic and social lives. **Provide students with networking opportunities** that support their academic work but that are one step removed from faculty oversight or involvement.

2. **Use e-mail and the course and learning management system for formal communication** with students. Experiment with text messaging and instant messaging/online chatting, and don't focus efforts on using social networks and telephone conversations to interact with students.

Undergraduate student behaviors and opinions are leading indicators of mainstream technology use and drive the adoption of technology used by faculty and staff. This year's findings distill into the broad thematic message that institutions and educators need to balance strategic innovation with solid delivery of basic institutional services and pedagogical practices, and to know their own students well enough to understand which innovations they value the most. The study's recommendations support this message by capturing the essence of the knowledge gained by asking students to share their technology experiences.

METHODOLOGY

Since 2004, ECAR has conducted an annual study of undergraduate students and information technology that sought to shed light on how information technology affects the college/university experience. These studies have relied on students recruited from the enrollment of institutions that volunteer to participate in the project. After securing local approval to participate in the 2012 study (e.g., successfully navigating the IRB process) and submitting sampling plan information, ECAR shared the link to the current year's survey with each participating institution. An institutional representative then sent the survey link to students in the institution's sample. Data were collected between February 16 and April 10, 2012, and 106,575 students from 195 institutions responded to the survey (see Table 1). ECAR issued $50 or $100 Amazon.com gift cards to 39 randomly selected student respondents who opted into a drawing—the opportunity drawing was offered as an incentive to participate in the survey.

Table 1. Summary of Institutional Participants and Response Rates

Carnegie Class/ Region	Institution Count	Percentage of Overall Responses Collected	Total Response Count	Overall Response Rates
AA	51	26%	26,555	7%
BA	18	9%	6,041	18%
MA Public	33	17%	21,241	12%
MA Private	27	14%	10,069	12%
DR Public	39	20%	25,762	8%
DR Private	16	8%	8,879	12%
Canadian	6	3%	3,767	9%
Other Countries	5	3%	4,261	6%
All	195	100%	106,575	9%

ECAR selected a representative sample of 10,000 respondents attending U.S.-based institutions, and this stratified random sample of U.S. students was designed to proportionately match the most recent IPEDS figures on age, gender, ethnicity, full-time/part-time status, Carnegie class, and institutional control (public/private) for U.S. undergraduates. (The 2011 sample of approximately 3,000 students was weighted to match national percentages for a similar set of factors.) The 2012 representative U.S. sample results in an approximate 5% margin of error. The international respondents were neither sampled nor weighted. All information in the report refers to the U.S. representative sample unless otherwise noted. When international data are used, it is explicitly labeled as such.

ACKNOWLEDGMENTS

Appendix A: Participating Institutions

Alphabetical List of Institutional Participants in the 2012 Student Technology Study

Albany State University
Aquinas College
Auburn University
Baldwin-Wallace College
Bellevue University
Benedictine University
Blue Ridge Community College
Boston University
Brandeis University
Brazosport College
Bridgewater State University
Bucknell University
Butler University
California Polytechnic State University–San Luis Obispo
California State Polytechnic University–Pomona
California State University–Channel Islands
California State University–Fresno
California State University–Fullerton
California State University–Northridge
California State University–Sacramento
Camosun College
Canadian University College
Catawba College
Cecil College
Central Connecticut State University
Central Michigan University
Central Virginia Community College
Chandler-Gilbert Community College
City University of Hong Kong
Clemson University
Colgate University
The College of Saint Rose
College of Wooster
Collin County Community College District
Community College of Vermont
Concordia University College of Alberta
Concordia University Texas
Coppin State University
Cornell University
Dabney S. Lancaster Community College
Danville Community College
Denison University
DeVry University–Home Office
Dominican University
Drexel University
Dublin City University
Eastern Kentucky University
Eastern Shore Community College

Elgin Community College
Embry-Riddle Aeronautical University–Daytona
Embry-Riddle Aeronautical University–Prescott
Embry-Riddle Aeronautical University–Worldwide
Emory University
Estrella Mountain Community College
Fairfield University
Fordham University
Franklin W. Olin College of Engineering
GateWay Community College
Geneva College
George Brown College
The George Washington University
Georgetown College
Georgia Gwinnett College
Georgia Southern University
Georgia State University
Germanna Community College
Glendale Community College
Greenville Technical College
Hamilton College
Harvard University
Harvey Mudd College
The Hong Kong Polytechnic University
Indiana University Bloomington
Indiana University Southeast
J. Sargeant Reynolds Community College
John Tyler Community College
Johnson & Wales University
Keene State College
La Roche College
Lawrence Technological University
LeTourneau University
Lewis University
Lone Star College–CyFair
Lone Star College–Kingwood
Lone Star College–Montgomery
Lone Star College–North Harris
Lone Star College–Tomball
Lone Star College–University Park
Lord Fairfax Community College
Loyola University Chicago
Madison Area Technical College
Marietta College
McGill University
Menlo College
Mesa Community College
Messiah College

Alphabetical List of Institutional Participants in the 2012 Student Technology Study, *continued*

Miami University
Minot State University
Mississippi State University
Morningside College
Mount St. Mary's College
Mountain Empire Community College
New River Community College
Northern State University
Northern Virginia Community College
NorthWest Arkansas Community College
Northwestern College of Iowa
Oakland University
Paradise Valley Community College
Passaic County Community College
Patrick Henry Community College
Paul D. Camp Community College
The Pennsylvania State University
Pepperdine University
Philadelphia University
Phoenix College
Piedmont Virginia Community College
Portland State University
Purdue University
Rappahannock Community College
Rhode Island College
Rio Salado College
Saint Mary's University
Saint Michael's College
Scottsdale Community College
South Dakota State University
South Mountain Community College
Southern Methodist University
Southside Virginia Community College
Southwest Virginia Community College
Southwestern Assemblies of God University
Springfield Technical Community College
St. John Fisher College
SUNY College at Cortland
Tallahassee Community College
Tarleton State University
Thomas Nelson Community College
Tidewater Community College
Trine University
Trinity University
Truman State University
Tufts University
University at Albany–SUNY
University of Akron
University of Alaska Fairbanks
The University of Arizona

University of Arkansas
University of California–Berkeley
University of Cape Town
University of Delaware
University of Florida
University of Indianapolis
University of La Verne
University of Maryland
University of Maryland–Baltimore County
University of Michigan–Ann Arbor
University of Mississippi
University of Missouri
The University of Montana
University of Nebraska at Kearney
University of Nevada–Las Vegas
University of New Mexico
University of North Carolina at Pembroke
University of North Carolina Charlotte
University of North Dakota
University of Oregon
University of South Carolina Upstate
The University of South Dakota
University of South Florida
University of South Florida St. Petersburg
University of Texas at Brownsville
University of Texas–Pan American
University of the Pacific
University of Tulsa
University of Washington
University of West Florida
University of West Georgia
University of Western Australia
University of Wisconsin–Eau Claire
University of Wisconsin–Madison
University of Wisconsin–Milwaukee
University of Wisconsin–Stevens Point
University of Wisconsin–Superior
University of Wisconsin–Whitewater
Valencia College
Villanova University
Virginia Highlands Community College
Virginia Western Community College
Washington University in St. Louis
Wayne State University
West Virginia University
Western Carolina University
Wichita State University
Winona State University
Wytheville Community College

NOTES

1. There is no fee to participate in the annual student technology study, and the window for institutions to pledge participation in the 2013 study closes on January 31, 2013. For more information about how to participate in future ECAR student technology studies, visit http://www.educause.edu/ecar or e-mail ecarstudy@educause.edu.

2. Thomas B. Cavanagh, "The Postmodality Era: How 'Online Learning' Is Becoming 'Learning,'" in *Game Changers: Education and Information Technologies*, ed. Diana Oblinger (Washington, DC: EDUCAUSE, 2012), 215–228.

3. Diana Oblinger, "Introduction," in *Game Changers: Education and Information Technologies*, ed. Diana Oblinger (Washington, DC: EDUCAUSE, 2012), 3–7.

4. David Wiley and Cable Green, "Why Openness in Education," in *Game Changers: Education and Information Technologies*, ed. Diana Oblinger (Washington, DC: EDUCAUSE, 2012), 81–89.

5. L. Johnson, S. Adams, and M. Cummins, *The NMC Horizon Report: 2012 Higher Education Edition* (Austin, TX: The New Media Consortium, 2012).

6. Rhonda M. Epper, Ann Derryberry, and Sean Jackson, "Game-Based Learning: Developing an Institutional Strategy" (Research Bulletin) (Louisville, CO: EDUCAUSE Center for Applied Research, August 9, 2012), available from http://www.educause.edu/ecar.

7. EDUCAUSE Core Data Service 2011, Module 2, Question 28, http://www.educause.edu/coredata.

8. Susan Grajek and Pam Arroway, *The EDUCAUSE 2011 Core Data Service Report Highlights and Insights into Higher Education Information Technology* (Boulder, CO: EDUCAUSE, January 2012), available from http://www.educause.edu/coredata.

9. Lee Rainie, *Tablet and E-Book Reader Ownership Nearly Double over the Holiday Gift-Giving Period* (Washington, DC: Pew Research Center, Internet & American Life Project, January 23, 2012), http://pewresearch.org/pubs/2176/tablet-computers-ebook-readers.

10. Grajek and Arroway, *The EDUCAUSE 2011 Core Data Service Report.*

11. Eden Dahlstrom and Khalid Warraich, *Student Mobile Computer Practices, 2012: Lessons Learned from Qatar* (Research Report) (Louisville, CO: EDUCAUSE Center for Applied Research, May 2012), available from http://wwww.educause.edu/ecar.

12. Aaron Smith, *46% of American Adults are Smartphone Owners* (Research Report) (Washington, DC: Pew Research Center, Internet & American Life Project, March 2012): 2, http://www.pewinternet.org/~/media//Files/Reports/2012/Smartphone%20ownership%202012.pdf.

13. According to the Pew Research Center's Internet & American Life Project, black (64%) and Hispanic (63%) smartphone owners outpace their white (52%) counterparts in using their cell phones as Internet portals. The same study also cites that twice as many black (51%) and almost twice as many Latino (40%) as white (24%) cell Internet users access the Internet "mostly" via their cell phone (Aaron Smith, *Cell Internet Use 2012* [Washington, DC: Pew Research Center, Internet & American Life Project, June 26, 2012], http://www.pewinternet.org/Reports/2012/Cell-Internet-Use-2012/Main-Findings/Cell-Internet-Use.aspx).

14. Rainie, *Tablet and E-Book Reader Ownership Nearly Double.*

15. Gregory Dobbin, with Pam Arroway, Eden Dahlstrom, and Mark C. Sheehan, *Mobile IT in Higher Education, 2011* (Research Report) (Boulder, CO: EDUCAUSE Center for Applied Research, December 2011), available from http://www.educause.edu/ecar.

16. It is interesting to note that investigating the relationship between availability and importance leads to a chicken-and-egg scenario. Is it that institutional resources were well spent to develop mobile capabilities in the areas most important to students or that these areas are most important to students because they have mobile capabilities?

17. Eden Dahlstrom, Pam Arroway, Susan Grajek, and Joy Hatch, *Information Technology Services in Community Colleges: Strengths, Opportunities, and Challenges* (Research Report) (Louisville, CO: EDUCAUSE Center for Applied Research, July 2012), available from http://www.educause.edu/ecar.

18. Dobbin, *Mobile IT in Higher Education.*

19. Kyle Bowen and Matthew D. Pistilli, "Student Preferences for Mobile App Usage" (Research Bulletin) (Louisville, CO: EDUCAUSE Center for Applied Research, forthcoming), available from http://www.educause.edu/ecar.

20. Thomas L. Friedman, *The Lexus and the Olive Tree* (New York: Farrar, Straus and Giroux, 1999), 45. It is important to note, however, that this democratizing effect is present only among students who own and use technology for academics, and this may discount students who are at a disadvantage (from a socioeconomic standpoint) regarding ownership.

21. It is interesting to note that when students were asked "When it comes to your success as an undergraduate, what is the one website or online resource you couldn't live without?" the most frequently cited sources were Google (33%) and Blackboard (16%); both of these significantly outranked students' citing the college or university library website (5%).

22. L. Johnson, R. Smith, H. Willis, A. Levine, and K. Haywood, *The 2011 Horizon Report* (Austin, TX: The New Media Consortium, 2011).

23. J.D. Walker, Manager, Research and Evaluation, University of Minnesota (e-mail correspondence August 27, 2012).

24. Though not explicitly asked in 2012 but based on the continued proliferation of Internet-capable devices students own, having Wi-Fi access is also a technology that students find instrumental to their success; in 2011, 78% of students said that Wi-Fi was extremely valuable to their academic success. Eden Dahlstrom, Tom de Boor, Peter Grunwald, and Martha Vockley, with a foreword by Diana Oblinger, *The ECAR National Study of Undergraduate Students and Information Technology, 2011* (Research Report) (Boulder, CO: EDUCAUSE Center for Applied Research, October 2011), available from http://www.educause.edu/ecar.