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Foreword

Few phenomena better illustrate the current pace of technological change than the recent rise of mobile computing. Technology that a decade ago would have seemed pure science fiction has become an indispensable accessory for modern life. The majority of the students, faculty, and staff in higher education now wield powerful mobile devices that sport high-resolution video cameras, geolocation awareness, and omnipresent high-speed Internet access—features that will forever change our classrooms and campuses. As IT people, we always have recommendations to make, but from the freshest undergraduates to the most seasoned university executives, consumers are making their own mobile-device purchasing decisions. Students, for example, now bring with them a combination of devices, applications, and usage preferences that are as diverse as their personalities. What's more, students bring their own bandwidth and attitudes toward security and privacy. Campuses are grappling with what it means to support mobile users. More than providing infrastructure, this support involves harnessing technology to deliver totally new services and rethinking—at some pretty deep levels—how we go about the business of teaching and research.

Campus IT leaders find themselves in a position to respond to and help shape the biggest technology revolution since the explosion of the consumer Internet. Somewhat paradoxically, despite the consumerization of mobile technology, the community increasingly calls on IT for support with mobile computing. Even with the loss of control, IT has an important role to play in helping institutions fulfill the promise of mobility. As this ECAR report reveals, the precise focus of our attention remains a difficult question, but it's one we cannot defer.

Due to the rapid evolution and extraordinary rate of churn among mobile devices, applications, and capabilities, finding the most effective strategies for mobile development and device management can be a challenge. For example, much digital ink has been spilled on the struggle between advocates for native application development and those championing the mobile web. Unfortunately, it isn't as simple as picking one direction or technology. The key for institutions is in understanding the nature of the options in order to establish a sensible overall approach for their situation. The correct answers most likely involve taking a portfolio approach to mobile technology investments, shaped by institutional characteristics, goals, and priorities.

Mobility remains in its formative stages, a journey with myriad possibilities and destinations we cannot yet even imagine, let alone describe. This report provides a snapshot that reflects where we are today, a map of the different perspectives and approaches institutions have taken so far to enable mobile technology. As you will see, there is no one right answer and no most popular route forward. When considering how to support mobile technology, the only mistake is not to start.

—Bill Allison, University of California, Berkeley

—Kyle Bowen, Purdue University

Executive Summary

In a remarkably short time, mobile devices have gone from being untethered phones to text-messaging tools, e-mail platforms, digital cameras, music and video players, entertainment and gaming devices, interactive maps, and so much more. Ownership of mobile devices—particularly smartphones but increasingly tablets, too—is on the rise, and for many, the question is no longer about what mobile devices *can* do but what they *can't* do.

Mobile computing is a part of everyday life, led largely by the consumer market for devices and applications, and it is moving into higher education in areas including teaching and learning but also administration and research. Many colleges and universities expect mobility to be a significant part of central IT operations soon, if it isn't already, and are trying to understand how best to capitalize on the potential of mobile computing, especially in tough economic times.

Key Findings

Fewer Trends, More Variance Than Usual

- The demographic factors that usually uncover patterns and statistically significant differences in ECAR research—Carnegie class, size, control (public or private), and whether an institution's mission is focused more on teaching or research—showed very few reportable trends in the mobility data.
- Responses in some areas were highly variable, such as spending on mobile apps: More than one-third of respondents said they had not spent any money on mobile-enablement in the past 12 months, while two institutions had spent more than half a million dollars.
- Staffing levels for mobile computing also vary widely, as does the number of services mobile-enabled, with 38% of respondents enabling none and some enabling 20–50.
- Our research found no association between the progress of mobile initiatives and the quality of local cell coverage.

Current Activity

- Nearly 40% of institutions didn't mobile-enable *any* services in the 12 months prior to the survey.
- Where mobile activity is taking place, services geared toward students are outpacing those for faculty or staff, both in priority and enablement.
- Still, general communications remains the area for which respondents expect the heaviest demand for the 2011–2012 academic year.

- In general, IT organizations believe they are reasonably well prepared to meet the expected demands for mobile computing across the four areas of general communication, instruction, administration, and research.
- In areas for which institutions see mobile computing as a priority—which, as noted, tend to be areas of student- and public-facing applications and services—they are making considerable progress. The fact that enablement of mobile services largely tracks priority highlights the importance of appropriately prioritizing the many services that might be included in a mobile initiative.

The Landscape for Mobile Computing

- Students are driving the adoption of mobile computing in higher education. Younger people own and use mobile devices at higher rates than older generations, and they increasingly expect institutional services to be available on those devices.
- A third of students see mobile devices as an important component of academic success, and majorities regularly use their devices for academic activities.
- Many respondents consider integrated student services as currently the most valuable area for development of mobile services. Specifically, applications related to student learning and course management systems were identified by large proportions of respondents as the “killer mobile app for higher education.”
- Not all services are equal in terms of the need to understand and address security concerns. Mobile apps that include personal information and require user authentication are necessarily more difficult to deploy, and those that enable transactions from mobile devices add yet another layer of risk.

Components of a Development Plan

- By a wide margin, central IT most often has primary responsibility for mobile-enablement of institutional services. At smaller institutions, though, and those with smaller budgets, vendor-supplied mobile apps are seen as an important part of mobile initiatives.
- Allocating money and staffing predictably results in progress in deploying mobile services, but these two factors together account for only about half the variation in the number of services that were mobile-enabled in the previous year.

- The median amount spent for each mobile app deployed in higher education is just above \$5,000, though the range of per-app costs runs from less than \$2,000 to more than \$16,000.
- Institutions pursuing a balanced approach to mobile development—one that includes elements from several strategies, such as mobile web, native apps, or mobile frameworks—tend to report greater progress. The most successful mobile efforts will likely be those that adopt a flexible portfolio of development options, including vendor apps.
- Collaborations to develop mobile apps and services enjoy very high levels of support and are seen as an effective way to pursue mobile development on a budget. However, actual participation remains low, with many institutions saying they will join a collaboration or deploy its solutions only when most of their peers are doing so.

Looking Ahead

The variability and lack of trends in our research hint that mobile computing in higher education remains at a nascent level for many institutions. We do see general patterns, and there is relatively broad consensus about the kinds of mobile applications and services that are most likely to benefit higher education. Still, many institutions are biding their time, waiting until more patterns come into focus about which approaches are likely to be the most effective.

Introduction

In 1877, following a demonstration of the telephone, U.S. President Rutherford B. Hayes said, “It’s a great invention, but who would want to use it anyway?” A Western Union memo of similar vintage suggested, “This ‘telephone’ has too many shortcomings to be seriously considered as a means of communication.” New technologies often challenge us to rethink basic assumptions about how we do certain things. With the phone, this happened at its invention and more than once since then.

When RIM’s BlackBerry introduced the world to mobile e-mail in 2003, it was a revelation to many users—especially businesspeople—who had come to depend on e-mail and were thrilled to be able to stay connected without lugging a laptop around and finding a network. The inconveniences of the small screen and tiny keyboard were trivial compared with the ability to stay connected nearly all the time, and the success of the BlackBerry was an important stepping-stone on the way to the mobile devices and capabilities we enjoy today. Still, the introduction of the iPhone in 2007 constituted a leap of faith: Would consumers really be willing to type on screen-based keys and use the device to check maps, surf the web, shop online, conduct banking, play games, and do countless other activities, especially after the novelty wore off? The answer, of course, was yes, and the emergence and growth of Android-based devices, the evolution of the BlackBerry, and the introduction (and success) of the iPad and other tablets are testament to the degree to which, despite its shortcomings, mobile computing has changed how—and when, and where—we interact with the people and the world around us.

Mobile computing has become a part of our everyday lives, as reflected in ownership and usage data from a wide range of sources.

- According to the Pew Internet & American Life Project, 42% of cell phone owners in the United States own smartphones. This works out to 35% of Americans overall, and, among people ages 18–29, that number rises to 52% overall.¹
- Similarly, research from the Nielsen Company shows that of U.S. cell phone subscribers, 43% own smartphones, which includes 54% of people ages 18–24 and 62% of those ages 25–34.²

ECAR research on students and technology finds similar levels of ownership, and data from the EDUCAUSE Core Data Service indicate that 92% of higher education institutions are providing some level of support—at no charge—to users of mobile devices, including smartphones and tablet computers. Even as rates of cell phone ownership have plateaued, ownership of smartphones and other mobile devices is steadily rising.

Moreover, owners of smartphones really do use the additional features of their mobile devices. Pew research shows that smartphone owners engage in a long list of mobile activities at significantly higher rates than owners of cell phones and

that younger users (ages 18–29) participate in those activities significantly more often than users ages 30 and older.³ The location awareness of mobile devices adds another dimension to mapping applications and social networking, and 55% of smartphone owners use location-based services.⁴ Services like Twitter and Facebook take on a new quality when users can access them virtually all the time, and the ability to take pictures or video with a mobile device and immediately upload those images to the web has had a profound impact on the news cycle, not to mention entertainment and popular culture.

Mobile computing has been described as the third digital revolution (following broadband Internet and social networking).⁵ For many, “there’s an app for that” is not just a marketing slogan but a tenet of life in the 21st century—we expect to be able to do anything on our mobile devices that we can do on any other

“Mobile presence is rising fast on our radar. As with other projects, we will be leveraging (and contributing to) the wisdom of the larger higher education community as we move forward”

computer. Younger generations, who never knew a world without mobile devices, have incorporated mobile technologies into the fabric of their lives and have done so on their own terms. As a result, they have high expectations for what they will be able to do with those devices on campus. In September 2011, the EDUCAUSE IT Issues Panel identified the consumerization of IT as one of the top-three

issues facing higher education.⁶ Students come to campus today with consumer devices and consumer expectations, and, having embraced the convenience and utility of mobile devices in their nonacademic lives, they want and expect mobile computing to play a similar role in their learning.

This environment puts higher education in an interesting, if anxious, position. The potential for mobile is clearly enormous, but there are difficult technical, security, policy, and cultural issues to resolve in order to capitalize on that potential. The consumer market for devices, platforms, and applications is large and shifting, leaving colleges and universities with considerably less control than they are comfortable having. The fact that this is happening in a time of severe budget pressures and financial uncertainty only leads to more hand-wringing over the highly consequential decisions about how to approach mobile computing. Nevertheless, 90% of the respondents to the ECAR survey on mobile computing said that they expect an increase in the amount of money their institutions spend on mobile applications and services over the next three years; just 10% expect no change, and not a soul expects a decrease.

For these reasons, in the summer of 2011, ECAR undertook a study of what colleges and universities are doing about mobile technology on their campuses. We sought to understand how institutions prioritized the mobile-enablement of various kinds of services and applications, what progress they had made, and what factors aided (or hindered) their efforts.

What We Didn't Find

The usual suspects are conspicuously absent. One of the standard analyses that ECAR uses in its research is to probe the data for statistically significant differences in terms of several demographic factors: Carnegie Classification, institution size, control (public versus private), and whether an institution's mission is focused more on teaching or research. In the history of ECAR research, these analyses typically uncover significant, if sometimes predictable, findings across these variables. The data from our survey of mobility, however, show very few demographic differences of either statistical or practical significance, and most reporting of trends by the usual factors would be speculative. Given the many facets of a mobile-development plan and the resources needed for any such undertaking—not to mention the variation in mobile priorities across institutions—we expect differences to surface eventually, particularly in terms of Carnegie and size. For the moment, however, we note the few differences we did find and otherwise treat higher education as a whole.

Trends remain elusive for spending and for the number of services that have been mobile-enabled. What we do see in the data is considerable variation in the responses to some of the survey questions. Asked how much money central IT had spent on mobile-enablement in the 12 months prior to the survey, 43% reported no spending on *infrastructure and tools*, and 35% reported *no spending at all*. However, 12% reported spending \$100,000 or more, with two institutions reporting more than half a million dollars. When asked how many services central IT had mobile-enabled in the same time period, 38% said none, another 30% said between one and three, and small percentages said 20–50.

The range of higher education activity for mobility remains wide, and clear paths have yet to emerge. Three years ago, ECAR research on messaging and communications asked about mobility. At that time, 44% had not mobile-enabled any services, though nearly two-thirds said that mobile devices would be essential in three years.⁷ The fact that so few trends have emerged since then hints that either the urgency of mobile services was overstated or the challenges of making it happen were underestimated—or perhaps some of both.

Progress for mobile computing does not depend on the quality of cell coverage. Another finding that is significant for what it does *not* show is the relationship between mobile signal coverage and the indicators of progress asked about in our survey (stage of enablement, degree to which current mobile demand is being met, preparedness to meet expected demand, and number of services, applications, and websites that were mobile-enabled in the previous year). Reported signal coverage has improved somewhat since the messaging survey, and there are predictable differences in coverage by location (urban versus rural), but better coverage is not associated with greater progress.

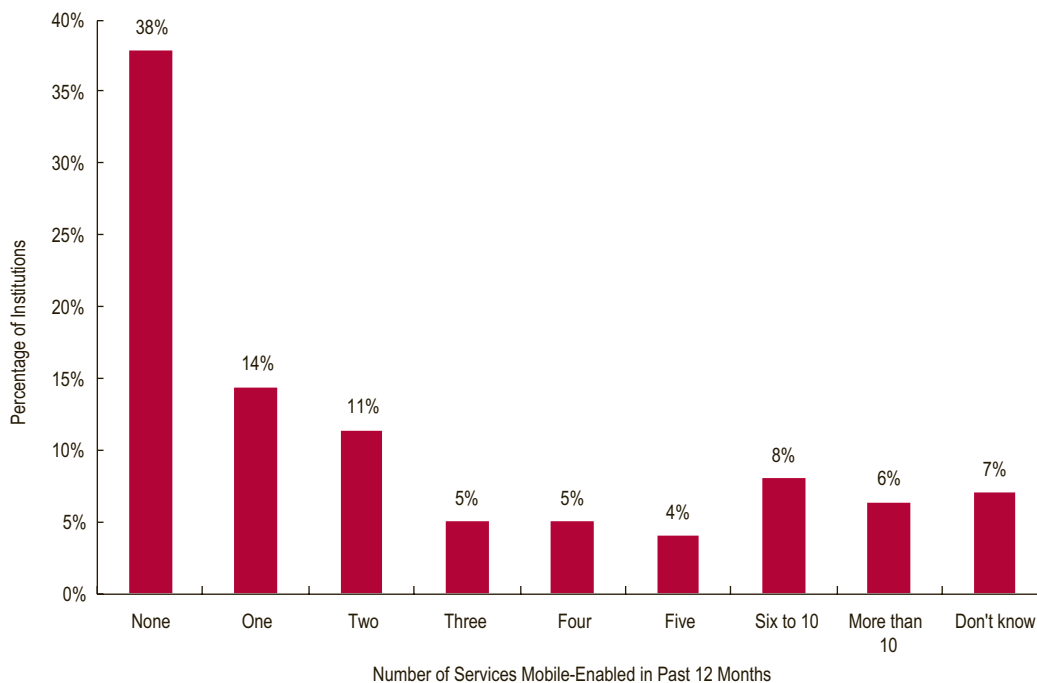
Mobile Activity Today

The current state of mobile computing in higher education is a mixed bag so far. With limited resources and growing hype about what mobile technologies have to offer, colleges and universities need to prioritize how and where to focus their attention in going mobile. Quite a few institutions report little if any activity in mobility. Among those that are making progress, some common themes show up in terms of areas where higher education perceives the greatest demand for and value from mobile services.

“Our institution has been behind the curve on mobile apps primarily due to resources, but I expect this will change with our new fiscal year and basic demand”

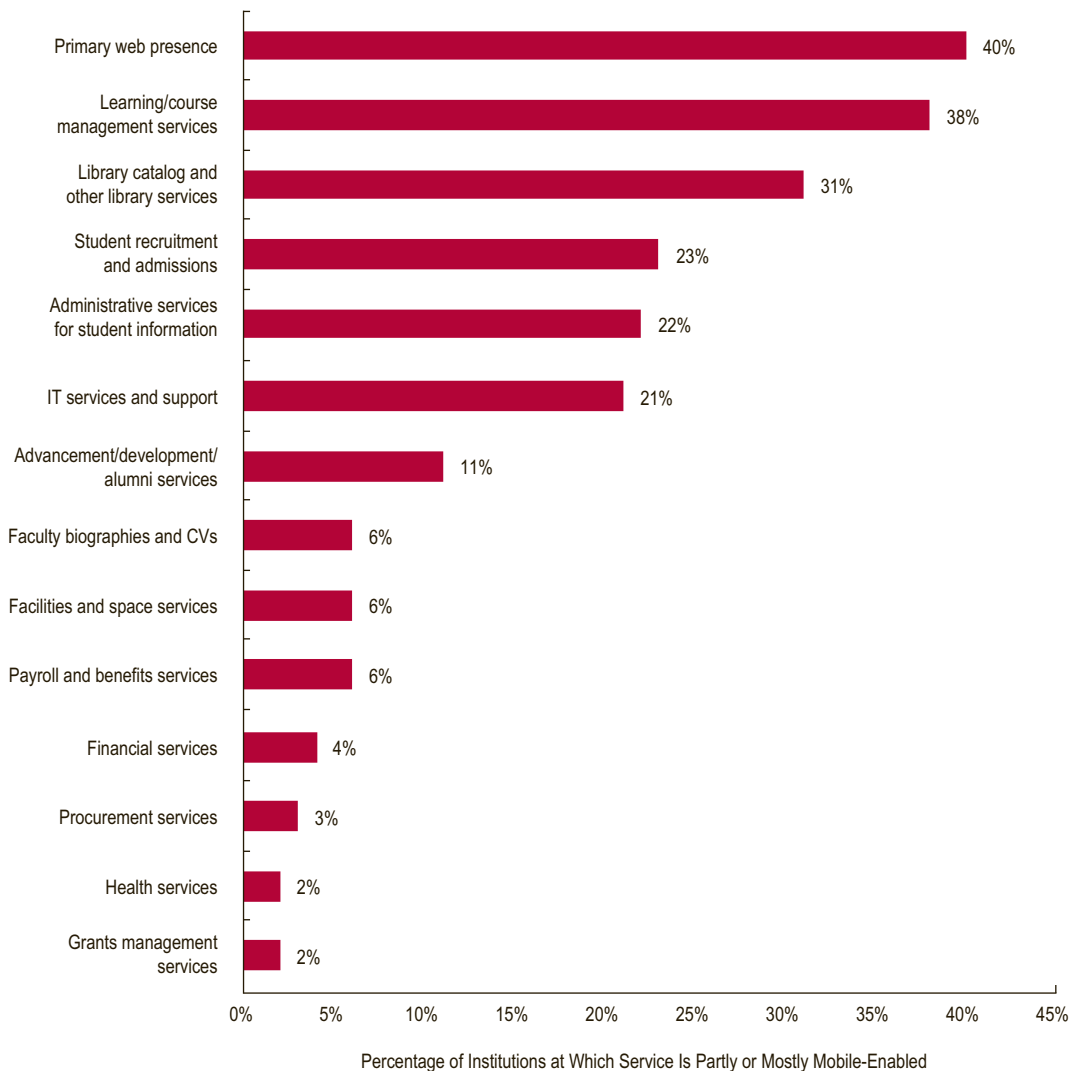
A surprising number of colleges and universities didn’t mobile-enable any services in the past year. Survey respondents were asked how many institutional services, applications, and websites had been mobile-enabled by central IT in the previous 12 months, and their responses are shown in Figure 1. Although some respondents might have answered in terms of a *single* mobile application that includes discrete services while others might have counted all of the services separately, the fact that two in five institutions reported mobile-enabling zero services is noteworthy.

Figure 1. Number of Services, Applications, and Websites Mobile-Enabled in Past Year



Services with an orientation toward students or the public are more fully developed than those for faculty or staff. Our survey asked about the mobile-enablement status for 14 types of services. As shown in Figure 2, primary web presence and learning/course management services lead the way, having been partly or mostly mobile-enabled by about two in five respondents. Library catalog and other library services are not far behind, reported as “some are enabled” or “most are enabled” by 31% of respondents, followed by a cluster of three services that have been partly or mostly enabled at between 21% and 23% of responding institutions. Seven mobile services included in the survey are languishing, deployed at 6% or fewer institutions. The services with higher levels of enablement across all institutions are those focused on student and academic needs, while services for faculty and staff functions trail, in most cases considerably.

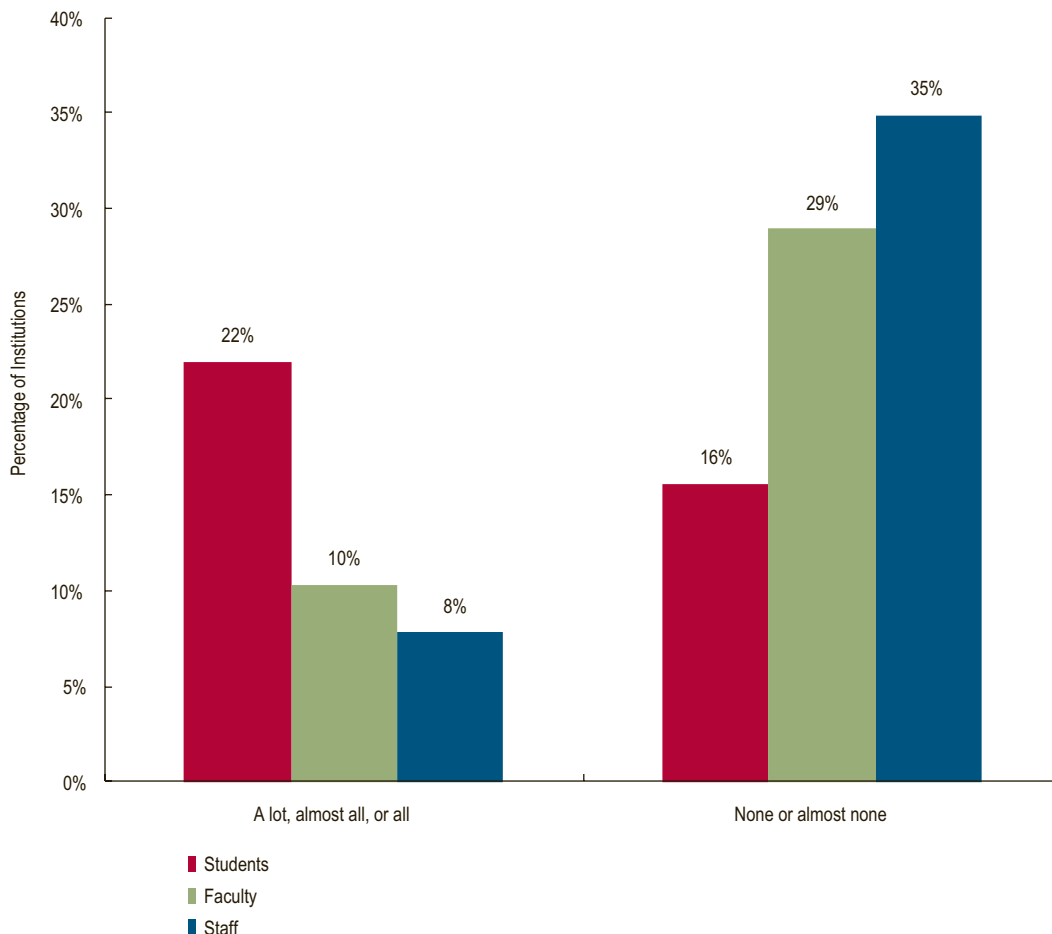
Figure 2. Institutions Reporting That Service Is Partly or Mostly Mobile-Enabled



When the average level of enablement across all 14 service areas is calculated by Carnegie, there is a statistically significant difference between groups: On our 6-point scale (where 1 = no discussion and 6 = most are enabled), doctoral institutions had a statistically significantly higher overall level of enablement (2.91) than did master’s (2.62), bachelor’s (2.23), or associate’s (2.15) institutions ($p = .002$, R-squared = .104).

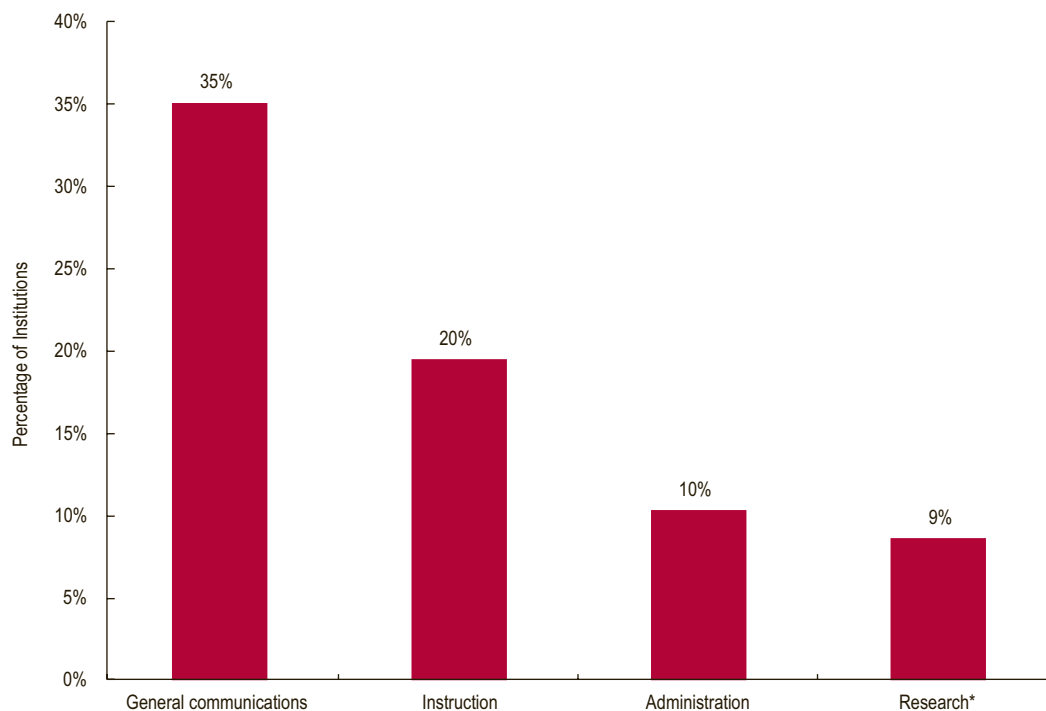
To further support the finding that respondents are meeting students’ mobile demands most effectively, institutions are meeting a lot, almost all, or all of the mobile demands for students at more than twice the rate at which they meet them for faculty and nearly three times the rate for staff (Figure 3). At the other end of the spectrum, *unmet* mobile demands of faculty and staff outpace those of students by about two to one.

Figure 3. Amount of Mobile Demand Being Met for Three Constituencies



General communications remains the highest area of demand. Our survey asked how prepared institutions are for the mobile demands of the 2011–2012 academic year, broken into four areas. Although twice as many institutions said they anticipate heavy or very heavy demand in the 2011–2012 academic year for instruction-focused mobile services as for administrative services, expectations for general communications exceeded both of these areas combined (Figure 4).

Figure 4. Expectations of Heavy or Very Heavy Demand for Mobile IT

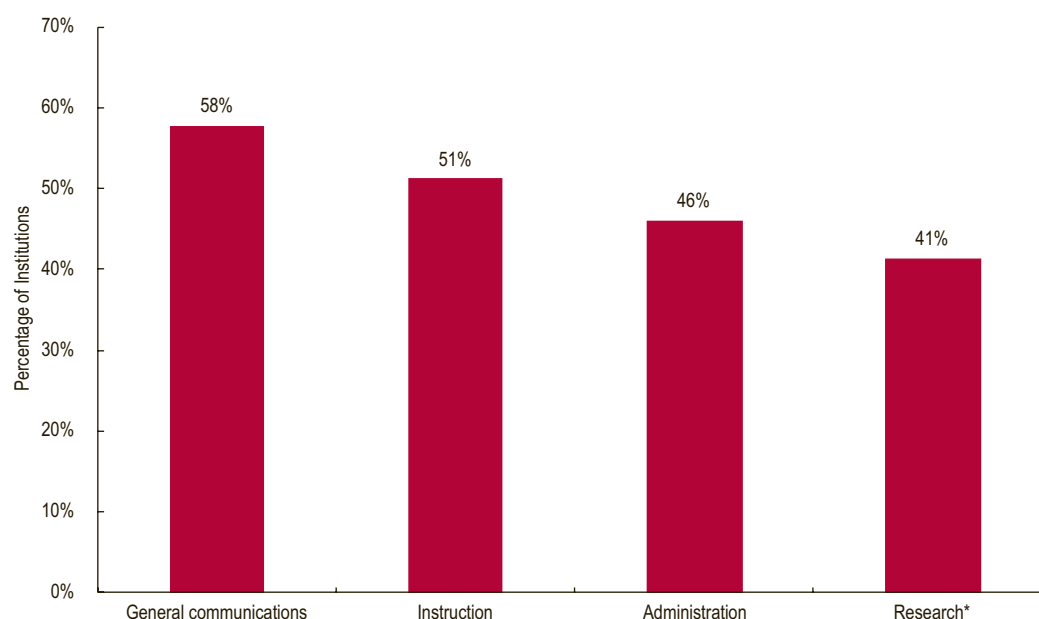


* Among only institutions reporting a research-focused mission

Even among institutions with a research focus, fewer than 10% expected heavy mobile demand for research, and none anticipated very heavy demand. That said, some experts believe the capabilities of mobile computing to support research are not well understood, even by researchers. As a result, our findings about the current state of demand for mobile research tools might change considerably as the potential for mobile research is explored.

IT organizations feel generally prepared to meet mobile demand. More than half of respondents agreed or strongly agreed that they were prepared to meet the mobile demands for general communications and instruction (Figure 5); just 20% and 26%, respectively, disagreed or strongly disagreed. Preparedness for administrative demand followed closely, with 46% agreeing or strongly agreeing that they are ready.

Figure 5. Institutions That Agree or Strongly Agree They Are Prepared to Meet Mobile Demands



**Among only institutions reporting a research-focused mission*

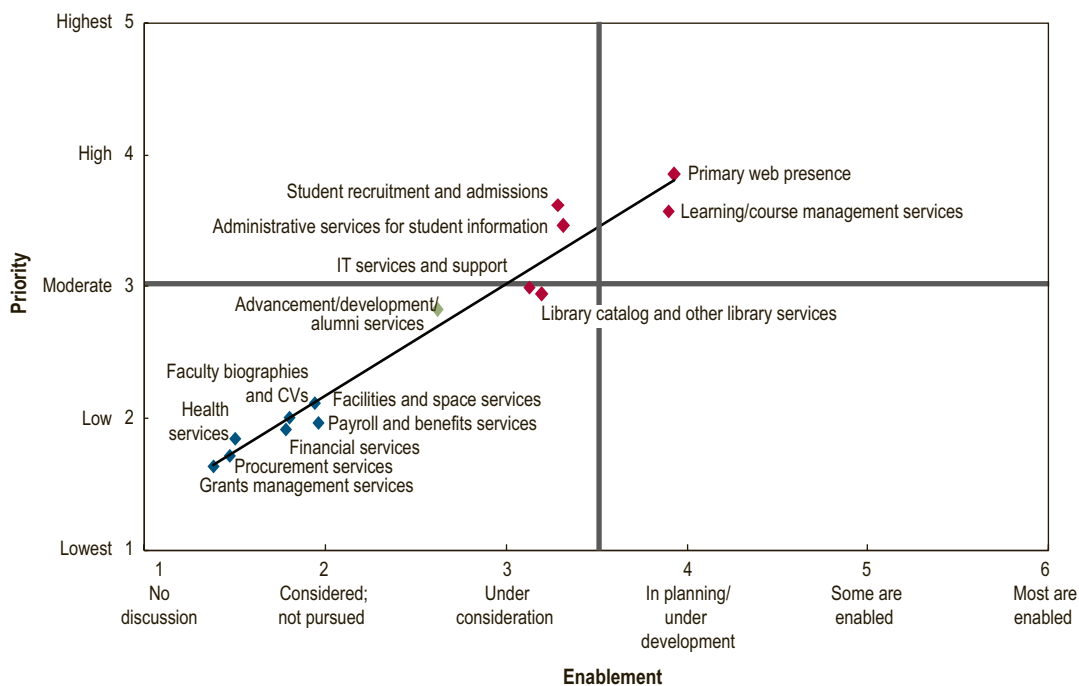
We did find a statistically significant difference in the preparedness for mobile demand for research. Institutions with a research orientation had a mean preparedness of 3.19—edging into the range of “agree” on our scale of 1 = strongly disagree to 5 = strongly agree—compared with a mean of 2.85 for institutions that identified themselves as being teaching focused ($p = .001$). Unsurprising as this may be, it reinforces the notion that an important part of a mobile implementation effort is understanding your institution’s particular needs and setting priorities accordingly for mobile development.

Institutions are deploying mobile services in areas they see as priorities.

We compared the mean priority (5-point scale) with mean level of enablement (6-point scale) for the 14 service areas of the survey and found that, broadly speaking, enablement follows priority (Figure 6). Just two services (primary web presence and learning/course management service) rise above the midpoints for both priority and enablement, though four others are close behind. Three areas may be lagging in enablement relative to priority: student recruitment and admissions, administrative services for student information, and advancement/development/alumni services.

“The greatest opportunity is in delivering course content and related teaching/learning activities”

Figure 6. Means for Priority and Enablement of Institutional Services



The pattern is clear: Where institutions see need and apply effort, they see substantial progress. This finding isn’t groundbreaking, but it highlights the importance of an institution’s process for deciding how to prioritize the long list of services that could be mobile-enabled. Figure 6 also reinforces the importance higher education is putting on student- and public-facing services for mobile-enablement (the red indicators), while priority and enablement of services for faculty and staff remain at low levels (blue indicators), with advancement/development/alumni services (green indicator) inhabiting a middle ground.

Directions for Mobile Computing

Our research showed that applications focused on student needs are in the greatest demand and are also those that have been most often mobile-enabled, along with services geared toward public consumption, including prospective students. Though not addressed directly in our survey, the distinction between public, private, and transactional mobile services is a key distinction for most mobile services.

Student and Public Services

Younger generations own, use, and embrace mobile devices. According to the Pew Research Center, not only is ownership of smartphones growing, but owners of those devices also routinely use them to access the Internet or e-mail.⁸ In their research, 94% of all smartphone owners ages 18–29 have used them at least

“I see tremendous potential for the application of mobile devices without ‘killer applications’ for the simplest things our students, faculty, and staff do every day”

once for these functions, and 81% use them this way on a typical day. Moreover, 25% of all smartphone owners use those devices as their *primary* Internet device, and among users ages 18–29 that number rises to 42%.⁹

Students are bringing the mobile revolution to higher education. The environment for mobility in higher education puts students

front and center. Large (and growing) proportions of students own mobile devices and use them for a long (and growing) list of daily activities. When they arrive on campus, they bring their devices with them, and they want and expect institutional services to be as available on mobile devices as on a laptop. Because the mobile revolution is being driven by the consumer market, colleges and universities of all sizes and shapes are facing a similar set of opportunities and challenges for mobility.

Findings from the recently released *ECAR National Study of Undergraduate Students and Information Technology, 2011*¹⁰ highlight the role mobile computing plays for students:

- More than half use smartphones to e-mail professors (66%), check grades (62%), text other students about coursework (61%), find information on Internet outside class (59%), or e-mail other students about coursework (57%); 45% find information on Internet during class.
- 33% say smartphones are “extremely valuable for academic success.”
- 35% of students strongly agree that technology helps them stay connected (with people and information), a hallmark of mobile technology.

Higher education recognizes that the goals of a mobile initiative should focus—at least initially—on integrated student services. As we saw in Figure 4, colleges and universities expect considerable mobile demand in the areas of instruction and general communications. Figure 6 shows a clear separation in priority between student and public apps, on the one hand, and those geared for faculty and staff, on the other. Open-ended responses on the survey support this understanding of where mobile investments are best made. Of the 127 responses to a question that asked what the “killer mobile app” for higher education would be, about half mentioned student services and/or LMS apps.

What’s the killer mobile app for higher education?

Percentage of responses that say...	
Student services	25%
LMS	25%
Messaging and calendaring	14%
Social network	6%
Personal productivity	6%
Classroom technology	6%
Portal	4%
Collaboration	2%
E-learning	2%
ERP	2%
Other	19%

“Application that gives students access to all university services, i.e., schedule, grades, student accounts.”

“One that provide a student a one-stop shop for all of his or her college needs ... campus e-mail, calendars, course schedules, current course materials, etc.”

“All LMS and ERP applications and data mobilized!”

“A social network, campus based, that will bring the friend, then fellow students, then faculty together and can be accessed by all either mobile or desktop.”

“A location-aware app that builds on social networking concepts and utilizes the location and video communication capabilities of the mobile device.”

“There is no one killer app. The mobile computing equation is much more complex than that.”

Also noteworthy in those responses was a focus on integration. Respondents used terms such as “one-stop shop” and “comprehensive app” and “all around” and “all-encompassing” to describe their vision of a killer app that would include virtually any service a student used on campus: LMS, student information system, grades, registration, billing, financial aid, student response systems, and others. The thrust of comments that concerned the LMS was simply that a mobile app should include *all* of the functions of the LMS.

Several open-ended responses highlighted the value of apps and services focused on learning. “Any that helps student with learning” and “Apps that integrate into the learning process itself, assist in learning” were two of the comments that hint at the distinction between tools that directly affect student learning and apps such as bus schedules, dining hall menus, and campus maps.

A separate open-ended question asked respondents to identify the apps that are currently experiencing the greatest demand, and the responses here, too, overwhelmingly support the placement of student services at the top of the list of mobile apps. Of approximately 150 responses, more than 40% mention academic and administrative services for students. Communication services and social networking were also mentioned frequently.

Mobile Apps and Security Issues

Different types of services require different levels of security. Online services can be grouped into three tiers: public, private, and transactional. Translating *public information* to display well and function properly on mobile devices is a question of presentation—mobile hardware and software typically require some compromises and adjustments in terms of colors, graphics, fonts, or animations, and the navigation of services might need to be rethought for mobile devices. As we saw in Figure 2, primary web presence has the highest overall level of mobile-enablement, and home pages are a good example of tier one, public information.

The second tier of services provides access to *private information*, such as grades, course resources and activities, tuition account balances, or other data. Having access to this kind of information on mobile devices significantly increases the convenience for users, and services in this tier are seen as highly valuable. The open-ended comments in our survey that call for mobile LMS apps and others focused on student services highlight the perceived importance of developing such services. Providing private information securely, however, requires a trusted authentication mechanism, as well as policies covering what information may be accessed through a mobile device. Although the principles of authentication and authorization apply equally to mobile devices as to laptops and desktops, mobile applications and the networks that enable these processes are sufficiently different as to pose new risks and amplify existing

“How can middleware help to secure the data and data access which is now extremely mobile?”

concerns.¹¹ Still, access to user-specific information will likely be a part of any institution's mobile efforts at some point.

The third level of services is *transactional*. Such services depend on the authentication and authorization necessary for tier-two services, but they up the ante by allowing mobile users to *do* something with sensitive information. In some cases, transactional services are effectively tier-two services with information going both ways—a sophisticated mobile application for an LMS, for example, would provide information and communications to students about the courses in which they were enrolled, and it would also let them submit coursework to instructors or share it with other students. In other cases, though, transactional services involve new considerations, such as allowing someone to pay a bill, drop a class, or order a transcript. The value of transactional mobile services was reflected in several of the open-ended responses, including this description of what would be the killer mobile app: “Comprehensive campus app that allows students to register for classes, pay tuition and fees, view classes online, and navigate the campus.”

Although an institution might reasonably see transactional services as the ultimate goal due to the added value and convenience they provide to users, these tier-three services are the most difficult to develop because of the security and policy concerns. The differences between tiers are highlighted in comments made by Hideko Mills, manager of IT research infrastructure at the University of Wisconsin–Madison. In describing the Mobile UW app, Mills said that the first version included only public data sources and that she expected “subsequent versions to address authentication issues surrounding accessing private information, such as student courses and grades.”¹² Allowing mobile users to exchange money, for instance, or execute actions affecting course enrollments exposes institutions to much greater repercussions if the systems are accessed by unauthorized users, but given that students (and faculty and staff) are increasingly able to do these sorts of activities with banks and stores, they will likely expect similar convenience from colleges and universities.

Mobile-Development Planning

Responses to the open-ended survey questions make clear that for many institutions, mobile computing is a priority, it is indeed the next revolution, and, as a strategic initiative, it rivals the Internet both in importance and in resources needed to develop it. At the same time, many respondents said the mobile landscape is too unsettled and the approaches too varied—particularly in tough economic times—to know how to get started. One respondent said:

Institutions need to develop mobile strategies and think about how to deploy mobile applications or a mobile web presence and approach it strategically. The mobile space is moving quickly, so institutions need to move quickly also to respond to the increasing demand.

Another put it this way:

Admittedly, we feel as though this is “the” moving target and spend much of our time and research in developing answers.

Each institution will need to chart its own course through the waters of mobile computing, deciding on a set of mobility goals that reflect the needs and capacities of that institution. In some cases, an institution might determine that certain functions or services should never be mobile-enabled due to concerns over security or privacy. In other cases, mobility goals might be seen as strategic (creating an advantage for the institution) or as utilities that simply need to meet a baseline level of expectation from

“The ‘flashy object’ of mobile computing must be tempered with the reality that not everything needs to be ‘mobile’ and that there must be a true purpose to the app to make it useful”

campus users. Whatever the specific goals, institutions face a number of factors and decision points that could have a significant influence on a mobile initiative.

As in the other areas of our research on mobility, we found few statistically significant differences in mobile development across Carnegie, institution size, control, or focus. Looking at higher education as a whole, however, we do find some interesting patterns and some results that—although they are in themselves not surprising—reinforce the picture of a higher education environment in which some institutions are applying resources and strategies to implement mobility while others are biding their time, waiting for the combination of demand, solutions, and standards before they move into mobile computing in earnest.

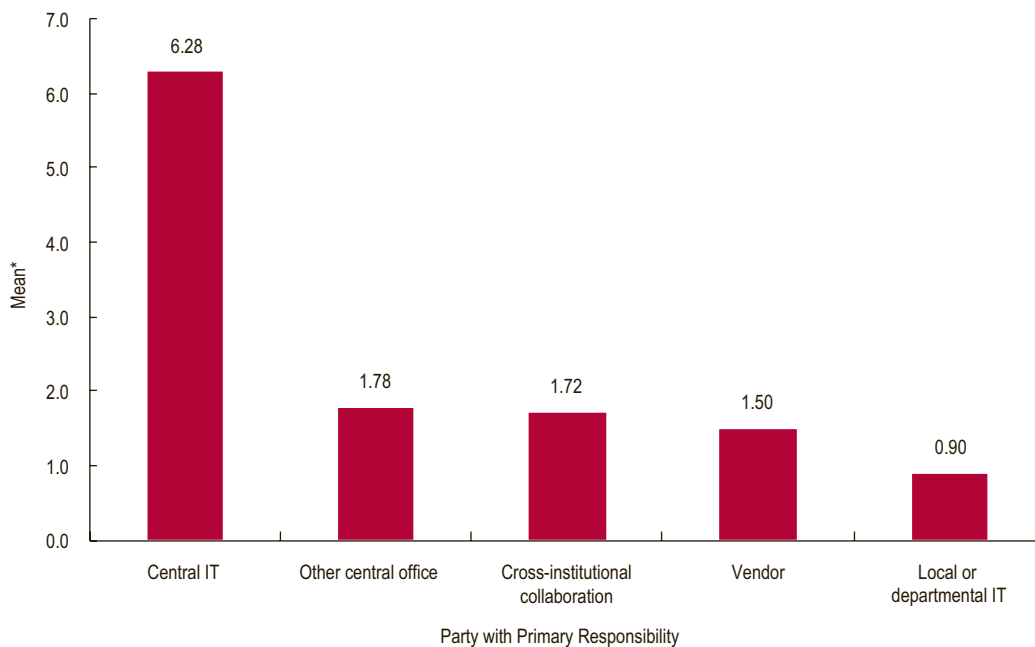
Leaders of Mobile Development

Central IT is usually in charge, but some institutions look to vendors to provide mobile versions of their software. We asked who has primary responsibility for the mobile-enablement of the 14 services in our survey. By a wide margin, central IT was identified as having the leading role in mobile-enabling campus services and applications (Figure 7). Vendors were reported to be primarily responsible for an average of fewer than 2 mobile services of the 14, but the open-ended responses suggest that some institutions, particularly those with smaller staffs and budgets, are waiting for (and counting on) vendors to take a greater role. One respondent said, “We really need our packaged-software vendors to step up and develop mobile-friendly versions.” Another expressed frustration at the current status of vendor-provided mobile solutions:

“Mobile is a strategic initiative, but often we have difficulty getting mobile ‘on the radar’ of our central IT as a priority. Desktop is currently the focus of central IT”

We are very early in the cycle of supporting mobile. We have a small staff with no capacity to do mobile development. We need to be able to purchase mobile solutions. The vendors seem not to be offering mobile solutions. Rather, they are selling tools with which we are to develop our own solutions. This is not a good model for us.

Figure 7. Primary Responsibility for Mobile-Enablement



Resources Allocated to Development

Money and people get results, but only up to a point. As noted earlier, reported spending on mobile-enablement spans a wide range, with many institutions saying they spent no money in the previous year on mobility. Among institutions that said they had mobile-enabled at least one service, application, or website during the previous 12 months, the median total amount spent was \$20,000, and the middle 50% of institutions (the 25th to 75th percentiles) spent between \$5,000 and \$62,500.

Similarly, although 80% of respondents said they had at least one FTE working on mobile-enablement, overall levels of staffing vary considerably. In what may be the most obvious finding of our research, institutions that spent more money on mobile computing and that assigned more central IT staff to mobile initiatives reported greater progress overall. In this regard, our results simply confirm what intuition and experience would suggest. That said, when we subjected these data to deeper scrutiny, we found

“I believe [mobile computing] will change the competitive landscape, particularly for smaller institutions [that] cannot afford to play in this game”

that these two variables—spending and staffing—account only for roughly half the variation in the number of services that were mobile-enabled in the previous year. Other factors not asked about in our survey are influencing institutions’ progress in enabling and

deploying mobile services, perhaps reflecting the still-emergent nature of mobility in higher education as well as the sometimes considerable variation at the local level.

We found that a lack of spending is associated with a lack of enablement—more than one-third of institutions spent nothing on mobile-enablement in the past 12 months, and, of that group, 80% reported enabling *no* services ($p < .001$, $V = .619$). We also found an association with a lack of staffing and a lack of enablement—92% of institutions that reported no staffing of mobile-enablement in the past 12 months have not enabled any mobile services, applications, or websites ($p < .001$, $V = .532$). Despite the variation in some of the research data, these strong associations suggest that large numbers of institutions have yet to get started in earnest with any mobility efforts.

In rough terms, higher education is spending about \$5,000 for each mobile app. We compared the amount of reported spending on mobile-enablement with the number of services institutions had enabled to see how much institutions are spending for each mobile app they deploy. Due to the wording of some of the survey questions, we were unable to pin down the development cost per mobile service as distinct from maintenance costs. We also did not ask respondents what kinds of services they had deployed for mobile devices, and some are certainly more costly to develop than others. Nevertheless, in looking at responses from institutions that had mobile-enabled at least one service, we found a median cost *per service* of \$5,143. Perhaps a more accurate general estimate of the cost per service is \$2,000 to \$16,250: one-quarter of respondents who had deployed at least one mobile app had spent less than \$2,000 per app, and one-quarter spent more than \$16,250 per app.

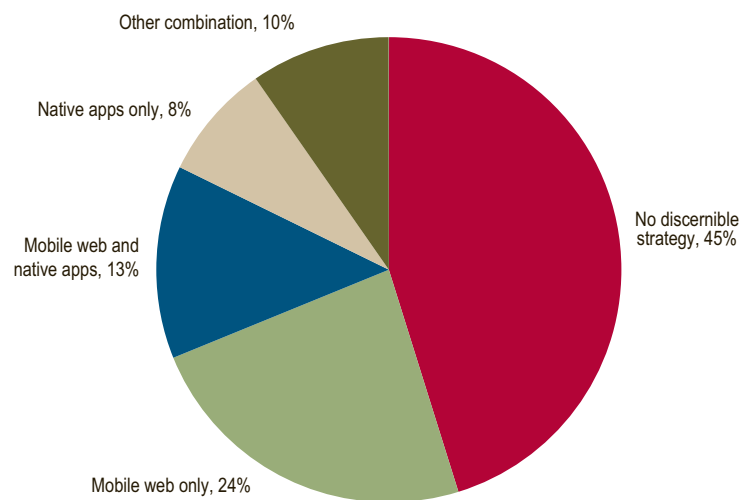
Development Strategy

Many institutions are pursuing no specific strategy, while others favor mobile web. When the time comes to start mobile-enabling IT services, institutions must determine what device(s) will be supported and decide what tools they will use to do the development work. At a coarse level, mobile development strategies break out into mobile web (device-neutral, browser-based) or native apps (tied to particular devices or operating systems), although a third strategy—mobile web frameworks, such as those developed by UCLA and MIT—is being pursued by small numbers of institutions.

“Our institution is developing in both web and app environments, and we need to sort out whether to invest in both or only one going forward”

Our survey asked about seven discrete mobile development strategies, which, for the purposes of our analysis, we organized into mobile web, native apps, and mobile frameworks. We then organized responses into groups to see how many institutions appear to be favoring one of those three strategies; how many are taking a multipronged approach (reporting some level of deployment of at least two of the strategies); and how many have no discernible strategy (institutions that did not report current enablement of IT services based on any of the strategies identified). The group with no apparent strategy accounted for the largest proportion of respondents, followed by mobile web only, mobile web/native apps combination, and native apps only (Figure 8).

Figure 8. Adoption of Mobile-Development Strategies



There is probably no single strategy that is right for everyone, but certain strategies might be wrong for some institutions. Many of the text responses on our survey indicate that higher education is looking for guidance about which development strategy to pursue. Numerous responses mentioned this uncertainty, as embodied in this excerpt:

The selection of one or more of these [strategies]—and the development sequence if one chooses more than one—is a fundamental, strategic question with major consequences for cost, maintenance, and future development.

Despite some notable examples of institutions that have adopted a native apps strategy with excellent results (and even standardized on a single platform), many colleges and universities see such an approach as unsupportable in the long run, based on some of the text responses we received, including “... the pursuit of native apps is likely a mistake ...” and “Developing [native] apps is a black hole. A strategy of mobilizing web applications is the correct direction.”

A diversified development portfolio likely contributes to greater progress. In our analysis of the influence of strategy on indicators of progress, we found no statistically significant relationships between development strategy and the current level of demand being met or preparedness to meet expected demand. We found some small variations for prevalence of certain strategies by Carnegie, but no strong patterns emerged.

Looking only at colleges and universities that appear to be pursuing one of the three most common strategies—a web apps strategy, a native apps strategy, or a strategy that includes both of these—institutions that take the balanced approach reported higher overall enablement scores (across all 14 service areas) than either other group. The drawbacks of a native apps approach are well known, but the fact that mobile web development has not vanquished native apps speaks to the added value—at least for some applications—that can come of device-specific features and functions. The real value might lie in understanding where the additional benefits will justify the extra effort of native apps.

Strategy Comparison

Mobile Web: Applications run in mobile browsers. They are device-neutral, they don’t need to be downloaded and installed, they are cost-effective to deploy and support, and the browser interface will be familiar to users.

Native Apps: Applications are developed for particular devices and/or operating systems, such as the iPhone or iPad, Android, or BlackBerry. Native apps frequently take advantage of device features unavailable to browser-based apps; they tend to be faster and provide a more sophisticated, rewarding user experience; and they are more likely to work when not connected to the Internet. The trade-off is the added cost and complexity of either standardizing on a single platform (and ensuring that every user has equal access to a compatible device) or developing services to work on multiple platforms.

Mobile Web Framework: With a mobile web framework, applications are built using a baseline framework that ensures some measure of consistency for presentation and functionality across all supported devices, eliminating the need for redundant work otherwise. Additional functions can be built in to take advantage of device-specific features, but the development process is more streamlined than in a native app approach.

Vendor-supplied mobile apps are another element of a matrix of development strategies. Mobile apps are increasingly on the radar of vendors of software packages for higher education, and in some cases these vendor options can be more easily deployed (and integrated with campus systems) than apps developed by the institution.

Although the current level of adoption of mobile frameworks among survey respondents is too low to allow for meaningful analysis, they offer one particular benefit worth noting. Mobile frameworks are particularly well suited to supporting distributed development. Particularly at institutions with a strong focus on research, mobile frameworks have the potential to be an effective development strategy for the decentralized projects that are characteristic of such research efforts.

Strategic plans and funding have an influence, but staffing is a better predictor than either. Numerous other areas of ECAR research have shown that the presence of a strategic plan for IT initiatives is associated with progress and success, and mobile computing appears to be no different. Our data show that the apparent adoption of *any* mobile development strategy is associated with greater progress, indicating that institutions that have “gotten in the game” in some way are reporting results in providing mobile services. Meanwhile, considerable numbers of

colleges and universities appear to be sitting on the sidelines, waiting for the right moment to jump in and get wet.

Institutions that are most actively involved in mobile-enablement have outlined a clear and intentional strategy (or strategies) for development, and they have devoted money and

staff to mobile efforts. Each of these factors—strategy, funding, and staffing—is positively associated with mobile progress as measured by the number of services, applications, and websites the institution has mobile-enabled. Although the influence that each factor exerts is relatively small, we did find that staffing—measured by the number of FTEs working on mobile-enablement—plays a larger role than either strategy or funding in the number of services enabled. The moral of the story might be that the allocation of *human* resources to mobile-enablement efforts is more important than either financial resources or the presence of a formal strategy.

“[O]ur IT organization is very traditional, and we have been stung by the growth in mobile devices, lacking the agility to embrace them”

Collaborations for Mobile Development

Most respondents believe collaborations have considerable potential to address higher education’s mobile development needs. We asked several

questions about respondents’ attitudes toward cross-institutional collaborations.

Overwhelming majorities are personally in favor of collaborations and believe they would be a successful model

for higher education’s mobility efforts (Figure 9). Moreover,

three-quarters agreed or strongly agreed that collabora-

tions have the potential to save higher education significant

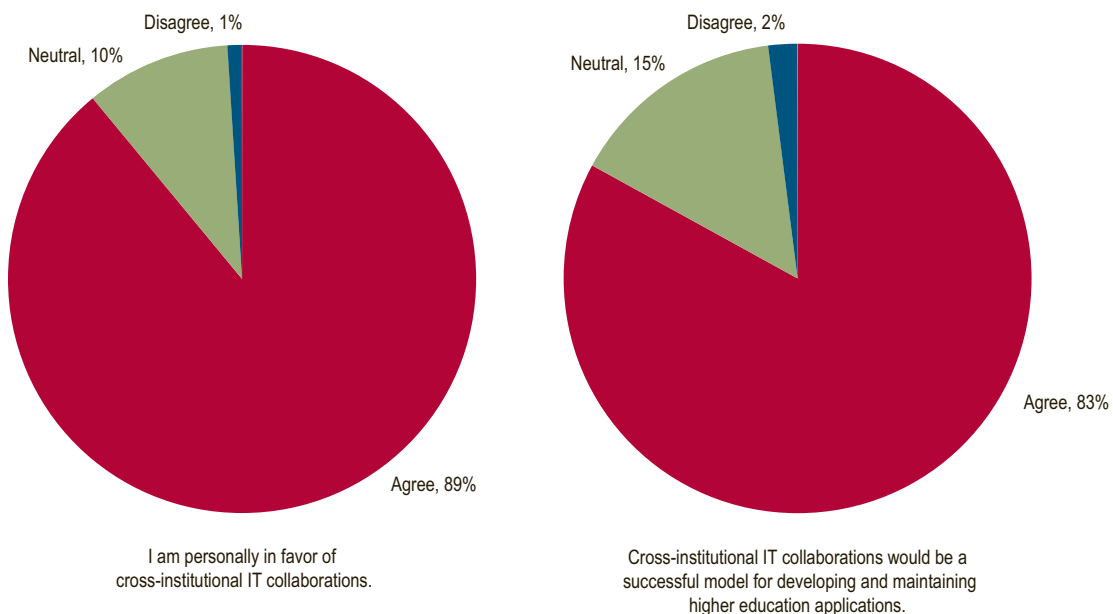
sums of money (74%) and that the respondent’s college or university might consider functional compromises

to realize those savings (76%). Small numbers of respondents said that unique institutional needs (3%) or institutional culture or leadership (8%) would prevent

participation in a collaboration to develop mobile services.

“Participation [in a collaboration to develop mobile services] would occur only if we could save money/redeploy resources, and there was clear evidence that the collaboration was effectively and efficiently managed”

Figure 9. Attitudes toward Collaborations



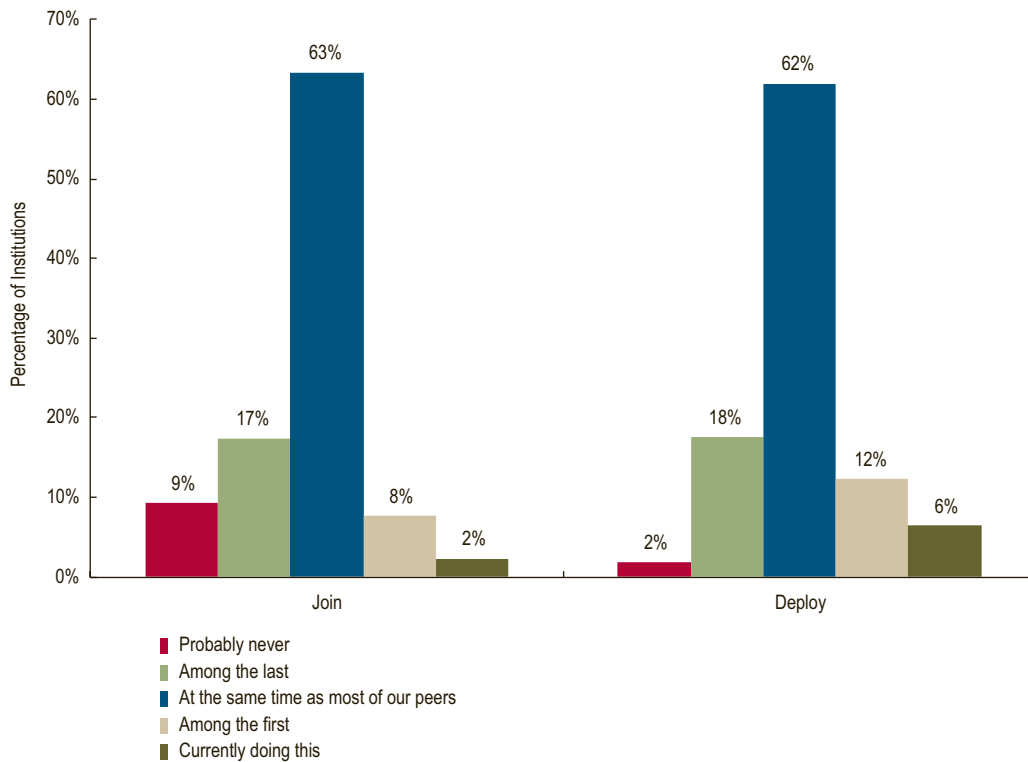
Despite the potential of collaborations, participation in collaborations to develop mobile applications remains low.

The survey question about who has primary responsibility for mobile-enablement showed that in relatively few cases are efforts being led by cross-institutional collaborations (see Figure 7). Separately, we asked about the time frame in which the institution would be likely to *join* a consortium to develop mobile applications or to *deploy solutions* that were developed by a consortium, irrespective of membership in it. Again, we found very little current activity in collaborations, either for membership or implementation of their solutions (Figure 10). That said, nearly two-thirds said they would be likely to join at the same time

“We would be more likely to join such a collaboration when the issue becomes more of a university priority and would more likely join on the back end of such initiatives”

as most of their peers. If and when consortia for mobile development reach a critical mass of activity, we could see broad uptake and significant adoption of those tools. The challenge will be to find the leverage point that incentivizes that critical mass.

Figure 10. Time Frame for Joining a Consortium or Deploying Its Solutions



Keeping a Focus on the Big Picture

In our data, few patterns emerge that argue strongly for or against particular approaches to the mobile-enablement of institutional services. Adopting an intentional strategy and allocating staff and financial resources predictably lead to greater progress, but these are broad-brush findings. Mobile web frameworks might prove to be an effective component of a development strategy, but their newness and relatively low adoption so far preclude any earnest forecasting. The same could be said for cross-institutional collaborations; although they have had success in other technology areas, their potential for mobile computing largely remains an open question.

The many factors affecting progress in mobile computing interact in complex ways. The degree to which any institution achieves success is in large measure a function of its unraveling and understanding those interactions and appropriately contextualizing them into the culture and priorities of the institution.

Conclusion and Recommendations

If Rutherford Hayes were alive today, he would know that the telephone not only overcame its shortcomings as a communication technology but—in the recent years—has also become indispensable to many people, and not simply for communication. Smartphones and their cousins the tablets have changed the way people work, conduct banking, travel, access entertainment, shop, and perform myriad other daily activities. As is so often the case, young people are leading the way—in terms of mobile device ownership, usage, and expectations—and colleges and universities are working to understand how best to incorporate mobile technologies into teaching and learning, research, administration, and other activities of the institution.

“[W]e face not only the development of applications and their compatibility with our services, but also an aging infrastructure”

Our research shines a light on the state of mobile computing in higher education, which in some areas is making steady progress, even as a considerable number of institutions are waiting, evaluating, and considering the options. Even though the world of mobile devices and applications remains too new for strong patterns and correlations to emerge, we offer the following recommendations for how higher education should approach the question of providing institutional services to mobile devices:

- *Focus on student apps, but don't neglect general communication.* The demand for mobile apps focused on students, and the benefits from those services, tend to be the most prominent drivers of mobile initiatives. But general communications remain a top priority for most institutions, and for good reason: Despite all their other capabilities, the communications abilities of mobile devices, whether for personal or academic purposes, remain central to the value of mobile devices.
- *Prioritize, and do it thoughtfully.* Mobile development costs money, and deploying and maintaining a full spectrum of mobile services can cost a lot of money. The allocation of resources—particularly staff—results in progress, but because resources are limited, appropriate prioritization of services is vital to an effective mobile plan.
- *Be prepared for the difficult mobile services.* Understand that different kinds of services require different levels of security/policy, and know that eventually you're probably going to have to provide mobile services that give access to private information and that allow users to conduct transactions from mobile devices.

- *Temper the enthusiasm for mobile computing with prudence.* When EDUCAUSE hosted a Mobile Computing 5-Day Sprint in the spring, one presenter pointed out that the only thing worse than having no mobile apps is having mobile apps that cause problems for other IT systems.
- *Be intentional—but flexible—with strategy.* Different development strategies have relative strengths and weaknesses, and the technologies and tools are rapidly evolving. A deliberate strategy is valuable, but so is having the flexibility to pursue different approaches based on specific needs. Keep vendors aware of institutional mobile needs so they can be part of a diverse development strategy, and include mobile apps in procurement discussions and decisions.
- *Participate in collaborative efforts and help them gain traction.* Efforts to cultivate cooperative relationships to develop mobile capacity hold considerable promise, and if they develop a full head of steam, they could become an integral part of a portfolio of development strategies. If most institutions play the “wait and see” game, that full head of steam—and the full benefits—will never develop.
- *Don’t wait too long.* Mobile apps and services are part of the everyday lives of most campus constituents, particularly students. Choosing to forgo or delay the development of mobile apps for your campus carries a risk of losing relevance—to today’s students as well as tomorrow’s.

Endnotes

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Acknowledgments

Many willing and talented individuals have contributed their time and insights to this report. We are most grateful to the IT leaders and professionals from 209 colleges and universities who took the time to provide the July 2011 data upon which this study is based. Without their thoughtful responses, ECAR would be unable to conduct its research.

The impetus for this research came from the overwhelmingly positive response to the April 2011 EDUCAUSE Mobile Computing 5-Day Sprint. The presenters and the hundreds of participants validated that mobile computing is transforming how our society functions and that its impact on higher education is considerable. It requires IT departments to embrace new roles; many of the best practices for computing generally apply equally to mobile computing; and attention must be paid to issues including infrastructure and security in order to support an effective mobile computing program. ECAR promised these engaged participants that further research would be done to learn more about the state of mobile computing in higher education, and this report and affiliated products are the result of that research.

To guide our research we engaged two leaders in the field of mobile IT: Bill Allison from the University of California, Berkeley, and Kyle Bowen from Purdue University. From advising on the research design to finalizing the survey questions to validating the interpretations of the data, these experts were indispensable to the research team. Pam Arroway, Senior Statistician at EDUCAUSE, prepared the data, consulted on statistical methods, and contributed to the interpretation of the results.

The team that produced this research is talented and diverse. Prior to his retirement from EDUCAUSE, ECAR Senior Research Analyst Mark C. Sheehan served as principal investigator for this research. His extensive contributions included designing and overseeing the data collection, conducting the initial analysis, and drafting the early versions of the research products. With great enthusiasm and aplomb, Gregory Dobbin, EDUCAUSE Editor and Project Manager, completed the analysis and wrote the final report with support from ECAR Senior Research Analyst Eden Dahlstrom.

We hope that you find this research information valuable and enlightening as you guide your institutions through mobile IT initiatives.

—Susan Grajek
EDUCAUSE Vice President for Data, Research, and Analytics
Boulder, Colorado

Appendix: Methodology

The 2011 ECAR Mobile IT Survey gathered data from 209 institutions in July and August 2011. For the first time, ECAR implemented a sampling methodology designed to reduce the number of survey requests sent to EDUCAUSE members. Invitations for previous ECAR surveys have been sent to all EDUCAUSE member institutions in the United States. For the Mobile IT Survey, invitations were sent to roughly half of EDUCAUSE member institutions selected via a stratified random sampling design.

Strata were defined by Carnegie Classification, and sample sizes were chosen proportional to the size of each stratum. That is, roughly half of each stratum was invited to complete the survey. The purpose of stratified sampling is to ensure adequate representation from different subpopulations. Controlling representation from subpopulations can improve estimates of population-level parameters (e.g., a mean for the entire population of interest) as well as subpopulation-level parameters (e.g., a mean for a subpopulation of interest).

As is typical with ECAR surveys, e-mail reminders were sent to non-respondents. In addition, phone reminders were used to encourage participation. Using a stratified random sampling design avoids selection bias, but bias due to non-response may still be present. For example, institutions that are not actively developing mobile IT on their campuses may be less likely to respond, thinking that the survey is not relevant to them. While we have not quantified this source of bias, the follow-up measures taken and the effective sample size ensure reasonable validity of the results.

The overall response rate of 23% is higher than for past ECAR surveys, though the total number of respondents (209) is somewhat smaller than for past ECAR surveys, which have typically had about 300 respondents. Table 1 summarizes the 209 survey respondents, whom we will refer to as the sample. Sample proportions may be used to estimate the corresponding population proportion with a margin of error of approximately 7%. For example, if 35% of respondents reported no spending at all, we may estimate that 35% (+/- 7%) of the target population is not spending anything. Margins of error for estimated means on 5-point and 6-point scales are generally between 0.2 and 0.3.

Table 1. Summary of Survey Respondents

Carnegie Classification	EDUCAUSE Members	Mobile IT Survey Invitees	Mobile IT Survey Respondents	Response Rate
AA	385	193	34	18%
BA	338	169	54	32%
MA	458	229	59	26%
DR	251	126	36	29%
Other	416	208	26	13%*
Total	1,848	925	209	23%

*Follow-up phone calls were not made to institutions outside the United States.

In previous ECAR studies, Carnegie Classification has shown to be the most consistent differentiator among IT organizations. Stratifying the population by Carnegie Classification does not preclude analyses by other institutional characteristics. It is standard ECAR practice to consider whether differences can be attributed to size of enrollment and control of the institution (public or private), as well as Carnegie Classification. All of these institutional characteristics are collected from publicly available IPEDS data.

Statistical significance is noted for many results, with *p*-values, effect sizes, and/or margins of error. The presence of statistical significance is considered conclusive in demonstrating, for example, association between responses to two questions. However, a statistically significant relationship does not imply a causal relationship or one that has practical significance. In some cases, a lack of statistical significance is noted, indicating a lack of conclusive evidence.